

TITLE OF THE INVENTIONDETERGENT COMPOSITION

This invention relates to a detergent composition, and, more particularly, to a detergent composition exhibiting superior foaming capability and yet capable of being very easily rinsed out.

The most basic capabilities demanded of a detergent composition for household use are detergency and foaming capability. No relation is considered to exist between detergency and foaming capability. A detergent exhibiting a superior forming capability is not necessarily a detergent having a good detergency.

In many of the cases, however, consumers tend to judge the extinction of foam as exhaustion of the detergency. The preference of consumers is thus for a detergent producing abundant foam. For this reason, a detergent composition having both excellent foaming and detergent capabilities is desired.

Conventional detergent compositions contain, as a primary detergent to account for foaming capability, an anionic surface active agent such as polyoxyethylenealkyl-ether sulfate, alkylbenzenesulfonate, α -olefinsulfonate, or the like. A nitrogen-containing amphoteric surface active agent such as a tertiary amine oxide, a higher fatty acid

alkanolamide, an alkylbetain, or the like, or a nonionic surface active agent are used together with an anionic-type surface active agent to promote detergency and to provide stronger foaming capability in the presence of oily dirt.

Reflecting the consumer's preference, detergent compositions generally available in the market are those producing abundant foam. These conventional detergent compositions exhibiting strong foaming capability, however, even at a low concentration are not free from the drawback of being difficult to rinse out. The capability of being easily rinsed out (rinse-out capability) is an important characteristic for detergent compositions used in the kitchen, etc. A poor rinse-out capability of a detergent requires a longer period of time and a larger amount of water for rinsing, rendering the use of the detergent composition less economical. In addition, such a poor rinse-out capability gives concern to the users about the foam in the waste water (foam pollution) they produce as a result of their use of the detergent. The byproduct of such foam indeed may develop into a social problem.

One of the solutions of this type of problem is the addition of a rinse-promoting agent to detergent compositions. Rinse-promoting agents widely used are salts of long-chained fatty acid, or low-HBL nonionic surface active agents such as esters of sorbitan fatty acid, esters of glycerine fatty acid, or the like. These rinse-promoting agents must be used in a large quantity to exhibit their

effects. The addition of too much of the agents, however, not only greatly impairs the low-temperature stability of the detergent composition for use in the kitchen, etc., but also adversely affects the foaming capability even at the time of washing. The use of rinse-promoting agents thus does not necessarily produce a satisfactory solution.

The development of a detergent composition possessing an excellent detergency, producing abundant foam during washing, and yet capable of being easily rinsed out is, therefore, strongly desired.

In view of this situation, the present inventors have undertaken extensive studies to overcome the above problem existing in the conventional detergent compositions. As a result, the inventors have found that formulating a specific type of polyoxyalkylene derivative into a detergent composition greatly improves its rinse-out capability without impairing its detergency, foaming capability, and low-temperature stability.

Accordingly, an object of this invention is to provide a substantially non-cationic detergent composition comprising a polyoxyalkylene derivative prepared by reacting (1) an alkylene oxide adduct of monohydric alcohol, alkylphenol, or monohydric mercaptan (such alkylene oxide adducts being herein referred to as "Compound A"), and (2) a diepoxide compound.

Other objects, features and advantages of the invention will hereinafter become more readily apparent from the following description.

According to the present invention, therefore,
there is provided a detergent composition
comprising:-

5 one or more surface active agents selected from
anionic or amphoteric surface active agents or
nonionic surface active agents selected from:-

fatty acid diethanolamide, dimethylalkylamine oxide,
polyoxyethylene alkyl ether and
polyoxyethylene alkylphenyl ether; and

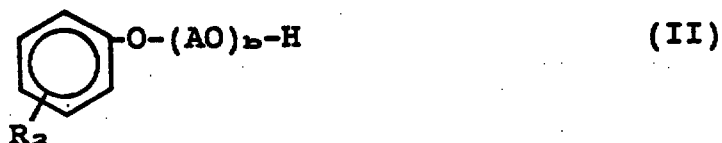
10 0.01 - 10% by weight of the composition of a
polyoxyalkylene derivative prepared by reacting an
alkylene oxide adduct of a monohydric alcohol, an
alkylphenol or a monohydric mercaptan with a diepoxide
compound;

15 wherein the surface activity of the composition is
substantially non-cationic and wherein the proportion
of the polyoxyalkylene derivative in the composition
is 0.02% to 50% by weight of the surface active
agents.

Compounds represented by the following general formulae (I), (II), and (III) may be used as Compound A in the composition of the present invention.



wherein R_1 represents an alkyl or alkenyl group of a C_{10-20} carbon atom content, AO represents an ethylene oxide group, propylene oxide group, or both, and a , which is the number of addition moles of the OA group, denotes a value 20 or more.



wherein R_2 represents an alkyl or alkenyl group of a C_{4-14} carbon atom content, AO represents an ethylene oxide group, propylene oxide group, or both, and b , which is the number of addition moles of the OA group, denotes a value of 20 or more.

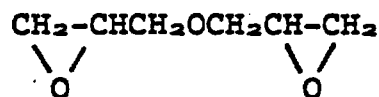


wherein R_3 represents an alkyl or alkenyl group of a C_{10-20} carbon atom content, AO represents an ethylene oxide group, propylene oxide group, or both, and c , which is the number

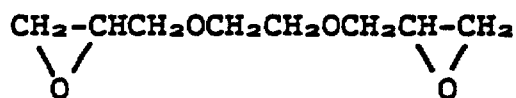
of addition moles of the OA group, denotes a value of 20 or more.

Given as examples of diepoxide compounds which can be used are the following compounds (i) to (xi):

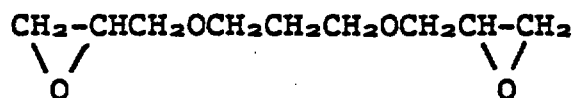
(i) β, γ -epoxypropylether



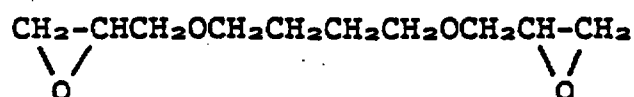
(ii) 1,2-bis(β, γ -epoxypropoxy)ethane



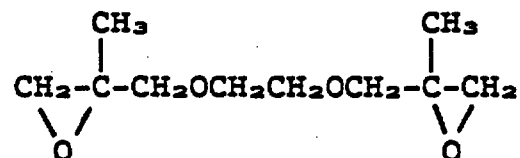
(iii) 1,3-bis(β, γ -epoxypropoxy)propane



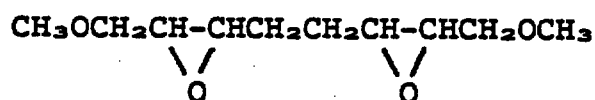
(iv) 1,4-bis(β, γ -epoxypropoxy)butane



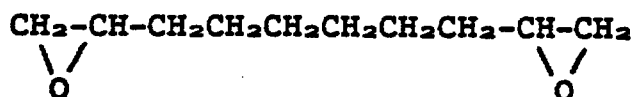
(v) 1,2-bis(β -methyl- β, γ -epoxypropoxy)ethane



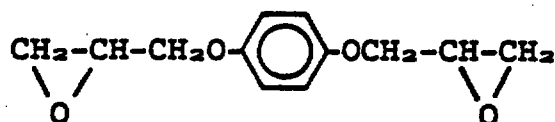
(vi) 1,2-bis(α , β -epoxy- γ -methoxypropyl)ethane



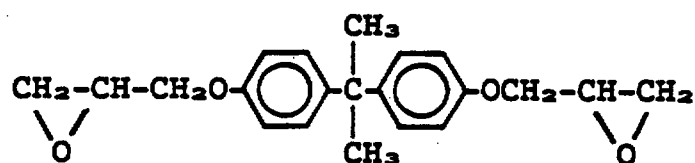
(vii) 1,6-bis(epoxyethyl)hexane



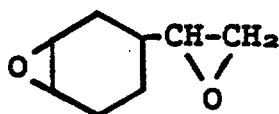
(viii) 1,4-bis(β , γ -epoxypropoxy)benzene



(ix) 2,2-bis[p-(β , γ -epoxypropoxy)phenyl]propane



(x) 1-epoxyethyl-3,4-epoxycyclohexane



(xi) α -limonenediepoxyde

Compound A used in this invention can be prepared by adding ethylene oxide, propylene oxide, or a mixture of ethylene oxide and propylene oxide, to a monohydric alcohol, an alkylphenol, or a monohydric mercaptan. The addition

reaction may be carried out according to a conventional method in the presence of an alkali catalyst. Ethylene oxide and propylene oxide, when used in the mixture, may be added either at random or in block.

The total carbon atom content in a monohydric alcohol, an alkylphenol, or a monohydric mercaptan is between 10 to 20, and preferably between 12 to 18. If the total carbon atom content is less than 10, the resulting polyoxyalkylene derivative exhibits only an insufficient rinse-out effect. On the other hand, if the carbon atom content exceeds 20, the resulting polyoxyalkylene derivative possesses a lower solubility in water, which, in turn, lowers the foaming capability of the detergent composition to which the derivative is formulated. In addition, the low-temperature stability of the detergent composition is impaired, which makes the composition unacceptable for use in the kitchen or the like.

In view of promoting the rinse-out effect of the polyoxyalkylene derivative, the desirable average number of alkylene oxide mols to be added to Compound A should be at least 20, with the preferable range being between 100 and 300.

A polyoxyalkylene derivative can be produced by reacting Compound A thus obtained with a diepoxide compound in the presence of an alkali catalyst. The ratio of Compound A and a diepoxide compound to be reacted is determined depending on the types of the compounds having an

active hydrogen atom to be added, the molecular weight of Compound A, and the kinds of diepoxide compounds.

Generally, the use of a diepoxide compound in the amount of 0.5 to 5 equivalent per 1 equivalent of hydroxyl group of Compound A is suitable. A reaction temperature of 50 to 200°C, preferably of 100 to 150°C, and a reaction time of 10 minutes to 10 hours, particularly preferably of 30 minutes to 3 hours, are applicable. The reaction proceeds smoothly in the above condition range, with a gradual increase in the viscosity of the reaction solution. The reaction is terminated at the point where the viscosity reaches a peak.

The amount of polyoxyalkylene derivative to be formulated into the detergent composition of this invention is in the range of 0.01 to 10% by weight, with the particularly preferable range being 0.05 to 5% by weight.

Anon-cationic surface active agent is contained in the detergent composition of this invention as a detergent component. Conventional anionic, nonionic, or amphoteric surface active agents can be used depending on the intended use of the detergent composition. Given as examples of surface active agents which can be used are: anionic surface active agents such as alkylbenzenesulfonate, alkylpolyoxyethylene sulfate, α -olefin sulfonate, alkane sulfonate, alkylglycerilether sulfonate, alkyl- or alkenyl carbonate, alkenyl succinate, N-acylsarcosinate, salts of alkylpolyoxyethylene carboxymethylated compound, salts of alkyl phosphate, and the like; nonionic surface active agents such as fatty acid diethanolamide, dimethylalkylamine

oxide, polyoxyethylene alkyl ether and polyoxyethylene alkylphenyl ether and the like; and amphoteric surface active agents such as alkylimidazol derivatives, dimethylalkylbetain, dimethylalkylsulfobetain, and the like. The polyoxyalkylene derivative providing a high rinsed-out effect to the detergent composition of this invention is used in the amount of 0.02 to 50% by weight, and preferably of 0.25 to 25% by weight, of the above-mentioned surface active agents.

Components other than surface active agents which can be formulated into the composition of this invention include solvents such as monoalcohol, dialcohol, glycerine, ethylene glycol monobutylether, diethylene glycol monomethylether, and the like, hydrotropic agents such as benzene sulfonate, p-toluene sulfonate, m-xylene sulfonate, urea, and the like, chelating agents, antiseptics, coloring agents, perfumes, UV ray absorbers, antioxidants, turbidity promoter, viscosity increasing agents, and the like. Usually the composition of this invention takes a liquid form containing water, although a solid form composition is acceptable.

The detergent composition of this invention can be used as detergents for washing or cleaning metals, machines, boats or ships, fabrics, glassworks, foods, tableware, fibers, and various household articles. The composition can also be used as a base detergent material for shampoos.

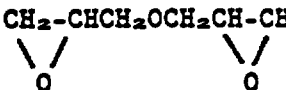
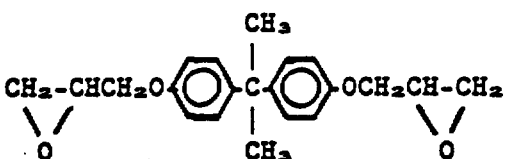
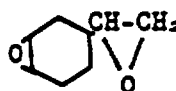
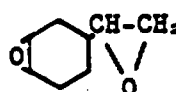
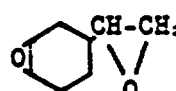
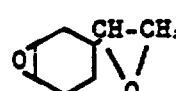
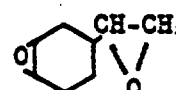
Other features of the invention will become apparent the course of the following description of the exemplary embodiments which are given for illustration of the invention and are not intended to be limiting thereof.

EXAMPLES

Synthesis Example 1-7

Polyoxyalkylene derivatives are prepared by adding a diepoxide compound to Compound A at prescribed ratios of equivalence, and by reacting the mixture at 150°C with stirring for 3 hours. Viscosities of a 10% aqueous solution of the reaction product were measured from time to time at 40°C, and the reaction was terminated when no more increase in the viscosity was observed. Polyoxyalkylene derivatives listed in Table 1 were prepared according to this manner using combinations of Compounds A and diepoxide compounds at ratios of equivalence shown in Table 1.

TABLE 1

Synthesis Example No.	Compound A	Diepoxide compound	Ratio of Equivalence *
1	$C_{16}H_{33}O-(CH_2CH_2O)_{100}-H$		1
2	$C_{16}H_{33}O-(CH_2CH_2O)_{100}-H$		2
3	$C_{16}H_{33}O-(CH_2CH_2O)_{100}-H$		4
4	$C_{16}H_{33}O-(CH_2CH_2O)_{50}-H$		4
5	$C_{16}H_{33}O-(CH_2CH_2O)_{200}-H$		4
6	 $-O-(CH_2CH_2O)_{100}-H$		4
7	$C_{12}H_{27}S-(CH_2\overset{\overset{CH_3}{ }}{CHO})_{200}-H$		4

* Epoxide group equivalent of diepoxide compound per equivalent of hydroxyl group in Compound A

Example 1

Detergent compositions having formulations given below were prepared to measure their detergency, foaming capability, and rinse-out capability. Each composition was stored in a thermostat at a temperature of -5°C to observe its stability after 1 week. The results are shown in Table 2.

The measurement of detergency, foaming capability, and rinse-out capability of the detergents were carried out according to the following methods:

(a) Detergency

Five (5) g of tallow fat to which 0.1% of Sudan III (a red coloring agent) was added as an indicator was applied to a porcelain dish (diameter: 25 cm). The dish was then scrubbed with a sponge to which 10 g of a detergent composition and 20 g of water were absorbed. Scrubbing with sponge was continued until no more tallow fat could be wiped away. The number of dishes which were cleaned out by this procedure was taken as the standard of the detergency.

(b) Foaming Capability

The foaming capability of a 0.5% detergent aqueous solution to which 0.1% of commercially available butter was added as a dirt component was measured. Forty (40) cc of this test solution was put into a glass cylinder (diameter: 5 cm), and rotating stirring was performed for 10 minutes, whereupon the height of the produced foam was measured.

(c) Rinse-out capability

Into a 500 cc separating funnel was charged 100 cc of a 0.25% detergent aqueous solution (temperature: 20°C). After the funnel was shaken for a prescribed number of times, the liquid was taken out and the volume of the remaining foam was measured. Then, 50 cc of water (temperature: 20°C) for rinsing was charged into the funnel. After the funnel was shaken slowly 10 times, the water was poured out. This procedure was repeated until no more foam remained in the funnel. The number of times for which this rinsing operation was performed were taken as the required rinsing times.

<Formulation>

Sodium linear alkyl(average C ₁₃)benzene sulfonate	15% (by weight)
Sodium polyoxyethylene (3) dodecylether sulfate	5%
Coconut fatty acid diethanolamide	5%
Ethanol	5%
Polyoxyalkylene derivative (prepared in Synthetic Examples 1-7)	0 or 0.1%
Water	Balance

<Result>

TABLE 2

	Synthesis Example No.	Detergency (Dishes)	Foaming Capability (mm)	Rinse-out Capability (Times)	Stability at -5°C
Inventive Composition 1	1	5	90	4	Transparent
Inventive Composition 2	2	5	92	4	Transparent
Inventive Composition 3	3	5	90	4	Transparent
Inventive Composition 4	4	5	89	5	Transparent
Inventive Composition 5	6	5	90	3	Transparent
Inventive Composition 6	6	5	90	5	Transparent
Inventive Composition 7	7	5	90	4	Transparent
Comparative Composition 1*	-	5	90	8	Transparent

* Comparative composition contains no polyoxyalkylene derivative.

Example 2

Detergent compositions having formulations presented in Table 3 were prepared to measure their detergency, foaming capability, and rinse-out capability in the same procedure as in Example 1. The results are shown in Table 3.

Obviously, numerous modifications and variations of the present invention are possible in light of the above

teachings. It is therefore to be understood that within the scope of the appended claims, the invention may be practiced otherwise than as specifically described herein.

TABLE 3

	Inventive Composition					Comparative Composition				
	8	9	10	11		2	3	4	5	
Sodium linear alkyl(average C ₁₃) benzene sulfonate	15	-	-	-	10	15	-	-	10	
Sodium polyoxyethylene (3) dodecylether sulfate	-	20	15	-	-	-	20	15	-	
Sodium α-olefin (average C ₁₄) sulfonate	5	-	5	-	5	-	-	5	-	
Sodium alkane (average C ₁₄) sulfonate	-	-	-	-	10	-	-	-	10	
Dodecylidimethylamine oxide	-	3	3	-	-	-	3	3	-	
Coconut fatty acid diethanolamide	5	3	3	5	5	5	3	3	5	
Ethanol	5	3	5	5	5	5	3	5	5	
Sodium p-toluene sulfonate	-	3	-	-	-	-	3	-	-	
Polyoxyalkylene derivative (prepared in Synthesis Example 5)	0.1	1.0	5.0	0.1	-	-	-	-	-	
Water (balance)										
Detergent capability	5	5	5	5	5	5	5	5	5	
Foaming capability (mm)	95	85	87	83	95	85	90	83		
Rinse-out capability	3	4	3	5	7	8	8	8		

CLAIMS:

1. A detergent composition comprising:-

one or more surface active agents selected from
5 anionic or amphoteric surface active agents or
nonionic surface active agents selected from:-

fatty acid diethanolamide, dimethylalkylamine oxide,
polyoxyethylene alkyl ether and
polyoxyethylene alkylphenyl ether; and

10 0.01 - 10% by weight of the composition of a
polyoxyalkylene derivative prepared by reacting an
alkylene oxide adduct of a monohydric alcohol, an
alkylphenol or a monohydric mercaptan with a diepoxide
compound;

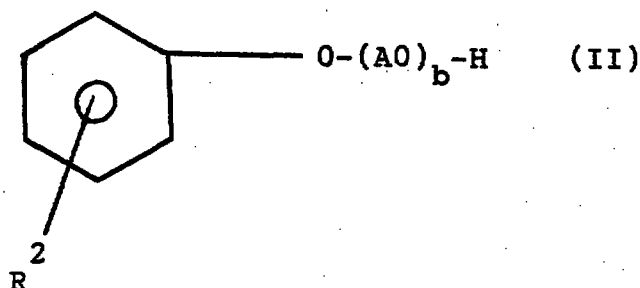
15 wherein the surface activity of the composition is
substantially non-cationic and wherein the proportion
of the polyoxyalkylene derivative in the composition
is 0.02% to 50% by weight of the surface active
agents.

20 2. A detergent composition according to claim 1,
wherein said alkylene oxide adduct of monohydric
alcohol, alkylphenol, and monomercaptan have the
following general formulae (I), (II) and (III)
25 respectively:-





wherein R_1 represents an alkyl or alkenyl group of a C_{10-20} carbon atom content, AO represents an ethylene oxide group, propylene oxide group, or both, and a , which is the average number of addition moles of the OA group, denotes a value 20 or more;



wherein R_2 represents an alkyl or alkenyl group of a C_{4-14} carbon atom content, AO represents an ethylene oxide group propylene oxide group, or both, and b , which is the average number of addition moles of the OA group, denotes a value of 20 or more; and



wherein R_3 represents an alkyl or alkenyl group of a C_{10-20} carbon atom content, AO represents an ethylene oxide group, propylene oxide group, or both, and c , which is the average number of addition moles of the OA group, denotes a value of 20 or more.

3. A detergent composition according to claim 1, wherein said diepoxide compound is selected from the group consisting of β, γ -epoxypropylether
1,2-bis(β, γ -epoxypropoxy)ethane,
1,3-bis(β, γ -epoxypropoxy)propane,
1,4-bis(β, γ -epoxypropoxy)butane,
1,2-bis(β -methyl- β, γ -epoxypropoxy)ethane,
1,2-bis(α, β -epoxy- γ -methoxypropyl)ethane,
1,6-bis(epoxyethyl)hexane, 1,4-bis(β, γ -epoxypropoxy)-benzene,
2,2-bis[p-(β, γ -epoxypropoxy)phenyl]propane,
1-epoxyethyl-3,4-epoxycyclohexane, and α -limonene diepoxide.

4. A detergent composition according to claim 1, wherein said anionic surface active agent is selected from the group consisting of alkylbenzenesulfonate, alkylpolyoxyethylene sulfate, α -olefin sulfonate, alkane sulfonate, alkylglycerilether sulfonate, alkyl-



or alkenyl carbonate, alkenyl succinate,
N-acylsarcosinate, salts of alkylpolyoxyethylene
carboxymethylated compound, and salts of alkyl
phosphate.

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5. A detergent composition according to claim 1,
wherein said amphoteric surface active agent is
selected from the group consisting of alkylimidazol
derivatives, dimethylalkylbetain, and
10 dimethylalkylsulfobetain.

6. A detergent composition as claimed in any
preceding claim and as hereinbefore described in
Example 1 or Example 2.

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7. In a detergent composition comprising one or more
surface active agents, the use of 0.01-10% by weight
of the composition of a polyoxyalkylene derivative to
improve the rinse out capability of the composition,
20 said derivative being prepared by reacting an alkylene
oxide adduct of a monohydric alcohol, an alkylphenol
or a monohydric mercaptan with a diepoxide compound,
the proportion of the polyoxyalkylene derivative in
the composition being 0.02-50% by weight of the
25 surface active agents.

