

"LIQUID DETERGENT COMPOSITION WITH FILM-FORMING INHIBITORY
CHARACTERISTIC"

BACKGROUND OF THE INVENTION

Field of the Invention:

This invention relates to a liquid detergent composition, and, more particularly, to a liquid detergent composition exhibiting an excellent film-forming inhibitory

Description of the Background Art:

For liquid detergent compositions, e.g. dishwashing detergents, anionic surfactants are generally used as a major detergent component because of their excellent detergency and lathering capability. They are usually used together with amphoteric surfactants and/or nonionic surfactants, such as tert-amine oxides, fatty acid alkanolamide and the like as an auxiliary agent for preventing the hand skin from being chapped.

These detergent compositions, however, have a disadvantage in that when water is evaporated from the solution as the time passes, the concentration of the anionic surfactants in a solution increases, thereby forming a film on the surface of the solution. The film frequently plugs the opening of the cap of the detergent container especially in the dry atmosphere during winter.

In order to resolve these problems, extensive studies have been undertaken, and trials of adding effective

ingredients to detergent compositions have been reported. These ingredients are, for example, polyethylene glycol and a water-soluble inorganic acid (Japanese Patent Laid-open No. 92809/1978), polyoxypropylene polyoxyethylene alkyl ether (Japanese Patent Laid-open No. 34306/1979), polyoxyethylene alkyl ether and magnesium sulfate (Japanese Patent Laid-open No. 110211/1979), lower alkylbenzene sulfonate and benzoate (Japanese Patent Laid-open No. 139792/1985), sulfate of polyoxyalkylene adduct of polyvalent alcohol (Japanese Patent Laid-open No. 89797/1987), water-soluble chitin compound (Japanese Patent Laid-open No. 193999/1988), and the like.

These trials, however, still demand improved film-forming inhibitory effect.

Alkyl glycosides known as saccharide-derived nonionic surfactants have lately attracted great attention because of their excellent lathering capability notwithstanding their nonionic nature. There have been some reports concerning detergent compositions making use of alkyl glycoside. They are, for example, a foaming detergent composition comprising, in addition to an alkyl glycoside (degree of saccharide polymerization: 1.5-10) and an anionic surfactant, 2-10% by weight of fatty acid alkanolamide and/or amine oxide (Japanese Patent Laid-open No. 186429/1983); and a dishwashing liquid detergent having high lathering capability and detergency comprising 2-25% by weight of an alkyl glycoside (degree of saccharide

polymerization: 1-1.4), 2-25% by weight of a sulfate- or sulfonate-type anionic surfactant, and 1-15% by weight of fatty acid alkanolamide (Japanese Patent Laid-open No. 74999/1987). In these examples the alkyl glycoside is used for improving lathering capability and detergency, and thus formulated in a great amount. The problem of insufficient film-forming inhibitory effect has not been solved in these compositions.

Development of a detergent composition possessing excellent film-forming inhibitory capability has been desired.

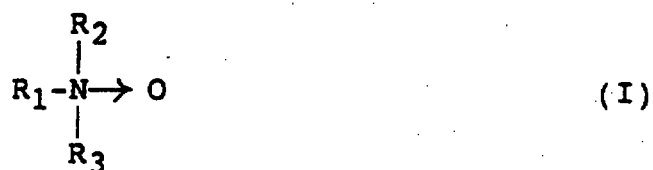
In view of this situation, the present inventors have undertaken extensive studies, and have found that desired detergent compositions exhibiting greatly improved film-forming inhibitory capability could be obtained by adding a small amount of specific alkyl glycoside to a detergent composition comprising a specific anionic surfactant, tert-amine oxide, and fatty acid alkanolamide. This finding has led to the completion of this invention.

SUMMARY OF THE INVENTION

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

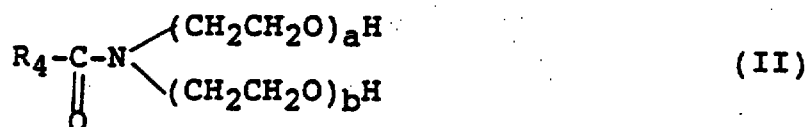
- (a) 10 to 30% by weight of an anionic surfactant having a sulfate group or a sulfonate group, or both;
- (b) 1 to 10% by weight of a tert-amine oxide

represented by formula (I):



wherein R_1 represents a linear or branched alkyl or alkenyl group having 8-18 carbon atoms, R_2 and R_3 may be the same or different and represent an alkyl or alkanol group having 1-3 carbon atoms;

(c) 1 to 15% by weight of a fatty acid alkanolamide represented by formula (II):



wherein R_4 represents a linear or branched alkyl or alkenyl group having 7-19 carbon atoms, a is a value of which the average is 0-5, and b is a value of which the average is 1-5.

(d) 0.5% to less than 2.0% by weight of an alkyl glycoside represented by formula (III):



wherein R_5 represents a linear or branched alkyl, alkenyl, or alkylphenyl group having 8-14 carbon atoms, R_6 represents an alkylene group having 2-4 carbon atoms, G represents a moiety derived from a reducing sugar having 5-6 carbon atoms, x is a value of

which the average is 0-5, and y is a value of which the average is 1.0-1.42.

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

DETAILED DESCRIPTION OF THE INVENTION AND PREFERRED EMBODIMENTS

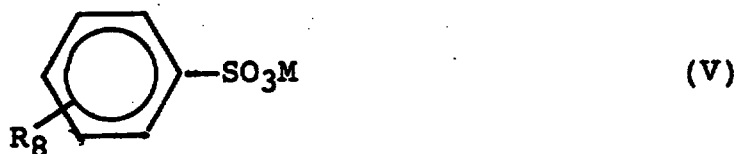
Given as examples of anionic surfactants containing a sulfate group and/or a sulfonate group, which are component (a) of the present invention, are polyoxyethylene alkyl ether sulfate, alkylbenzene sulfonate, α -olefin sulfonate, alkane sulfonate, α -sulfonated fatty acid derivatives, and the like. They are used singly or as a mixture of one or more of them.

Among them, polyoxyethylene alkyl ether sulfates, especially those represented by formula (IV), are preferable from the aspect of mildness to the skin.



wherein R_7 represents an alkyl or alkenyl group having 10-18 carbon atoms, M represents an alkali metal, ammonium, or alkanolamine, and n is a value of which the average is 1-7. A preferable carbon number of R_7 is 10-18, particularly 12-14, considering detergency and low-temperature stability of a detergent composition. A preferable average addition mol (n) of ethylene oxide in formula (IV) is 1-7, particularly 2-5, considering detergency and irritation to the hand skin.

From the aspect of both detergency and the cost, alkylbenzene sulfonates represented by formula (V) are preferable.



wherein R_8 represents an alkyl group having 10-16 carbon atoms and M has the same meaning as previously defined. A preferable carbon number of R_8 is 10-16, and, in particular, 11-13.

Component (a) is incorporated as a major component in the detergent composition of the present invention in an amount of 10-30% by weight. The amount of less than 10% by weight results in poor detergency and insufficient lathering capability. If the amount exceeds 30% by weight, the low-temperature stability of the composition greatly decreases.

Tert-amine oxide, component (b) of the present invention, is defined by formula (I). Among those represented by formula (I), alkyldimethylamine oxides having 12-14 carbon atoms is particularly preferable. 1-10% by weight of component (b) is incorporated in the composition for improving mildness to the skin and reducing the chapping of the hand skin, thus making up for the drawbacks of major component (a), and for increasing detergency and lathering capability. If the amount is less than 1% by weight, these effects are only insufficiently exhibited, while the amount exceeding 10% by weight gives an adverse effect on low-temperature stability.

Fatty acid alkanolamide, component (c) of the present invention, is represented by the compounds of formula (II). A preferable carbon number of R_4 in formula (II) is 10-14. Average ethylene oxide addition mol a and b in formula (II) is preferably 0-2 and 1-3, respectively. Component (c) is incorporated in the composition in an amount of 1-15% by weight for the same purpose as of component (b). If the amount is less than 1% by weight, the above effects are suppressed, while an amount exceeding 10% by weight results in unacceptably poor low-temperature stability.

Alkyl glycoside, which is component (d) of this invention and represented by formula (III), contributes to the promotion of film-forming inhibitory capability of the composition when incorporated therein in a certain amount. A carbon number of R_5 in formula (III) must be in a range of 8-14. If the carbon number is out of this range, the effect is remarkably reduced. The preferable carbon number of R_5 is 8-12. As R_6 which represents an alkylene group of a C_{2-4} atom content, ethylene group is preferable. Of the average alkylene oxide addition mol x of 0-5 in formula (III), a preferable range is 0-2. When the value y in formula (III) is larger than 1, i.e., when an alkyl glycoside contains a di- or higher saccharide as the hydrophilic group, the saccharide chain bonds may be 1-2, 1-3, 1-4, 1-6, α -pyranoside, β -pyranoside, or franoside, or a mixture thereof. Among the value y which is 1.0-1.42, a preferable range is about 1.10-1.40.

The value y is determined by the proton NMR method.

The structure of G in formula (I) depends upon whether the raw material contain a monosaccharide or di- or higher saccharide. Monosaccharides include glucose, galactose, xylose, mannose, lyxose, arabinose, and the like, as well as their mixtures. Examples of di- or higher saccharides are maltose, xylobiose, isomaltose, cellobiose, gentiobiose, lactose, sucrose, nigerose, turanose, raffinose, gentianose, melezitose, and the like, as well as their mixtures. Among these, from the aspect of easy availability and low cost, preferable monosaccharides are glucose and fructose, and preferable di- or higher saccharides are maltose and sucrose.

Component (d) must be incorporated in an amount at least 0.5% by weight and up to 2.0% by weight. If the amount is smaller than 0.5% by weight only the composition imparts only insufficient effects, while at the amount greater than 2.0% by weight the film-forming inhibitory effect is impaired. A particularly preferable range is 1.0-1.8% by weight.

It is desirable that the pH of a neat liquid of the detergent composition of the present invention be adjusted to 4 to 10, particularly preferably to 5 to 8.

Besides the above essential components, the composition of the present invention may comprise other conventionally known surfactants inasmuch as the effect of the present invention is not affected. Such surfactants may include

nonionic surfactants, e.g. polyoxyethylene(EO=3-20) alkyl or alkenyl(C₇₋₁₆, linear or branched) ether, polyoxyethylene(EO=3-20) alkyl or alkenyl(C₇₋₁₆, linear or branched)phenyl ether; amphoteric surfactants, e.g. alkyl(C₈₋₁₈) betain, alkyl(C₈₋₁₈) sulfobetain; and the like.

Besides the above-mentioned components, other components which are generally used in detergent compositions can optionally be used for the detergent composition of the present invention. Such components include, for example, lower alcohols such as ethanol and the like; lower alkylbenzene sulfonates such as p-toluene sulfonate and the like; glycols such as ethylene glycol, propylene glycol, and the like; hydrotropic agents such as urea and the like; pH buffers such as citric acid, malic acid, and the like; organic or inorganic builders; natural juice such as lemon, lime, and the like; hand-chapping protecting agents; enzyme; protein derivatives; pigments; perfumes; turbidity agents; chelating agents; antiseptics; ultraviolet ray absorbers; and the like.

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

Example 1

Detergent compositions listed in Table 1 were prepared.

A film-forming inhibitory effect of each composition was evaluated according to the following method. The results are shown in Table 1.

<Evaluation Method>

50 g of each composition was charged into a 100 ml beaker, and allowed to stand in an air-conditioned room at 20°C and 40% humidity for three days. The state of the compositions was then evaluated according to the following standard.

Evaluation standard

AAA: No change

BBB: A thin film was formed

CCC: A steady film was formed

TABLE 1
(components: % by weight)

Component	Inventive Composition					Comparative Composition				
	1	2	3	4	5	6	7	8	9	
Component (a)										
Sodium polyoxyethylene(3) dodecyl ether sulfate	20	15	10	10	20	15	10	10	21	
Sodium linear alkylbenzene-sulfonate (MW=344)	-	15	-	10	-	15	-	10	-	
Sodium α -olefin sulfonate (MW=326)	-	-	20	-	-	-	20	-	-	
Sodium alkane sulfonate (MW=356)	-	-	-	10	-	-	-	10	-	
Component (b)										
Dodecyl dimethylamine oxide	2	2	3	3	2	2	3	3	-	
Component (c)										
Coconut oil fatty acid diethanolamide	5	5	7	7	5	5	7	7	3	
Component (d)										
Alkyl glycoside *1	1	1	1.5	1.8	-	0.1	3	5	1.5	
Ethanol	3	3	3	3	3	3	3	3	3	
Water	Balance	Balance	Balance	Balance	Balance	Balance	Balance	Balance	Balance	
Film-forming inhibitory effect	AAA	AAA	AAA	AAA	CCC	CCC	BBB	BBB	BBB	

* 1 R5: C₁₀, x: 0, 6: glucose residue, y: 1.3 in formula (III)

Example 2

Detergent compositions shown below were prepared and the film-forming inhibitory effect of each composition was studied. The results are shown in Table 2.

Sodium polyoxyethylene(EO=4) dodecyl ether sulfate	20.0% by weight
Dodecyldimethylamine oxide	3.0%
Lauric acid diethanolamide	5.0%
Alkyl glycoside (see Table 2)	0 or 1.8%
Ethanol	3.0%
Water	Balance

Table 2

Composition	Alkyl glycoside R ₅ (OR ₆) _x G _y (III)					Film-forming inhibitory effect
	R ₅	R ₆	x	G	y	
Inventive Composition						
10	C ₁₀ H ₂₁	-	0	Glucose	1.4	AAA
11	C ₉ H ₁₉	-	0	Maltose	1.1	AAA
12	C ₁₂ H ₂₃	CH ₂ CH ₂	1	Glucose	1.0	AAA
13	C ₁₂ H ₂₃	CH ₂ CH ₂	2	Glucose	1.3	AAA

Comparative Composition						
14	C ₁₆ H ₃₁	CH ₂ CH ₂	3	Glucose	1.4	CCC
15	C ₁₂ H ₂₃	-	0	Glucose	1.7	CCC
16	C ₁₀ H ₂₁	-	0	Glucose	2.0	CCC
17	Not added					CCC

The liquid detergent compositions of the present invention exhibit excellent film-forming inhibitory effect and have advantages that an opening of cap is not blocked and their qualities do not deteriorate even when used under low humidity for a prolonged period of time.

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.

WHAT IS CLAIMED IS:

1. A detergent composition comprising:

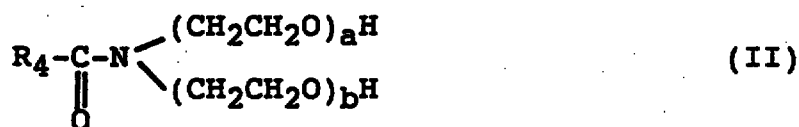
(a) 10 to 30% by weight of an anionic surfactant having a sulfate group or a sulfonate group, or both;

(b) 1 to 10% by weight of a tert-amine oxide represented by formula (I):



wherein R_1 represents a linear or branched alkyl or alkenyl group having 8-18 carbon atoms, R_2 and R_3 may be the same or different and represent an alkyl or alkanol group having 1-3 carbon atoms;

(c) 1 to 15% by weight of a fatty acid alkanolamide represented by formula (II):



wherein R_4 represents a linear or branched alkyl or alkenyl group having 7-19 carbon atoms, a is a value of which the average is 0-5, and b is a value of which the average is 1-5.

(d) 0.5% to less than 2.0% by weight of an alkyl



glycoside represented by formula (III):



wherein R_5 represents a linear or branched alkyl, alkenyl, or alkylphenyl group having 8-14 carbon atoms, R_6 represents an alkylene group having 2-4 carbon atoms, G represents a moiety derived from a reducing sugar having 5-6 carbon atoms, x is a value of which the average is 0-5, and y is a value of which the average is 1.0-1.42.

2. A detergent composition as claimed in Claim 1 substantially as hereinbefore described in the examples.
-

