

TITLE OF THE INVENTION

NEUTRAL LIQUID DETERGENT COMPOSITION

BACKGROUND OF THE INVENTIONField of the Invention:

The present invention relates to a detergent composition, and, more particularly, to a neutral liquid detergent composition exhibiting remarkably reduced irritation and damage to the hair or the skin, possessing high foaming capability, and imparting a favorable feeling upon use. After washing, the detergent components can easily be rinsed off leaving the least amount of water on the washed object such as tableware.

Description of the Background Art:

Because of increased awareness towards safety of the human body in recent years, a number of trials have been undertaken in order to moderate the action of detergent compositions which frequently contact the skin, such as laundry detergents, dishwashing detergents, household detergents, hair shampoos, body shampoos, and the like. One of the approaches is adjusting the pH of detergent compositions to a weakly acidic range, e.g. pH 5-6, close to the pH of human skins so as to be mild to the skin. Another approach is using a low irritant detergent as a major detergent base component. Amino acid surfactants, alkyl phosphate surfactants, or the like are used as a low irritant detergent (Japanese Patent Publication Nos. 40125/1975, 426023/1976, 9033/1980, and 27319/1983).

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Even though these surfactants are low irritant, they do not necessarily exhibit sufficient detergency and foaming capability when used alone. Poor water-solubility is also their drawback. Sodium alkylbenzenesulfonates have conventionally been popular detergent base components for dishwashing detergents because of their strong detergency. The compounds, however, give a strong defatting action to the skin and thus can be a cause of roughened hands.

Because of these reasons, sodium alkylethoxysulfates which are less irritant to the skin have gained a wider popularity as the base components for dishwashing detergents in recent years. Their detergent performances are even promoted when they are used together with adjuvants such as ternary amine oxides, higher fatty acid diethanolamides, and the like. Their action to the skin is also reduced to some extent by such a combination as compared with conventional detergent composition.

The degree of mildness which has heretofore been achieved by the above-mentioned various detergent compositions are not sufficient.

Alkyl glycosides, which are saccharide-derived surface active agents, are less irritant compounds. Although they are non-ionic surfactants, they not only produce stable foam themselves but also can act as a foam stabilizer when used together with anionic surfactants. Thus, alkyl glycosides are gaining much attention in recent years. Japanese Patent Laid-open No. 104625/1983, for example, discloses a foaming

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surfactant composition comprising an alkyl glycoside and nonionic surface active agent, and Japanese Patent Laid-open No. 74999/1987 discloses a liquid dishwashing detergent composition comprising an alkyl glycoside, nonionic surface active agent, and a fatty acid alkanolamide. They claim that the composition is low irritant and has an excellent detergency. Even though these detergent compositions exhibit performances better than conventional detergent compositions containing polyoxyethylenealkylethers as a base component, such performances are still to be improved. They have problems such as an inferior feeling upon use, poor rinsability of the foam, and insufficient drainability.

In view of this situation, the present inventors have conducted extensive studies to make the maximum use of the characteristics of alkyl glycosides, and found that a detergent composition exhibiting an excellent feeling upon use, good rinsability of the foam, and superior drainability by using alkyl glycosides together with a specific amount of certain types of higher alcohol and water-soluble salt. Such a finding has led to the completion of this invention.

SUMMARY OF THE INVENTION

Accordingly, an object of the present invention is to provide a neutral liquid detergent composition comprising:

- (a) 3-60% by weight of an alkyl glycoside,
- (b) 0.001-0.5% by weight of a higher alcohol having 8-14 carbon atom, and

(c) 0.001-8% by weight of one or more water-soluble organic or inorganic salts selected from the group consisting of sulfates, chlorides, borates, phosphates, p-toluensulfonates, m-xylenesulfonates, benzoates, malates, succinates, tartarates, citrates, lactates, and edates of sodium and potassium.

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

Desirable alkyl glycosides used in the composition of the present invention are those represented by following formula (I),



wherein R_1 is a linear or branched alkyl, alkenyl, or alkylphenyl group having 8-18 carbon atoms, wherein R_2 is an alkylene group having 2-4 carbon atoms, G is a reduced saccharide residue having 5-6 carbon atoms, x is a mean value of 0-5, and y is a mean value of 1-10.

Among the defined mean value of x, 0-5, especially preferable range is 0-2. This value affects the water-solubility and crystalline property of the alkyl glycosides. Higher the value x, are the alkyl glycosides more soluble in water and less crystalline. When the value y is larger than 1, i.e., when alkyl glycosides contain those having di- or higher saccharides as the hydrophillic groups, 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 1-10, a preferable range is about 1.1-3.0, with an especially preferable range being 1.2-1.42. The value y is determined by the proton NMR method. R_1 in formula (I) is a C_8 - $_{18}$ linear or branched alkyl, alkenyl, or alkylphenyl group. From the aspect of water-solubility and foaming capability, a preferable carbon number is C_{10} - $_{14}$. R_2 in formula (I) is a C_2 - $_{4}$ alkylene group. From the aspect of water-solubility and the like, a preferable carbon number is C_2 - $_{3}$. The structure of G in formula (I) depends upon whether it represents 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, gintoninose, 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.

The composition of the present invention contains 3-60% by weight of component (a).

Component (b) of the present invention is higher alcohols having a linear or branched alkyl group, of which

the average carbon atom content is 8-14. Higher alcohols having the average carbon atom content outside this range are not preferable, since they cannot sufficiently exhibit the intended effects of the present invention in conjunction of component (c).

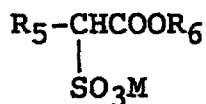
A preferable amount of component (b) in the composition is 0.001-0.5% by weight, with the especially preferable range being 0.005-0.1% by weight. The amount of component (b) exceeding 0.5% by weight does not bring about the intended effects. In some cases, the odor of the resulting composition is so impaired that its commercial value is lost.

Component (c) is selected from one or more of water-soluble organic or inorganic salts mentioned above. Among them, especially preferable salts are sodium and potassium sulfates, chlorides, borates, phosphates, p-toluensulfonates, benzoates, citrates, and edates.

Component (c) is incorporated into the composition of the present invention in an amount of 0.001-8% by weight. A preferable amount is 0.01-5% by weight, with the most preferable range being 0.1-4% by weight. The amount exceeding 8% by weight not only impairs the intended effects, but also adversely affects the liquid stability of the composition.

Furthermore, it is desirable that the ratio by weight of component (b)/(c) be in a range of 1/5,000-50/1, and preferably of 1/3,000-30/1.

Besides the above essential components, commonly known surfactant detergents can optionally be incorporated into the composition of the present invention in order to promote its detergency and foaming capability. Such surfactants may include, for example, nonionic surfactants such as polyoxyethylenealkylethers (EO=4-20, alkyl group: C₇₋₁₈, linear or branched), C₃₋₂₂ higher fatty acid mono- or di-alkanolamides (alkanol group: C₂₋₃), tert-alkylamine oxides (alkyl group: C₈₋₁₈, linear or branched), and the like; anionic surfactants such as C₈₋₂₀ α-olefin sulfonates (Na, K, Mg, triethanolamine (TEA), NH₄ salts), polyoxyethylenealkyl sulfates (EO=2-8; alkyl group: C₈₋₁₈, linear or branched; Na, K, Mg, TEA, NH₄ salts), salts of α-sulfo-fatty acid ester represented by the formula,



(wherein R₅: C₈₋₁₈, R₆: C₁₋₄, M: alkali metal), N-acylglutamates (acyl group: C₈₋₁₈; Na, K, TEA salts), monoalkyl phosphates (alkyl group: C₈₋₁₈; Na, K, TEA, arginine salts), linear alkylbenzenesulfonates (alkyl group: C₁₀₋₁₈; Na, K, Mg salts), and the like; and amphoteric surfactants such as alkyl betaine, alkyl sulfobetaine, alkyl hydroxysulfobetaine, and the like.

In detergent compositions of the present invention, component (a), alkyl glycoside, is used as a base component together with 1-20% by weight of the above-mentioned anionic or amphoteric surfactants and 1-10% by weight of nonionic

surfactants other than alkyl glycosides, remarkably improved detergency can be exhibited without impairing their foaming capability.

The pH range of a raw liquid of the detergent composition of the present invention is preferably 6-8, and especially preferably 6.5-7.5.

In addition to the above components, other optional components can be formulated to the composition of the present invention to the extent that its stability, detergency, and foaming capability are not adversely affected. Such optional components include lower aliphatic alcohols, e.g. ethanol; solubilizers, e.g. urea; viscosity adjusting agents, e.g. clay minerals, water-soluble polymers; water-insoluble abrasives, e.g. calcite, silica, calcium phosphate, zeolite, polyethylene, nylon, polystyrene; moisturizing agents, e.g. glycerol, sorbitol; feeling improvers, e.g. cationized cellulose; enzyme; perfumes; pigments; antiseptics; antifungal agents; and the like.

The detergent composition of the present invention thus prepared has excellent foaming capability, is mild to the skin and the hair, and imparts a favorable feeling to the hands during and after use. The foam is easily rinsed off and after washing water is easily drained from the tableware and the like. Thus, it is a neutral detergent composition having a high practical value.

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

The detergent compositions having the formulations shown in Table 1 were prepared. Their foaming capability, rinsability, feeling to the hands during and after use, and drainability were evaluated. The results are shown in Table 1.

The feeling to the hands during and after use was tested using composition A (Composition 11 in Table 1) as a standard. Evaluation was made by comparing the feelings given to the hands when composition A and composition B (Compositions 1-10 in Table 1) were used.

<Test Methods and Evaluation Standards>

(1) Foaming capability

Foaming capability was measured on samples prepared by adding a commercially available butter in an amount of 0.1%, as a dirt component, to 0.5% detergent composition solutions. Forty milliliters of the solution of the detergent composition to which butter was added was charged into a glass cylinder and subjected to a rotational stirring for 10 minutes. The height of the foam produced was measured after termination of the stirring.

(2) Rinsability

Three liters of a sample solution with 0.25% detergent

concentration was charged into a container (diameter: 30 cm, height: 12 cm) and rotationally stirred for 10 minutes, after which the liquid was discharged through an opening at the bottom of the container, leaving the foam in the container. Three liters of tap water was then charged to the container, and the ten minutes stirring and discharge of liquid were repeated. This procedure was repeated until no foam was observed in the container. The number of times of tap water charge and discharge required for the foam to diminish was taken as the standard of rinsability.

(3) Feeling to the hands during and after use

Two 10% detergent composition solutions, A and B, at 40°C were charged into 2 l beakers. Feeling of solutions A and B to the hands was sensually evaluated according to the following standard.

(i) Feeling of the solution

Hands were dipped into solutions A and B, i.e., one hand to solution A and the other to solution B. After 10 minutes, the feeling to the hands was compared according to the following standard.

B is less slippery than A	+2
B is slightly less slippery than A	+1
Cannot tell which is more slippery	0
B is slightly more slippery than A	-1
B is more slippery than A	-2

(ii) Feeling after use

After the above test, the hands were thoroughly washed

with water and wiped out with a dry towel. Then feeling of the hands were compared according to the following standard.

B is less sticky than A	+2
B is slightly less sticky than A	+1
Cannot tell which is more sticky	0
B is slightly more sticky than A	-1
B is more sticky than A	-2

The above tests were carried out by 10 panelists. The total scores gained by solution B was taken as the feeling of the solution B.

(4) Drainability

Three liters of a 0.15 % detergent composition solution (in 3.5°DH at 25°C) was charged into a container (diameter: 30 cm, depth: 12 cm). A piece of porcelain dish having a 25 cm diameter was dipped into the solution for 3 minutes. The dish was taken out from the solution and dried at 25°C. This procedure was repeated 3 times. After this, the dish was again dipped into the solution, following which it was taken out from the solution and rinsed for 30 seconds in a water stream and dried. The number of water spots remaining on the surface of the dish was counted to evaluate the drainability according to the following standard.

Evaluation Standard:

- A: No water spots are present
- B: Less than 20 water spots are present
- C: 20 or more of water spots are present

TABLE 1

Component	Example Compositions						Comparative Compositions				
	1	2	3	4	5	6	7	8	9	10	11
<u>Component (a)</u>											
Alkyl glycoside: in formula (I), x=0, G=glucose residue,											
R ₁ : C ₉₋₁₁ alkyl, y=1.2	23	23	-	-	23	-	23	23	-	-	23
R ₁ : C ₉₋₁₁ alkyl, y=1.42	-	-	23	23	-	23	-	-	23	23	-
<u>Component (b)</u>											
	Average C										
n-Hexyl alcohol	6.0	-	-	-	-	-	0.1	-	-	-	-
n-Octyl alcohol	8.0	0.1	-	-	-	0.05	-	-	0.7	-	-
n-Dodecyl alcohol	12.0	-	0.1	-	-	0.05	-	-	-	-	-
Dobanol 23 ¹⁾	12.0	-	-	0.1	-	-	0.1	-	-	0.1	0.1
Alfol ²⁾	12.9	-	-	-	0.1	-	-	-	-	-	-
Dobanol 45 ³⁾	14.3	-	-	-	-	-	-	0.1	-	-	-
<u>Component (c)</u>											
Na ₂ SO ₄	1.0	-	-	-	-	0.5	1.0	-	-	-	-
KCl	-	1.0	-	-	-	-	-	-	1.0	-	-
NaH ₂ PO ₄	-	-	-	-	-	0.1	-	-	-	-	-
Sodium malate	-	-	1.0	-	-	-	-	1.0	-	-	-

TABLE 1 (Continued)

Component	Example Compositions						Comparative Compositions				
	1	2	3	4	5	6	7	8	9	10	11
Sodium lactate	-	-	-	1.0	-	-	-	-	-	-	-
Sodium p-toluene sulfonic acid	-	-	-	-	0.5	0.4	-	-	-	1.0	-
Disodium edate	-	-	-	-	0.5	-	-	-	-	-	-
Water	Balance	Balance	Balance	Balance	Balance	Balance	Balance	Balance	Balance	Balance	Balance
pH 4) (raw liquid)	7.0	6.5	7.3	6.2	7.9	7.1	7.0	7.5	6.6	6.8	7.0
Evaluation											
Foaming capability (mm)	90	89	92	91	92	92	85	83	82	84	85
Rinsability (times)	5	5	5	5	5	5	7	7	8	8	7
Felling to the hands											
During use	+8	+8	+9	+8	+8	+8	+2.5	+2.1	+1.6	+0.5	±0
After use	+8	+8	+9	+8	+8	+8	+2.5	+2.0	+1.6	+0.6	±0
Drainability	A	A	A	A	A	A	B	C	C	C	C

1) Synthetic alcohol, product of Shell Co., alkyl group composition: C₁₂/C₁₃/C₁₄=36/63/1, liner/branched=82/18

2) Synthetic alcohol, product of Conoco Co., alkyl group composition: C₁₂/C₁₄/C₁₆=54/45/1, liner/branched=97/3

3) Synthetic alcohol, product of Shell Co., alkyl group composition: C₁₂/C₁₃/C₁₄/C₁₅=1/1/62/36, liner/branched=79/21

4) pH was appropriately adjusted with H₂SO₄ or NaOH.

Example 2**Light duty liquid detergent composition for laundry**

	% by weight
Alkyl glycoside 1)	20
Sodium polyoxyethylene($\bar{p}$ =2.5)- alkyl(C ₁₂₋₁₃)ether sulfate	10
Softanol 70 2)	5
Dobanol 23 3)	0.1
NaBO ₂	0.1
Sodium citrate	3
Ethanol	4
Perfume, enzyme	Small amount
Water	Balance
	100

(The above mixture was adjusted to pH 8.0)

1) In formula (I), $x=1$, $y=1.35$, $R_1=C_{10-12}$ alkyl, $R_2=C_2$ alkylene, G=glucose residue

2) Trademark, a nonionic surfactant produced by Nippon Shokubai Kagakukogyo Co., Ltd.

3) Trademark, synthetic alcohol produced by Shell Co., Ltd.

Example 3**Dishwashing detergent composition**

	% by weight
Alkyl glycoside 1)	20

Sodium polyoxyethylene($\bar{p}=4$)- laurylether sulfate	5
Perm oil fatty acid diethanolamide	2
Decyl alcohol	0.05
Tetradecyldimethylamine oxide	2
Sodium sulfate	2.5
Ethanol	3
Perfume, enzyme	Small amount
Water	Balance
	100

(The above mixture was adjusted to pH 7.0)

- 1) In formula (I), $x=0$, $y=1.3$, $R_1=C_{9-11}$ alkyl,
G=glucose residue

Example 4

Bath cleanser

	% by weight
Alkyl glycoside 1)	4
Sodium linear alkyl(C_{12-13})- benzenesulfonate	2
Emulgen 120 2)	1
Alfol 1214 3)	0.5
Sodium benzoate	1.0
Dipotassium edate	0.1
Perfume, enzyme	Small amount
Water	Balance
	100

(The above mixture was adjusted to pH 6.3)

- 1) In formula (I), $x=0$, $y=1.4$, $R_1=C_{8-12}$ alkyl,
G=glucose residue
- 2) Trademark, a nonionic surfactant produced by Kao Corp.
- 3) Trademark, synthetic alcohol produced by Conoco Co.

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.



THIS SHEET HAS BEEN
REPLACED

WHAT IS CLAIMED IS:

1. A neutral liquid detergent composition comprising:
 - (a) 3-60% by weight of an alkyl glycoside,
 - (b) 0.001-0.5% by weight of a higher alcohol having 8-14 carbon atom, and
 - (c) 0.001-8% by weight of one or more water-soluble organic or inorganic salts selected from the group consisting of sulfates, chlorides, borates, phosphates, p-toluensulfonates, m-xylenesulfonates, benzoates, malates, succinates, tartarates, citrates, lactates, and edates of sodium and potassium.
2. A neutral liquid detergent composition according to Claim 1, wherein said alkyl glycoside is a compound represented by formula (I),



wherein R_1 is a linear or branched alkyl, alkenyl, or alkylphenyl group having 8-18 carbon atoms, wherein R_2 is an alkylene group having 2-4 carbon atoms, G is a reduced saccharide residue having 5-6 carbon atoms, x is a mean value of 0-5, and y is a mean value of 1-10.

3. A neutral liquid detergent composition according to Claim 1, further comprising 1-20% by weight of one or more surfactants selected from anionic surfactants and amphoteric surfactants, and 1-10% by weight of one or more nonionic surfactants other than said alkyl glycoside.

This Sheet Has Been Replaced

