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— 国際調査報告 (条約第 21 条(3))

(54) Title: LIQUID DETERGENT COMPOSITION

(54) 発明の名称: 液体洗淨剤組成物

(57) Abstract: The present invention is a liquid detergent composition containing: (A) a nonionic surfactant; (B) a specific cationic surfactant; (D) and hydrogen peroxide all within specific ranges, and also containing water. As (A), a nonionic surfactant (A1) represented by the general formula (A1) below constitutes 0.5 to 10mass% of the composition, the mass ratio of fatty acids and salts thereof and other anionic surfactants (c1) with respect to component (B), i.e. (c1)/(B) falls within the range of 0 to 1; and the pH at 20°C as described in JIS K3362: 1998 Paragraph 8.3 falls within the range of 3.0 to 7.0. R-O-(C₂H₄O)_x-H(A1) [In the formula, R is a straight-chain alkyl group having 12 carbon atoms, and the carbon atom of the R which bonds to the oxygen atom of R-O- is a primary carbon atom. x is the number of moles of ethylene oxy groups added, and is an integer from 2 to 5.]

(57) 要約: 本発明は、非イオン界面活性剤 (A)、特定の陽イオン界面活性剤 (B)、過酸化水素 (D) をそれぞれ特定範囲で含有し、水を含む液体洗淨剤組成物であって、(A)として下記一般式 (A1) で示される非イオン性化合物 (A1) を組成物中に 0.5 ~ 10 質量% 含有し、(B) 成分に対する、脂肪酸及びその塩以外の陰イオン界面活性剤 (c1) の割合が (c1)/(B) の質量比で 0 ~ 1 であり、JIS K3362: 1998 の 8.3 項に記載の 20°C における pH が 3.0 ~ 7.0 である、液体洗淨剤組成物である。R-O-(C₂H₄O)_x-H (A1) [式中、R は炭素数 12 の直鎖アルキル基であり、R-O- の酸素原子に結合する R の炭素原子が第 1 級炭素原子である。x はエチレンオキシ基の付加モル数であって 2 ~ 5 の整数である。]

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DESCRIPTION

Title of the Invention

LIQUID DETERGENT COMPOSITION

Field of the invention

[0001]

The present invention relates to a liquid detergent composition for textile products, and moreover for clothing.

[0002]

Background of the invention

The trend toward nuclear families expands the dual-income generation. An increasing number of households thus do the laundry as a whole at night or on a holiday and dry washed items in a room. In addition, the recent growing awareness of energy conservation has provided a momentum to develop a washing and drying machine with a reduced energy loss. There has been thus proposed a new drying technique at low temperature using the dehumidification function of air conditioners. However, drying in a room or at low temperature is prone to cause wet-and-dirty-dustcloth-like-malodor.

[0003]

There is also a change in attitudes to laundry. More specifically, there has been an increasing tendency to use the presence of an odor as a criterion for doing the laundry even without dirt or a stain. The presence of a cigarette odor or a body odor after exercise on a textile product is a traditional factor enough to evoke a sense of necessity to do the laundry. Recently, even the presence or generation of a trace odor has become a factor to evoke the sense. The generation of an odor on a textile product due to a prolonged damp-dry (half-dry)

state during drying after washing is thus an undesirable condition. The public consciousness of an odor due to damp-dry is further increased with the spreading information about the association of bacteria growth with an odor due to damp-dry. As used herein, the "damp-dry" refers to a moist state of a textile product, moreover with a small amount of moisture. The "damp-dry" specifically includes a moist state when a textile product is washed and hung in humid conditions without a drier until the product dries and a moist state when a dry textile product is used to wipe a wet hand or body, or got rained or wet from sweating.

[0004]

Various substances have been pointed out and known to be responsible for an odor due to damp-dry. Specific examples of the substance include decomposition products from sebum steins such as metabolites formed through bacteria growth. Hanihara and Sonoda reported that an odor due to damp-dry (odor caused when dried in a room) is a composite odor containing a "musty odor-like smell" of medium-chain aldehydes, medium-chain alcohols, and ketones, a "sour smell" of short-chain fatty acids and medium-chain fatty acids, a "fishy smell" of nitrogen compounds, and a smell of sulfur compounds, in which medium-chain fatty acids make a large contribution to the odor, in "Heyaboshi shuu wo yokusei suru senzai nituite (detergents for controlling an odor caused when dried in a room)", Koryo (fragrance), 2004, September, No.223, p.109-116. Takeuchi et al. reported that an odor due to damp-dry on clothing contains a strong smell of 4-methyl-3-hexenoic acid, which is one of the medium-chain fatty acids, in "Trui no namagawaki shuu no kaiseki (analysis of the odor due to damp-dry on clothing)", Japan Society for Bioscience, Biotechnology, and Agrochemistry 2010 annual meeting Abstracts, p.149. JP-A-2009-244094 proposes

the use of a medium chain fatty acid having a specific structure as an indicator for an odor due to damp-dry.

[0005]

The odor due to damp-dry according to the present invention includes an odor caused when a textile product is dried in a room, an odor caused when a textile product is left as is after dehydration, and an odor caused when a dry textile product is again wetted with sweat or rain. Odors caused when dried in a room and when left as is can be eliminated or reduced by fully drying. However, the recurrent odor caused when a dry textile product is again wetted is hard to be eliminated, and once a textile product generates the odor, easy to recur when the product is used, although the odor can be temporally eliminated by washing and fully drying. The recurrent odor is reminiscent of an odor of cleaning equipment for floor and table such as well-used rag and mop. Once generated, the easy recurrent odor can generate even when dried outside a room and is hard to be eliminated.

[0006]

The recurrent odor is characterized by that it generates a little or no on a textile product washed and fully dried, but generates significantly when the product becomes damp. The recurrent odor due to damp-dry also easily generates during storage for a long time in a closet or the like. Once generates the recurrent odor, textile products often contacting with a human skin and often used with a short cycle of washing and using, including underwear, handkerchiefs, and towels, often recur the recurrent odor while in use, and also have a tendency of developing the stronger odor with increasing the number of washing.

[0007]

For eliminating an odor or the like from a textile product, there have been conventionally known methods including masking with a perfume component, and eliminating responsible bacteria for the odor by killing or controlling the bacteria with a bactericide or an antibacterial agent. For example, JP-A2010-31285 and JP-A2007-314693 describe a method of masking with a treating agent for fabric, containing an alicyclic ketone compound as a perfume component or a stabilizer for a perfume component. For eliminating an odor by killing or controlling responsible bacteria for the odor with a bactericide or an antibacterial agent, a treatment with a diketone compound, a cationic organic antibacterial agent, or a treating agent containing a bactericide such as triclosan and dichlorosan has been known. For example, JP-A2009-263812 discloses a method for controlling an odor due to damp-dry by using a bactericide. In addition, JP-A2008-173441 discloses a production inhibitor of a volatile sulfur compound, containing a specific perfume component and acting through enzyme suppression by the perfume component.

[0008]

There are also known liquid bleaching agents, containing hydrogen peroxide, a cationic surfactant, and a nonionic surfactant. JP-A09-59675 discloses a liquid bleaching composition containing hydrogen peroxide, a nonionic surfactant having an HLB of 5 to 12, an anionic or cationic surfactant, and a perfume. JP-A09-188895 and JP-A09-217090 also disclose a liquid bleaching composition containing a nonionic surfactant and a cationic surfactant. JP-A2007-169530 and JP-A2007-177145 discloses a liquid detergent composition, containing hydrogen peroxide, a boron compound, and a polyhydric alcohol, in which the boron compound and the polyhydric alcohol act to bring a pH of an aqueous

dilution of the composition to alkalinity, when diluted in water in use, thereby enhancing detergency.

[0009]

JP-A2006-169515 discloses a liquid detergent composition, containing hydrogen peroxide, a boron compound, a hydroxy compound, a bleach activator, a surfactant, and water.

JP-A2007-106903 discloses a liquid bleaching detergent composition, containing hydrogen peroxide, a boron compound, a hydroxy compound, a bleach activator, a nonionic surfactant, and a quaternary ammonium salt. JP-A2010-059296 discloses a liquid detergent composition, containing hydrogen peroxide, an acid, and a surfactant. JP-A2011-063784 discloses a liquid detergent composition, containing a nonionic surfactant, an anionic surfactant, and a water-miscible organic solvent.

JP-A2010-265445 discloses a liquid detergent composition, containing a nonionic surfactant, an anionic surfactant, a cationic surfactant, and a water-miscible organic solvent.

[0010]

JP-A2011-116932, published on 2011 June 18, discloses a detergent composition for textile products, containing a nonionic surfactant and a cationic surfactant.

JP-A2011-168730, published on 2011 September 1, discloses a surfactant composition containing a nonionic surfactant and a nonionic compound. JP-A2011-168731, published on 2011 September 1, discloses a liquid detergent composition, containing a nonionic surfactant, a hydrophobic organic solvent, and water. JP-A2011-168732, published on 2011 September 1, discloses a liquid detergent composition, containing a nonionic surfactant, a nonionic compound, a water-soluble salt, and water. JP-A2011-168733, published on 2011 September 1, discloses a liquid detergent composition, containing a nonionic surfactant, a cationic compound, a nonionic compound, and water.

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JP-A2011-168734, published on 2011 September 1, discloses a liquid detergent composition, containing a nonionic surfactant, hydrogen peroxide, a hydrocarbon, an organic acid, and water. JP-A2011-246585, published on 2011 December 8, discloses a liquid detergent composition, containing a surfactant, a hydrotrope agent, hydrogen peroxide, a water-miscible solvent, and water.

[0011]

Summary of the invention

In one aspect, the present invention relates to a liquid detergent composition, containing:

(A) a nonionic surfactant [hereinafter, referred to as component (A)] in an amount of 15 to 70% by mass,

(B) a cationic surfactant represented by the formula (B1) [hereinafter, referred to as component (B)] in an amount of 0.3 to 5% by mass,

(D) hydrogen peroxide [hereinafter, referred to as component (D)] in an amount of 0.3 to 10% by mass, and water,

wherein the component (A) contains, as at least part, (A1) a nonionic compound represented by the formula (A1) in an amount of 0.5 to 10% by mass of the composition,

a mass ratio of (c1) an anionic surfactant other than fatty acid or a salt thereof to the component (B), (c1)/(B), is 0 to 1, and

the composition has a pH of 3.0 to 7.0 at 20°C, as measured in accordance with JIS K3362:1998 Section 8.3.

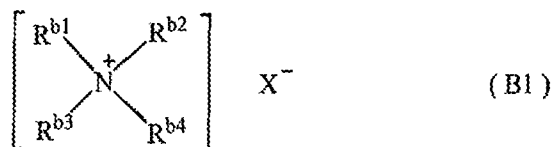


wherein, R represents a linear alkyl group having 12 carbon atoms, and has a primary carbon atom at which R bonds to an oxygen

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atom of R-O-; and x represents a mole number of ethyleneoxy groups added and is an integer ranging from 2 to 5:

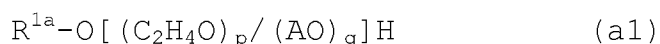
[0012]



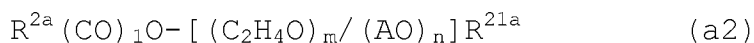
[0013]

wherein, R^{b1} represents a chain hydrocarbon group having 12 to 18 carbon atoms, and may have $-(A'O)_s-$ therein, wherein $A'O$ represents an ethyleneoxy group or propyleneoxy group, and s represents an average mole number of $A'O$, ranging from 0 to 10; R^{b2} , R^{b3} , and R^{b4} each independently represent a methyl group, an ethyl group, a benzyl group, or a hydroxyalkyl group having 1 to 3 carbon atoms; and X^- represents $CH_3SO_4^-$ or $CH_3CH_2SO_4^-$, or a halogen ion, and

wherein the component (A) comprises at least one nonionic surfactant selected from those represented by the formulae (a1) and/or (a2) in an amount of 10 to 60% by mass:



wherein, R^{1a} represents an alkyl or alkenyl group having 8 to 22 carbon atoms; AO represents an alkyleneoxy group having 3 to 5 carbon atoms; p represents an average mole number of added C_2H_4O groups, ranging from 8 to 40; q represents an average mole number of added AO groups, ranging from 0 to 5; and "/" represents that C_2H_4O groups and AO groups may be arranged in either a random addition or a block addition:



wherein, R^{2a} represents an alkyl or alkenyl group having 8 to 22 carbon atoms, R^{21a} represents an alkyl group having 1 to 3 carbon atoms; 1 represents the number 0 or 1; AO represents an alkyleneoxy group having 3 to 5 carbon atoms; m represents an average mole number of added C_2H_4O groups, ranging from 5 to 30; n represents an average mole number of added AO groups, ranging from 0 to 5; and "/" represents that C_2H_4O groups and AO groups may be arranged in either a random addition or a block addition.

[0014]

In another aspect, the present invention relates to a method for washing a textile product with an aqueous solution of the liquid detergent composition of the present invention.

[0015]

In a further aspect, the present invention relates to a method for cleaning a textile product, containing a step of applying a liquid detergent composition to the textile product and making lather with the detergent composition, wherein the detergent composition contains:

(A) a nonionic surfactant [hereinafter, referred to as component (A)] in an amount of 15 to 70% by mass,

(B) a cationic surfactant represented by the formula (B1) [hereinafter, referred to as component (B)] in an amount of 0.3 to 5% by mass,

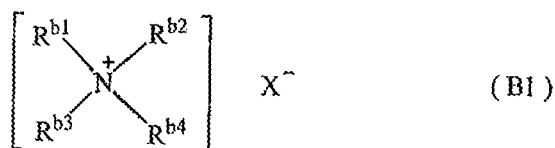
(D) hydrogen peroxide [hereinafter, referred to as component (D)] in an amount of 0.3 to 10% by mass, and water, wherein the component (A) contains (A1) a nonionic compound represented by the formula (A1) in an amount of 0.5 to 10% by mass of the composition.

a mass ratio of (c1) an anionic surfactant other than fatty acid or a salt thereof to the component (B), (c1)/(B), is 0 to 1, and

the composition has a pH of 3.0 to 7.0 at 20°C, as measured in accordance with JIS K3362:1998 Section 8.3:



wherein, R represents a linear alkyl group having 12 carbon atoms, and has a primary carbon atom at which R bonds to an oxygen atom of R-O-; and x represents an added mole number of ethyleneoxy group and is an integer ranging from 2 to 5:
[0016]

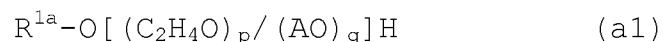


[0017]

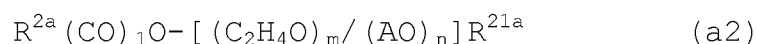
wherein, R^{b1} represents a chain hydrocarbon group having 12 to 18 carbon atoms, and may have $-(\text{A}'\text{O})_s-$ therein, wherein $\text{A}'\text{O}$ represents an ethyleneoxy group or propyleneoxy group, and s represents an average mole number of $\text{A}'\text{O}$ added, ranging from 0 to 10; R^{b2} , R^{b3} , and R^{b4} each independently represent a methyl group, an ethyl group, a benzyl group, or a hydroxyalkyl group having 1 to 3 carbon atoms; and X^- represents CH_3SO_4^- or $\text{CH}_3\text{CH}_2\text{SO}_4^-$, or a halogen ion, and

wherein the component (A) of the liquid detergent composition comprises at least one non-ionic surfactant

selected from those represented by the formulae (a1) and/or (a2) in an amount of 10 to 60% by mass:



wherein, R^{1a} represents an alkyl or alkenyl group having 8 to 22 carbon atoms; AO represents an alkyleneoxy group having 3 to 5 carbon atoms; p represents an average mole number of added C_2H_4O groups, ranging from 8 to 40; q represents an average mole number of added AO groups, ranging from 0 to 5; and "/" represents that C_2H_4O groups and AO groups may be arranged in either a random addition or a block addition;



wherein, R^{2a} represents an alkyl or alkenyl group having 8 to 22 carbon atoms; R^{21a} represents an alkyl group having 1 to 3 carbon atoms; 1 represents the number 0 or 1; AO represents an alkyleneoxy group having 3 to 5 carbon atoms; m represents an average mole number of added C_2H_4O groups, ranging from 5 to 30; n represents an average mole number of added AO groups, ranging from 0 to 5; and "/" represents that C_2H_4O groups and AO groups may be arranged in either a random addition or a block addition.

In a still further aspect, the present invention relates to use of the liquid detergent composition for cleaning a textile product.

[0018]

Detailed description of the invention

The present invention provides a liquid detergent composition that suppresses generation of an odor due to damp-dry on a textile product, and then a liquid detergent composition that has a high control effect against wet-and-dirty-dustcloth-like malodor including a recurrent odor when it gets wet with sweat etc, which is more difficult to be eliminated than other odors due to damp-dry.

[0019]

The present invention also provides a liquid detergent composition that enables to visually judge the presence of bacteria by lathering without deteriorating the detergency, and a method for cleaning a textile product with the visual judgment.

[0020]

Considering these issues, the present inventors have studied odors due to damp-dry from the viewpoints of a causative substance, causative bacteria, and a mechanism of generation, in consideration with the way of cleaning and using a textile product, and focused on not only an odor due to damp-dry caused when a textile product is left in a damp state for a long time until it dries, and also a recurrent odor due to damp-dry generating again when a textile product washed and fully dried becomes damp. The present inventors have surprisingly found that a recurrent odor due to damp-dry on a textile product is generated by microorganisms, especially bacteria, that the bacteria can survive or grow on a textile product even after the textile product has been washed and dried to fully eliminate the wet-and-dirty-dustcloth-like-malodor,

and that a trace amount of the odor due to damp-dry is trapped in fibers through drying and released when a textile product becomes damp, or damp-dry, while unperceived after dried, which odor is easily perceived due to its low threshold. The present inventors also have found that a principal smell of the recurrent odor is derived from medium branched-chain fatty acids mainly composed of 4-methyl-3-hexenoic acid described above (hereinafter, also referred to as 4M3H). The present inventors have identified the causative bacteria generating 4M3H, which is a Moraxellbacteria (Moraxella sp.), and found that the bacteria is tolerant to desiccation. It is evident by considering such facts that a good, conventional elimination of odors after washing and drying does not directly mean that a recurrent odor due to damp-dry can also be effectively suppressed. In order to correctly evaluate an effect on the recurrent odor due to damp-dry, a liquid detergent composition should be considered and evaluated from a new standpoint with the awareness of the cause of these issues.

[0021]

The present inventors have developed a liquid detergent composition being effective to not only a conventional deodorant of an odor due to damp-dry, but also deodorant of a recurrent odor due to damp-dry, especially an odor of 4-methyl-3-hexenoic acid.

[0022]

The liquid detergent composition of the present invention has a deodorant effect of odors due to damp-dry generating on a textile product, including a recurrent odor generating when a dry textile produce again becomes damp, and especially a 4M3H odor.

[0023]

The liquid detergent composition of the present invention can make conspicuous lather in the presence of bacteria in a textile product when applied to the textile product, and thus the application of the composition can be conducted with confirming the presence of the bacteria.

[0024]

Below, the liquid detergent composition of the present invention will be described in detail.

[0025]

<Component (A)>

The liquid detergent composition of the present invention contains the nonionic surfactant component (A), which is a main surfactant.

[0026]

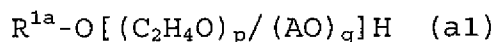
Examples of the nonionic surfactant component (A) include those having a chain hydrocarbon group having 8 to 22 carbon atoms and a hydrophilic group such as an ethyleneoxy group and hydroxy group in a molecule. Specific examples include polyalkylene alkyl or alkenyl ethers having an ethyleneoxy group as an alkyleneoxy group, polyoxyalkylene alkyl (more preferably having 1 to 3 carbon atoms) ether fatty acid esters having an ethyleneoxy group as an alkyleneoxy group, alkyl polyglycosides, alkyl glycosides, sorbitan fatty acid esters, polyoxyethylene sorbitan fatty acid esters, other polysaccharide surfactants, fatty acid monoglycerides, fatty acid alkanolamides, polyhydroxy fatty acid amides, polyglycerol fatty acid esters, and polyglycerol alkyl ethers.

[0027]

Especially from the viewpoints of detergency and deodorant effect, the component (A) preferably contains at least one nonionic surfactant selected from the following (a1) to (a5), and more preferably a combination of a nonionic surfactant

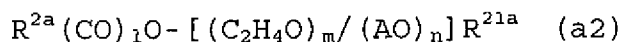
selected from (a1) or (a2) or nonionic surfactants selected from (a1) and (a2) with a nonionic surfactant selected from (a3). From the viewpoints of detergency, deodorant effect, and visual judgment of the presence of bacteria on a textile product through lathering of an applied composition to the textile product (hereinafter, also referred to as visual judgment of lathering), the component (A) preferably contains a combination of nonionic surfactants selected from (a1) and (a3). Lathering property through application is attributable to a surfactant selected from (a1). A surfactant selected from (a1) more preferably has a PO group. Preferred conditions for surfactants (a1), (a2), and (a3) are described consecutively. [0028]

(a1) polyoxyalkylene (alkyl or alkenyl) ether nonionic surfactants [hereinafter, referred to as component (a1)], represented by the formula (a1):



wherein, R^{1a} represents an alkyl or alkenyl group having 8 to 22 carbon atoms; AO represents an alkyleneoxy group having 3 to 5 carbon atoms; p represents an average mole number of added C_2H_4O groups, ranging from 8 to 40; q represents an average mole number of added AO groups, ranging from 0 to 5; and "/" represents that C_2H_4O groups and AO groups may be arranged in either a random addition or a block addition.

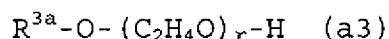
(a2) polyoxyalkylene (short-chain alkyl ether fatty acid ester or aliphatic alkyl ether) nonionic surfactants [hereinafter, referred to as component (a2)], represented by the formula (a2)



wherein, R^{2a} represents an alkyl or alkenyl group having 8 to 22 carbon atoms; R^{21a} represents an alkyl group having 1 to 3 carbon atoms; 1 represents the number 0 or 1; AO represents an

alkyleneoxy group having 3 to 5 carbon atoms; m represents an average of moles of added C_2H_4O groups, ranging from 5 to 30; n represents an average of moles of added AO groups, ranging from 0 to 5; and "/" represents that C_2H_4O groups and AO groups may be arranged in either a random addition or a block addition.

(a3) polyoxyethylene alkyl ether nonionic surfactants [hereinafter, referred to as component (a3)], represented by the formula (a3):



wherein, R^{3a} represents an alkyl or alkenyl group having 8 to 22 carbon atoms, and has a primary and/or secondary carbon atom at which R^{3a} bonds to an oxygen atom of $R^{3a}-O-$; and r represents an average mole number of added C_2H_4O groups, ranging from 2 to less than 8.

(a4) polyglycerol (alkyl or alkenyl) ether nonionic surfactants [hereinafter, referred to as component (a4)]

(a5) polysaccharide surfactants [hereinafter, referred to as component (a5)]

[0029]

A preferred embodiment of the component (a1) will be described below.

[0030]

The component (a1) can be produced from a primary or secondary alcohol having an alkyl or alkenyl group, more preferably an alkyl group having 8 to 22 carbon atoms, more preferably 10 to 18 carbon atoms, and even more preferably 12 to 16 carbon atoms by adding ethylene oxide [hereinafter, also referred to as EO] and an alkylene oxide having 3 to 5 carbon atoms in a random or block addition. In the formula (a1), R^{1a} preferably has a primary and/or secondary carbon atom, more preferably a primary carbon atom at which R^{1a} bonds to an oxygen atom of $R^{1a}-O-$, and is preferably a linear alkyl group.

[0031]

In the formula (a1), p represents an average mole number of added ethyleneoxy groups (C_2H_4O , hereinafter, also referred to as EO groups). From the viewpoints of water-solubility and cleaning performance (detergency), p ranges from 8 to 40, preferably 10 to 40, more preferably 14 to 35, and even more preferably 16 to 30. q represents an average mole number of added AO groups. From the viewpoint of cleaning performance, q ranges from 0 to 5, preferably from 1 to 5, more preferably from 1 to 4, and even more preferably from 1 to 3. In cases of q representing 0, p preferably ranges from 18 to 35, and more preferably ranges 20 to 30.

[0032]

In the formula (a1), each AO group is introduced through addition of an alkylene oxide having 3 to 5 carbon atoms, and preferably has a branched methyl, ethyl or propyl group at a bonding position. Each AO group preferably represents an alkyleneoxy group having 3 or 4 carbon atoms, and AO groups may be same or different. Specific examples of the AO group include a trimethyleneoxy, an oxypropan-1,2-diyl, an oxybutan-1,2-diyl, an oxybutan-1,3-diyl, an oxybutan-2,3-diyl, and an oxytetramethylene groups. An oxypropan-1,2-diyl group (hereinafter, also referred to as a propyleneoxy group or PO group) is more preferred.

[0033]

From the viewpoints of storage stability at low temperature, cleaning performance, and visual judgment of lathering in application, the present invention preferably uses a nonionic surfactant having the formula (a1) in which R^{1a} represents a linear alkyl group having 10 to 18 carbon atoms, and more preferably 12 to 16 carbon atoms, and having a primary carbon atom at which R^{1a} bonds to an oxygen atom of $R^{1a}-O-$; p represents

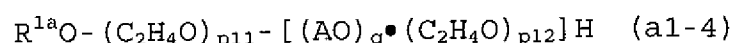
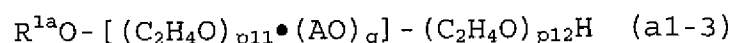
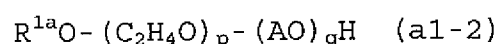
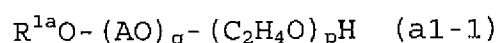
an average mole number of added EO groups, ranging from 14 to 35, and more preferably 16 to 30; an AO group represents a propyleneoxy group; and q represents an average mole number of added AO groups, ranging from 1 to 4, more preferably 1 to 3, and even more preferably 2 to 3 [hereinafter, referred to as nonionic surfactant (a1')]. The nonionic compound represented by the formula (A1) is highly hydrophobic. However, by combining the nonionic surfactant that has many ethyleneoxy groups and is hydrophilic, the nonionic compound represented by the formula (A1) can be stably incorporated in the composition, providing the effects of the present invention. In addition, the presence of a propyleneoxy group in the nonionic surfactant contributes to more stabilization and higher detergency of the liquid detergent composition, and the composition easily makes more conspicuous lather in the presence of bacteria, and yet fast vanishes the lather, and additionally has good penetrability into fibers. For these reasons, the present invention preferably contains the nonionic surfactant (a1') in the component (A).

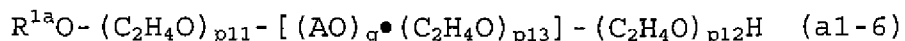
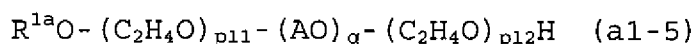
[0034]

In the formula (a1), "/" refers to that the component (a1) of the present invention has EO groups and AO groups arranged in either a random or block addition. AO groups may be arranged in a plurality of separated blocks.

[0035]

Examples of the nonionic surfactant represented by the formula (a1) include those represented by the formulae (a1-1) to (a1-6):





wherein, R^{1a} , p , q , and AO have the same meanings as above; $p11$, $p12$, and $p13$ each represent an average mole number of added C_2H_4O groups, excluding 0, with the proviso that $p = p11 + p12 + p13$ or $p = p11 + p12$; and " $\bullet$ " represents that groups are arranged in a random addition.

[0036]

Nonionic surfactants represented by the formulae (a1-1) to (a1-6) can be produced from $R^{1a}OH$ through reactions with alkylene oxides in consideration of a reactants' proportions and an order of the reaction. In the formulae (a1-1) to (a1-6), an average mole number of each alkyleneoxy group added may represent the mole number of each alkylene oxide used per mole of $R^{1a}OH$ in a reaction, or an average mole number of each alkyleneoxy groups in a obtained compound. $p11$ and $p12$ are, independently of each other, preferably 1 to 20. $p11$ more preferably represents 3 to 20, and even more preferably 4 to 15. $p12$ more preferably represents 1 to 15, and even more preferably 3 to 15. $p13$ preferably represents the number from 0.1 to 10. Respective ranges of $p11$, $p12$, and $p13$ should depend on ranges or preferred ranges of p and q in the formula (a1). The formulae (a1-1) to (a1-6) are more preferably defined as subordinates to the nonionic surfactant (a1').

[0037]

As described above, R^{1a} in the formula (a1) may be derived from an alcohol produced from natural fats and oils. From the viewpoint of storage stability, preferably used is a nonionic surfactant represented by the formula (a1-2), (a1-4), (a1-5), or (a1-6), more preferably the formula (a1-5), or (a1-6), and even more preferably the formula (a1-5).

[0038]

The component (a1) of the present invention can be produced, for example, by reacting $R^{1a}OH$ with an alkylene oxide having 3 to 5 carbon atoms and ethylene oxide so as to obtain an intended structure represented by one of the formulae (a1-1) to (a1-6). The reaction conditions and an order of addition can be designed as preferred for an intended structure including a random arrangement or block arrangement. Reaction proportions of an alkylene oxide having 3 to 5 carbon atoms and ethylene oxide per mole of $R^{1a}OH$ can be within the ranges of p and q described for the formula (1), or $p = 8$ to 40 and $q = 0$ to 5 , respectively, or as satisfying $p = p_{11} + p_{12} + p_{13}$ or $p = p_{11} + p_{12}$, or within the preferred ranges described above. In other words, an alkylene oxide having 3 to 5 carbon atoms and ethylene oxide can be reacted with the aliphatic alcohol at any proportions within the ranges of p and q, p_{11} , p_{12} , and p_{13} .

[0039]

In general, respective proportions of ethylene oxide and propylene oxide reacted per mole of $R^{1a}OH$ are substantially equal to an average mole number of corresponding alkyleneoxy groups in the respective formulae described above. However, in the present invention, these may be different according to a method of production.

[0040]

The component (a1) of the present invention is more preferably a nonionic surfactant represented by the formula (a1-5) or (a1-6), more preferably the formula (a1-5), and even more preferably the formula (a1-5) in which $p_{11}/(p_{11} + p_{12})$ ranges from 0.2 to 0.8 .

[0041]

The component (a1) having p_{11} , p_{12} , p_{13} , and q within narrower ranges can be produced, under more preferred

production conditions, by a method including the following steps A to D:

step A: adding ethylene oxide to $R^{1a}OH$ at a proportion of 4 moles to 14 moles, and preferably 8 moles to 12 moles (the range of moles may be used as the definition of p_{11} in the formula) per mole of $R^{1a}OH$;

step B: next adding propylene oxide at a proportion of 1 mole to 3 moles, and preferably 2 moles to 3 moles (the range of moles may be used as the definition of q in the formula) and ethylene oxide at a proportion of 0 to 4 moles (the range of moles may be used as the definition of p_{13} in the formula) in a random or block addition, more preferably adding only propylene oxide at a proportion of 2 moles to 3 moles (the range of moles may be used as the definition of n in the formula);

step C: again adding ethylene oxide at a proportion of 4 moles to 14 moles, and preferably 8 moles to 12 moles (the range of moles may be used as the definition of p_{12} in the formula); and

step D: treating a catalyst used in the reaction. Examples of the treatment include neutralization of an alkali catalyst with an acid and filtration of a solid catalyst.

[0042]

Values of p , q , and the like in the component (a1), can be determined by means of NMR, liquid chromatography, or the like. In cases of compounds having a short chain of alkyleneoxy groups such as a product from a reaction between 1 mole of primary linear alcohol having an alkyl group and less than 8 moles of ethylene oxide, gas chromatography may be used. In the present invention, p and q and the like may also be proportions of an alkylene oxide having 3 to 5 carbon atoms and ethylene oxide reacted with 1 mole of $R^{1a}O-H$.

[0043]

A preferred embodiment of the component (a2) will be described below.

[0044]

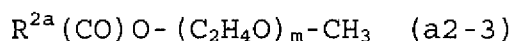
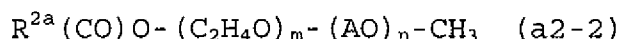
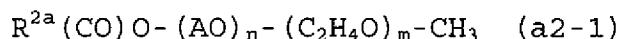
In the formula (a2) of the component (a2), R^{2a} represents an alkyl or alkenyl group having 8 to 22 carbon atoms, preferably 10 to 18 carbon atoms, more preferably 12 to 14 carbon atoms, and even more preferably a linear alkyl group having 12 to 14 carbon atoms. R^{21a} represents an alkyl group having 1 to 3 carbon atoms, and preferably a methyl group. l represents the number 0 or 1, more preferably 1. AO represents an alkyleneoxy group having 3 to 5 carbon atoms. Each AO group is introduced through addition of an alkylene oxide having 3 to 5 carbon atoms, and preferably has a branched methyl, ethyl or propyl group at a bonding position. Each AO group preferably represents an alkyleneoxy group having 3 or 4 carbon atoms, and AO groups may be the same or different from one another. Specific examples of the AO group include a trimethyleneoxy group, an oxypropan-1,2-diyl group, an oxybutan-1,2-diyl group, an oxybutan-1,3-diyl group, an oxybutan-2,3-diyl group, and an oxytetramethylene group. Among these, an oxypropan-1,2-diyl group (hereinafter, also referred to as a propyleneoxy group or PO group) is more preferred as an AO group. m represents an average mole number of added C_2H_4O groups, ranging from 5 to 30, more preferably from 8 to 25, and even more preferably from 10 to 20. n represents an average of moles of added AO groups, ranging from 0 to 5, and more preferably 0 to 3.

[0045]

In cases of n satisfying $0 < n \leq 3$, and more preferably n ranging from 0.5 to 3, the nonionic surfactant represented by the formula (a2) is preferably represented by the formula (a2-1), (a2-2), or (a2-3), and more preferably the formula (a2-2), from the viewpoint of storage stability of the liquid. AO preferably

represents an oxypropan-1,2-diyl group (hereinafter, also referred to as a propyleneoxy group or PO group). m preferably ranges from 5 to 30, more preferably from 8 to 25, and even more preferably from 10 to 20. In cases of the formula (a2-3), m preferably ranges from 10 to 30.

[0046]



[0047]

A preferred embodiment of the component (a3) will be described below.

[0048]

In the formula (a3) of the component (a3), R^{3a} represents an alkyl or alkenyl group having 8 to 22 carbon atoms, preferably 10 to 18 carbon atoms, more preferably 12 to 14 carbon atoms, and even more preferably a linear alkyl group having 12 to 14 carbon atoms. R^{3a} has a primary and/or secondary carbon atom at which R^{3a} bonds to an oxygen atom of $R^{3a}-O-$. In the present invention, some alkyl or alkenyl groups having a secondary carbon atom may also be referred to as a linear group to be distinguished from a branched hydrocarbon group. r represents an average of moles of ethyleneoxy groups added, ranging from 2 or more and less than 8, preferably from 2.5 to 7.5, and more preferably 3 to 7.

[0049]

In a method of producing a nonionic surfactant having a primary carbon atom at which R^{3a} bonds to an oxygen atom, ethylene oxide is added to a primary alcohol. A nonionic surfactant having a secondary carbon atom at which R^{3a} bonds to an oxygen atom can be produced by any known method, for example, by adding ethylene oxide to a secondary alcohol, by reacting 1-olefin or

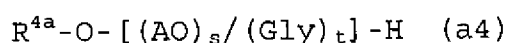
an internal olefin with ethylene oxide, by reacting an olefin with polyethylene glycol, or by introducing a hydroxy group in n-paraffin and adding ethylene oxide.

[0050]

A preferred embodiment of the component (a4) will be described below.

[0051]

The component (a4) preferably contains a compound represented by the formula (a4):



wherein, R^{4a} represents an alkyl or alkenyl group having 8 to 22 carbon atoms; AO represents an ethyleneoxy group or propyleneoxy group; Gly represents a residual group derived from glycerol; s represents an average mole number of added AO groups, ranging from 0 to 5; t represents an average mole number of added Gly groups, ranging from 2 to 10; and "/" represents that AO groups and Gly groups may be arranged in a random or block addition.

[0052]

In the formula (a4), the number of carbon atoms in R^{4a} is preferably 12 to 16, and more preferably 12 or 14. R^{4a} preferably represents a linear alkyl group, and more preferably a linear alkyl group having a primary carbon atom at which R^{4a} bonds to an oxygen atom of $R^{4a}-O-$. s preferably represents 0, and t represents an average mole number and preferably ranges from 2 to 5.

[0053]

The compound represented by the formula (a4) may be a mixture of compounds having s representing 0 and different values of t' representing a mole number of added Gly groups (integer). In this case, the mixture preferably contains at least one, more preferably two or more compounds having t'

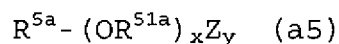
representing 3, 4, or 5. In the mixture, the total proportion of compounds having t' representing 3, 4, or 5 is preferably not less than 40% by mass, more preferably not less than 60% by mass, and even more preferably not less than 80% by mass. From the viewpoint of cleaning performance at a low temperature, the total proportion is preferably not more than 99% by mass, more preferably not more than 90% by mass, and even more preferably not more than 85% by mass. In the mixture, a proportion of compounds having t' representing 1 or 2 is preferably less than 50% by mass, and more preferably less than 35% by mass.

[0054]

A preferred embodiment of the component (a5) will be described below.

[0055]

The component (a5) includes a polysaccharide surfactant represented by the formula (a5):



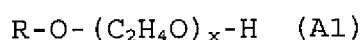
wherein, R^{5a} represents an alkyl or alkenyl group having 8 to 18 carbon atoms; R^{51a} represents an alkylene group having 2 to 4 carbon atoms; Z represents a residual group derived from a reducing sugar having 5 or 6 carbon atoms; x represents an average mole number of added OR^{51a} groups, ranging from 0 to 6; and y represents an average degree of condensation, ranging from 1 to 10.

[0056]

In the formula (a5), the number of carbon atoms in R^{5a} is preferably 12 to 16, and more preferably 12 or 14. R^{5a} preferably represents a linear alkyl group, and more preferably a linear alkyl group having a primary carbon atom at which R^{5a} bonds to an oxygen atom of $R^{5a}-O-$. x preferably represents 0. z preferably represents a glucose residue. y preferably

represents an average degree of condensation ranging from 1.2 to 3. The compound represented by the formula (a5) may be a mixture of compounds having different y's representing an integer of the degree of condensation of Z. In this case, the mixture preferably contains at least one, more preferably two or more compounds having x representing 0 and y' representing 1, 2, or 3. In the mixture, the total proportion of compounds having y' representing 1, 2, or 3 is preferably not less than 60% by mass, and more preferably not less than 80% by mass. [0057]

The liquid detergent composition of the present invention contains a nonionic compound represented by the formula (A1) [hereinafter, also referred to as component (A1)] in the component (A):



wherein, R represents a linear alkyl group having 12 carbon atoms, and has a primary carbon atom at which R bonds to an oxygen atom of R-O-; and x represents a mole number of added ethyleneoxy groups and is an integer ranging from 2 to 5.

[0058]

For attaining the present invention, it is important that, in the formula (A1), R should represent a linear alkyl group having 12 carbon atoms, and has a primary carbon atom at which a hydrocarbon group of an alkyl group bonds to an oxygen atom. The nonionic compound component (A1) can exert together with the cationic surfactant component (B) the deodorant effect of odors due to damp-dry mainly composed of a 4M3H odor on a textile product, which is difficult to be eliminated in a conventional art, and further suppressing generation of a recurrent odor due to damp-dry. The component (A1) is preferably represented by the formula (A1) in which x represents 3, 4, or 5, because compounds having 3, 4, and 5 EO groups have a better deodorant

effect of odors due to damp-dry, especially a recurrent odor due to damp-dry. In the component (A1), a total proportion of compounds represented by the formula (A1) in which x represents 3, 4, or 5 is preferably 70 to 100% by mass, and more preferably 80 to 100% by mass.

[0059]

A compound having a single mole number of ethyleneoxy group may be blended as the component (A1). A mixture of polyoxyethylene alkyl ethers having different mole numbers of ethyleneoxy group, produced or being available commercially, may be blended as a nonionic surfactant. From the economical viewpoint in production, the component (A1) may be derived from the component (a1) or (a3). In cases of being derived from the component (a3), the component (a3) has the formula (a3) in which R^{3a} represents a linear alkyl group having 12 carbon atoms and has a primary carbon atom at which R^{3a} bonds to an oxygen atom of $R^{3a}-O-$. In this case, the composition of the present invention preferably contains a nonionic surfactant represented by the formula (a3), for example, produced by adding ethylene oxide in an average amount of not less than 2 moles to less than 8 moles to lauryl alcohol in the presence of an alkali or acid catalyst, as a nonionic surfactant containing the component (A1). In this case, the component (a3) is a mixed product containing polyoxyethylene lauryl ethers having different moles of ethyleneoxy groups including the component (A1). A content of a compound corresponding to the component (A1) in the component (a3) should be confirmed, and the component (a3) should be blended in an adjusted amount according to contents of the component (A) and (A1) in the composition.

[0060]

Depending on methods of productions, in some methods of production, the component (A1) may be contained in a small

amount in the component (a1) in which q represents 0 and R^{1a} is derived from lauryl alcohol (representing a lauryl group). Therefore, a content of a compound corresponding to the component (A1) in the component (a1) should be confirmed in consideration of a structure and a method of production of the component (a1), and the component (a1) should be blended in an adjusted amount according to contents of the component (A) and (A1) in the composition. In cases of the component (a1) in which q represents not less than 1 and further the AO contains a propyleneoxy group, the composition contains almost no component (A1) derived from the component (a1).

[0061]

The component (A1) may be the component (a3). For example, in the case of the component (a3) containing compounds in which R^{3a} represents a linear alkyl group having 12 carbon atoms, and has a primary carbon atom at which R^{3a} bonds to an oxygen atom of $R^{a3}-O-$, and has a single mole number of ethyleneoxy groups having no distribution, an average mole number of added ethyleneoxy groups can be 2, 3, 4, or 5. Accordingly, the component (a3) can also serve as the component (A1). The component (a3) thus can include the component (A1). The component (A1) may include two or more different compounds together.

[0062]

In cases of blending the component (A1) as a component in the component (a3), such a component (a3) is produced by adding ethylene oxide at a small molar ratio, and thus is available as a mixture with an unreacted alcohol. If an unreacted alcohol causes an odor or affects a product in storage stability, the alcohol can be reduced through distillation or the like.

[0063]

In the present invention, a proportion of an unreacted alcohol and a compound having one mole of EO groups, or an aliphatic alcohol having a hydrocarbon group having 8 to 22 carbon atoms and a compound produced from the alcohol by adding one mole of EO groups, in the nonionic surfactant component (A) is preferably not more than 10% by mass, more preferably not more than 5% by mass, and even more preferably not more than 3% by mass. The lower limit is determined according to energy required for distillation and environmental burdens.

[0064]

For the deodorant effect of odors due to damp-dry, especially a 4M3H odor on a textile product, the liquid detergent composition of the present invention contains the nonionic compound component (A1) in an amount of 0.5 to 10% by mass, preferably 1 to 8% by mass, and more preferably 2 to 5% by mass. The component (A1) forms a part of the nonionic surfactant component (A).

[0065]

From the viewpoint of detergency, the liquid detergent composition of the present invention contains the nonionic surfactant component (A) in an amount of 15 to 70% by mass, preferably 20 to 65% by mass, more preferably 25 to 60% by mass, and even more preferably 30 to 55% by mass. This amount of the component (A) contains an amount of the component (A1) in the component (A).

[0066]

For components (a1) to (a5), and more preferably components (a1) to (a3) exemplified as a nonionic surfactant, a total proportion of these components in the component (A) is preferably 50 to 100% by mass, more preferably 60 to 100% by mass, and even more preferably 80 to 100% by mass. Among these components, the component (a1) and/or the component (a2), more

preferably the component (a1) preferably serves as a main nonionic surfactant. From the viewpoint of detergency and the viewpoint of visual judgment of lathering in application, the liquid detergent composition of the present invention preferably contains the component (a1) and/or the component (a2), more preferably the component (a1) in an amount of 10 to 60% by mass, more preferably 15 to 55% by mass, and even more preferably 20 to 50% by mass. From the viewpoint of deodorant effect and liquid stability, the liquid detergent composition of the present invention preferably contains the component (a3) in an amount of 0.5 to 20% by mass, more preferably 1 to 18% by mass, and even more preferably 2 to 15% by mass.

[0067]

To stably contain components (A1) and (B) and fully achieve detergency and the deodorant effect due to damp-dry, the liquid detergent composition of the present invention preferably contains components (A) and (A) satisfying at least one of the following conditions(1) to (8):

[0068]

Condition (1): A content of the component (A) is 20 to 65% by mass, and preferably 25 to 60% by mass of the liquid detergent composition.

Condition (2): A content of the component (A1) is 1 to 8% by mass, and preferably 2 to 5% by mass of the liquid detergent composition.

Condition (3): The component (A) contains the component (a1).

Condition (4): The component (A) contains the component (a1) represented by the formula (a1), more preferably the formula (a1-5) in which R^{1a} represents an alkyl group having 12 to 16 carbon atoms, and has a primary carbon atom at which R^{1a} bonds to an oxygen atom of $R^{1a}-O-$; $A0$ represents a

propyleneoxy group; and $p = 14$ to 35 (in cases of the formula (a1-5), additionally $p_{11} = 1$ to 20 , and $p_{12} = 1$ to 20); and $q = 1$ to 3 .

Condition (5): A content of the component (a1) is 15 to 55% by mass, and preferably 20 to 50% by mass of the liquid detergent composition.

Condition (6): The component (A) contains the component (a3).

Condition (7): The component (A) contains the component (a3) represented by the formula (a3) in which R^{a3} represents a linear alkyl group having 12 to 14 carbon atoms, and has a primary carbon atom at which R^{3a} bonds to an oxygen atom of $R^{a3}-O-$; and r represents the number of 3 to 7.

Condition (8): A content of the component (a3) is 1 to 18% by mass, and preferably 2 to 15% by mass of the liquid detergent composition.

[0069]

Considering these conditions, the liquid detergent composition of the present invention preferably contains the component (A) in an amount of 20 to 60% by mass, more preferably 25 to 55% by mass, the component (A1) in an amount of 1 to 8% by mass, more preferably 2 to 5% by mass, the component (a1) as the component (A), which is represented by the formula (a1), more preferably the formula (a1-5) in which R^{1a} represents an alkyl group having 12 to 16 carbon atoms, and has a primary carbon atom at which R^{1a} bonds to an oxygen atom of $R^{1a}-O-$, AO represents a propyleneoxy group, and $p = 14$ to 35 (in cases of the formula (a1-5), additionally $p_{11} = 1$ to 20 , and $p_{12} = 1$ to 20), and $q = 1$ to 3 , in an amount of 15 to 55% by mass, more preferably 20 to 50% by mass, and the component (a3) in the component (A), which is represented by the formula (a3) in which R^{a3} represents a linear alkyl group having 12 to 14 carbon atoms, and has a

primary carbon atom at which R^{3a} bonds to an oxygen atom of $R^{a3}-O-$, and r represents the number of 3 to 7, in an amount of 1 to 18% by mass, more preferably 2 to 15% by mass.

[0070]

The component (A1) may be derived from the component (a1), as well as from the component (a3). Respective components satisfy structural conditions describe above in their preferred embodiments. Ranges of each concentration and a total concentration of nonionic surfactants in the subordinate category are only required to be within the range of a concentration of the component (A) of the superordinate category. Preferred ranges of concentrations may be combined.

[0071]

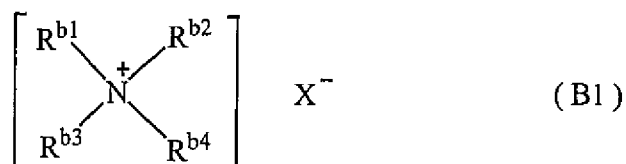
The conditions (1) to (8) and preferred conditions described above are also preferred from the viewpoint of visual judgment of lathering in application.

[0072]

<Component (B)>

The liquid detergent composition of the present invention contains the cationic surfactant component (B) represented by the formula (B1).

[0073]



[0074]

wherein, R^{b1} represents a chain hydrocarbon group having 12 to 18 carbon atoms, and may have $-(A'O)_s-$ therein, wherein $A'O$ represents an ethyleneoxy or propyleneoxy group, and s represents an average mole number of $A'O$ added, ranging from

0 to 10; R^{b2} , R^{b3} , and R^{b4} each independently represent a methyl group, an ethyl group, a benzyl group, or a hydroxyalkyl group having 1 to 3 carbon atoms; and X^- represents $CH_3SO_4^-$ or $CH_3CH_2SO_4^-$, or a halogen ion.

[0075]

In the formula (B1), R^{b1} preferably has 14 to 18 carbon atoms, and more preferably 14 to 16 carbon atoms. The chain hydrocarbon group of R^{b1} is a hydrocarbon group excluding a benzene ring or a cyclic group. The chain hydrocarbon group is preferably a linear alkyl or alkenyl group, and additionally preferably derived from natural fats and oils. s preferably represents 0.

[0076]

In the formula (B1), X^- is a counter ion of the component (B), and preferably represents $CH_3SO_4^-$ or $CH_3CH_2SO_4^-$ for fully achieving the deodorant effect of odors.

[0077]

The component (B) can contain a nonionic surfactant selected from the following compounds (b1) to (b4), and more preferably from compounds (b1) and (b3). A proportion of the compound (b1) is preferably not less than 50% by mass, more preferably not less than 60% by mass, and even more preferably not less than 80% by mass of the component (B). The compounds (b1) to (b4) preferably have R^{b1} having 12 to 16 carbon atoms, and more preferably 14 to 16 carbon atoms. The chain hydrocarbon group of R^{b1} is preferably a linear alkyl group, and additionally preferably derived from natural fats and oils. The counter ion is preferably $CH_3SO_4^-$ or $CH_3CH_2SO_4^-$.

[0078]

(b1) Quaternary ammonium salts represented by the formula (B1) in which R^{b1} represents a linear alkyl group having 12 to

18 carbon atoms, and R^{b2} to R^{b4} each represent methyl group or ethyl group.

(b2) Quaternary ammonium salts represented by the formula (B1) in which R^{b1} represents a branched alkyl group having 12 to 18 carbon atoms, and R^{b2} to R^{b4} each represent methyl group or ethyl group.

(b3) Quaternary ammonium salts represented by the formula (B1) in which R^{b1} represents a linear alkyl group having 12 to 18 carbon atoms, and R^{b3} and R^{b4} each represent methyl group or ethyl group.

(b4) Quaternary ammonium salts represented by the formula (B1) in which R^{b1} represents a linear alkyl group having 12 to 18 carbon atoms, s ranges from 1 to 5, and R^{b2} , R^{b3} , and R^{b4} each represent methyl group or ethyl group.

[0079]

The cationic surfactant component (B) can work together with the nonionic compound (A1) to suppress growth of desiccation-tolerant causative bacteria in odor generation on a textile product. In other words, the combination exhibits a remarkable suppressing effect against, among odors due to damp-dry, a recurrent odor due to damp-dry on a textile product when the product is fully dried and then again becomes damp. The combination effectively suppresses generation of the odor of medium chain fatty acids mainly composed of 4-methyl-3-hexenoic acid.

[0080]

From the viewpoint of the deodorant effect of odors due to damp-dry, especially a 4M3H odor, and detergency, the liquid detergent composition of the present invention contains the component (B) in an amount of 0.3 to 5% by mass, preferably 0.3 to 4% by mass, more preferably 0.5 to 3% by mass, and even more preferably 0.8 to 3% by mass.

[0081]

<Component (C)>

The nonionic surfactant (A) containing the nonionic compound (A1) and the cationic surfactant (B) are essential components in the liquid detergent composition of the present invention. However, the composition may further conditionally contain (C) other surfactant such as an anionic surfactant or an amphoteric surfactant [hereinafter, referred to as component (C)].

[0082]

Anionic surfactants other than fatty acid surfactants or salts thereof may decrease the deodorant effect of the liquid detergent composition of the present invention. Therefore, fatty acid surfactants and salts thereof are separately described from the other anionic surfactants. In cases of the liquid detergent composition of the present invention having an acidic pH, in the composition, some surfactants may be present in the form of acid. Such an acid compound should also be included in the surfactant.

[0083]

(c1) Other anionic surfactants than fatty acid surfactants or salts thereof

Specific examples of the other anionic surfactant include:

(c1-1) alkylbenzenesulfonates that have an alkyl group having 10 to 20 carbon atoms in average,

(c1-2) polyoxyalkylene alkyl ether sulfate ester salts that have an alkyl group derived from a linear primary or secondary alcohol or from a branched alcohol, which group has 10 to 20 carbon atoms in average, and alkyleneoxy groups in an average amount of 1 to 5 moles, in which alkyleneoxy groups contains an ethyleneoxy group and may contain a propyleneoxy group in an average amount of 0.2 to 2 moles,

(c1-3) alkyl- or alkenylsulfate ester salts that have an alkyl or alkenyl group having 10 to 20 carbon atoms in average, and

(c1-4) polyoxyalkylene alkyl ether carboxylates that have an alkyl group derived from a linear primary or secondary alcohol or from a branched alcohol, which group has 10 to 20 carbon atoms in average, and alkyleneoxy groups in an average amount of 1 to 5 moles, in which alkyleneoxy groups contains an ethyleneoxy group and may contain a propyleneoxy group in an average amount of 0.2 to 2 moles.

From the viewpoint of the deodorant effect of odors due to damp-dry, the salt is preferably selected from alkali metal salts such as sodium and potassium salts.

[0084]

In the present specification, bleach activators having an anionic group, more preferably an alkanoyloxybenzenesulonic acid, an alkanoyloxybenzoic acid or an alkali metal salt thereof, having a linear or branched alkyl group having 8 to 22 carbon atoms, are included in the other anionic surfactant (c1).

[0085]

(c2) Fatty acid surfactants and salts thereof

Fatty acid surfactants and salts thereof preferably have 10 to 18 carbon atoms, and may be derived from natural fats and oils with a fatty acid distribution. Fatty acid surfactants and salts thereof can be blended as a defoaming agent in the liquid detergent composition of the present invention. The salt is preferably selected from alkali metal salts such as sodium salt or potassium salt.

[0086]

(c3) Amphoteric surfactants

Examples of the amphoteric surfactant include sulfo betaine and carbo betaine, having an alkyl group having 8 to 22 carbon

atoms, and fatty acid amide propyl (or hydroxypropyl) betaine and fatty acid amide propyl (or hydroxypropyl) carbo betaine, having an alkyl group having 7 to 21 carbon atoms.

[0087]

(c4) Other cationic surfactants than the component (B)

Examples of the other cationic surfactant than the component (B) include quaternary ammonium compounds and amine compounds other than the component (B) such as fatty acid amidopropyl dimethylamines having 7 to 21 carbon atoms.

[0088]

The other anionic surfactant (c1) reduces a bactericidal effect of the combination of components (A1) and (B), and thus is added in a limited amount in order to fully achieve the the deodorant effect of odors due to damp-dry on a textile product. More specifically, a mass ratio of the other anionic surfactant (c1) to the cationic surfactant (B), $(c1)/(B)$, is 0 to 1, preferably 0 to 0.8, more preferably 0 to 0.5, and even more preferably 0 to 0.1. As described above, a bleach activator having an anionic group is included in the other anionic surfactant (c1). A proportion of the bleach activator is thus preferably low. A mass of the other anionic surfactant (c1) is calculated based on its acid form. Within the mass ratio $(c1)/(B)$, a content of the other anionic surfactant (c1) than fatty acids and salts thereof is preferably not more than 5% by mass, more preferably not more than 3% by mass, even more preferably not more than 2% by mass, and even more preferably not more than 0.4% by mass of the liquid detergent composition.

[0089]

The amphoteric surfactant can be added within the range that does not impair the effects of the present invention, but preferably within the range that a mass ratio $[(c1)+(c3)]/(B)$ falls within the range of the mass ratio $(c1)/(B)$. With

satisfaction of the mass ratio $[(c1)+(c3)]/(B)$, a content of the component (c3) is preferably not more than 5% by mass, more preferably not more than 3% by mass, and even more preferably not more than 1% by mass.

[0090]

A content of the component (c2) selected from fatty acids and salts thereof is 0.05 to 5% by mass, preferably 0.1 to 4% by mass, and more preferably 0.1 to 3% by mass of the composition, calculated based on the form of fatty acid (acid form). In the composition, some fatty acid salts may be present in the form of an acid t hereof according to pH. From the point of the deodorant effect of odors due to damp-dry, alkali metal salts such as sodium salt or potassium salt are preferred.

[0091]

<Component (D)>

The liquid detergent composition of the present invention contains hydrogen peroxide as the component (D) in order to suppress odors due to damp-dry. The present invention uses the nonionic compound (A1), the cationic surfactant (B), and the hydrogen peroxide (D) under specific conditions to exert the the deodorant effect on a whole textile product, including the recurrent odor due to damp-dry, which is not sufficiently resolved conventionally.

[0092]

From the viewpoints of the deodorant effect of odors due to damp-dry and stability of hydrogen peroxide, the liquid detergent composition of the present invention contains the component (D) in an amount of 0.3 to 10% by mass, preferably 0.5 to 8% by mass, and more preferably 1 to 6% by mass. A concentration of hydrogen peroxide in the composition can be determined by reverse titration with a solution of potassium iodide.

[0093]

<Other components>

Other components that can be used in the present invention will be further described.

[0094]

[Component (E)]

The liquid detergent composition of the present invention preferably contains a water-miscible organic solvent as the component (E). As used herein, the water-miscible organic solvent refers to a solvent dissolves in an amount of not less than 50 g in 1L of ion-exchanged water at 25°C, or has a water-solubility of not less than 50 g/L.

[0095]

The component (E) is preferably selected from water-miscible organic solvents having a hydroxy group and/or an ether group.

[0096]

Examples of the water-miscible organic solvent include:

(e1) alkanols such as ethanol, 1-propanol, 2-propanol, and 1-butanol;

(e2) glycols such as propylene glycol, butylene glycol, and hexylene glycol;

(e3) glycols such as diethylene glycol, triethylene glycol, tetraethylene glycol, dipropylene glycol, and tripropylene glycol;

(e4) alkyl ethers such as diethylene glycol monomethyl ether, diethylene glycol dimethyl ether, triethylene glycol monomethyl ether, diethylene glycol monoethyl ether, diethylene glycol diethyl ether, dipropylene glycol monomethyl ether, dipropylene glycol monoethyl ether, tripropylene glycol monomethyl ether, 1-methoxy-2-propanol, 1-ethoxy-2-propanol, 1-methylglyceryl ether, 2-methylglyceryl ether,

1,3-dimethylglyceryl ether, 1-ethyl glyceryl ether, 1,3-diethyl glyceryl ether, triethyl glyceryl ether, 1-pentyl glyceryl ether, 2-pentyl glyceryl ether, 1-octyl glyceryl ether, 2-ethylhexyl glyceryl ether, and diethylene glycol monobutyl ether; and

(e5) aromatic ethers such as 2-phenoxyethanol, diethylene glycol monophenyl ether, triethylene glycol monophenyl ether, polyethylene glycol monophenyl ether having an average molecular weight of about 480, phenoxypropylene glycol, 2-benzyloxyethanol, and diethylene glycol monobenzyl ether.
[0097]

The component (E) can serve as a viscosity-control agent and/or an antigelling agent in the composition. The component (E) is preferably at least one compound selected from (e1) alkanols, (e2) glycols, (e4) alkyl ethers, and (e5) aromatic ethers, and more preferably (e2) glycols, (e4) alkyl ethers, and (e5) aromatic ethers for effectively adjusting a viscosity and/or suppressing gelation of the composition.
[0098]

To stably formulating hydrogen peroxide in the liquid detergent composition of the present invention to suppress odors due to damp-dry, the component (E) is preferably at least one compound selected from (e4) alkyl ethers and (e5) aromatic ethers, more preferably from diethylene glycol monobutyl ether, diethylene glycol monophenyl ether, triethylene glycol monophenyl ether, and phenoxypropylene glycol, and even more preferably from diethylene glycol monobutyl ether and triethylene glycol monophenyl ether.
[0099]

The liquid detergent composition of the present invention preferably contains the component (E) in an amount of 1 to 40%

by mass, more preferably 4 to 20% by mass, and even more preferably 5 to 10% by mass.

[0100]

[Component (F)]

The liquid detergent composition of the present invention preferably contains a hydrotrope agent as a component (F) to stabilize the composition. The hydrotrope agent used in the present invention is an organic compound having an anionic group and additionally one or two alkyl groups selected from a methyl group, an ethyl group, and a propyl group, and a sulfonate or carboxylate group. Examples of the hydrotrope agent include alkylbenzenecarboxylic and alkylbenzenesulfonic acids and salts thereof, and benzoic acids and salts thereof. Specific examples of the hydrotrope agent include p-toluenesulfonic acid, cumenesulfonic acid, m-xylenesulfonic acid, and benzoic acid. The salt is preferably selected from alkali metal salts. In the present invention, preferred are p-toluenesulfonic acid and alkali metal salts thereof. The hydrotrope agent may be added in the form of acid and neutralized with an alkali agent in the composition. The component (F) can impart stability to the composition without impairing the deodorant effect of odors due to damp-dry.

[0101]

The component (F) is preferably added in an alkali metal salt form. A content of the component (F) is preferably 0.1 to 5% by mass, more preferably 0.5 to 4% by mass, and even more preferably 1 to 3% by mass of the liquid detergent composition of the present invention, calculated based on its acid form.

[0102]

[Component (G)]

For stably formulating hydrogen peroxide and the like, the liquid detergent composition of the present invention

preferably contains an alkali agent [hereinafter, referred to as component (G)] to neutralize the anionic surfactant, the hydrotrope agent, and/or a chelating agent in the form of acid to adjust pH. As described below, in the liquid detergent composition of the present invention having a pH of not more than 7.0, there may be almost no free alkali agent. The alkali agent used for neutralization is preferably selected from alkali metal hydroxides, and more preferably selected from potassium hydroxide and/or sodium hydroxide.

[0103]

In cases of using water-miscible organoamine compounds, more preferably alkanolamines having the total carbon atoms of 6 or less, such as monoethanolamine, diethanolamine, and triethanolamine [hereinafter, also referred to as component (G')] as a neutralizing agent, from the viewpoint of the deodorant effect of odors due to damp-dry, a content of the neutralizing agent is preferably less than 1% by mass, more preferably not more than 0.5% by mass, and even more preferably not more than 0.08% by mass of the composition. The amount of the component (G') includes an amount of an alkali agent (neutralizing agent for adjusting pH) and also an amount of an anionic compound added in the form of salt.

[0104]

[Component (H)]

The liquid detergent composition of the present invention preferably contains an organic chelating agent that can chelate a polyvalent metal ion [hereinafter, referred to as component (H)] to preserve the effects of the present invention over time. Examples of the organic chelating agent component (H) include aminopolyacetic acids such as nitrilotriacetic acid, iminodiacetic acid, ethylenediaminetetraacetic acid, diethylenetriaminepentaacetic acid, glycol ether

diaminetetraacetic acid, hydroxyethyliminodiacetic acid, triethylenetetraminehexaacetic acid, and dienkollic acid and salts thereof; other polycarboxylic acids, excluding aminopolyacetic acids, such as diglycolic acid, oxydisuccinic acid, carboxymethyloxysuccinic acid, citric acid, lactic acid, tartaric acid, oxalic acid, malic acid, oxydisuccinic acid, gluconic acid, carboxymethylsuccinic acid, and carboxymethyltartaric acid and salts thereof; and organophosphonic acids such as aminotri(methylenephosphonic acid), 1- hydroxyethylidene-1,1-diphosphonic acid, ethylenediaminetetra(methylenephosphonic acid), diethylenetriaminepenta(methylenephosphonic acid) and salts thereof. Examples of the salt include alkali metal salts. The component (H) may be added in its acid form and neutralized with an alkali agent in the composition to form a salt. Among organic chelating agents, preferred are organophosphonic acids and salts thereof, and more preferred is 1-hydroxyethylidene-1,1-diphosphonic acid. The counter ion is preferably selected from alkali metal salts.

[0105]

For suppressing reduction of the effects of the present invention during storage, the composition of the present invention preferably contains an organic chelating agent. The suppressing effect of the organic chelating agent is mainly brought by the action of the agent to suppress decomposition of hydrogen peroxide by possible heavy metal ions in the composition. However, many compounds used as the organic chelating agent have properties to reduce the change of pH upon dilution. For achieving good detergency, an organic chelating agent being effective at a small amount is preferable in order to facilitate the change of pH with water to close to neutral. Such an organic chelating agent is preferably an

organophosphonic acid or a salt thereof. The salt is preferably a potassium salt or sodium salt.

[0106]

In the composition, a content of the component (H) is preferably 0.01 to 0.5% by mass, more preferably 0.03 to 0.3% by mass, and even more preferably 0.05 to 0.2% by mass, calculated based on its acid form. The composition more preferably contains 1- hydroxyethylidene-1,1-diphosphonic acid as the component (H) within the limited range of the content.

[0107]

[Component (I)]

The liquid detergent composition of the present invention preferably contains a water-soluble polymer as a component (I) to enhance the deodorant effect of odors due to damp-dry. The water-soluble polymer preferably has a constitutional unit having a carboxylate group. Examples of the water-soluble polymer include polyacrylic acids, acrylic acid-maleic acid copolymers, and copolymers of acrylic acid or maleic acid and an olefin having 2 to 5 carbon atoms. In a concentrated system containing a much amount of surfactant, preferably used are polymers having a constitutional unit having a carboxylate group and a constitutional unit having a polyoxyethylene chain. Examples of the polymer include those described in JP-A10-60476 and JP-A2004-155937. A content of the component (I) is preferably 0.1 to 5% by mass, and more preferably 0.5 to 4% by mass.

[0108]

[Other components than the above]

The liquid detergent composition of the present invention can optionally contain one or more components selected from the

following (i) to (vii) within the range that does not impair the effects of the present invention.

(i) enzymes such as cellulase, amylase, pectinase, protease, and lipase;

(ii) enzyme stabilizers such as calcium ion sources (calcium ion providing compounds), dihydroxy compounds, and formic acid;

(iii) fluorescent dyes such as commercial dyes including Tinopal CBS (trade name of Ciba specialty Chemicals Inc.) and Whitex SA (trade name, Sumitomo Chemical Co., Ltd.);

(iv) antioxidants such as butyl hydroxytoluene, distyrenated cresol, sodium sulfite, and sodium hydrogen sulfite;

(v) anti-gelling polymer described in JP 11-513067 W, and more preferably polypropylene glycol and polyethylene glycol having a weight average molecular weight of 600 to 5000, and more preferably 1000 to 4000, as measured by the light scattering method using a dynamic light scattering spectrophotometer (e.g., DLS-8000 series, Otsuka Electronics Co., Ltd.);

(vi) water-immiscible organic solvents such as paraffins (e.g., octane, decane, dodecane, and tridecane), olefins (e.g., decene and dodecene), alkyl halides (e.g., methylene chloride and 1,1,1-trichloroethane), and terpenes (e.g., D-limonene); and

(vii) other agents such as a pigment, a perfume, an antiseptic, and a defoaming agent (e.g., silicones).

[0109]

The following concentrations of these optional components are indications when added in the liquid detergent composition of the present invention. These concentrations may be properly

adjusted so as to not impair the effect of the present invention, or even to be zero if a component is unfit to the composition.

A content of the enzyme (i) is preferably 0.001 to 2% by mass. A content of the enzyme stabilizer (ii) is preferably 0.001 to 2% by mass. A content of the fluorescent dye (iii) is preferably 0.001 to 1% by mass. A content of the antioxidant (iv) is preferably 0.01 to 2% by mass. A content of the polyalkylene glycol anti-gelling polymer (v) is preferably 0.01 to 2% by mass. A content of the water-immiscible organic solvent (vi) is preferably 0.001 to 2% by mass. A content of the other agent (vii) may be any known concentration.

[0110]

From the viewpoints of liquid stability and suppression of decomposition of hydrogen peroxide, the liquid detergent composition of the present invention preferably contains a bleach activator such as that having an anionic group in an amount of less than 1% by mass, more preferably not more than 0.4% by mass, and even more preferably does not contain a bleach activator. As used herein, the "bleach activator" refers to a compound that reacts with hydrogen peroxide in water under mild conditions like as in domestic use to generate an organic peracid. Examples of the bleach activator include TAED (tetraacetythylenediamine) and alkanoyloxybenzenesulfonic and alkanoyloxybenzenecarboxylic acids, having a linear or branched alkyl group having 8 to 22 carbon atoms and alkali metal salts thereof, which are known to be blended in liquid bleaching composition. Among them, alkanoyloxybenzenesulfonic and alkanoyloxybenzenecarboxylic acids, having a linear or branched alkyl group having 8 to 22 carbon atoms and alkali metal salts thereof are known to be stably blended with hydrogen peroxide. However, these acids and salts thereof are also the bleach activators having an anionic group and the anionic

surfactants (c1) other than fatty acids or salts thereof in the present invention, and thus subjected to the limitation of the mass ratio (c1)/(B). The bleach activator can be contained in an amount such that a mass ratio (c1)/(B) falls within the specified range, but will fail to fully exert its effect in such amount in the liquid detergent composition of the present invention. In addition, the bleach activator imposes a limitation on the composition to be stably blended in the composition, and causes reduction of the deodorant effect of the present invention.

[0111]

In general, a washing liquid and a bleaching liquid containing hydrogen peroxide increase their bleaching effects at higher pH when the liquid is used. However, the liquid detergent composition of the present invention preferably contains substantially no boron compound, which is used to alkalify an aqueous dilution of the composition. In the present invention, boron compounds reduce detergency. As used herein, the "boron compound" includes boric acid, borax, and borates. Specific examples of the borate include sodium borate, potassium borate, ammonium borate, sodium tetraborate, potassium tetraborate, and ammonium tetraborate. In the present invention, the phrase "containing substantially no boron compound" excludes trace contamination of a boron compound, for example, from an enzyme preparation containing the boron compound as an enzyme stabilizer. Specifically the composition contains a boron compound in an amount of less than 0.1% by mass, and more preferably less than 0.01% by mass, as calculated based on the form of boric acid, with the proviso that borax is calculated based on its mass. The lower limit is 0% by mass.

[0112]

The rest of the liquid detergent composition of the present invention is water. The water used is preferably sterilized deionized water.

[0113]

From the viewpoints of detergency and deodorant effect, the liquid detergent composition of the present invention preferably has a pH of 3.0 to 7.0, more preferably 3.5 to 7.0, and even more preferably 4.0 to 6.0 at 20°C in accordance with JIS K3362:1998 section 8.3.

[0114]

More preferably, the liquid detergent composition of the present invention preferably has a pH of 4.0 to 8.5, and more preferably 6.0 to 8.0 at 20°C in the form of a solution of 2 ml of the composition in 3 L of soft water having a hardness of 4°DH and a pH of 6.0 to 8.0 at 20°C prepared by adding calcium carbonate to deionized water.

[0115]

From the viewpoint of easiness in handling, the liquid detergent composition of the present invention preferably has a viscosity of 10 to 1,000 mPa•s, more preferably 50 to 600 mPa•s, and even more preferably 100 to 300 mPa•s at 20°C. The viscosity can be controlled by varying proportions of components (a1), (a2), and (E), and water, and the like. To decrease the viscosity of the composition, the nonionic surfactant (a1') of the component (a1) is suitably used.

[0116]

In the present invention, the viscosity is measured using a B-type viscometer. A rotor is selected according to a viscosity. The liquid detergent composition is rotated at a rate of 60 r/min, and a measured value after 60 seconds of the rotation is considered as the viscosity of the composition.

[0117]

The liquid detergent composition of the present invention can be used for textile products, preferably for household textile products such as clothing, towel, bathroom rug, and bed lines, and more preferably for clothing. The liquid detergent composition of the present invention can also be suitably used for washable textile products.

[0118]

In the present invention, the liquid detergent composition of the present invention produces a good detergency and a good deodorant effect when it is used in a cleaning liquid containing water, for example an aqueous solution of the composition, to wash a textile product. The cleaning liquid is preferably prepared by dissolving 0.3 to 1.0 g of the composition in 1 L of water. Such a cleaning liquid, for example an aqueous solution, is generally called a washing liquid. The cleaning liquid can be at any temperature in washing. According to the present invention, the liquid detergent composition can produce detergency and the deodorant effect, provided that the temperature of a washing liquid is not limited, within a wide range of water temperature from 5°C to 40°C. A step of immersing in an immersing liquid may be introduced before washing. In this case, a concentration of the liquid detergent composition in the immersing liquid is preferably 3 to 6 times as large as that in the cleaning liquid.

[0119]

The liquid detergent composition of the present invention can make conspicuous lather in the presence of bacteria in a used textile product, especially a worn textile product, when applied (in a non-lather state) to the textile product. The lather is produced through dismutation by a catalase of the bacteria. Interestingly, the lather does not appear on a new textile product or a textile product after one day use or wear.

The lather appears when the liquid detergent composition of the present invention is applied on a textile product repeatedly used or worn and cleaned several times, and in some cases, on a well-used textile produce even right after cleaned and dried.

[0120]

Therefore, the present invention also provides a method for cleaning a textile product, including a step of applying the liquid detergent composition of the present invention to the textile product to make lather. In this method, a part or whole of the liquid detergent composition can be applied to the textile product with confirming the presence of bacteria by generation of lather.

[0121]

The method including such application of the present invention enables to not only confirm the state of the presence of bacteria, but also concentrate the application of the liquid detergent composition to an area showing the presence of bacteria. This concept has been disclosed in JP-A2010-59296 relating to a hard surface detergent. Some conventional liquid bleaching compositions for textile products, containing hydrogen peroxide, also make lather in the presence of bacteria. Such lather however cannot be conspicuous enough for the visual judgment due to low concentration of a surfactant in such a convention liquid bleaching composition containing hydrogen peroxide. In addition, conventional bleaches for textile products are directed to bleach and intended to be concentrically applied to a visually dirty spot such as a stain, a collar, and a cuff. In contrast, the composition of the present invention is intended to suppress odors caused by bacteria, and thus benefits from conspicuous lather that enables the visual judgment by lathering.

[0122]

The liquid detergent composition of the present invention makes lather through the contact with bacteria. The composition having good properties for the visual judgment of the presence of bacteria by lathering has a structure following the preferred conditions for the liquid detergent composition described above, for example, in which as the nonionic surfactant (A) the compounds of the formulae (a1) and (a2) are preferable, and more preferably a compound having PO groups in an amount of not less than 1 mole to not more than 3 moles in average. The composition having such a structure readily makes conspicuous lather in the presence of bacteria, and takes a proper period from the generation to the vanishment of lather.

[0123]

The present invention also relates to a method for cleaning a textile product, including steps of applying the liquid detergent composition of the present invention to the textile product to make lather, and washing the textile product with a washing liquid containing water. The textile product with the liquid detergent composition of the present invention applied thereto can be washed together with any other textile product in a washing machine using any detergent. The any detergent does not exclude the rest of the applied liquid detergent composition of the present invention or another detergent. More specifically, a textile product can be cleaned by applying a part of the whole amount of the liquid detergent composition of the present invention to be used in cleaning to the textile product, and contacting the applied textile product with a washing liquid containing the rest of the composition and water. Even more in details, the method for cleaning a textile product includes applying a part of the liquid detergent composition of the present invention, placing the textile product and, if needed, optionally any textile product, and the

rest of the composition and water in a washing tank, and washing the textile products in the aqueous solution, and can provide a good deodorant effect also on a part of the textile product with no composition applied and the any other textile product washed together. The whole of the liquid detergent composition of the present invention to be used can be applied to a textile produce to be washed. In cases of including the step of applying, the liquid detergent composition of the present invention is preferably used in such amount as that a concentration of the composition in a washing liquid is within the range of 0.3 to 1.0 g/L as described above (a concentration may be a calculated value based on an amount applied) for fully achieving the effects of the present invention.

[0124]

As used herein, the "washing" or "washing treatment" includes mechanical agitation by a washing machine and manual treatments by hand-wash such as rubbing, beating, and stomping.

[0125]

The method for cleaning a textile product of the present invention can be clearly distinguished from a conventional purpose in use by directing the invention to a deodorizing method or a deodorising and cleaning method.

[0126]

Examples

The following Examples demonstrate the present invention. Examples are intended to illustrate the present invention and not to limit the present invention.

[0127]

<Test Example (determination of causative substance for odor due to damp-dry)>

Cotton towels with a strong odor due to damp-dry after washed and dried were collected from home, and cut into a piece

weighing 50 g. A piece was treated with 500 mL of dichloromethane to extract a component emitting the odor. The extract solution was concentrated under reduced pressure. To this was added 200 mL of aqueous solution of 1M sodium hydroxide. The aqueous layer was collected. To the organic layer was added 200 mL of hydrochloric acid to acidify the mixture. To the mixture was added 200 mL of dichloromethane. The organic layer was concentrated at a reduced pressure to obtain 1mL of a concentrate of an acidic component.

[0128]

Next, using an Agilent's gas chromatography machine and a Gerstel's Preparative Fraction Collector (PFC) connected thereto, the precise dilution was fractioned according to a retention time in GC under the following conditions. Thirty GC fractions around a target component were each trapped with 200 mg of filler (product name: TENAX TA, GL Sciences Inc.) in a glass tube having an inner diameter of 6 mm and a length of 117 mm.

[0129]

(GC-PFC conditions)

GC: Agilent 6890N (product name, Agilent Technologies Inc.)
column: DB-1 (product name, Agilent Technologies Inc.),
length: 30 m, inner diameter: 0.53 mm, thickness: 1 μ m
40°C for 1 min. hold $\rightarrow$ 6°C/min. to 60°C $\rightarrow$ 4°C/min to 300°C
Injection volume: 2 μ L
PFC (Gerstel K.K. Japan): trapping time: minute 18 to minute 24, 30 fractions

trap: TENAX TA (product name, GL Sciences Inc.) 200 mg
[0130]

Finally, the target component trapped with TENAX TA was analyzed in a Gerstel Thermal Desorption system (TDS) connected to an Agilent GC-MS under the following conditions.

(TDS-GC-MS conditions)

GC: Agilent 6890N (product name, Agilent Technologies Inc.)

MS: Agilent 5973 (product name, Agilent Technologies Inc.)

TDS desorption: 250°C, purge flow rate: 50 mL/min, purge time: 3 min.

column: DB-FFAP (product name, Agilent Technologies Inc.), length: 30 m, inner diameter: 250 µm, thickness: 0.25 µm

40°C for 1 min. hold → 6°C/min to 60°C at. → 2°C/min to 240°C
[0131]

The analysis detected branched middle-chain fatty acids including 4M3H in the causative component of the odor due to damp-dry.

[0132]

<Examples and Comparative Examples>

(1) Evaluation for detergency

(1-1) Preparation of cut piece of collar

Collars of polyester/cotton blend shirts worn for three days were cut from the shirts and screened to select dirty collars to the same degree, which were used as test clothes of dirty collar. Selected test clothes were cut in halves and separately sewn on a cotton cloth having dimensions of 30 cm by 30 cm (hereinafter, referred to as cut piece). Six pairs of cut pieces (total twelve pieces) were prepared for each of liquid detergent compositions shown in Tables 1 to 3. Six sheets of one halves of the pieces were washed with each composition of Examples and Comparative Examples, and the other halves were washed with a standard detergent for determining detergency.

[0133]

(1-2) Preparation of washing water

Hard water was prepared by dissolving 25.14 g of calcium chloride dihydrate and 8.70 g of magnesium chloride hexahydrate

in 2966.13 g of ion-exchanged water to have a hardness of 400°DH and a ratio of calcium/magnesium = 8/2 as hardness components. The prepared hard water was diluted in ion-exchanged water to a hardness of 4°DH and used as washing water in a detergency test.

[0134]

(1-3) Judgment

In the detergency test, a washing machine (NA-FV8001; Panasonic Corporation) and the washing water as prepared above were used. Ten panelists (men in their thirties) judged about detergency. Six halves of the cut pieces washed with a liquid detergent composition of the liquid detergent compositions (test detergents) shown in Tables 1 to 3, and the other halves washed in the same way, excepting that the standard detergent described in JIS K3362:1998 was used instead of the liquid detergent compositions were visually observed. It was judged which detergents were the better in detergency. A washed pair of cut pieces is rated a "+1" if a cut piece washed with a test detergent is cleaner than with the standard detergent, or a "-1" if less cleaner than the standard detergent. A score rated in total by a panelist ranges from "+6" to "-6". Each test detergent was judged by ten panelists and evaluated according to the total of ten scores. A test detergent got the total score within the range of +5 to -5 is considered as having the same detergency to the standard detergent. With the total score of +6 or higher, a test detergent is considered as better in detergency than the standard detergent, and with -6 or lower, considered as worse. A test detergent got the higher total score is considered as having the better detergency.

[0135]

(2) Evaluation for odor wet-and-dirty-dustcloth-like-malodor

Of underwears (100% cotton) repeatedly worn by male adults in their twenties to forties and cleaned, collected were those generated the common odor due to damp-dry when becoming damp, while generating no odor after cleaned and fully dried. Collected underwears were cut into pieces having dimensions of 5 cm by 5 cm, and screened by special panelists to select pieces generating an odor to the same degree when becoming damp. The common odor due to damp-dry was qualitatively analyzed and confirmed to comprise odors of branched middle-chain fatty acids mainly composed of a 4M3H odor and of sulfur.

[0136]

In order to examine the cut pieces collected and selected as test pieces of real clothes for examination possibly in the same initial state as one another, these cut pieces were washed in a washing liquid containing 0.67 g/L of standard detergency with the following composition without a perfume using a stirring washing tester (Terg-O-tometer) under conditions of: a water temperature of 25°C, a stirring rate of 85 rpm, a stirring time of 10 minutes, and a bath ratio of 15. Washed cut pieces were fully rinsed with tap water and immediately placed in an environment with 25°C and a relative humidity of 35%, and allowed to stand for 24 hours to fully dry. Among dried cut pieces, further selected were those having an odor intensity rated a "1 (no odor)" of the rating score described below by five specialized examiners consensually. These selected pieces were used as test pieces of real test clothes. These test pieces treated with the standard detergency were confirmed to generate an odor containing a 4M3H odor when becoming a damp-dry state.

[0137]

The standard detergent comprised:

(1) sodium alkyl (12 carbon atoms, linear) benzenesulfonate in an amount of 10% by mass, (2) sodium alkyl (12 carbon atoms)

sulfate in an amount of 2% by mass, (3) sodium salt of fatty acid derived from palm oil in an amount of 2% by mass, (4) polyoxyethylene(average of moles added: 10) alkyl(12 to 14 carbon atoms) ether in an amount of 10% by mass, (5) sodium carbonate in an amount of 15% by mass, (6) zeolite in an amount of 10% by mass, (7) acrylic acid-maleic acid copolymer (weight average molecular weight: 70000, molar ratio: acrylic acid/maleic acid = 6/4) in an amount of 5% by mass, (8) No.2 sodium silicate in an amount of 1% by mass, and (9) sodium sulfate in the rest (100% by mass in total).

[0138]

Next, test pieces were washed with liquid detergent compositions shown in Tables 1 to 3 and examined according to the following odor intensity tests (odor intensity evaluations A and B).

[0139]

- Odor intensity evaluation A (evaluation for odor generating from a damp-dry textile product in a short time)

For each of liquid detergent compositions shown in Tables 1 to 3, a washing liquid containing 0.67 g/L of liquid detergent composition was prepared and used to wash a set of five test pieces of real clothes using a stirring washing tester (Targot-o-Meter) under conditions of: a water temperature of 25°C, a stirring rate of 85 rpm, a stirring time of 10 minutes, and a bath ratio of 15. The washed test pieces were fully rinsed with tap water, and stored in a culture chamber for 3 hours under conditions of 30°C and a relative humidity of 90%, which was likely to develop an odor due to damp-dry. The stored test pieces were sensory evaluated for an odor due to damp-dry (complex odor containing odors of S, N, aldehydes, short-chain fatty acids, and branched middle-chain fatty acids, such as 4M3H) by five specialized examiners.

[0140]

• Odor intensity evaluation B (evaluation for recurrent odor generating from a dry textile product)

For each of liquid detergent compositions shown in Tables 1 to 3, a washing liquid containing 0.67 g/L of liquid detergent composition was prepared and used to wash a set of five test pieces of real clothes using a stirring washing tester (Targot-o-Meter) under conditions of: a water temperature of 25°C, a stirring rate of 85 rpm, a stirring time of 10 minutes, and a bath ratio of 15. The washed test pieces were fully rinsed with tap water, and stored in a culture chamber for 12 hours under conditions of 30°C and a relative humidity of 90%, which was likely to develop an odor due to damp-dry. Then, the test pieces were allowed to stand all night and all day in an environment of 25°C and a relative humidity of 35% to fully dry. The dried test pieces had no odor due to damp-dry.

[0141]

The test pieces became damp again with 0.1 g of tap water sprayed through a sprayer. The damp test pieces were sensory evaluated for a recurrent odor due to damp-dry (odor of branched middle-chain fatty acids mainly composed of a 4M3H odor) by the same five specialized examiners.

[0142]

Ratings of the odor intensity evaluations A and B were determined according to the following rating score by specialized examiners consensually.

rating score

1: no odor

2: almost no odor

3: subtle odor

4: odor recognized when carefully sniffing

5: recognizable odor

Results of the odor intensity evaluations A and B are shown in Table 1 to 3. Ratings of 3 to 5 mean that at least four examiners noticed an odor.

[0143]

【Table 1】

Liquid detergent composition										Example										Comparative example									
Components (mass%)										1	2	3	4	5	6	1	2	3	4	5	6	7	8	9					
										20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	
(A)	(a1)	a1-1								2.0	3.0	4.0			3.0														
		a3-2																											
		a3-3																											
	(a3)	a3-4																											
		a3-5																											
		a3-6																											
		a3-8																											
	(B)	b1-2									1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
(C)	(c1)	LAS																											
	(c2)	Palm oil fatty acid																											
	(c4)	Di-long chain alkyl (C14) cation																											
	(D)	Hydrogen peroxide									3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
										Sterile water										Balance									
										Total										Balance									
										pH(20°C)										Balance									
										Content of component(A) (mass%)										Balance									
										Content fo component(A1) (mass%)										Balance									
										(c1)/(B) (mass ratio)										Balance									
(1) Evaluation of detergency										29										29									
(2) Odor intensity A										2										2									
(3) Odor intensity B										2										2									

[Table 2]

Liquid detergent composition		Example															
		7	8	9	10	11	12	13	14	15	16	17	18	19	20		
Components (mass%)	a1-1	30.0	30.0	30.0	40.0	40.0	60.0	40.0	40.0	40.0	45.0	45.0	45.0				
	a1-2																
	(a1) a1-3																
	a1-4																
	a1-5																
	(a2) a2-1																
	a2-2																
	a3-1						5.0	5.0	3.0	10.0	5.0	5.0	5.0	5.0	5.0		
	(a3) a3-2	5.0			5.0		5.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		
	a3-3				5.0				5.0								
	a3-6			8.0													
	(B) b1-1																
	b1-2								2.0	2.0	2.0	2.0	2.0	2.0	2.0		
	b1-3	1.0	1.0	1.0	1.0	1.0	1.0	1.0									
	(C) (c1) LAS																
	(c2) Palm oil fatty acid	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0		
	(D) Hydrogen peroxide	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		
	e-1	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	10.0	5.0	5.0	5.0	5.0	5.0		
	(E) e-2	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0		5.0	5.0	5.0	5.0	5.0		
	e-3																
	(F) f-1	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0		
	(H) h-1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1		
	(I) i-1	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0		
	Fluorescent dye																
	Enzyme																
	Perfume	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5		
	Sterile water	Balance	Balance	Balance	Balance	Balance	Balance	Balance	Balance	Balance	Balance	Balance	Balance	Balance	Balance		
	Total	100	100	100	100	100	100	100	100	100	100	100	100	100	100		
	pH (20°C)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5		
	Content of component(A) (mass%)	35.0	35.0	38.0	45.0	45.0	65.0	48.0	48.0	53.0	53.0	53.0	53.0	53.0	53.0		
	Content of component (A1) (mass%)	5.0	5.0	4.0	5.0	5.0	5.0	3.0	8.0	3.0	3.0	3.0	3.0	3.0	3.0		
	(c1)/(B) (mass ratio)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
	(1) Evaluation of detergency	32	31	32	34	34	39	35	37	40	38	38	35	36	37		
	(2) Odor intensity A	1	1	1	1	1	1	1	1	1	1	1	1	1	1		
	(3) Odor intensity B	2	2	1	1	1	1	1	1	1	1	1	1	1	1		
Evaluation																	

[Table 3]

Table 3

		Example					Comparative example									
		21	22	23	24	25	10	11	12	13	14	15	16	17	18	
Liquid detergent composition	(A)	a1-1	40.0	40.0	40.0		45.0	45.0	45.0	45.0	40.0	10.0		40.0	40.0	
		a1-2														
		a1-3														
		a1-4														
		a1-5														
	(B)	a2-1			45.0	45.0										
		a2-2					5.0	5.0	5.0	5.0		5.0			5.0	
		a3-1			5.0	5.0	5.0	3.0	3.0	3.0	5.0	5.0	10.0			
	(C)	a3-2	3.0	3.0	3.0	2.0	2.0	3.0	3.0	3.0						
		a3-3														
		a3-6														
	(D)	b1-1		5.0			2.0	2.0	2.0	2.0			0.5			
		b1-2	2.0		2.0		2.0	2.0		2.0	1.0	1.0		1.0	1.0	
		b1-3				1.0										
	(E)	(c1) LAS	1.0	3.0	1.0	1.0	2.0	2.0	2.0	2.0	2.0	2.0		2.0	2.0	
		(c2) Palm oil fatty acid	2.0	2.0	2.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
		Hydrogen peroxide	0.5	0.5	3.0	3.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	
	(F)	e-1	10.0	10.0	10.0		5.0	5.0	5.0	5.0	5.0	5.0		5.0	5.0	
		e-2				5.0	5.0	5.0	5.0	5.0	5.0	5.0				
		e-3				5.0	5.0	5.0	5.0	5.0	5.0	5.0				
	(G)	f-1	2.0	2.0	2.0	1.0	2.0	2.0	2.0	2.0	2.0	2.0		2.0	2.0	
		h-1	0.1	0.1	0.1	0.5	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	
		i-1	2.0	2.0	2.0		2.0	2.0	2.0	2.0	2.0	2.0		2.0	2.0	
	(H)	(c1) Bleaching activator														
		Fluorescent dye				0.2										
		Enzyme	0.2	0.2												
Evaluation	(1) Evaluation of detergency	Perfume	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	
		Sterile water														
		Total	100	100	100	100	100	100	100	100	100	100	100	100	100	
	(2) Odor intensity A	pH (20°C)	4.0	3.0	4.5	6.0	4.5	4.5	4.5	4.5	4.5	2.5	2.5	4.5	4.5	
		Content of component (A) (mass%)	43.0	43.0	43.0	52.0	50.0	53.0	53.0	53.0	45.0	15.0	10.0	40.0	45.0	
		Content of component (A1) (mass%)	3.0	3.0	3.0	2.0	0.0	3.0	3.0	3.0	5.0	5.0	10.0	0.0	5.0	
	(3) Odor intensity B	(c1)/(B) (mass ratio)	0.5	0.6	0.5	1.0	0.0	0.0	-	2.5	1.5	0.0	0.0	0.0	1.2	
	(4) Evaluation of detergency		35	33	35	29	31	30	32	36	38	35	8	29	34	
	(5) Odor intensity A		2	2	1	1	1	1	4	2	1	2	2	2	2	
	(6) Odor intensity B		2	2	2	2	3	3	4	4	3	3	4	4	3	

[0146]

Composition Examples of the liquid detergent composition of the present invention will be shown in Table 4 below.

[0147]

[Table 4]

					Compounding example				
					1	2	3	4	5
Liquid detergent composition	Components (mass%)	(A)	(a1)	a1-1	40.0	40.0	40.0	35.0	
				a1-2					30.0
			(a3)	a3-6	5.0		10.0		
				a3-7		5.0		10.0	15.0
		(B)		b1-1			5.0		
				b1-2	2.0	2.0			1.5
				b1-3				1.5	
		(C)	(c1)	LAS	1.0				0.5
		(D)		Hydrogen peroxide	3.0	3.0	3.0	3.0	3.0
		(E)		e-1	10.0	10.0	5.0		10.0
				e-2			5.0	10.0	
		(F)		f-1	2.0	2.0	2.0	2.0	2.0
		(H)		h-1	0.1	0.1	0.1	0.1	0.1
		(I)		i-1	2.0	2.0	1.5	2.0	2.0
				Perfume	0.5	0.5	0.8	—	0.8
				Sterile water	Balance	Balance	Balance	Balance	Balance
				Total	100	100	100	100	100
				pH (20°C)	4.0	3.5	5.0	5.5	4.0
				Content of component (A) (mass%)	45.0	45.0	50.0	45.0	45.0
				Content of component (A1) (mass%)	2.5	1.7	5.0	3.4	5.1
				(c1)/(B) (mass ratio)	0.5	0.0	0.0	0.0	0.3

[0148]

Ingredients shown in Tables are as follows.

<Ingredient>

In the following description, ethylene oxide and propylene oxide are abbreviated to EO and PO, respectively. A concentration of an anionic organic compound used in its salt form was converted to a concentration in its acid form. The converted concentration is shown in Tables. Values of pH of compositions were adjusted with an aqueous solution of sodium hydroxide or an aqueous solution of hydrochloric acid.

[0149]

Component (A)

Component (a1)

- a1-1:

polyoxyethylene(9)polyoxypropylene(2)polyoxyethylene(9) alkyl ether (the numbers in parentheses represent an average added mole number) [a produced obtained by adding 9 moles of ethylene oxide, 2 moles of propylene oxide and 9 moles of ethylene oxide in this order in a block addition per mole of a saturated linear primary alcohol having 10 to 14 carbon atoms, that is, a compound represented by the formula (a1-5) in which $p_{11} = 9$, $q = 2$ and $p_{12} = 9$. The component (A1) is not contained].

- a1-2:

polyoxyethylene(8)polyoxypropylene(2)polyoxyethylene(8) alkyl ether (the numbers in parentheses represent an average added mole number) [a produced obtained by adding 8 moles of ethylene oxide, 2 moles of propylene oxide, and 8 moles of ethylene oxide in this order in a block addition per mole of a saturated linear primary alcohol having 10 to 14 carbon atoms, that is, a compound represented by the formula (a1-5) in which $p_{11} = 8$, $q = 2$, and $p_{12} = 8$. The component (A1) is not contained].

- a1-3:

polyoxyethylene(15)polyoxypropylene(2)polyoxyethylene(15) alkyl ether (the numbers in parentheses represent an average added mole number) [a produced obtained by adding 15 moles of ethylene oxide, 2 moles of propylene oxide and 15 moles of ethylene oxide in this order in a block addition per mole of a saturated linear primary alcohol having 10 to 14 carbon atoms, that is, a compound represented by the formula (a1-5) in which $p_{11} = 15$, $q = 2$, and $p_{12} = 15$. The component (A1) is not contained].

- a1-4: polyoxyethylene(20)polyoxypropylene(2) alkyl ether (the numbers in parentheses represent an average added mole number) [a produced obtained by adding 20 moles of ethylene oxide and 2 moles of propylene oxide in this order in a block additio per mole of a saturated linear primary alcohol having 10 to 14 carbon atoms, that is, a compound represented by the formula (a1-2) in which $p = 20$ and $q = 2$. The component (A1) is not contained].

- a1-5:

polyoxyethylene(14)polyoxypropylene(2)polyoxyethylene(4) alkyl ether (the numbers in parentheses represent an average added mole number) [a produced obtained by adding 14 moles of ethylene oxide and 2 moles of propylene oxide and 4 moles of ethylene oxide in this order in a block addition per mole of a saturated linear primary alcohol having 10 to 14 carbon atoms, that is, a compound represented by the formula (a1-5) in which $p_{11} = 14$, $q = 2$, and $p_{12} = 4$. The component (A1) is not contained].

[0150]

Component (a2)

- a2-1: a nonionic surfactant represented by the formula (a2) in which R^{2a} represents a linear primary alkyl group having

11 carbon atoms, l represents 1, m represents 15, n represents 0, and R^{21a} represents a methyl group.

- a2-2: a nonionic surfactant represented by the formula (a2) in which R^{2a} represents a linear primary alkyl group having 11 carbon atoms, l represents 1, m represents 10, n represents 0, and R^{21a} represents a methyl group.

{0151}

Component (a3)

- a3-1: a nonionic surfactant represented by the formula (a3) in which R^{3a} represents a linear alkyl group having 12 to 14 carbon atoms, and has a secondary carbon atom at which R^{3a} bonds to an oxygen atom of $R^{3a}-O-$, and $r = 7$ (a produced obtained by adding 7 moles of EO per mole of a saturated linear secondary alcohol having 12 to 14 carbon atoms and separating an unreacted alcohol by distillation. The content of $R^{a2}OH$ is less than 0.1% by mass).

- a3-2: a nonionic surfactant represented by the formula (a3) in which R^{3a} represents a linear alkyl group having 12 carbon atoms, and has a primary carbon atom at which R^{3a} bonds to an oxygen atom of $R^{3a}-O-$, and $r = 3$ (with simple distribution), about 100% of a3-2 is the component (A1) which is a compound represented by the formula (A1) in which $x = 3$.

- a3-3: a nonionic surfactant represented by the formula (a3) in which R^{3a} represents a linear alkyl group having 12 carbon atoms, and has a primary carbon atom at which R^{3a} bonds to an oxygen atom of $R^{3a}-O-$, and $r = 5$ (with simple distribution), about 100% of a3-2 is the component (A1) which is a compound represented by the formula (A1) in which $x = 5$.

- a3-4: a nonionic surfactant represented by the formula (a3) in which R^{3a} represents a linear alkyl group having 14 carbon atoms, and has a primary carbon atom at which R^{3a} bonds to an

oxygen atom of $R^{3a}-O-$, and $r = 5$ (with simple distribution), not containing the component (A1).

- a3-5: a nonionic surfactant represented by the formula (a3) in which R^{3a} represents a linear alkyl group having 10 carbon atoms, and has a primary carbon atom at which R^{3a} bonds to an oxygen atom of $R^{3a}-O-$, and $r = 5$ (with simple distribution).

- a3-6: a nonionic surfactant having 3 moles of EO on the average, produced by adding ethylene oxide to lauryl alcohol, or a nonionic surfactant represented by the formula (a3) in which R^{3a} represents a linear alkyl group having 12 carbon atoms, and has a primary carbon atom at which R^{3a} bonds to an oxygen atom of $R^{3a}-O-$, and $r = 3$, containing the component (A1) of which nonionic compounds represented by the formula (A1) in which $x = 2, 3, 4$, or 5 account for 50 % by mass of a3-6 in total, and nonionic compounds in which $x = 3, 4$, or 5 account for 32% by mass of a3-6 in total. In a3-6 is contained nonionic compounds that can be represented by the formula (A1) in which $x = 0$ or 1 for convenience and has the same R as described in the formula (A1) in the total amount of 33% by mass.

- a3-7: a nonionic surfactant having 6 moles of EO on the average, produced by adding ethylene oxide to lauryl alcohol, or a nonionic surfactant represented by the formula (a3) in which R^{3a} represents a linear alkyl group having 12 carbon atoms, and has a primary carbon atom at which R^{3a} bonds to an oxygen atom of $R^{3a}-O-$, and $r = 6$, containing the component (A1) of which nonionic compounds represented by the formula (A1) in which $x = 2, 3, 4$, or 5 account for 34 % by mass of a3-7 in total, and nonionic compounds in which $x = 3, 4$, or 5 account for 27% by mass of a3-7 in total. a3-7 also comprises nonionic compounds that can be represented by the formula (A1) in which $x = 0$ or 1 for convenience and has the same R as described in the formula (A1) in the total amount of 10% by mass.

• a3-8: a nonionic surfactant represented by the formula (a3) in which R^{3a} represents a linear alkyl group having 12 carbon atoms, and has a primary carbon atom at which R^{3a} bonds to an oxygen atom of $R^{3a}-O-$, and $r = 8$ (with simple distribution), not containing the component (A1) but containing a compound that can be represented by the formula (A1) for convenience and contains about 100% of compounds with $x = 8$.

[0152]

Component (B)

- b1-1: N-(1-dodecyl)-N,N,N-trimethylammonium ethyl sulfate.
- b1-2: N-(1-tetradecyl)-N,N-dimethyl-N-ethylammonium ethyl sulfate.
- b1-3: N-(1-octadecyl)-N,N,N-trimethylammonium methyl sulfate.

[0153]

Component (C)

- LAS: alkylbenzenesulfonic acid having a linear alkyl group having 10 to 14 carbon atoms (average of the number of carbon atoms: 11.7)
- palm oil fatty acid: Lunac L-55 (product name), Kao corporation
- di(long-chain alkyl(C14)) cation: di(linear alkyl(14 carbon atoms))dimethylammonium ethyl sulfate, in which two C14 alkyl groups bond to the nitrogen atom have a primary carbon atom.

[0154]

Component (E)

- e-1: diethylene glycol monobutyl ether (also referred to as butoxy diglycol).
- e-2: triethylene glycol monophenyl ether (PHG-30, Nippon Nyukazai Co.Ltd.).

- e-3: ethanol.

[0155]

Component (F)

- f-1: sodium p-toluenesulfonate (a concentration shown in Tables is calculated based on its acid form).

Component (H)

- h-1: 1- hydroxyethylidene-1,1-diphosphonic acid.

Component (I)

- i-1: a polymer compound produce by a method of Synthesis Example 1 described in JP-A10-60476 p.4 paragraph 0020.

(Others)

- fluorescent dye: Tinopal CBS-X (product name) (BASF Japan).

- enzyme: Everlase 16.0L-EX (product name) (protease, Novozymes).

[0156]

<Lathering property in application>

Liquid detergent compositions of Examples 7 to 20 in Table 2 and Comparative Example 11 in Table 3 are prepared. Black cotton socks are worn for 12 hours by any male adults in their twenties to forties, washed with the standard detergent described in Evaluation for odor due to damp-dry, and dried in a room of 20°C and 60% RH. This cycle of wearing, washing, and drying is repeated ten times. Black cotton socks thus prepared are used for evaluation.

[0157]

A liquid detergent composition is applied to the bottom of a sock thus worn and washed repeatedly. Each of the liquid detergent compositions of Examples makes a significant lather although lathering changes from wearer to another. The lather is formed within 15 seconds from the application and vanishes within 60 seconds from the application. The liquid detergent

composition of Comparative Example 11 without hydrogen peroxide does not make lather.

[0158]

Throughout this specification and the claims which follow, unless the context requires otherwise, the word "comprise", and variations such as "comprises" and "comprising", will be understood to imply the inclusion of a stated integer or step or group of integers or steps but not the exclusion of any other integer or step or group of integers or steps.

[0159]

The reference in this specification to any prior publication (or information derived from it), or to any matter which is known, is not, and should not be taken as an acknowledgment or admission or any form of suggestion that that prior publication (or information derived from it) or known matter forms part of the common general knowledge in the field of endeavour to which this specification relates.

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The Claims Defining the Invention are as Follows:

1. A liquid detergent composition, comprising:

(A) a non-ionic surfactant [hereinafter, referred to as component (A)] in an amount of 15 to 70% by mass,

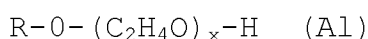
(B) a cationic surfactant represented by the formula (B1) [hereinafter, referred to as component (B)] in an amount of 0.3 to 5% by mass,

(D) hydrogen peroxide [hereinafter, referred to as component (D)] in an amount of 0.3 to 10% by mass, and water,

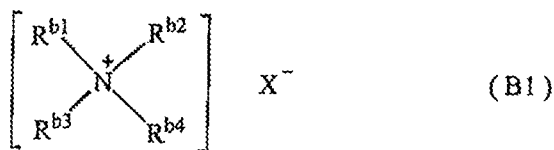
wherein the component (A) comprises (A1) a nonionic compound represented by the formula (A1) in an amount of 0.5 to 10% by mass of the composition,

a mass ratio of (c1) an anionic surfactant other than fatty acid or a salt thereof to the component (B), (c1)/(B), is 0 to 1, and

the composition has a pH of 3.0 to 7.0 at 20°C, as measured in accordance with JIS K3362:1998 Section 8.3:



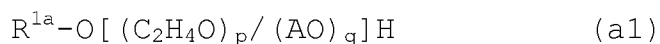
wherein, R represents a linear alkyl group having 12 carbon atoms, and has a primary carbon atom at which R bonds to an oxygen atom of R-O-; and x represents a mole number of added ethyleneoxy group and is an integer ranging from 2 to 5:



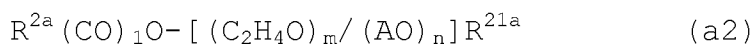
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wherein, R^{b1} represents a chain hydrocarbon group having 12 to 18 carbon atoms, and may have $-(A'O)_s-$ therein, wherein $A'O$ represents an ethyleneoxy group or propyleneoxy group, and s represents an average mole number of $A'O$, ranging from 0 to 10; R^{b2} , R^{b3} , and R^{b4} each independently represent a methyl group, an ethyl group, a benzyl group, or a hydroxyalkyl group having 1 to 3 carbon atoms; and X^- represents $CH_3SO_4^-$, $CH_3CH_2SO_4^-$ or a halogen ion, and

wherein the component (A) comprises at least one nonionic surfactant selected from those represented by the formulae (a1) and/or (a2) in an amount of 10 to 60% by mass:



wherein, R^{1a} represents an alkyl or alkenyl group having 8 to 22 carbon atoms; AO represents an alkyleneoxy group having 3 to 5 carbon atoms; p represents an average mole number of added C_2H_4O groups, ranging from 8 to 40; q represents an average mole number of added AO groups, ranging from 0 to 5; and "/" represents that C_2H_4O groups and AO groups may be arranged in either a random addition or a block addition:



wherein, R^{2a} represents an alkyl or alkenyl group having 8 to 22 carbon atoms, R^{21a} represents an alkyl group having 1 to 3 carbon atoms; 1 represents the number 0 or 1; AO represents an alkyleneoxy group having 3 to 5 carbon atoms; m represents an average mole number of added C_2H_4O groups, ranging from 5 to 30; n represents an average mole number of added AO groups, ranging from 0 to 5; and "/" represents that C_2H_4O groups and AO groups

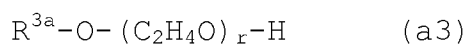
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may be arranged in either a random addition or a block addition.

2. The liquid detergent composition according to claim 1, wherein, in the component (A1), the total proportion of compounds wherein x represents 3, 4, or 5 is 70 to 100% by mass.

3. The liquid detergent composition according to claim 1 or 2, comprising component (A1) in the amount of 1 to 8% by mass.

4. The liquid detergent composition according to any one of claims 1 to 3, wherein the component (A) comprises a nonionic surfactant represented by the formula (a3) in an amount of 0.5 to 20% by mass:



wherein, R^{3a} represents an alkyl or alkenyl group having 8 to 22 carbon atoms, and has a primary and/or secondary carbon atom at which R^{3a} bonds to an oxygen atom of $R^{3a}-O-$; and r represents an average mole number of added C_2H_4O groups, ranging from 2 to less than 8.

5. The liquid detergent composition according to any one of claims 1 to 4, further comprising (c2) a fatty acid and a salt thereof in an amount of 0.05 to 5% by mass calculated based on its acid form.

6. The liquid detergent composition according to any one of claims 1 to 5, further comprising (E) a water-miscible

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organic solvent in an amount of 1 to 40% by mass.

7. The liquid detergent composition according to any one of claims 1 to 6, further comprising (H) an organic chelating agent in an amount of 0.01 to 0.5% by mass.

8. The liquid detergent composition according to any one of claims 1 to 7, wherein a content of a water-miscible organoamine compound is less than 1% by mass.

9. The liquid detergent composition according to any one of claims 1 to 8, comprising no bleach activator.

10. A method for cleaning a textile product with an aqueous solution of the liquid detergent composition according to any one of claims 1 to 9.

11. A method for cleaning a textile product, comprising a step of applying a liquid detergent composition to the textile product and making lather with the detergent composition, wherein the detergent composition comprises:

(A) a nonionic surfactant [hereinafter, referred to as component (A)] in an amount of 15 to 70% by mass,

(B) a cationic surfactant represented by the formula (B1) [hereinafter, referred to as component (B)] in an amount of 0.3 to 5% by mass,

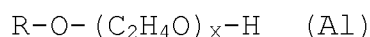
(D) hydrogen peroxide [hereinafter, referred to as component (D)] in an amount of 0.3 to 10% by mass, and water,

wherein the component (A) comprises (A1) a non-ionic compound represented by the formula (A1) in an amount of 0.5 to 10% by mass of the composition,

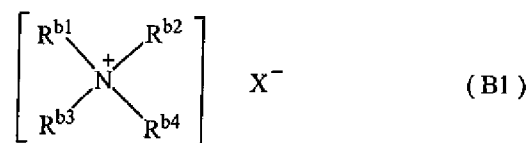
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a mass ratio of (c1) an anionic surfactant other than fatty acid or a salt thereof to the component (B), (c1)/(B), is 0 to 1, and

the composition has a pH of 3.0 to 7.0 at 20°C, as measured in accordance with JIS K3362:1998 Section 8.3:

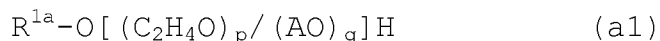


wherein, R represents a linear alkyl group having 12 carbon atoms, and has a primary carbon atom at which R bonds to an oxygen atom of R-O-; and x represents a mole number of ethyleneoxy groups added and is an integer ranging from 2 to 5:

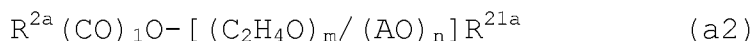


wherein, R^{b1} represents a chain hydrocarbon group having 12 to 18 carbon atoms, and may have $-(\text{A}'\text{O})_s-$ therein, wherein $\text{A}'\text{O}$ represents an ethyleneoxy group or a propyleneoxy group, and s represents an average mole number of $\text{A}'\text{O}$ added, ranging from 0 to 10; R^{b2} , R^{b3} , and R^{b4} each independently represent a methyl group, an ethyl group, a benzyl group, or a hydroxyalkyl group having 1 to 3 carbon atoms; and X^- represents CH_3SO_4^- , $\text{CH}_3\text{CH}_2\text{SO}_4^-$ or a halogen ion, and

wherein the component (A) of the liquid detergent composition comprises at least one nonionic surfactant selected from those represented by the formulae (a1) and/or (a2) in an amount of 10 to 60% by mass:



wherein, R^{1a} represents an alkyl or alkenyl group having 8 to 22 carbon atoms; AO represents an alkyleneoxy group having 3 to 5 carbon atoms; p represents an average mole number of added C_2H_4O groups, ranging from 8 to 40; q represents an average mole number of added AO groups, ranging from 0 to 5; and "/" represents that C_2H_4O groups and AO groups may be arranged in either a random addition or a block addition;



wherein, R^{2a} represents an alkyl or alkenyl group having 8 to 22 carbon atoms; R^{21a} represents an alkyl group having 1 to 3 carbon atoms; 1 represents the number 0 or 1; AO represents an alkyleneoxy group having 3 to 5 carbon atoms; m represents an average mole number of added C_2H_4O groups, ranging from 5 to 30; n represents an average mole number of added AO groups, ranging from 0 to 5; and "/" represents that C_2H_4O groups and AO groups may be arranged in either a random addition or a block addition.

12. The method for cleaning a textile product according to claim 11, comprising applying a part of the liquid detergent composition to be used to the textile product and contacting the applied textile product with a washing liquid comprising the rest of the liquid detergent composition and water to wash the textile product.

13. Use of the liquid detergent composition according to any one of claims 1 to 9 for cleaning a textile product.