

DESCRIPTION

LIQUID DETERGENT

TECHNICAL FIELD

[0001]

The present invention relates to a liquid detergent.

Priority is claimed on Japanese Patent Application No. 2013-253646, filed December 6, 2013, the content of which is incorporated herein by reference.

BACKGROUND ART

[0002]

From the viewpoint of enhancing attention to hygiene, it is desirable that liquid detergents for clothing not only remove soiling adhered to the clothing or the like (the items being laundered), but also remove unpleasant odors that develop from the items being laundered, or prevent unpleasant odors from developing from the items being laundered.

The development of unpleasant odors from the items being laundered is mainly due to the proliferation of microbes adhered to the fibers during drying or storage of the laundered items.

In order to deal with this problem, detergents containing a cationic surfactant having a sterilizing effect or antibacterial effect have been proposed. Patent Document 1 discloses a liquid detergent containing a cationic surfactant, a nonionic surfactant, and benzoic acid and/or a salt thereof.

CITATION LIST

Patent Documents

[0003]

Patent Document 1: Japanese Unexamined Patent Application, First Publication
No. 2006-316130

SUMMARY OF THE INVENTION

Problems to be Solved by the Invention

[0004]

However, changes in modern lifestyles have resulted in an increase in the number of households in which laundering is performed at night, and indoor drying is then performed, with the laundered items being dried inside. With indoor drying, because the ventilation is poor, making it difficult to dry the laundered items, microbes adhered to the fibers can proliferate readily.

Accordingly, detergents capable of inhibiting the development of unpleasant odors from the laundered items even during indoor drying (hereafter also referred to as "indoor drying odors") are required. With the liquid detergent disclosed in Patent Document 1 mentioned above, suppression of these types of indoor drying odors is inadequate. Further, simply increasing the amount of the cationic surfactant having a sterilizing effect or antibacterial effect results in a deterioration in the detergency effect, which also makes it more difficult to obtain a favorable suppression effect on the development of indoor drying odors.

[0005]

In order to investigate methods of enhancing the suppression effect on the development of indoor drying odors, the inventors of the present invention focused their

attention on the degradation and removal of the biofilm adhered to the items being laundered or the washing tub, and particularly to the reverse side of the washing tub. They discovered that by utilizing a sugar-degrading enzyme such as mannanase, indoor drying odors could be effectively suppressed.

However, when a sugar-degrading enzyme is added, a problem arises in that maintaining the storage stability (for example, the transparency uniformity and the fluidity) of the liquid detergent is difficult.

[0006]

The present invention has been developed in light of these circumstances, and has an object of providing a liquid detergent which has a superior effect in suppressing the development of indoor drying odors, and also exhibits favorable storage stability.

Means for Solving the Problems

[0007]

As a result of further investigations, the inventors of the present invention discovered that by adding, to the surfactant solution, a sugar-degrading enzyme formulation of mannanase or the like, together with a hydroxycarboxylic acid or a salt thereof in an amount equal to or greater than the amount of the sugar-degrading enzyme formulation, the above object could be achieved, and they were thus able to complete the present invention. In other words, the present invention relates to a liquid detergent containing a component (A) that is a surfactant, a component (B) that is a sugar-degrading enzyme formulation, and a component (C) that is a hydroxycarboxylic acid or a salt thereof, wherein the mass ratio represented by component (B)/component (C) is not more than 1.

In the liquid detergent of the present invention, the component (A) preferably includes a cationic surfactant.

[0008]

In other words, the present invention relates to the following.

[1] A liquid detergent containing:

a component (A): a surfactant,

a component (B): a sugar-degrading enzyme formulation, and

a component (C): a hydroxycarboxylic acid or a salt thereof, wherein

the mass ratio represented by component (B)/component (C) is not more than 1.

[2] The liquid detergent according to [1], wherein the component (A) contains a cationic surfactant.

Effects of the Invention

[0009]

The liquid detergent of the present invention has a superior effect in suppressing the development of indoor drying odors, and also exhibits favorable storage stability.

BEST MODE FOR CARRYING OUT THE INVENTION

[0010]

The liquid detergent of the present invention contains a component (A) that is a surfactant, a component (B) that is a sugar-degrading enzyme formulation, and a component (C) that is a hydroxycarboxylic acid or a salt thereof.

The liquid detergent of the present invention can be used for household, commercial and industrial applications, can be used particularly favorably for household applications, and is ideal as a liquid detergent for clothing.

Examples of the laundry target items (items being laundered) include the same laundry target items as those typically targeted by household laundering, and specific examples include textile products such as clothing, cloths, towels, sheets and curtains.

[0011]

<Component (A): Surfactant>

The liquid detergent of the present invention exhibits detergency as a result of containing the component (A).

The types of surfactants typically used in liquid detergents for clothing and the like can be used as the component (A), and examples include nonionic surfactants, anionic surfactants, cationic surfactants and amphoteric surfactants.

In the present description, a nonionic surfactant is sometimes referred to as component (A-1), an anionic surfactant is sometimes referred to as component (A-2), and a cationic surfactant is sometimes referred to as component (A-3).

[0012]

(Component (A-1): Nonionic Surfactant)

Examples of the component (A-1) include the nonionic surfactants (1) to (9) described below.

- (1) Polyoxyalkylene alkyl (or alkenyl) ethers
- (2) Polyoxyethylene alkyl (or alkenyl) phenyl ethers
- (3) Fatty acid alkyl ester alkoxylates having an alkylene oxide added within the ester linkage of a long-chain fatty acid alkyl ester
- (4) Polyoxyethylene sorbitan fatty acid esters
- (5) Polyoxyethylene sorbit fatty acid esters
- (6) Polyoxyethylene fatty acid esters
- (7) Polyoxyethylene hardened castor oils

(8) Glycerol fatty acid esters

(9) Alkyl amine alkoxyates having an alkylene oxide added to a long-chain alkyl (or alkenyl) amine

[0013]

Among the various possible components (A-1), components of types (1), (3) and (9) mentioned above are preferred. Among these, in terms of achieving good storage stability and enhancing the suppression effect on film formation at the surface of the liquid, a surfactant of type (3) above is particularly preferred. Further, in those cases where the component (A-2) described below functions as the main detergent component, using a surfactant of type (1) above is preferable, as it makes it easier to obtain the effects of the present invention.

[0014]

Preferred examples of the surfactant of type (3) above include polyoxyalkylene nonionic surfactants represented by general formula (a-1-1) shown below (hereafter also referred to as "component (a-1-1)").

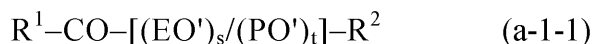
Further, preferred examples of the surfactant of type (1) above include polyoxyalkylene nonionic surfactants represented by general formula (a-1-2) shown below (hereafter also referred to as "component (a-1-2)") and polyoxyalkylene nonionic surfactants represented by general formula (a-1-3) shown below (hereafter also referred to as "component (a-1-3)").

Furthermore, preferred examples of the surfactant of type (9) above include polyoxyalkylene alkyl amine nonionic surfactants represented by general formula (a-1-4) shown below (hereafter also referred to as "component (a-1-4)").

[0015]

- Component (a-1-1)

The component (a-1-1) is a polyoxyalkylene nonionic surfactant represented by general formula (a-1-1) shown below.



In the formula, R^1 represents an alkyl group having a carbon number of 7 to 18 or an alkenyl group having a carbon number of 7 to 18, R^2 represents an alkyl group having a carbon number of 1 to 3, s represents the average number of repetitions of EO' and is a number from 6 to 20, t represents the average number of repetitions of PO' and is a number from 0 to 6, EO' represents an oxyethylene group, PO' represents an oxypropylene group, and $[(EO')_s/(PO')_t]$ means that EO' and PO' may be arranged as a mixture.

[0016]

In the above formula (a-1-1), from the viewpoint of detergency, R^1 is preferably an alkyl group having a carbon number of 9 to 18 or an alkenyl group having a carbon number of 9 to 18, and may be either linear or branched.

Examples of R^1 include an alkyl group or alkenyl group derived from a raw material such as a primary or secondary higher alcohol, a higher fatty acid, or a higher fatty acid amide or the like.

[0017]

In formula (a-1-1), R^2 is an alkyl group having a carbon number of 1 to 3, and is preferably a methyl group.

[0018]

In formula (a-1-1), s represents a number from 6 to 20, and is preferably a number from 6 to 18, more preferably a number from 11 to 18, and most preferably a number from 14 to 16. Further, s may be an integer, or may include decimals.

If s exceeds 20, then the HLB value becomes overly high, and the detergency tends to deteriorate. On the other hand, if s is less than 6, then the raw material odor of the component (a-1-1) itself tends to worsen.

Furthermore, t represents a number from 0 to 6, and is preferably a number from 0 to 3. Moreover, t may be an integer, or may include decimals.

If t exceeds 6, then the storage stability of the liquid detergent under conditions of high temperature tends to deteriorate.

In the present description and the claims, the expression "average number of repetitions" means the number of moles of ethylene oxide or propylene oxide reacted with each 1 mole of the alcohol that is used.

The nomenclature " $[(EO')_s/(PO')_t]$ " means that the EO' and PO' may be arranged as a mixture, and that the EO' and PO' may be added randomly or added in blocks.

In the component (a-1-1), there are no particular limitations on the distribution of the number of repetitions of EO' or PO' , and this distribution is prone to fluctuation depending on the reaction method used when producing the component (a-1-1). For example, when the ethylene oxide or propylene oxide is added to a hydrophobic raw material (such as a primary or secondary higher alcohol, a higher fatty acid, or a higher fatty acid amide) using a typical alkali catalyst such as sodium hydroxide or potassium hydroxide, the distribution of the number of repetitions of EO' or PO' tends to be comparatively broad. Further, when the ethylene oxide or propylene oxide is added to an aforementioned hydrophobic raw material using a specific alkoxylation catalyst such as magnesium oxide containing added metal ions such as Al^{3+} , Ga^{3+} , In^{3+} , Tl^{3+} , Co^{3+} , Sc^{3+} , La^{3+} or Mn^{2+} , as disclosed in Japanese Examined Patent Application, Second Publication No. Hei 6-15038, the distribution of the number of repetitions of EO' or PO' tends to be comparatively narrow.

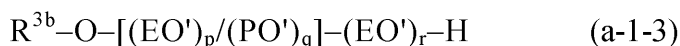
[0019]

Preferred examples of the component (a-1-1) include polyoxyalkylene nonionic surfactants obtained by adding 11 to 18 (and preferably 15) molar equivalents of ethylene oxide to a fatty acid methyl ester having a carbon number of 10 to 18 (and preferably 12 to 14).

[0020]

- Component (a-1-2) and Component (a-1-3)

The component (a-1-2) is a polyoxyalkylene nonionic surfactant represented by general formula (a-1-2) shown below, and the component (a-1-3) is a polyoxyalkylene nonionic surfactant represented by general formula (a-1-3) shown below.



In these formulas, each of R^{3a} and R^{3b} independently represents an alkyl group having a carbon number of 8 to 18 or an alkenyl group having a carbon number of 8 to 18, u represents the average number of repetitions of EO' and is a number from 5 to 20, p represents an average number of repetitions of EO' , q represents the average number of repetitions of PO' , and r represents an average number of repetitions of EO' , wherein p , q and r are numbers that satisfy $17 > p > 1$, $17 > r > 1$, $0 < q \leq 3$ and $p + r = 10$ to 20, EO' represents an oxyethylene group, PO' represents an oxypropylene group, and $[(EO')_p/(PO')_q]$ means that EO' and PO' may be arranged as a mixture.

[0021]

In the above formulas (a-1-2) and (a-1-3), from the viewpoint of detergency, each of R^{3a} and R^{3b} preferably independently represents an alkyl group having a carbon number of 10 to 18 or an alkenyl group having a carbon number of 10 to 18, and may be either linear or branched.

In formula (a-1-2), u is a number from 5 to 20, and is preferably a number from 8 to 18, more preferably a number from 10 to 16, and most preferably a number from 14 to 16. If u exceeds 20, then the HLB value becomes overly high, and the detergency tends to deteriorate. On the other hand, if u is less than 5, then the raw material odor of the component (a-1-2) itself tends to worsen.

In formula (a-1-3), " $[(EO')_p/(PO')_q]$ " means that the EO' and PO' may be arranged as a mixture, and that the EO' and PO' may be added randomly or added in blocks.

In formula (a-1-3), the ratio between EO' and PO' is such that the ratio represented by $q/(p+r)$ is preferably from 0.1 to 0.5, and more preferably from 0.1 to 0.3. When the ratio represented by $q/(p+r)$ is at least as large as the preferred lower limit, foaming is not excessive, and the degree of foaming can be optimized. When the ratio is not more than the preferred upper limit, an appropriate viscosity is more readily obtained, and gelling is more easily suppressed.

[0022]

The component (a-1-2) and the component (a-1-3) can be produced by conventionally known methods. The component (a-1-2) can be produced, for example, by adding ethylene oxide to an alcohol containing R^{3a} derived from a natural oil or fat. The component (a-1-3) can be produced, for example, by performing sequential addition of ethylene oxide and then propylene oxide, or by performing mixed addition (random addition) of ethylene oxide and propylene oxide, to an alcohol containing R^{3b} derived from a natural oil or fat, and subsequently performing a second addition of ethylene oxide.

By using the component (a-1-2) or the component (a-1-3), an appropriate viscosity can be more easily achieved for the liquid detergent, and gelling is also better.

suppressed. Further, the foaming properties improve, and the biodegradability also improves.

[0023]

Preferred examples of the component (a-1-2) and the component (a-1-3) include nonionic surfactants obtained by adding 12 molar equivalents or 15 molar equivalents of ethylene oxide to an alcohol such as Diadol (product name, an alcohol having a carbon number of 13 (C13)) manufactured by Mitsubishi Chemical Corporation, Neodol (product name, a mixture of alcohols having a carbon number of 12 (C12) and C13) manufactured by Royal Dutch Shell plc, or Safol 23 (product name, a mixture of C12 and C13) manufactured by Sasol Ltd.; nonionic surfactants obtained by adding 12 molar equivalents or 15 molar equivalents of ethylene oxide to a natural alcohol such as CO-1214 (product name) or CO-1270 (product name) manufactured by Procter & Gamble Company; a nonionic surfactant obtained by adding 7 molar equivalents of ethylene oxide to a C13 alcohol obtained by subjecting a C12 alkene obtained by trimerizing butene to the oxo process (for example, product name: Lutensol TO7, manufactured by BASF Corporation); a nonionic surfactant obtained by adding 9 molar equivalents of ethylene oxide to a C10 alcohol obtained by subjecting pentanol to the Guerbet reaction (for example, product name: Lutensol XP90, manufactured by BASF Corporation); a nonionic surfactant obtained by adding 7 molar equivalents of ethylene oxide to a C10 alcohol obtained by subjecting pentanol to the Guerbet reaction (for example, product name: Lutensol XL70, manufactured by BASF Corporation); a nonionic surfactant obtained by adding 6 molar equivalents of ethylene oxide to a C10 alcohol obtained by subjecting pentanol to the Guerbet reaction (for example, product name: Lutensol XA60, manufactured by BASF Corporation); nonionic surfactants obtained by adding 9 molar equivalents or 15 molar equivalents of ethylene oxide to a secondary alcohol having a

carbon number of 12 to 14 (for example, product names: Softanol 90 and Softanol 150, manufactured by Nippon Shokubai Co., Ltd.); and a nonionic surfactant obtained by sequentially adding 8 molar equivalents of ethylene oxide and then 2 molar equivalents of propylene oxide to a natural alcohol (such as a mixture of an alcohol having a carbon number of 12 and an alcohol having a carbon number of 14), and then adding a further 8 molar equivalents of ethylene oxide.

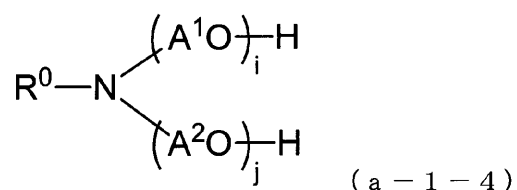
[0024]

- Component (a-1-4)

The component (a-1-4) is a polyoxyalkylene alkyl amine nonionic surfactant represented by general formula (a-1-4) shown below.

[0025]

[Chemical Formula 1]



In the formula, R^0 represents an alkyl group having a carbon number of 10 to 20 or an alkenyl group having a carbon number of 10 to 20, each of A^1O and A^2O independently represents an oxyalkylene group having a carbon number of 2 or 3, i represents the average number of repetitions of A^1O , and j represents the average number of repetitions of A^2O , wherein $i > 0$, $j > 0$ and $i + j$ is a number from 10 to 50.

[0026]

In the above formula (a-1-4), R^0 has a carbon number of 10 to 20, and from the viewpoint of the detergency, is preferably an alkyl group having a carbon number of 10

to 18 or an alkenyl group having a carbon number of 10 to 18, and may be either linear or branched.

Provided the carbon number of R^0 is at least 10, good detergency performance can be obtained, whereas provided the carbon number is not more than 20, good solubility can be achieved.

In formula (a-1-4), $(A^1O)_i$ and $(A^1O)_j$ represent repeating structures of oxyalkylene groups having a carbon number of 2 or 3, and each structure may be a repeating structure composed solely of oxyethylene groups (EO'), a repeating structure composed solely of oxypropylene groups (PO'), or a structure composed of a mixture of EO' and PO'. When the structure is composed of a mixture of the two oxyalkylene groups, the EO' and PO' may be added randomly or added in blocks. Among the various possibilities, in terms of achieving superior detergency relative to sebum soiling, $(A^1O)_i$ and $(A^1O)_j$ are preferably both repeating structures composed solely of EO'.

In formula (a-1-4), i and j are numbers that satisfy $40 > i > 0$ and $40 > j > 0$, wherein the value of $i+j$ is a number from 10 to 50. The value of $i+j$ is preferably from 10 to 40, and more preferably from 10 to 30. When $i+j$ is at least as large as the lower limit of the above range, the detergency performance improves, and when $i+j$ is not more than the upper limit of the above range, the storage stability of the liquid detergent can be further enhanced.

[0027]

Preferred examples of the component (a-1-4) include polyoxyalkylene alkyl amine nonionic surfactants obtained by adding 20 molar equivalents of ethylene oxide (namely, $i+j = 20$) to an alkyl amine having a carbon number of 16.

[0028]

A single component (A-1) may be used alone, or a combination of two or more components may be used.

Among the various types of the components (A-1), components of types (1), (3) and (9) mentioned above are preferred, and components of types (1) and (3) are particularly preferred. Among these, in terms of achieving superior detergency and achieving more favorable low-temperature stability for the liquid detergent, the component (a-1-1), the component (a-1-2) and the component (a-1-3) are preferable, and the component (a-1-1) is particularly desirable. Among the various possibilities for the component (a-1-1), fatty acid ester nonionic surfactants in which $t = 0$ in the above formula (a-1-1) are particularly preferred.

Although there are no particular limitations on the proportion of the component (A-1) within the entire component (A), the proportion is preferably from 10 to 96% by mass, more preferably from 30 to 90% by mass, still more preferably from 50 to 90% by mass, and most preferably from 70 to 90% by mass, relative to the total mass of the component (A). Provided the proportion of the component (A-1) satisfies the preferred range above, the detergency relative to soiling adhered to the items being laundered can be further enhanced.

[0029]

(Component (A-2): Anionic Surfactant)

Examples of the component (A-2) include the anionic surfactants (11) to (22) described below.

(11) Linear or branched alkylbenzene sulfonates (LAS or ABS) having an alkyl group with a carbon number of 8 to 18.

(12) Alkane sulfonates having a carbon number of 10 to 20.

(13) α -olefin sulfonates (AOS) having a carbon number of 10 to 20.

(14) Alkyl sulfates (AS) having a carbon number of 10 to 20 or alkenyl sulfates (AS) having a carbon number of 10 to 20.

(15) Alkyl (or alkenyl) ether sulfates (AES, AEPS) having a linear or branched alkyl group (or alkenyl group) with a carbon number of 10 to 20, to which has been added an average of 0.5 to 10 mol of any alkylene oxide having a carbon number of 2 to 4, or a mixture of ethylene oxide (EO) and propylene oxide (PO) (molar ratio EO/PO = 0.1/9.9 to 9.9/0.1).

(16) Alkyl (or alkenyl) phenyl ether sulfates having a linear or branched alkyl group (or alkenyl group) with a carbon number of 10 to 20, to which has been added an average of 3 to 30 mol of any alkylene oxide having a carbon number of 2 to 4, or a mixture of ethylene oxide (EO) and propylene oxide (PO) (molar ratio EO/PO = 0.1/9.9 to 9.9/0.1).

(17) Alkyl (or alkenyl) ether carboxylates having a linear or branched alkyl group (or alkenyl group) with a carbon number of 10 to 20, to which has been added an average of 0.5 to 10 mol of any alkylene oxide having a carbon number of 2 to 4, or a mixture of ethylene oxide (EO) and propylene oxide (PO) (molar ratio EO/PO = 0.1/9.9 to 9.9/0.1).

(18) Alkyl polyhydric alcohol ether sulfates such as alkyl glyceryl ether sulfonates having a carbon number of 10 to 20.

(19) Long-chain monoalkyl, dialkyl or sesquialkyl phosphates.

(20) Polyoxyethylene monoalkyl, polyoxyethylene dialkyl, or polyoxyethylene sesquialkyl phosphates.

(21) α -sulfo fatty acid methyl ester salts (MES) with a carbon number of 14 to 18.

(22) Fatty acid salts (soaps) with a carbon number of 10 to 22.

These components (A-2) can be used in the form of alkali metal salts such as sodium and potassium salts, alkaline earth metal salts such as magnesium salts,

alkanolamine salts such as monoethanolamine and diethanolamine salts, or ammonium salts or the like.

[0030]

A single component (A-2) may be used alone, or a combination of two or more components may be used.

Among the various types of the component (A-2), components of types (11), (15), (21) and (22) mentioned above are preferred, and components of type (11) are particularly preferred.

Although there are no particular limitations on the proportion of the component (A-2) within the entire component (A), the proportion is preferably from 1 to 30% by mass, more preferably from 2 to 20% by mass, and still more preferably from 3 to 15% by mass, relative to the total mass of the component (A). Provided the proportion of the component (A-2) satisfies the preferred range above, the detergency relative to soiling adhered to the items being laundered can be further enhanced.

[0031]

(Component (A-3): Cationic Surfactant)

Examples of the component (A-3) include the cationic surfactants (31) to (33) described below.

(31) Di-long-chain alkyl, di-short-chain alkyl quaternary ammonium salts.

(32) Mono-long-chain alkyl, tri-short-chain alkyl quaternary ammonium salts.

(33) Tri-long-chain alkyl, mono-short-chain alkyl quaternary ammonium salts.

In these types (31) to (33), the term "long-chain alkyl" indicates an alkyl group having a carbon number of 10 to 26. The carbon number of the alkyl group of this long-chain alkyl group is preferably from 10 to 18. Specific examples of preferred cationic

surfactants include C12 alkyl trimethyl ammonium chloride and didecyl dimethyl ammonium chloride.

The term "short-chain alkyl" indicates an alkyl group having a carbon number of 1 to 4 which may have a substituent. The carbon number of the alkyl group of this short-chain alkyl group is preferably 1 or 2. Examples of the substituent which the alkyl group may have include a phenyl group, benzyl group, hydroxyl group, hydroxyalkyl group, and polyoxyalkylene group. The hydroxyalkyl group preferably has a carbon number of 2 to 4, and more preferably 2 or 3. The carbon number of the oxyalkylene group in the polyoxyalkylene group is preferably from 2 to 4, and more preferably 2 or 3.

[0032]

A single component (A-3) may be used alone, or a combination of two or more components may be used.

Among the various types of the component (A-3), components of type (32) above are particularly preferred.

Although there are no particular limitations on the proportion of the component (A-3) within the entire component (A), the proportion is preferably from 0.01 to 30% by mass, more preferably from 0.1 to 20% by mass, and still more preferably from 0.5 to 10% by mass, relative to the total mass of the component (A). Provided the proportion of the component (A-3) satisfies the preferred range above, the development of unpleasant odors from the laundered items during indoor drying (namely, indoor drying odors) are better suppressed.

[0033]

Examples of the amphoteric surfactant include imidazoline-based amphoteric surfactants, amide betaine-based amphoteric surfactants, alkyl dimethyl amine oxides, and alkyl amido propyl dimethyl amine oxides. Specific examples of preferred

amphoteric surfactants include 2-alkyl-N-carboxymethyl-N-hydroxyethyl imidazolinium betaine, lauramidopropyl betaine, and among the various alkyl dimethyl amine oxides, C12 amine oxide and C14 amine oxide.

A single amphoteric surfactant may be used alone, or a combination of two or more amphoteric surfactants may be used.

Although there are no particular limitations on the proportion of the amphoteric surfactant within the entire component (A), the proportion is preferably from 0 to 60% by mass, and more preferably from 0 to 30% by mass, relative to the total mass of the component (A). Provided the proportion of the amphoteric surfactant satisfies the preferred range above, the detergency relative to soiling adhered to the items being laundered can be further enhanced.

[0034]

In the liquid detergent, a single component (A) may be used alone, or a combination of two or more types of the component (A) may be used.

The use of a combination of the component (A-1) and the component (A-2) as the component (A) is preferred.

When the component (A-1) and the component (A-2) coexist, the detergency relative to all manner of soiling adhered to the items being laundered, including sebum soiling, protein soiling and sugar soiling and the like can be further improved, enabling the effects of the present invention to manifest more dramatically.

The mass ratio represented by component (A-1)/component (A-2) (also referred to as "the mass ratio (A-1)/(A-2)") is preferably within a range from 0.1 to 20, and more preferably from 0.5 to 10.

Provided the mass ratio (A-1)/(A-2) is at least as large as the preferred lower limit, the detergency relative to sebum soiling in particular can be further enhanced, whereas

provided the mass ratio (A-1)/(A-2) is not more than the preferred upper limit, the detergency relative to protein soiling in particular can be further enhanced.

In the present invention, "the mass ratio represented by component (A-1)/component (A-2)" means the mass ratio of the amount of the component (A-1) relative to the amount of the component (A-2) within the liquid detergent.

The mass ratio represented by component (A-1)/component (A-2) may be within a range from 5 to 20.

[0035]

Further, in the liquid detergent of the [present invention, the component (A) preferably includes the component (A-3). By including the component (A-3), the effect of the invention in suppressing the development of indoor drying odors during indoor drying can be further enhanced.

[0036]

Furthermore, in terms of enhancing the detergency relative to various types of soiling, and making it easier to obtain a favorable suppression effect on the development of indoor drying odors, the use of a combination of the component (A-1), the component (A-2) and the component (A-3) is preferred.

The mass ratio represented by [component (A-1)+component (A-2)]/component (A-3) (also referred to as "the mass ratio [(A-1)+(A-2)]/(A-3)") is preferably within a range from 1 to 50, more preferably from 5 to 30, and still more preferably from 18 to 46.

Provided the mass ratio [(A-1)+(A-2)]/(A-3) is at least as large as the preferred lower limit, the storage stability (transparency uniformity and fluidity) can be further improved, whereas provided the mass ratio [(A-1)+(A-2)]/(A-3) is not more than the preferred upper limit, the suppression effect on the development of indoor drying odors can be further enhanced.

In the present invention, "the mass ratio represented by [component (A-1)+component (A-2)]/component (A-3)" means the combined amount of the component (A-1) and the component (A-2) relative to the amount of the component (A-3) in the liquid detergent.

[0037]

The amount of the component (A) in the liquid detergent, relative to the total mass of the liquid detergent, is preferably at least 20% by mass, more preferably 30% by mass or greater, and most preferably 40% by mass or greater. Provided the amount of the component (A) is at least as large as the preferred lower limit, a favorable detergency effect relative to the soiling adhered to the items being laundered can be more easily obtained, and the larger the amount of the component (A), the more dramatic the effects of the present invention become.

On the other hand, the upper limit for the amount of the component (A) is preferably not more than 80% by mass, more preferably not more than 70% by mass, and still more preferably 60% by mass or less. Provided the amount of the component (A) is not more than the preferred upper limit, better transparency uniformity of the external appearance and favorable fluidity can be more readily obtained.

In other words, the amount of the component (A), relative to the total mass of the liquid detergent, is preferably at least 20% by mass but not more than 80% by mass, more preferably at least 30% by mass but not more than 70% by mass, and still more preferably at least 40% by mass but not more than 60% by mass.

The amount of the component (A), relative to the total mass of the liquid detergent, may be within a range 27 to 48% by mass.

[0038]

<Component (B): Sugar-Degrading Enzyme Formulation>

The component (B) is an enzyme formulation containing a sugar-degrading enzyme.

In the liquid detergent of the present invention, including the component (B) mainly yields a suppression effect on the development of indoor drying odors.

Examples of the sugar-degrading enzyme include cellulase, amylase, mannanase, pectinase, xylanase, glucoamylase, glucosidase, glucanase, dextranase, chitinase, sialidase, mannosidase, saccharase, fucosidase, alginate lyase and pectin lyase. Among these, in terms of obtaining superior suppression of the development of indoor drying odors, cellulase, amylase and mannanase are preferred, and amylase and mannanase are particularly desirable.

[0039]

Specific examples of commercially available products of the component (B) include enzyme formulations containing a cellulase, such as Endolase 5000L, Celluzyme 0.4L and Carezyme Premium 4500L (all product names) available from Novozymes A/S. Further, examples of enzyme formulations containing an amylase include Termamyl 300L, Termamyl Ultra 300L, Duramyl 300L, Stainzyme 12L and Stainzyme Plus 12L (all product names) available from Novozymes A/S, the product Maxamyl available from Genencor International BV, the product Pullulanase Amano available from Amano Enzyme Inc., and the product DB-250 available from Seikagaku Corporation. Examples of enzyme formulations containing a mannanase include the product Mannaway 4L available from Novozymes A/S.

[0040]

A single component (B) may be used alone, or a combination of two or more components may be used.

In terms of further enhancing the detergency effect and the suppression effect on the development of indoor drying odors, the amount of the component (B) in the liquid detergent, relative to the total mass of the liquid detergent, is preferably at least 0.01% by mass, more preferably at least 0.03% by mass, and still more preferably 0.05% by mass or greater.

On the other hand, in terms of ensuring good storage stability (such as suppressing enzyme precipitation) and avoiding saturation of the effect of adding the component (B), the upper limit for the amount of the component (B), relative to the total mass of the liquid detergent, is preferably not more than 2% by mass, more preferably not more than 1.5% by mass, and still more preferably 1% by mass or less. In other words, the amount of the component (B), relative to the total mass of the liquid detergent, is preferably at least 0.01% by mass but not more than 2% by mass, more preferably at least 0.03% by mass but not more than 1.5% by mass, and still more preferably at least 0.05% by mass but not more than 1% by mass.

Further, the amount of the component (B), relative to the total mass of the liquid detergent, is most preferably from 0.1 to 0.5% by mass.

[0041]

<Component (C): Hydroxycarboxylic Acid or Salt thereof>

The component (C) is a hydroxycarboxylic acid or a salt thereof, namely at least one compound selected from the group consisting of hydroxycarboxylic acids and hydroxycarboxylates.

In the present invention, the expression "hydroxycarboxylic acid" describes a compound having a carboxyl group (-COOH) and an alcoholic hydroxyl group (-OH) within a single molecule.

In the liquid detergent of the present invention, including the component (C) mainly maintains the transparency uniformity of the external appearance of the liquid detergent, or maintains the fluidity of the liquid detergent, thus providing excellent storage stability.

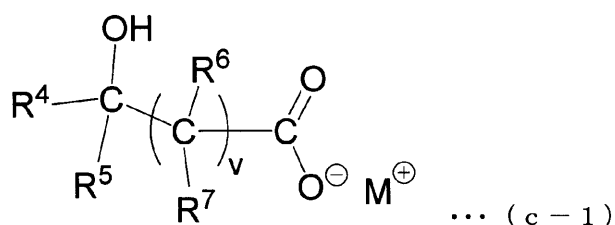
Examples of the hydroxycarboxylates include alkali metal salts such as sodium and potassium salts, alkaline earth metal salts such as calcium and magnesium salts, and alkanolamine salts such as ammonium salts and ethanolamine salts, of the hydroxycarboxylic acid.

[0042]

Preferred examples of the component (C) include compounds represented by general formula (c-1) shown below.

[0043]

[Chemical Formula 2]



In the formula, each of R^4 and R^5 independently represents a hydrogen atom, an alkyl group having a carbon number of 1 to 10 which may have a substituent, an aryl group which may have a substituent, a nitro group ($-\text{NO}_2$), an ester group, an ether group, an amino group ($-\text{NH}_2$) which may have a substituent, or an amine derivative group, each of R^6 and R^7 independently represents a hydrogen atom or an alkyl group having a carbon number of 1 to 5, v represents an integer of 0 to 4, and M^+ represents a counter ion.

[0044]

In the above formula (c-1), the alkyl group for R^4 and R^5 has a carbon number of 1 to 10, and preferably a carbon number of 1 to 5, and among such groups, a methyl group, ethyl group, propyl group, isopropyl group, n-butyl group, isobutyl group, tert-butyl group, pentyl group, isopentyl group or neopentyl group is preferred, a methyl group, ethyl group, propyl group or isopropyl group is more preferred, a methyl group or ethyl group is still more preferred, and a methyl group is the most desirable. The aryl group for R^4 and R^5 preferably has a carbon number of 6 to 15, and more preferably a carbon number of 6 to 10, and among such groups, a phenyl group or naphthyl group is particularly preferred.

Preferred examples of the ester group for R^4 and R^5 include $-\text{COOR}^8$.

Preferred examples of the ether group for R^4 and R^5 include $-\text{R}^4-\text{O}-\text{R}^5$.

[0045]

In R^4 and R^5 , an "alkyl group having a substituent", an "aryl group having a substituent" or an "amino group having a substituent" means an alkyl group, aryl group or amino group in which at least one hydrogen atom that constitutes the alkyl group, at least one hydrogen atom that constitutes the aryl group, or at least one hydrogen atom that constitutes the amino group has been substituted with a substituent.

[0046]

Examples of the substituent which the alkyl group may have include an aryl group, nitro group, nitro derivative group, hydroxyl group ($-\text{OH}$), hydroxy derivative group, ester group, ether group, amino group, amine derivative group, amide group, amide derivative group and halogen atom.

Examples of the substituent which the aryl group may have include an alkyl group, nitro group, nitro derivative group, hydroxyl group, hydroxy derivative group,

ester group, ether group, amino group, amine derivative group, amide group, amide derivative group and halogen atom.

Examples of the substituent which the amino group may have include an alkyl group, aryl group, nitro group, nitro derivative group, hydroxyl group, hydroxy derivative group, ester group, ether group, amine derivative group, amide group, amide derivative group and halogen atom.

[0047]

Examples of the alkyl group, aryl group or ester group for the above substituent include the same alkyl groups, aryl groups and ester groups as those described above for R^4 and R^5 .

Preferred examples of the amide group for the substituent include $-C(=O)NH-R^9$.

Examples of the halogen atom for the substituent include a fluorine atom, chlorine atom, bromine atom and iodine atom, and a fluorine atom is preferred.

[0048]

Among the above possibilities, each of R^4 and R^5 is preferably a hydrogen atom, an alkyl group having a carbon number of 1 to 10 which may have a substituent, or an aryl group which may have a substituent.

Further, compounds in which R^4 and R^5 are both hydrogen atoms, compounds in which one of R^4 and R^5 is a hydrogen atom and the other is an alkyl group having a carbon number of 1 to 10 which may have a substituent, and compounds in which one of R^4 and R^5 is a hydrogen atom and the other is an aryl group which may have a substituent are particularly desirable.

[0049]

In the above formula (c-1), each of the alkyl groups for R^6 and R^7 has a carbon number of 1 to 5, and among such groups, a methyl group, ethyl group, propyl group or

isopropyl group is preferred, a methyl group or ethyl group is more preferred, and a methyl group is the most desirable.

Further, compounds in which R^6 and R^7 are both hydrogen atoms, and compounds in which one of R^6 and R^7 is a hydrogen atom and the other is a methyl group are particularly preferred.

Moreover, v represents an integer of 0 to 4, and is preferably 0, 1 or 2, more preferably 0 or 1, and most preferably 0.

[0050]

M^+ is a counter ion, and may be any counter ion capable of forming a water-soluble salt with $-COO^-$. Examples of this counter ion include alkali metal ions, alkaline earth metal ions (in which case the counter ion is a divalent ion), protonated amines, an ammonium ion, and a proton. When M^+ represents a proton, the compound represented by general formula (c-1) is a hydroxycarboxylic acid.

Examples of alkali metals that can form the counter ion include sodium and potassium.

Examples of alkaline earth metals that can form the counter ion include calcium and magnesium.

Examples of amines that can form the counter ion include primary, secondary and tertiary amines, and amines having a total carbon number of 1 to 6 are preferable. These amines may have a hydroxyl group, and examples of these types of amines include alkanolamines, wherein the carbon number of the alkanolamine is preferably from 1 to 3. Specific examples of these alkanolamines include monoethanolamine, diethanolamine and triethanolamine.

Amines that can form the counter ion are protonated counter ions.

In terms of ease of availability and enhancing the solubility, M^+ is preferably an alkali metal ion, is more preferably a sodium ion or a potassium ion, and is most preferably a sodium ion.

[0051]

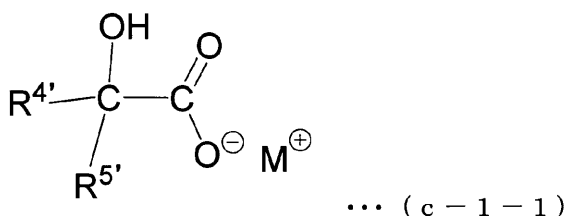
Specific examples of preferred compounds for the component (C) include glycolic acid, lactic acid (α -hydroxypropionic acid and β -hydroxypropionic acid), hydroxybutyric acid (2-hydroxybutyric acid, 3-hydroxybutyric acid and γ -hydroxybutyric acid), hydroxyisobutyric acid (2-hydroxyisobutyric acid and 3-hydroxyisobutyric acid), mandelic acid, optical isomers of these compounds, and salts of these compounds.

[0052]

Among the above possibilities, in terms of achieving particularly favorable storage stability, the component (C) is preferably an α -hydroxycarboxylic acid or a salt thereof, is more preferably an α -hydroxy-monocarboxylic acid or a salt thereof, and is particularly preferably a compound represented by general formula (c-1-1) shown below.

[0053]

[Chemical Formula 3]



In the formula, each of $R^{4'}$ and $R^{5'}$ independently represents a hydrogen atom, an alkyl group having a carbon number of 1 to 10 which may have a substituent, an aryl group which may have a substituent, a nitro group ($-\text{NO}_2$), an ether group, an amino

group (-NH_2) which may have a substituent, or an amine derivative group, and M^+ has the same meaning as M^+ in the above formula (c-1).

[0054]

In formula (c-1-1), examples of the alkyl group having a carbon number of 1 to 10 and the aryl group for $\text{R}^{4'}$ and $\text{R}^{5'}$ include the same groups as those described above for the alkyl group having a carbon number of 1 to 10 and the aryl group for R^4 and R^5 .

Compounds in which $\text{R}^{4'}$ and $\text{R}^{5'}$ are both hydrogen atoms, compounds in which one of $\text{R}^{4'}$ and $\text{R}^{5'}$ is a hydrogen atom and the other is an alkyl group having a carbon number of 1 to 10 which may have a substituent, and compounds in which one of $\text{R}^{4'}$ and $\text{R}^{5'}$ is a hydrogen atom and the other is an aryl group which may have a substituent are preferable; compounds in which one of $\text{R}^{4'}$ and $\text{R}^{5'}$ is a hydrogen atom and the other is an alkyl group having a carbon number of 1 to 10 which may have a substituent, and compounds in which one of $\text{R}^{4'}$ and $\text{R}^{5'}$ is a hydrogen atom and the other is an aryl group which may have a substituent are more preferable; and compounds in which one of $\text{R}^{4'}$ and $\text{R}^{5'}$ is a hydrogen atom and the other is an alkyl group having a carbon number of 1 to 10 which may have a substituent are particularly preferred.

[0055]

Specific examples of preferred compounds represented by the above formula (c-1-1) include glycolic acid, α -hydroxypropionic acid, 2-hydroxybutyric acid, 2-hydroxyisobutyric acid, mandelic acid, optical isomers of these compounds, and salts of these compounds, and among these, α -hydroxypropionic acid, mandelic acid and salts thereof are preferred, and α -hydroxypropionic acid and salts thereof are particularly preferred.

[0056]

A single component (C) may be used alone, or a combination of two or more components may be used.

The amount of the component (C) in the liquid detergent, relative to the total mass of the liquid detergent, is preferably within a range from 0.1 to 5% by mass, more preferably from 0.5 to 4% by mass, still more preferably from 1 to 3% by mass, and most preferably from 1 to 2% by mass.

Provided the amount of the component (C) is within the preferred range above, the stability of the component (B) in the liquid detergent is enhanced. In addition, the effect of the invention in suppressing film formation at the surface of the liquid can be more readily obtained.

Provided the amount of the component (C) is at least as large as the preferred lower limit, the transparency uniformity of the external appearance of the liquid detergent and the fluidity can be further improved. On the other hand, provided the amount of the component (C) is not more than the preferred upper limit, precipitation or the like is less likely to occur when the liquid detergent is prepared.

[0057]

In the present invention, "the mass ratio represented by component (B)/component (C)" means the mass ratio of the amount of the component (B) relative to the amount of the component (C) within the liquid detergent.

The mass ratio represented by component (B)/component (C) (also referred to as "the mass ratio (B)/(C)") is not more than 1, and is preferably within a range from 0.001 to 1, more preferably from 0.01 to 0.75, and still more preferably from 0.1 to 0.25.

Provided the mass ratio (B)/(C) is not more than the upper limit mentioned above, the transparency uniformity of the external appearance of the liquid detergent, and the fluidity can be maintained, thus providing excellent storage stability. In addition, the

effect in suppressing film formation at the surface of the liquid can be more readily obtained. If the mass ratio (B)/(C) exceeds the above upper limit, then there is a possibility that precipitation or the like may occur when the liquid detergent is prepared.

On the other hand, provided the mass ratio (B)/(C) is at least as large as the preferred lower limit, the detergency improves, and the suppression effect on the occurrence of indoor drying odors is also enhanced.

[0058]

<Component (D)>

The component (D) in the present invention is at least one compound selected from the group consisting of isopropyl methylphenol (IPMP), 3-iodo-2-propynyl butyl carbamate (IPBC), thiabendazole (TBZ), polylysine, polyhexamethylene biguanide, and acid salts of these compounds. Including the component (D) mainly imparts an antibacterial effect.

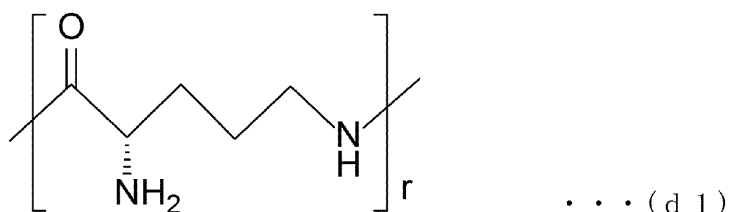
[0059]

<<Polylysine or Acid Salt thereof>>

For the polylysine, any of α -poly-L-lysine, ϵ -poly-L-lysine, α -poly-D-lysine or ϵ -poly-D-lysine may be used. Among these, in terms of safety, α -poly-L-lysine and ϵ -poly-L-lysine are preferred, and ϵ -poly-L-lysine is more preferred. Among such polylysines, from the viewpoint of safety, an ϵ -poly-L-lysine represented by general formula (d1) shown below is particularly desirable.

[0060]

[Chemical Formula 4]



In the formula, r represents an integer of 5 to 100.

[0061]

In the above formula (d1), r represents an integer of 5 to 100, is preferably an integer of 10 to 50, and more preferably an integer of 13 to 27.

ϵ -poly-L-lysine is obtained by cultivation of a microbe of the genus *Streptomyces*, and is a polypeptide obtained by condensation of lysine, which is an essential amino acid in humans. When this polylysine is hydrolyzed by enzymes in the body or the like, the L-lysine that represents the original structural component is obtained, and therefore the polymer exhibits excellent safety.

[0062]

Either a free polylysine, or a polylysine that exists in the form of an acid salt with an inorganic acid or an organic acid may be used as the polylysine.

In the case of an acid salt, a hydrochloride, gluconate or acetate salt is preferred, and a hydrochloride is more preferred.

Further, in order to facilitate handling, a polylysine that has been processed with an excipient or an extender may also be used.

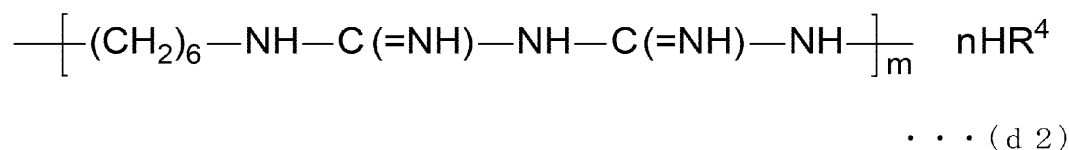
[0063]

<<Polyhexamethylene Biguanide or Acid Salt thereof>>

Examples of the or polyhexamethylene biguanide or acid salt thereof include compounds represented by general formula (d2) shown below (hereafter referred to as "the component (d2)").

[0064]

[Chemical Formula 5]



In the formula, m represents an integer of 2 to 14, HR^4 represents an organic acid or inorganic acid, and n means the number of HR^4 moieties, and is an integer of 0 to 5m.

[0065]

In the above formula (d2), m represents an integer of 2 to 14, and is preferably an integer of 10 to 14, more preferably an integer of 11 to 13, and most preferably 12.

In formula (d2), HR^4 represents an organic acid or inorganic acid, is preferably hydrochloric acid, gluconic acid or acetic acid, and is more preferably hydrochloric acid.

Moreover, n represents an integer of 0 to 5m. The number "5m" means " $5 \times m$ ".

When n is 0, the component (d2) is hexamethylene biguanide. When n is not 0, the component (d2) is a partial acid salt or total acid salt of polyhexamethylene biguanide. Further, n is preferably an integer of 1 to 5m, more preferably an integer of 2 to 3m, still more preferably an integer of m to 2m, and most preferably m.

The expressions "3m" and "2m" mean " $3 \times m$ " and " $2 \times m$ " respectively.

[0066]

A single component (D) may be used alone, or a combination of two or more components may be used.

In terms of ensuring better maintenance of the external appearance stability, the component (D) is preferably IPMP, IPBC or a combination of IPMP and IPBC, and is more preferably IPMP.

The amount of the component (D) in the liquid detergent, relative to the total mass of the aforementioned liquid detergent, is preferably within a range from 0.01 to 2% by mass, and more preferably from 0.1 to 1% by mass. Provided the amount of the component (D) is at least as large as the preferred lower limit, a more favorable suppression effect on indoor drying odors can be obtained, whereas provided the amount of the component (D) is not more than the upper limit, the storage stability of the liquid detergent can be further improved.

In the present invention, "the mass ratio represented by component (B)/component (D)" means the mass ratio of the amount of the component (B) relative to the amount of the component (D) within the liquid detergent.

The mass ratio represented by component (B)/component (D) (also referred to as "the mass ratio (B)/(D)") is preferably within a range from 0.2 to 100, and is more preferably from 2.5 to 20. Provided the mass ratio (B)/(D) is at least as large as the above lower limit, the transparency uniformity of the external appearance of the liquid detergent, and the fluidity can be maintained, providing excellent storage stability. In addition, the effect in suppressing film formation at the surface of the liquid can be more readily obtained. Provided the mass ratio (B)/(D) is not more than the upper limit mentioned above, the detergency improves, and the suppression effect on the development of indoor drying odors is also enhanced.

[0067]

<Solvent>

From the viewpoints of ease of preparation, and solubility in water when the liquid detergent is used, the liquid detergent of the present invention preferably includes water as a solvent, and the use of ion-exchanged water is particularly desirable.

The amount of water in the liquid detergent, relative to the total mass of the liquid detergent, is preferably not more than 70% by mass, more preferably 60% by mass or less, and still more preferably 50% by mass or less. The lower the amount of water, the more dramatic the effects of the present invention become. In addition, a concentrated detergent can be prepared more easily.

On the other hand, the lower limit for the amount of water is preferably at least 30% by mass. Provided the amount of water is at least as large as the preferred lower limit, the storage stability of the liquid detergent over time can be improved.

In other words, when the liquid detergent includes water as a solvent, the amount of the water in the liquid detergent is preferably at least 30% by mass but not more than 70% by mass, is more preferably at least 30% by mass but not more than 60% by mass, and is still more preferably at least 30% by mass but not more than 50% by mass.

Further, the amount of water in the liquid detergent may be from 40% by mass to 70% by mass.

[0068]

<Other Components>

The liquid detergent of the present invention may also include components besides the components (A) to (C) described above (namely, other components) as required, provided these other components do not impair the effects of the present invention.

There are no particular limitations on these other components, and the types of components typically used in liquid detergents for clothing and the like can be added, including enzyme formulations besides the component (B) (hereafter also referred to as "optional enzyme formulations"), enzyme stabilizers, preservatives, alkaline agents, antioxidants, water-miscible organic solvents, fragrances, viscosity reducers or

solubilizers, colorants, detergency builders, antifoaming agents, pH modifiers, silicones, fluorescent brighteners, migration inhibitors, anti-resoiling agents, pearl agents, soil release agents, foam control agents, chelating agents, emulsifiers and extracts.

[0069]

For the enzyme formulations besides the component (B) (the optional enzyme formulations), liquid formulations having an enzyme component dispersed in a liquid, and powder formulations having an enzyme fixed to a powdered stabilizer or the like can be used. Any of the enzyme components that can be used in conventional liquid detergents for clothing may be used as the enzyme component. Examples of the optional enzyme formulations include protease formulations and lipase formulations.

Examples of the protease formulations include Savinase 16L, Savinase Ultra 16L, Savinase Ultra 16XL, Everlase 16L Type EX, Everlase Ultra 16L, Esperase 8L, Alcalase 2.5L, Alcalase Ultra 2.5L, Liquanase 2.5L, Liquanase Ultra 2.5L, Liquanase Ultra 2.5XL and Coronase 48L (all product names) available from Novozymes A/S; and Purafect L, Purafect OX and Properase L (all product names) available from Genencor International BV.

Examples of the lipase formulations include Lipex 100L and Lipolase 100L (both product names) available from Novozymes A/S.

[0070]

A single optional enzyme formulation may be used, or a combination of two or more formulations may be used.

By using at least one optional enzyme formulation in combination with the component (B), the suppression effect on the development of indoor drying odors can be further enhanced.

The mass ratio represented by "component (B)/optional enzyme formulations" is preferably within a range from 0.2 to 1, and more preferably from 0.5 to 1. Provided this mass ratio satisfies this preferred range, the suppression effect on the development of indoor drying odors can be further enhanced.

In the present invention, "the mass ratio represented by "component (B)/optional enzyme formulations" means the mass ratio of the amount of the component (B) relative to the amount of enzyme formulations other than the component (B) in the liquid detergent.

Among the various possible optional enzyme formulations, protease formulations are preferred, and among these, Savinase 16L, Savinase Ultra 16L, Savinase Ultra 16XL, Everlase 16L, Everlase Ultra 16L, Liquanase 2.5L, Liquanase Ultra 2.5L, Liquanase Ultra 2.5XL and Coronase 48L are preferred, and Everlase 16L, Savinase 16L and Coronase 48L are particularly desirable.

[0071]

The amount of the optional enzyme formulations within the liquid detergent, relative to the total mass of the liquid detergent, is preferably within a range from 0.01 to 2% by mass, more preferably from 0.01 to 1% by mass, and still more preferably from 0.03 to 0.8% by mass. Provided the amount of the optional enzyme formulations is at least as large as the preferred lower limit, the effect of the enzyme can manifest more easily, and provided the amount is not more than the upper limit, precipitation of the enzyme formulations is unlikely, even in compositions having a low water content.

[0072]

Examples of the enzyme stabilizers include boric acid, sodium borate, formic acid or salts thereof, and calcium salts such as calcium chloride and calcium sulfate. The

amount of the enzyme stabilizer, relative to the total mass of the liquid detergent, is preferably at least 0.001% by mass but not more than 2% by mass.

[0073]

Examples of the preservatives include the product KATHON CG manufactured by Rohm and Haas Company. The amount of the preservative, relative to the total mass of the liquid detergent, is preferably within a range from 0.001 to 1% by mass.

Further, benzoic acid or a salt thereof, which exhibits the effects of a preservative, may be included for the purpose of improving the storage stability. The amount of the benzoic acid or salt thereof, relative to the total mass of the liquid detergent, is preferably within a range from 0.1 to 5% by mass, and more preferably from 0.15 to 2% by mass.

[0074]

Examples of the alkaline agents include monoethanolamine, diethanolamine and triethanolamine. The amount of the alkaline agent, relative to the total mass of the liquid detergent, is preferably from 0.5 to 5% by mass.

[0075]

There are no particular limitations on the antioxidants, but in terms of achieving better maintenance of the detergency and the liquid stability, phenol-based antioxidants are preferable, and among these, monophenol-based antioxidants such as dibutylhydroxytoluene and butylhydroxyanisole, bisphenol-based antioxidants such as 2,2'-methylenebis(4-methyl-6-*t*-butylphenol), and polymeric phenol-based antioxidants such as *dl*- α -tocopherol are more preferable, and monophenol-based antioxidants and polymeric phenol-based antioxidants are particularly desirable. The amount of the antioxidant, relative to the total mass of the liquid detergent, is preferably from 0.01 to 2% by mass.

[0076]

A water-miscible organic solvent is an organic solvent for which at least 50 g of the solvent can be dissolved in 1 L of ion-exchanged water at 25°C. The water-miscible organic solvent may be any solvent that forms a uniform solution upon mixing with water, and examples include alcohols such as ethanol, 1-propanol, 2-propanol and 1-butanol, glycols such as propylene glycol, butylene glycol and hexylene glycol, polyglycols such as diethylene glycol, triethylene glycol, tetraethylene glycol, polyethylene glycol having an average molecular weight of about 200, polyethylene glycol having an average molecular weight of about 400, polyethylene glycol having an average molecular weight of about 1,000 and dipropylene glycol, and alkyl ethers such as diethylene glycol monomethyl ether and diethylene glycol dimethyl ether. The amount of the water-miscible organic solvent, relative to the total mass of the liquid detergent, is preferably from 0.1 to 15% by mass.

[0077]

Examples of the viscosity reducers or solubilizers include toluenesulfonic acid, xylenesulfonic acid, cumenesulfonic acid, substituted or unsubstituted naphthalenesulfonic acid, toluenesulfonate salts, xylenesulfonate salts, cumenesulfonate salts, and substituted or unsubstituted naphthalenesulfonate salts. Examples of the aromatic sulfonic acid salts include sodium salts, potassium salts, calcium salts, magnesium salts, ammonium salts and alkanolamine salts.

A single viscosity reducer or solubilizer may be used alone, or a combination of two or more viscosity reducers or solubilizers may be used. The amount of the viscosity reducer or solubilizer, relative to the total mass of the liquid detergent, is preferably from 0.01 to 15% by mass. Provided the amount of the viscosity reducer or solubilizer satisfies this preferred range, the inhibitory effect that suppresses formation of a film at

the liquid surface of the liquid detergent as a result of gelling of the liquid detergent can be enhanced.

[0078]

Either inorganic builders or organic builders can be used as detergency builders. The amount of the detergency builder, relative to the total mass of the liquid detergent, is preferably from 0.01 to 20% by mass.

Further, the liquid detergent of the present invention may also include a short-chain fatty acid for the purpose of suppressing foaming, preferably in an amount of 0 to 5% by mass relative to the total mass of the liquid detergent.

[0079]

The pH of the liquid detergent of the present invention at 25°C is preferably within a range from 4 to 9, and more preferably from 6 to 9. Provided the pH satisfies this type of range, the storage stability of the liquid detergent can be more favorably maintained.

The pH of the liquid detergent may be adjusted by adding a pH modifier. Examples of the pH modifier include hydrochloric acid, sulfuric acid, sodium hydroxide, potassium hydroxide, and alkanolamines. A single one of these pH modifiers may be used alone, or a combination of two or more pH modifiers may be used.

In the present invention, the pH of the liquid detergent is the value obtained by adjusting the temperature of the liquid detergent to 25°C, and then measuring the pH using a pH meter (product name: HM-30G, manufactured by DKK Toa Corporation) or the like. Even if a pH value falls outside the range specified in the present description, if the pH value satisfies the range specified in the present invention upon correction to an equivalent pH value at 25°C, then that pH is also deemed to be included within the scope of the present invention.

[0080]

From the viewpoint of factors such as the dischargeability from the container, the viscosity of the liquid detergent of the present invention at 25°C is preferably about 10 to 1,000 mPa·s, and more preferably about 80 to 500 mPa·s.

In the present description, the viscosity of the liquid detergent indicates the value obtained by adjusting the temperature of the liquid detergent to 25°C, and then measuring the viscosity with a B-type viscometer. Even if a viscosity value falls outside the range specified in the present description, if the viscosity value satisfies the range specified in the present invention upon correction to an equivalent viscosity value at 25°C, then that viscosity is also deemed to be included within the scope of the present invention.

[0081]

The liquid detergent of the present invention is prepared by mixing a solvent (preferably water) with the component (A), the component (B), the component (C), and any other optional components as required.

For example, by mixing the solvent and the component (A), adding and mixing the component (B) and the component (C), subsequently adjusting the pH by adding a pH modifier, and then adding and mixing any remaining portion of solvent in those cases where residual solvent exists, the target liquid detergent can be obtained.

In other words, one aspect of a method for preparing the liquid detergent of the present invention includes mixing some or all of the solvent with the component (A), and then adding and mixing the component (B) and the component (C) with the thus obtained mixed solution. Moreover, the method may also include adding other additional components to the mixed solution, and in those cases where a remaining portion of the

solvent exists, the method may also include adding and mixing this residual solvent with the mixed solution.

[0082]

The liquid detergent of the present invention may be used via the same methods as those employed with typical liquid detergents. Examples include a method in which the liquid detergent of the present invention is added to the water together with the items to be laundered at the time of laundering, a method in which the liquid detergent of the present invention is applied directly to soiling on the items to be laundered, and a method in which the liquid detergent of the present invention is first dissolved in water, and the clothing items are then immersed in the resulting solution. Further, a method in which the liquid detergent of the present invention is applied to the items to be laundered, and after standing for an appropriate length of time, normal laundering is performed using a typical washing liquid is also preferable. In these methods, the amount used of the liquid detergent of the present invention is typically about 10 g/30 L.

[0083]

As described above, in the liquid detergent of the present invention, by using a combination of the component (B) and the component (C) in a specific mass ratio (wherein the mass ratio represented by component (B)/component (C) is not more than 1) in a liquid containing the component (A), the suppression effect on the development of indoor drying odors is excellent, and the storage stability is favorable.

In other words, by adding the component (B), sugars that contribute to the formation of biofilm structures adhered to the items being laundered or the washing tub, and particularly the reverse side of the washing tub, are degraded and removed, and by reducing the bacterial count on the laundered items, even if the items are subsequently

dried indoors, the development of unpleasant odors from the laundered items (indoor drying odors) is suppressed.

Further, by combining the component (B) and the component (C) in a specific mass ratio, the component (C) is able to adsorb favorably to the surface of the component (B), thereby enhancing the solubility of the component (B) in the liquid detergent and improving the storage stability (transparency uniformity and fluidity).

[0084]

Furthermore, because the liquid detergent of the present invention has the effect of degrading and removing biofilm, repeated use during laundering suppresses the formation of biofilm on the items being laundered and the washing tub.

Moreover, in the liquid detergent of the present invention, film formation at the liquid surface is also unlikely. Accordingly, the liquid detergent of the present invention is useful in preparing so-called concentrated detergents having a high concentration of surfactants.

[0085]

Another aspect of the liquid detergent of the present invention is a liquid detergent containing:

the component (A): a surfactant

the component (B): a sugar-degrading enzyme formulation,

the component (C): at least one compound selected from the group consisting of hydroxycarboxylic acids and salts thereof,

a solvent, preferably water, and more preferably ion-exchanged water, and

other components as required; wherein

relative to the total mass of the liquid detergent,

the amount of the component (A) is at least 20% by mass but not more than 80% by mass, and is preferably from 27 to 48% by mass,

the amount of the component (B) is at least 0.01% by mass but not more than 2% by mass, and is preferably from 0.1 to 0.5% by mass,

the amount of the component (C) is from 0.1 to 5% by mass, and preferably from 1 to 2% by mass, and

the amount of the solvent is at least 30% by mass but not more than 70% by mass, and is preferably from 48 to 70% by mass,

provided that the combined amount of all of these components does not exceed 100% by mass; and

the mass ratio represented by component (B)/component (C) is within a range from 0.001 to 1, and is preferably from 0.1 to 0.25.

[0086]

Yet another aspect of the liquid detergent of the present invention is a liquid detergent containing:

the component (A): at least one surfactant selected from the group consisting of nonionic surfactants (A-1), anionic surfactants (A-2) and cationic surfactants (A-3),

the component (B): at least one sugar-degrading enzyme formulation selected from the group consisting of cellulase, amylase and mannanase,

the component (C): a compound represented by formula (c-1) shown below,

a solvent, preferably water, and more preferably ion-exchanged water, and

other components as required; wherein

relative to the total mass of the liquid detergent,

the amount of the component (A) is at least 20% by mass but not more than 80% by mass, and is preferably from 27 to 48% by mass,

the amount of the component (B) is at least 0.01% by mass but not more than 2% by mass, and is preferably from 0.1 to 0.5% by mass,

the amount of the component (C) is from 0.1 to 5% by mass, and preferably from 1 to 2% by mass, and

the amount of the solvent is at least 30% by mass but not more than 70% by mass, and is preferably from 48 to 70% by mass,

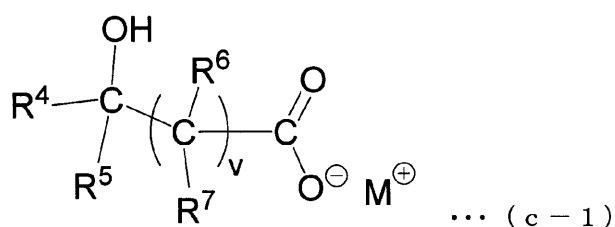
provided that the combined amount of all of these components does not exceed 100% by mass; and

the mass ratio represented by component (B)/component (C) is within a range from 0.001 to 1, and is preferably from 0.1 to 0.25,

when the liquid detergent includes the component (A-1) and the component (A-2), the mass ratio represented by component (A-1)/component (A-2) is within a range from 0.1 to 20, and preferably from 5 to 20, and

when the liquid detergent includes the component (A-1), the component (A-2) and the component (A-3), the mass ratio represented by [component (A-1)+component (A-2)]/component (A-3) is within a range from 1 to 50, and preferably from 18 to 46:
[0087]

[Chemical Formula 6]



wherein each of R^4 and R^5 independently represents a hydrogen atom, an alkyl group having a carbon number of 1 to 10 which may have a substituent, an aryl group

which may have a substituent, a nitro group ($-\text{NO}_2$), an ester group, an ether group, an amino group ($-\text{NH}_2$) which may have a substituent, or an amine derivative group, each of R^6 and R^7 independently represents a hydrogen atom or an alkyl group having a carbon number of 1 to 5, v represents an integer of 0 to 4, and M^+ represents a counter ion.

[0088]

Yet another aspect of the liquid detergent of the present invention is a liquid detergent containing:

the component (A): at least one surfactant selected from the group consisting of nonionic surfactants (A-1), anionic surfactants (A-2) and cationic surfactants (A-3),

the component (B): at least one sugar-degrading enzyme formulation selected from the group consisting of amylase and mannanase,

the component (C): a compound represented by formula (c-1-1) shown below, a solvent, preferably water, and more preferably ion-exchanged water, and other components as required; wherein

the component (A-1) is at least one surfactant selected from the group consisting of polyoxyalkylene nonionic surfactants represented by general formula (a-1-1) shown below, polyoxyalkylene nonionic surfactants represented by general formula (a-1-2) shown below, polyoxyalkylene nonionic surfactants represented by general formula (a-1-3) shown below, and polyoxyalkylene alkyl amine nonionic surfactants represented by general formula (a-1-4) shown below,

the component (A-2) is at least one surfactant selected from the group consisting of linear or branched alkylbenzene sulfonates having an alkyl group with a carbon number of 8 to 18, alkyl (or alkenyl) ether sulfates having a linear or branched alkyl group (or alkenyl group) with a carbon number of 10 to 20, to which has been added an average of 0.5 to 10 mol of any alkylene oxide having a carbon number of 2 to 4, or a

mixture of ethylene oxide (EO) and propylene oxide (PO) (molar ratio EO/PO = 0.1/9.9 to 9.9/0.1), α -sulfo fatty acid methyl ester salts with a carbon number of 14 to 18, and fatty acid salts with a carbon number of 10 to 22, and

the component (A-3) is a mono-long-chain alkyl, tri-short-chain alkyl quaternary ammonium salt; and

relative to the total mass of the liquid detergent,

the amount of the component (A) is at least 20% by mass but not more than 80% by mass, and is preferably from 27 to 48% by mass,

the amount of the component (B) is at least 0.01% by mass but not more than 2% by mass, and is preferably from 0.1 to 0.5% by mass,

the amount of the component (C) is from 0.1 to 5% by mass, and preferably from 1 to 2% by mass, and

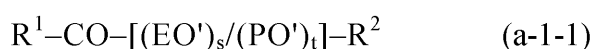
the amount of the solvent is at least 30% by mass but not more than 70% by mass, and is preferably from 48 to 70% by mass,

provided that the combined amount of all of these components does not exceed 100% by mass; and

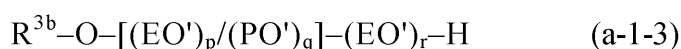
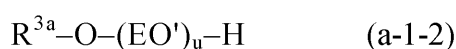
the mass ratio represented by component (B)/component (C) is within a range from 0.001 to 1, and is preferably from 0.1 to 0.25,

when the liquid detergent includes the component (A-1) and the component (A-2), the mass ratio represented by component (A-1)/component (A-2) is within a range from 0.1 to 20, and preferably from 5 to 20, and

when the liquid detergent includes the component (A-1), the component (A-2) and the component (A-3), the mass ratio represented by [component (A-1)+component (A-2)]/component (A-3) is within a range from 1 to 50, and preferably from 18 to 46:



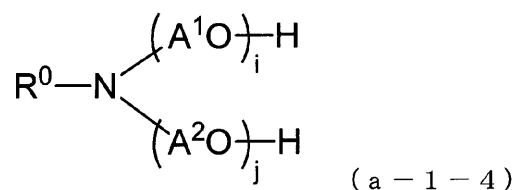
wherein R^1 represents an alkyl group having a carbon number of 7 to 18 or an alkenyl group having a carbon number of 7 to 18, R^2 represents an alkyl group having a carbon number of 1 to 3, s represents the average number of repetitions of EO' and is a number from 6 to 20, t represents the average number of repetitions of PO' and is a number from 0 to 6, EO' represents an oxyethylene group, PO' represents an oxypropylene group, and $[(EO')_s/(PO')_t]$ means that EO' and PO' may be arranged as a mixture;



wherein each of R^{3a} and R^{3b} independently represents an alkyl group having a carbon number of 8 to 18 or an alkenyl group having a carbon number of 8 to 18, u represents the average number of repetitions of EO' and is a number from 5 to 20, p represents an average number of repetitions of EO', q represents the average number of repetitions of PO', and r represents an average number of repetitions of EO', wherein p , q and r are numbers that satisfy $p > 1$, $r > 1$, $0 < q \leq 3$ and $p + r = 10$ to 20, EO' represents an oxyethylene group, PO' represents an oxypropylene group, and $[(EO')_p/(PO')_q]$ means that EO' and PO' may be arranged as a mixture;

[0089]

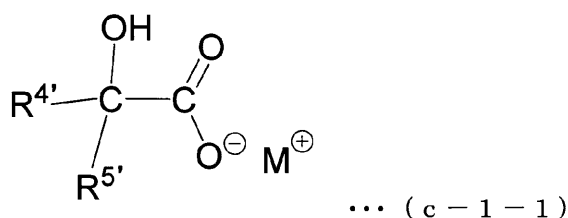
[Chemical Formula 7]



wherein R^0 represents an alkyl group having a carbon number of 10 to 20 or an alkenyl group having a carbon number of 10 to 20, each of A^1O and A^2O independently represents an oxyalkylene group having a carbon number of 2 or 3, i represents the average number of repetitions of A^1O , and j represents the average number of repetitions of A^2O , wherein $i > 0$, $j > 0$ and $i + j$ is a number from 10 to 50;

[0090]

[Chemical Formula 8]



wherein each of $R^{4'}$ and $R^{5'}$ independently represents a hydrogen atom, an alkyl group having a carbon number of 1 to 10 which may have a substituent, an aryl group which may have a substituent, a nitro group ($-\text{NO}_2$), an ether group, an amino group ($-\text{NH}_2$) which may have a substituent, or an amine derivative group, and M^+ represents a counter ion.

[0091]

Yet another aspect of the liquid detergent of the present invention is a liquid detergent containing:

the component (A): a surfactant

the component (B): a sugar-degrading enzyme formulation,

the component (C): at least one compound selected from the group consisting of hydroxycarboxylic acids and salts thereof,

the component (D): at least one compound selected from the group consisting of isopropyl methylphenol (IPMP), 3-iodo-2-propynyl butyl carbamate (IPBC), thiabendazole (TBZ), polylysine, polyhexamethylene biguanide, and acid salts of these compounds,

a solvent, preferably water, and more preferably ion-exchanged water, and

other components as required; wherein

relative to the total mass of the liquid detergent,

the amount of the component (A) is at least 20% by mass but not more than 80% by mass, and is preferably from 27 to 48% by mass,

the amount of the component (B) is at least 0.01% by mass but not more than 2% by mass, and is preferably from 0.1 to 0.5% by mass,

the amount of the component (C) is from 0.1 to 5% by mass, and preferably from 1 to 2% by mass,

the amount of the component (D) is from 0.1 to 2% by mass, and

the amount of the solvent is at least 30% by mass but not more than 70% by mass, and is preferably from 48 to 70% by mass,

provided that the combined amount of all of these components does not exceed 100% by mass; and

the mass ratio represented by component (B)/component (C) is within a range from 0.001 to 1, and is preferably from 0.1 to 0.25.

[0092]

Yet another aspect of the liquid detergent of the present invention is a liquid detergent containing:

the component (A): at least one surfactant selected from the group consisting of nonionic surfactants (A-1), anionic surfactants (A-2) and cationic surfactants (A-3),

the component (B): at least one sugar-degrading enzyme formulation selected from the group consisting of cellulase, amylase and mannanase,

the component (C): a compound represented by formula (c-1) shown below,

a solvent, preferably water, and more preferably ion-exchanged water,

the component (D): at least one compound selected from the group consisting of compounds represented by general formula (d1) shown below, and compounds represented by general formula (d2) shown below, and

other components as required; wherein

relative to the total mass of the liquid detergent,

the amount of the component (A) is at least 20% by mass but not more than 80% by mass, and is preferably from 27 to 48% by mass,

the amount of the component (B) is at least 0.01% by mass but not more than 2% by mass, and is preferably from 0.1 to 0.5% by mass,

the amount of the component (C) is from 0.1 to 5% by mass, and preferably from 1 to 2% by mass, and

the amount of the solvent is at least 30% by mass but not more than 70% by mass, and is preferably from 48 to 70% by mass,

provided that the combined amount of all of these components does not exceed 100% by mass; and

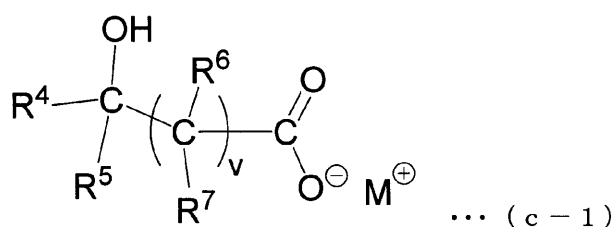
the mass ratio represented by component (B)/component (C) is within a range from 0.001 to 1, and is preferably from 0.1 to 0.25,

when the liquid detergent includes the component (A-1) and the component (A-2), the mass ratio represented by component (A-1)/component (A-2) is within a range from 0.1 to 20, and preferably from 5 to 20, and

when the liquid detergent includes the component (A-1), the component (A-2) and the component (A-3), the mass ratio represented by [component (A-1)+component (A-2)]/component (A-3) is within a range from 1 to 50, and preferably from 18 to 46:

[0093]

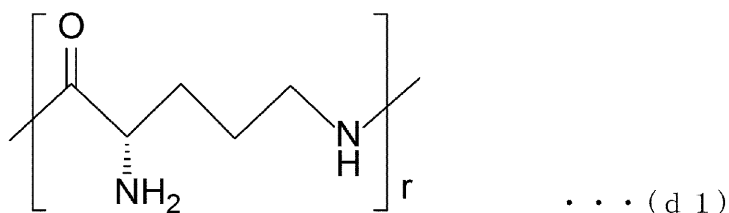
[Chemical Formula 9]



wherein each of R^4 and R^5 independently represents a hydrogen atom, an alkyl group having a carbon number of 1 to 10 which may have a substituent, an aryl group which may have a substituent, a nitro group ($-\text{NO}_2$), an ester group, an ether group, an amino group ($-\text{NH}_2$) which may have a substituent, or an amine derivative group, each of R^6 and R^7 independently represents a hydrogen atom or an alkyl group having a carbon number of 1 to 5, v represents an integer of 0 to 4, and M^+ represents a counter ion;

[0094]

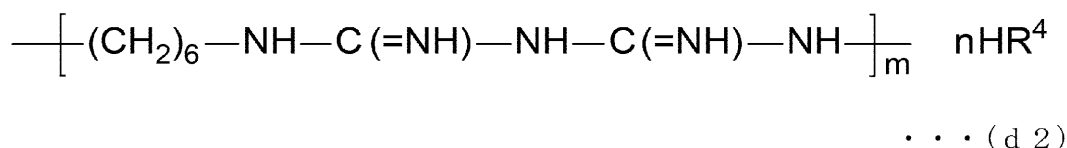
[Chemical Formula 10]



wherein r represents an integer of 5 to 100;

[0095]

[Chemical Formula 11]



wherein m represents an integer of 2 to 14, HR^4 represents an organic acid or inorganic acid, and n indicates the number of HR^4 moieties, and is an integer of 0 to 5m.
[0096]

Yet another aspect of the liquid detergent of the present invention is a liquid detergent containing:

the component (A): at least one surfactant selected from the group consisting of nonionic surfactants (A-1), anionic surfactants (A-2) and cationic surfactants (A-3),

the component (B): at least one sugar-degrading enzyme formulation selected from the group consisting of amylase and mannanase,

the component (C): a compound represented by formula (c-1-1) shown below,

the component (D): at least one compound selected from the group consisting of isopropyl methylphenol (IPMP), 3-iodo-2-propynyl butyl carbamate (IPBC), thiabendazole (TBZ), polylysines represented by formula (d1) above and acid salts thereof, polyhexamethylene biguanides represented by formula (d2) above, and combinations of a polylysine represented by formula (d1) above and a polyhexamethylene biguanide represented by formula (d2) above,

a solvent, preferably water, and more preferably ion-exchanged water, and other components as required; wherein

the component (A-1) is at least one surfactant selected from the group consisting of polyoxyalkylene nonionic surfactants represented by general formula (a-1-1) shown below, polyoxyalkylene nonionic surfactants represented by general formula (a-1-2) shown below, polyoxyalkylene nonionic surfactants represented by general formula (a-1-

3) shown below, and polyoxyalkylene alkyl amine nonionic surfactants represented by general formula (a-1-4) shown below,

the component (A-2) is at least one surfactant selected from the group consisting of linear or branched alkylbenzene sulfonates having an alkyl group with a carbon number of 8 to 18, alkyl (or alkenyl) ether sulfates having a linear or branched alkyl group (or alkenyl group) with a carbon number of 10 to 20, to which has been added an average of 0.5 to 10 mol of any alkylene oxide having a carbon number of 2 to 4, or a mixture of ethylene oxide (EO) and propylene oxide (PO) (molar ratio EO/PO = 0.1/9.9 to 9.9/0.1), α -sulfo fatty acid methyl ester salts with a carbon number of 14 to 18, and fatty acid salts with a carbon number of 10 to 22, and

the component (A-3) is a mono-long-chain alkyl, tri-short-chain alkyl quaternary ammonium salt; and

relative to the total mass of the liquid detergent,

the amount of the component (A) is at least 20% by mass but not more than 80% by mass, and is preferably from 27 to 48% by mass,

the amount of the component (B) is at least 0.01% by mass but not more than 2% by mass, and is preferably from 0.1 to 0.5% by mass,

the amount of the component (C) is from 0.1 to 5% by mass, and preferably from 1 to 2% by mass, and

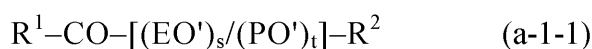
the amount of the solvent is at least 30% by mass but not more than 70% by mass, and is preferably from 48 to 70% by mass,

provided that the combined amount of all of these components does not exceed 100% by mass; and

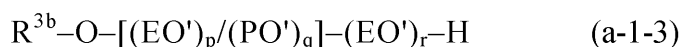
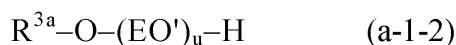
the mass ratio represented by component (B)/component (C) is within a range from 0.001 to 1, and is preferably from 0.1 to 0.25,

when the liquid detergent includes the component (A-1) and the component (A-2), the mass ratio represented by component (A-1)/component (A-2) is within a range from 0.1 to 20, and preferably from 5 to 20, and

when the liquid detergent includes the component (A-1), the component (A-2) and the component (A-3), the mass ratio represented by [component (A-1)+component (A-2)]/component (A-3) is within a range from 1 to 50, and preferably from 18 to 46:



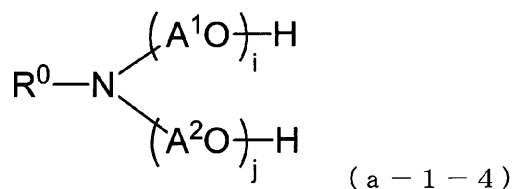
wherein R^1 represents an alkyl group having a carbon number of 7 to 18 or an alkenyl group having a carbon number of 7 to 18, R^2 represents an alkyl group having a carbon number of 1 to 3, s represents the average number of repetitions of EO' and is a number from 6 to 20, t represents the average number of repetitions of PO' and is a number from 0 to 6, EO' represents an oxyethylene group, PO' represents an oxypropylene group, and $[(EO')_s/(PO')_t]$ means that EO' and PO' may be arranged as a mixture;



wherein each of R^{3a} and R^{3b} independently represents an alkyl group having a carbon number of 8 to 18 or an alkenyl group having a carbon number of 8 to 18, u represents the average number of repetitions of EO' and is a number from 5 to 20, p represents an average number of repetitions of EO', q represents the average number of repetitions of PO', and r represents an average number of repetitions of EO', wherein p , q and r are numbers that satisfy $p > 1$, $r > 1$, $0 < q \leq 3$ and $p+r = 10$ to 20, EO' represents an oxyethylene group, PO' represents an oxypropylene group, and $[(EO')_p/(PO')_q]$ means that EO' and PO' may be arranged as a mixture;

[0097]

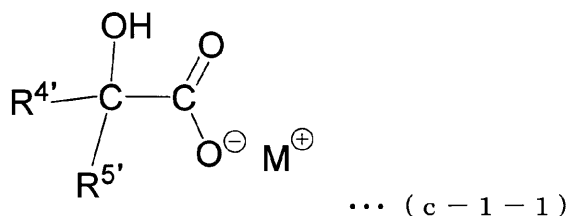
[Chemical Formula 12]



wherein R⁰ represents an alkyl group having a carbon number of 10 to 20 or an alkenyl group having a carbon number of 10 to 20, each of A¹O and A²O independently represents an oxyalkylene group having a carbon number of 2 or 3, i represents the average number of repetitions of A¹O, and j represents the average number of repetitions of A²O, wherein i>0, j>0 and i+j is a number from 10 to 50;

[0098]

[Chemical Formula 13]



wherein each of R^{4'} and R^{5'} independently represents a hydrogen atom, an alkyl group having a carbon number of 1 to 10 which may have a substituent, an aryl group which may have a substituent, a nitro group (-NO₂), an ether group, an amino group (-NH₂) which may have a substituent, or an amine derivative group, and M⁺ represents a counter ion.

EXAMPLES

[0099]

The present invention is described below in further detail using a series of examples, but the present invention is in no way limited by these examples. In the examples, unless stated otherwise, "%" refers to "% by mass.

The compositions of the liquid detergents of the various examples are shown in Tables 1 to 3.

The raw materials used in the examples are described below.

[0100]

<Component (A): Surfactants>

Component (A-1): Nonionic Surfactants

A-1-1: a compound obtained by using an alkoxylation catalyst to add 15 molar equivalents of ethylene oxide to coconut fatty acid methyl ester (a mixture in which the mass ratio of methyl laurate/methyl myristate = 8/2) (MEE). A compound of the above general formula (a-1-1), in which R^1 = an alkyl group having a carbon number of 11 and an alkyl group having a carbon number of 13, R^2 = a methyl group, $s = 15$ and $t = 0$, synthesized using the synthesis method described below.

[MEE Synthesis Method]

Synthesis was performed in accordance with the synthesis method disclosed in Japanese Unexamined Patent Application, First Publication No. 2000-144179.

A 4 L autoclave was charged with 2.2 g of a calcined alumina-magnesium hydroxide (unmodified) catalyst, which was obtained by calcining an alumina-magnesium hydroxide having a composition of $2.5\text{MgO} \cdot \text{Al}_2\text{O}_3 \cdot w\text{H}_2\text{O}$ (product name: Kyoward 330, manufactured by Kyowa Chemical Industry Co., Ltd.) at 600°C for one hour in a nitrogen atmosphere, 2.9 mL of a 0.5 N ethanol solution of potassium hydroxide, 280 g of methyl laurate and 70 g of methyl myristate, and the catalyst was modified inside the autoclave. Subsequently, the inside of the autoclave was flushed

with nitrogen, and with the temperature held at 180°C and the pressure held at 0.3 MPa, 1,052 g of ethylene oxide was introduced into the autoclave and reacted under constant stirring.

The reaction liquid was then cooled to 80°C, 159 g of water was added and mixed, together with 5 g of each of activated clay and diatomaceous earth as filtration aids, and the catalyst was then filtered off, yielding MEE.

[0101]

A-1-2: a compound obtained by adding 15 molar equivalents of ethylene oxide to a natural alcohol (LMAO). A compound of the above general formula (a-1-2) in which R^{3a} = an alkyl group having a carbon number of 12 and an alkyl group having a carbon number of 14 and $u = 15$, synthesized using the synthesis method described below.

[LMAO Synthesis Method]

A pressure-resistant reaction vessel was charged with 861.2 g of CO-1214 (a product name) manufactured Procter & Gamble Company and 2.0 g of a 30% by mass aqueous solution of NaOH, and the atmosphere inside the reaction vessel was replaced with nitrogen. Subsequently, dewatering of the reaction liquid inside the reaction vessel was performed at a temperature of 100°C and a pressure of not more than 2.0 kPa for a period of 30 minutes, and the temperature inside the reaction vessel was then raised to 160°C. With the reaction liquid undergoing constant stirring, 760.6 g of (gaseous) ethylene oxide was then added gradually to the reaction liquid. A blow tube was used for the addition of the ethylene oxide, and the rate of addition was controlled so that the reaction temperature of the reaction liquid did not exceed 180°C.

Following completion of the addition of the ethylene oxide, the reaction liquid was heated for 30 minutes at a temperature of 180°C and a pressure of not more than 0.3 MPa, and unreacted ethylene oxide was then removed from the reaction liquid by

distillation for 10 minutes at a temperature of 180°C and a pressure of not more than 6.0 kPa.

Subsequently, the temperature of the reaction liquid was cooled to 100°C or lower, and a neutralization was performed by adding a 70% by mass solution of p-toluenesulfonic acid to adjust the pH of a 1% by mass aqueous solution of the reaction product to approximately 7, thus obtaining LMAO.

[0102]

A-1-3: a nonionic surfactant obtained by sequential block addition of 8 mol of ethylene oxide, 2 mol of propylene oxide, and then 8 mol of ethylene oxide to a natural alcohol (mass ratio of alcohol having a carbon number of 12/alcohol having a carbon number of 14 = 7/3). A compound of the above general formula (a-1-3) in which R^{3b} = an alkyl group having a carbon number of 12 and an alkyl group having a carbon number of 14, and $p = 8$, $q = 2$ and $r = 8$.

[Synthesis Method for Nonionic Surfactant Represented by Formula (a-1-3)]

An autoclave was charged with 194.5 g of CO-1214 (a product name) manufactured Procter & Gamble Company and 1.1 g of potassium hydroxide, and following dewatering at 110°C and 1.3 kPa for 30 minutes, the autoclave was flushed with nitrogen. Following nitrogen flushing, the temperature was raised to 140°C, 352 g of ethylene oxide was introduced, and an addition reaction and subsequent heating operation were performed. Next, the temperature was cooled to 120°C, 116 g of propylene oxide was introduced, and an addition reaction and subsequent heating operation were performed. Subsequently, the temperature was once again raised to 140°C, a further 352 g of ethylene oxide was introduced, and an addition reaction and subsequent heating operation were performed. Following completion of these reactions,

the temperature was cooled to 80°C, 1.2 g of acetic acid was added to the autoclave, and following stirring at 80°C for 30 minutes, the product was extracted to obtain (a-1-3).

[0103]

A-1-4: a compound synthesized using the synthesis method described below (Ethomeen). A compound of the above general formula (a-1-4) in which R^0 = an alkyl group having a carbon number of 16, A^1O = an oxyethylene group, A^2O = an oxyethylene group, and $i+j = 20$.

[Ethomeen Synthesis Method]

An autoclave (manufactured by Taiatsu Techno Corporation) was charged with a fatty acid amine (n-hexadecylamine, manufactured by Tokyo Chemical Industry Co., Ltd.), and following flushing of the inside of the system with nitrogen, the fatty acid amine was heated to 150°C, and ethylene oxide (EO) was added gradually in small amounts until a prescribed amount had been reached, thus synthesizing a tertiary amine in which the average number of added moles (namely, the average number of repetitions) of EO was 2 mol (first stage).

Subsequently, an autoclave was charged with the thus obtained tertiary amine and an alkali catalyst (NaOH, 0.8 parts by mass per 100 parts by mass of the tertiary amine, a 40% by mass aqueous solution of NaOH was used), the inside of the system was flushed with nitrogen, and following dewatering under heat and reduced pressure, the mixture was heated to 150°C, and EO was added gradually in small amounts until a prescribed amount had been reached, thus obtaining a product in which the average number of added moles (namely, the average number of repetitions) of EO was 20 mol (second stage).

Following completion of the EO addition reactions, the product was neutralized with acetic acid to obtain Ethomeen. Calculation of the molecular weight by measuring the amine value revealed a molecular weight of 1121.

[0104]

Component (A-2): Anionic Surfactants

A-2-1: LAS, a sodium salt of a linear alkyl (carbon number: 10 to 14) benzenesulfonic acid [product name: Lipon LH-200 (LAS-H, purity = 96% by mass), manufactured by Lion Corporation], average molecular weight: 322 (as a sodium salt obtained by neutralization of LAS-H during liquid detergent preparation).

A-2-2: MES, an α -sulfo fatty acid methyl ester salt, product name: MIZULAN FL-80, manufactured by Lion Eco Chemicals Sdn. Bhd.

A-2-3: AES, a polyoxyethylene lauryl ether sulfate salt, product name: SINOLIN SPE-1350, manufactured by New Japan Chemical Co., Ltd.

A-2-4: AEPS: a polyoxyalkylene alkyl ether sulfate monoethanolamine salt (wherein the alkyl groups are linear alkyl groups having a carbon number of 10 to 14, the average number of added moles (namely, the average number of repetitions) of propylene oxide is 1, and the average number of added moles (namely, the average number of repetitions) of ethylene oxide is 3).

A-2-5: coconut fatty acid sodium salt (a compound obtained by neutralizing Coconut Fatty Acid (a product name, manufactured by NOF Corporation) with sodium).

[0105]

(A-3): Cationic Surfactants

A-3-1: an alkyl (carbon number: 12) trimethylammonium chloride, product name: Arquad 12-37W, manufactured by Lion Specialty Chemicals Co., Ltd.

A-3-2: an alkyl (carbon number: 14) trimethylammonium chloride, manufactured by Tokyo Chemical Industry Co., Ltd. (reagent).

A-3-3: an alkyl (carbon number: 16 to 18) trimethylammonium chloride, product name: Arquad T-800, manufactured by Lion Specialty Chemicals Co., Ltd.

A-3-4: didecyldimethylammonium chloride, product name: Arquad 210, manufactured by Lion Specialty Chemicals Co., Ltd.

[0106]

<Component (B): Sugar-Degrading Enzyme Formulations>

B-1: a mannanase formulation, product name: Mannaway 4L, manufactured by Novozymes A/S.

B-2: an amylase formulation, product name: Termamyl 300L, manufactured by Novozymes A/S.

[0107]

<Component (B'): Protein-Degrading Enzyme Formulations, Comparative Component for Component (B)>

B'-1: a protease formulation, product name: Coronase 48L, manufactured by Novozymes A/S.

B'-2: a protease formulation, product name: Everlase 16L, manufactured by Novozymes A/S.

[0108]

<Component (C): at least one compound selected from the group consisting of α -hydroxy-monocarboxylic acids and salts thereof>

C-1: sodium lactate, manufactured by Kanto Chemical Co., Inc., a compound of the above general formula (c-1-1) in which R^4 = a methyl group, and R^5 = a hydrogen atom.

C-2: mandelic acid, manufactured by Kanto Chemical Co., Inc., a compound of the above general formula (c-1-1) in which R^4 = a phenyl group, and R^5 = a hydrogen atom.

[0109]

<Component (D): at least one compound selected from the group consisting of isopropyl methylphenol (IPMP), 3-iodo-2-propynyl butyl carbamate (IPBC), thiabendazole (TBZ), polylysine, polyhexamethylene biguanide, and acid salts of these compounds>

D-1: a polylysine, product name: Polylysine 25% aqueous solution, manufactured by Chisso Corporation.

D-2: a polyhexamethylene biguanide, product name: PROXEL IB, manufactured by Lonza Japan Ltd.

D-3: 2-isopropyl-5-methylphenol (IPMP), product name: BIOSOL, manufactured by Osaka Kasei Co., Ltd.

D-4: 3-iodo-2-propynyl butyl carbamate (IPBC), product name: GLYCACIL, manufactured by Lonza Japan Ltd.

[0110]

<Other components>

Common components:

Sodium benzoate, manufactured by Toagosei Co., Ltd.

Monoethanolamine: manufactured by Nippon Shokubai Co., Ltd.

Dibutylhydroxytoluene: product name: SUMILIZER BHT-R, manufactured by Sumitomo Chemical Co., Ltd.

Ethanol: product name: Special Alcohol 95% Synthetic, manufactured by Japan Alcohol Trading Co., Ltd.

Fatty acid 2-ethylhexyl ester: product name: PASTELL 2H-08, manufactured by Lion Corporation.

Fragrance: fragrance composition A disclosed in Tables 11 to 18 of Japanese Unexamined Patent Application, First Publication No. 2002-146399.

para-toluenesulfonic acid: product name: PTS, manufactured by Kyowa Hakko Chemical Co., Ltd.

Colorant: product name: Green No. 3, manufactured by Taketombo Co., Ltd.

[0111]

pH modifiers: sodium hydroxide (manufactured by Tsurumi Soda Co., Ltd.), sulfuric acid (manufactured by Toho Zinc Co., Ltd.).

Ion-exchanged water.

[0112]

<Preparation of Liquid Detergents>

(Examples 1 to 35, Comparative Examples 1 to 4)

Various liquid detergents with the compositions (components and amounts (% by mass)) shown in Tables 1 to 3 were prepared using the production method described below.

In the tables, an empty cell means that particular component is not added.

In the tables, the amount of each component is shown as the equivalent amount of the pure component.

The expression "appropriate amount" describing the amount of the pH modifier indicates the total amount of pH modifier (sodium hydroxide, sulfuric acid) added in order to adjust the pH of the liquid detergent at 25°C to pH 7.0.

The term "balance" used to indicate the amount of ion-exchanged water means the amount of water added to make the combined amount (% by mass) of all the components within the liquid detergent up to a value of 100% by mass.

In the tables, the "mass ratio (B)/(C)" means the mass ratio of the amount of the component (B) relative to the amount of the component (C) in the liquid detergent, or in Comparative Example 2, means the mass ratio of the amount of the component (B') relative to the amount of the component (C) in the liquid detergent

The "mass ratio (A-1)/(A-2)" means the mass ratio of the amount of the component (A-1) relative to the amount of the component (A-2) in the liquid detergent,

The "mass ratio [(A-1)+(A-2)]/(A-3)" means the mass ratio of the total amount of the component (A-1) and the component (A-2) relative to the amount of the component (A-3) in the liquid detergent.

[0113]

In the tables, the composition of the common components is as follows. The amount of each component (% by mass) indicates the proportion of that component in the liquid detergent. The total amount of all the common components was 11.5505% by mass relative to the total mass of the liquid detergent.

Sodium benzoate: 0.5% by mass, monoethanolamine: 1% by mass, dibutylhydroxytoluene: 0.05% by mass, ethanol: 7% by mass, fatty acid 2-ethylhexyl ester: 1.5% by mass, fragrance: 0.5% by mass, para-toluenesulfonic acid: 1% by mass, colorant: 0.0005% by mass.

[0114]

[Liquid Detergent Production Method]

A 500 mL beaker was charged with ethanol and the component (A) in accordance with the composition shown in Tables 1 to 4, and the components were stirred thoroughly using a magnetic stirrer (manufactured by Mitamura Kogyo Inc.).

Subsequently, the ion-exchanged water and the common components besides ethanol were added under continuous stirring, and a pH modifier (sodium hydroxide or sulfuric acid) was then added to adjust the pH (25°C) to 7. At this time, the amount of ion-exchanged water added was such that the total mass of all the components at this point represented 95% by mass of the total mass of the final liquid detergent.

Following adjustment of the pH to a value of 7, the component (B) or the component (B'), and the component (C) were added and stirred. Subsequently, a pH modifier (sodium hydroxide or sulfuric acid) was added to adjust the pH (25°C) to 7, and additional ion-exchanged water was then added to bring the total amount to 100% by mass, thus obtaining a liquid detergent.

The pH of each liquid detergent was measured by adjusting the sample to 25°C, and then measuring the pH using a pH meter (product name: HM-30G, manufactured by DKK Toa Corporation).

[0115]

<Evaluations of Liquid Detergents>

The liquid detergent of each example was evaluated for its suppression effect on the development of indoor drying odors, storage stability, and its suppression effect on film formation at the liquid surface.

[0116]

[Evaluation of Suppression Effect on Development of Indoor Drying Odors]

Ten hand towels which had been used and laundered repeatedly over a half-year period in a typical household were each used (without laundering) for about 2 days in

normal lifestyle situations. These ten hand towels were laundered in a washing machine (JW-Z23A, manufactured by Haier Group) using the liquid detergent of one of the examples, and using the normal course setting of the washing machine (water temperature: about 20°C, tap water with a hardness of about 3° DH, bath ratio: 20-fold). During laundering, the amount of the liquid detergent added to the washing machine was 10 mL per 30 L of tap water.

In order to adjust the bath ratio to the above value, new 100% cotton T-shirts (manufactured by B.V.D.) that had been laundered 5 times in a fully automatic washing machine (NA-F70SD1, manufactured by Panasonic Corporation) using the automatic setting (water temperature: about 20°C, tap water with a hardness of about 3° DH) were used. At this time, a commercially available synthetic detergent TOP (manufactured by Lion Corporation) was used, and the amount of this detergent used in each laundering treatment was 25 g per 30 L of tap water.

Following laundering of the above hand towels, the hand towels were hung indoors at room temperature (about 23°C) and a relative humidity of 90%, and dried for 5 hours (indoor drying).

Subsequently, six specialist panelists conducted a sensory evaluation by smelling the odor from each of the hand towels that had been dried for 5 hours (indoor drying).

In the sensory evaluation, each towel was awarded a numerical score based on the following evaluation criteria. Specifically, each specialist panelist smelt the odor of each of the ten hand towels that had been dried indoors, and evaluated the strength of the odor against the 6-step scale shown in the following evaluation criteria. The average value across the ten hand towels was then calculated, and this average value was used to evaluate the suppression effect on the development of indoor drying odors. The average

values are shown in Tables 1 to 3. An average value of 2.5 points or lower was deemed a passing grade.

Sensory Evaluation Criteria (Odor Strength)

0 points: absolutely no unpleasant odor.

1 point: unpleasant odor just at the detectable level.

2 points: unpleasant odor is slightly noticeable.

3 points: unpleasant odor is felt somewhat strongly.

4 points: unpleasant odor is felt strongly.

5 points: unpleasant odor is felt intensely.

[0117]

[Evaluation of Storage Stability]

Thirty mL of the liquid detergent from each example was placed in a cylindrical glass vial, and the vial was sealed with a lid.

The liquid detergent was stored in this state in a 5°C constant-temperature bath for 24 hours.

Subsequently, the cylindrical glass vial containing the liquid detergent was removed from the constant-temperature bath, the transparency uniformity and the fluidity of the 5°C liquid detergent were observed, and the storage stability of the liquid detergent was evaluated against the following evaluation criteria. An evaluation result of A or B was deemed a passing grade.

Evaluation Criteria

A: transparency was uniform, fluidity was good.

B: some partial gelling was noticeable, but fluidity was still acceptable.

C: detergent solidified and exhibited no fluidity, or precipitation was observed.

[0118]

[Evaluation of Suppression Effect on Film Formation at Liquid Surface]

Five g of the liquid detergent from each example was placed in a container of length 5.3 cm $\times$ width 3.3 cm $\times$ height 1.5 cm (MAJY case, model SS, manufactured by Maruemu Corporation).

Without placing a lid across the length $\times$ width surface, but rather leaving the container open, the liquid detergent was left to stand at 5°C for 24 hours, and the liquid surface was then inspected, and the suppression effect of the liquid detergent on film formation at the liquid surface was evaluated against the following evaluation criteria. An evaluation result of A or B was deemed a passing grade.

Evaluation Criteria

A: no film formation observed at the liquid surface, and the liquid detergent retained good fluidity.

B: film formation was observed at the liquid surface, but the liquid detergent retained fluidity.

C: the liquid detergent had undergone overall gelling or solidification.

[0119]

[Table 1]

				Example										
				1	2	3	4	5	6	7	8	9	10	11
Composition [% by mass]	Component (A)	Component (A-1)	A-1-1	40	40	30				40	40	40	40	40
			A-1-2				30							
			A-1-3					30						
			A-1-4						30					
		Component (A-2)	A-2-1	5	5	5	5	5	5				1	5
			A-2-2							5				
			A-2-3								5			
			A-2-4									5		
			A-2-5	1	1	1	1	1	1	1	1	1	1	1
		Component (A-3)	A-3-1	2	2	2	2	2	2	2	2	2	2	1
			A-3-2											
			A-3-3											
			A-3-4											
	Component (B)	B-1	0.5		0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
		B-2		0.5										
	Component (B')	B'-1	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
		B'-2												
	Component (C)	C-1	2	2	2	2	2	2	2	2	2	2	2	2
		C-2												
	Component (D)	D-1												
		D-2												
		D-3												
		D-4												
	Other components	common components	11.5505											
		pH modifier	appropriate amount											
		ion-exchanged water	balance											
Mass ratio (B)/(C)				0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Mass ratio (A-1)/(A-2)				6.7	6.7	5.0	5.0	5.0	5.0	6.7	6.7	6.7	20	6.7
Mass ratio [(A-1)+(A-2)]/(A-3)				23	23	18	18	18	18	23	23	23	21	46
Mass ratio (B)/(D)														
Evaluations	Suppression effect on development of indoor drying odors			1.5	1.7	1.7	2.0	2.2	1.8	1.7	2.0	1.8	2.0	1.8
	Storage stability			A	A	A	B	A	B	A	A	A	A	A
	Suppression effect on film formation at liquid surface			A	A	A	B	A	B	A	A	A	A	A

[0120]

[Table 2]

				Example														
				12	13	14	15	16	17	18	19	20	21	22	23	24	25	
Composition [% by mass]	Component (A)	Component (A-1)	A-1-1		40		40	40	40	40	40	40	40	40	40	40	40	
			A-1-2			5												
			A-1-3															
			A-1-4															
		Component (A-2)	A-2-1	10			5	5	5	5	5	5	5	5	5	5	5	4
			A-2-2															
			A-2-3			15												
			A-2-4															
			A-2-5	10		5	1	1	1	1	1	1	1	1	1	1	1	1
		Component (A-3)	A-3-1	2	2	2	2	2	2	2							2	2
			A-3-2								2							
			A-3-3									2						
			A-3-4										2					
	Component (B)	B-1		0.5	0.5	0.5	0.3	0.1	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	
		B-2																
	Component (B')	B'-1		0.5	0.5	0.5	0.5	0.5		0.5	0.5	0.5	0.5	0.5		0.5	0.5	
		B'-2							0.5									
	Component (C)	C-1		2	2	2	0.4	1	2		2	2	2	2	2	0.5	2	
		C-2								3								
	Component (D)	D-1																
		D-2																
		D-3																
		D-4																
	Other components	common components		11.5505														
		pH modifier		appropriate amount														
		ion-exchanged water		balance														
Mass ratio (B)/(C)				0.25	0.25	0.25	0.75	0.10	0.25	0.17	0.25	0.25	0.25	0.25	0.25	1.00	0.25	
Mass ratio (A-1)/(A-2)				-	0	0.25	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	8.0	
Mass ratio [(A-1)+(A-2)]/(A-3)				10	20	13	23	23	23	23	23	23	23	-	-	23	23	
Mass ratio (B)/(D)																		
Evaluations	Suppression effect on development of indoor drying odors			2.3	2.3	2.2	1.7	2.0	1.7	1.5	1.7	2.0	1.7	2.3	2.2	1.8	1.5	
	Storage stability			B	A	A	B	A	A	A	A	A	A	A	A	B	A	
	Suppression effect on film formation at liquid surface			B	A	A	B	A	A	A	A	A	A	A	A	B	A	

[0121]

[Table 3]

[illegible]

[0122]

[Table 4]

				Comparative Example			
				1	2	3	4
Composition [% by mass]	Component (A)	Component (A-1)	A-1-1	40	40	40	40
			A-1-2				
			A-1-3				
			A-1-4				
		Component (A-2)	A-2-1	5	5	5	5
			A-2-2				
			A-2-3				
			A-2-4				
			A-2-5	1	1	1	1
		Component (A-3)	A-3-1	2	2		
			A-3-2				
			A-3-3				
	Component (B)	B-1		2			0.5
		B-2					
	Component (B')	B'-1			0.5		0.5
		B'-2					
	Component (C)	C-1		1	2	2	
		C-2					
	Other components	common components		11.5505			
		pH modifier		appropriate amount			
		ion-exchanged water		balance			
Mass ratio (B)/(C)				2.0	0.25	0	-
Mass ratio (A-1)/(A-2)				6.7	6.7	6.7	6.7
Mass ratio [(A-1)+(A-2)]/(A-3)				23	23	-	-
Evaluations	Suppression effect on development of indoor drying odors			-	2.7	3.5	1.6
	Storage stability			C	A	A	C
	Suppression effect on film formation at liquid surface			-	A	A	C

[0123]

The results shown in Table 1 to 4 confirmed that the liquid detergents of Examples 1 to 35 according to the present invention had a superior suppression effect on the development of indoor drying odors, and also exhibited favorable storage stability.

In addition, it is evident that the liquid detergents of Examples 1 to 35 also exhibited a favorable suppression effect on film formation at the liquid surface.

INDUSTRIAL APPLICABILITY

[0124]

The liquid detergent of the present invention has a superior suppression effect on the development of indoor drying odors, and also exhibits favorable storage stability, and is therefore extremely usefully industrially.

CLAIMS

1. A liquid detergent comprising:
a component (A): a surfactant,
a component (B): mannanase,
a component (C): glycolic acid, α -hydroxypropionic acid, 2-hydroxybutyric acid, 2-hydroxyisobutyric acid, mandelic acid, optical isomers of these compounds, or salts of these compounds, and
water of 30 to 70% by mass, wherein
a mass ratio represented by component (B)/component (C) is not more than 1.
2. The liquid detergent according to Claim 1, wherein the amount of the component (C) is not more than 3% by mass.
3. The liquid detergent according to Claim 1 or 2, wherein the amount of the component (A) is 30 to 70% by mass, relative to the total mass of the liquid detergent.
4. The liquid detergent according to any one of Claims 1 to 3, wherein the component (A) comprises a component (A-1): nonionic surfactant, and the amount of the component (A-1) is 50 to 90% by mass, relative to the total mass of the component (A).
5. The liquid detergent according to any one of Claims 1 to 4, wherein the component (A) comprises a cationic surfactant.
6. The liquid detergent according to any one of Claims 1 to 5, further comprising:
a component (D): at least one compound selected from the group consisting of isopropyl methylphenol (IPMP), 3-iodo-2-propynyl butyl carbamate (IPBC), thiabendazole (TBZ), polylysine, polyhexamethylene biguanide, and acid salts of these compounds.