

DESCRIPTION

Title of the Invention: DETERGENT ARTICLE

Field of the Invention

[0001]

The present invention relates to a detergent article including a detergent composition and a water-soluble film for wrapping the detergent composition.

Background of the Invention

[0002]

In recent years, consumers have become more and more convenience-oriented, leading to a need for easier-to-use detergent compositions. From the viewpoint of enhancing usability of detergent compositions, for example, detergent articles containing detergent compositions wrapped in water-soluble films are disclosed.

On the other hand, night-time washing and indoor drying have been recently increased, and troubles of bacteria-derived laundry odor have also been accordingly increased. Further, the awareness of hygiene has been more increased due to coronavirus in recent years, and the effect on bacteria has become essential as the basic function of detergents.

Furthermore, in recent years, reduction of the amount of detergent compositions used, in particular, the

amount of surfactants, has been required from the viewpoints of less chemicals and environmental load reduction.

[0003]

JP-A 2002-241799 discloses an article for washing, obtained by wrapping a surfactant-containing solid composition for washing, in a predetermined water-soluble film.

JP-A 2002-3897 discloses an article for washing, obtained by wrapping a surfactant-containing composition for washing, in a water-soluble film including a predetermined copolymer.

JP-A H4-164998 discloses an individual detergent package, wherein a detergent composition containing (a) an anionic surfactant and (b) an alkali builder, in which a total amount of potassium ions in components (a) and (b) occupies 0.5 weight% or more in the composition, is wrapped as a unit, in a film including predetermined modified polyvinyl alcohol.

WO 99/29830 discloses a detergent particle group containing (A) a base granule group 1 containing a water-insoluble inorganic salt, a nonionic surfactant, an anionic surfactant, and an alkaline builder.

Summary of the Invention

[0004]

Solid detergent compositions are preferable from the viewpoint of efficiently performing washing, but may have a risk of deteriorated finishing performance due to the occurrence of undissolved residue.

The present invention provides a detergent article including a detergent composition and a water-soluble film for wrapping the detergent composition, in which the detergent article is inhibited from causing undissolved residue of the detergent composition and further, provides excellent washing performance for textile products and excellent antimicrobial properties imparted to textile products.

[0005]

The present invention relates to a detergent article including a detergent composition and a water-soluble film for wrapping the detergent composition, wherein the detergent composition contains the following components (a), (b), (c), and (d), and a content of component (d) is more than 5 mass%,

component (a): a nonionic surfactant,
component (b): an anionic surfactant,
component (c): a cationic surfactant, and
component (d): an alkali agent.

[0006]

The present invention provides a detergent article including a detergent composition and a water-soluble film for wrapping the detergent composition, in which the

detergent article is inhibited from causing undissolved residue of the detergent composition and further, provides excellent washing performance for textile products and excellent antimicrobial properties imparted to textile products.

Embodiment of the Invention

[0007]

While the mechanism in which the detergent article of the present invention is inhibited from causing undissolved residue of the detergent composition and further, provides excellent washing performance for textile products and excellent antimicrobial properties imparted to textile products is not elucidated, the following is inferred.

It is inferred that the detergent composition included in the detergent article of the present invention achieves improved washing performance by combined use of the nonionic surfactant of component (a) with the anionic surfactant of component (b) and the alkali agent of component (d).

It is also inferred that, as the detergent composition included in the detergent article of the present invention contains component (b), even when component (d) in a lump form is formed during preparation of a washing liquid by dissolution of the detergent article of the present invention in water, component (b)

acts on component (d), thereby delaying dissolution of component (d) to inhibit the formation of component (d) in a lump form; and even if component (d) in a lump form is formed, softness of component (d) in a lump form is improved, thereby allowing component (d) in a lump form to be more easily dissolved in the washing liquid.

Further, it is inferred that as components (a) to (d) are combined in the detergent composition included in the detergent article of the present invention, the detergent composition is inhibited from remaining undissolved and further, the solubility of the detergent article is improved, without any loss of the antimicrobial performance of component (c).

Note that the detergent article of the present invention is not limited to the above action mechanisms at all.

[0008]

[Detergent article]

The detergent article of the present invention includes a detergent composition containing the following components (a), (b), (c), and (d), and a water-soluble film for wrapping the detergent composition. In the present specification, the above detergent composition is referred to as the detergent composition of the present invention.

component (a): a nonionic surfactant,

component (b): an anionic surfactant,

component (c): a cationic surfactant, and

component (d): an alkali agent.

[0009]

<Component (a)>

Component (a) is a nonionic surfactant. Examples of component (a) can include one or more selected from polyoxyalkylene alkyl or alkenyl ether, alkyl (poly)glycoside (glycoside-type nonionic surfactant), a sorbitan-based nonionic surfactant, a compound in which an alkylene oxide is added between ester bonds of a long-chain fatty acid alkyl ester, a fatty acid monoglyceride, and a sucrose fatty acid ester from the viewpoint of washing performance.

[0010]

The nonionic surfactant of component (a) is preferably (a1) a nonionic surfactant containing an alkyleneoxy group and having an average number of added moles of the alkyleneoxy group of 1 or more and 30 or less [hereinafter, referred to as component (a1)].

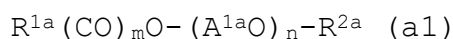
The alkyleneoxy group in component (a1) is preferably one or more groups selected from alkyleneoxy groups with 2 or more and 4 or less carbons, and more preferably one or more groups selected from ethyleneoxy group and propyleneoxy group.

An average number of added moles of the alkyleneoxy group in component (a1) is 1 or more, preferably 6 or more and more preferably 10 or more, and 30 or less,

preferably 25 or less, more preferably 20 or less and further preferably 15 or less from the viewpoint of washing performance.

[0011]

Component (a1) is preferably one or more selected from a nonionic surfactant represented by the following general formula (a1):



wherein R^{1a} is an aliphatic hydrocarbon group with 8 or more and 18 or less carbons, R^{2a} is a hydrogen atom or a methyl group, CO is a carbonyl group, m is a number of 0 or 1, $A^{1a}O$ group is one or more selected from alkyleneoxy groups with 2 or more and 4 or less carbons, and n is an average number of added moles of $A^{1a}O$ group and is a number of 1 or more and 30 or less.

[0012]

R^{1a} in the general formula (a1) has 8 or more, preferably 10 or more and more preferably 12 or more, and 18 or less, preferably 16 or less and more preferably 14 or less carbons from the viewpoint of washing performance.

R^{1a} is an aliphatic hydrocarbon group, and is preferably a group selected from alkyl groups and alkenyl groups.

[0013]

$A^{1a}O$ group in the general formula (a1) is one or more selected from alkyleneoxy groups with 2 or more and 4 or

less carbons, preferably one or more selected from alkyleneoxy groups with 2 or more and 3 or less carbons, and more preferably ethyleneoxy group. When A^{1a}O group includes a plurality of different alkyleneoxy groups, the different alkyleneoxy groups may be bonded in blocks or bonded at random.

[0014]

n in the general formula (a1) is an average number of added moles of A^{1a}O group and is a number of 1 or more and 30 or less. n in the general formula (a1) is 1 or more, preferably 6 or more and more preferably 10 or more, and 30 or less, preferably 25 or less, more preferably 20 or less and further preferably 15 or less from the viewpoint of washing performance.

m in the general formula (a1) is preferably 0 from the viewpoint of washing performance.

R^{2a} in the general formula (a1) is preferably a hydrogen atom from the viewpoint of washing performance.

[0015]

Specific examples of a nonionic surfactant other than component (a1) and not having an alkyleneoxy group include one or more selected from a sucrose fatty acid ester, a glycerin fatty acid ester, a sorbitan fatty acid ester, an alkyl glycoside, and a glyceryl monoether.

[0016]

<Component (b)>

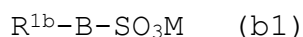
Component (b) is an anionic surfactant. Component (b) is preferably one or more selected from an alkylarylsulfonic acid-type surfactant, a sulfate-type surfactant, an alkanesulfonic acid-type surfactant, an olefin sulfonic acid-type surfactant, a sulfosuccinic acid alkyl ester-type surfactant, a sulfofatty acid ester-type surfactant, and a fatty acid and a salt thereof, more preferably one or more selected from an alkylarylsulfonic acid-type surfactant, a sulfate-type surfactant, a sulfosuccinic acid alkyl ester-type surfactant, and a fatty acid and a salt thereof, and further preferably one or more selected from an alkylarylsulfonic acid-type surfactant, and a fatty acid and a salt thereof from the viewpoint of washing performance.

Note that, when component (b) is a salt, examples of the salt as component (b) include inorganic salts such as a sodium salt, a potassium salt, an ammonium salt, a magnesium salt, and the like, and organic salts such as a monoethanolamine salt, a diethanolamine salt, a triethanolamine salt, a morpholine salt, and the like. The salt as component (b) is preferably an inorganic salt selected from alkali metal salts such as a sodium salt, a potassium salt, and the like, and alkaline earth metal salts such as a magnesium salt and the like, more preferably an alkali metal salt, and further preferably a sodium salt.

[0017]

Component (b) is preferably one or more selected from a compound represented by the following general formula (b1) [hereinafter, referred to as component (b1)] and a compound represented by the following general formula (b2) [hereinafter, referred to as component (b2)] from the viewpoint of solubility control.

Component (b) more preferably contains one or more selected from component (b1) and one or more selected from component (b2) from the viewpoint of solubility control:



wherein in the formula (b1), R^{1b} represents an alkyl group with 9 or more and 14 or less carbons, B represents a benzene ring, a carbon atom in R^{1b} , bonded with a carbon atom in B, is a secondary carbon atom, M represents a cation, and a sulfonic acid group is bonded at the ortho-, meta- or para-position to R^{1b} bonded to B; and



wherein in the formula (b2), R^{2b} represents an alkyl group or an alkenyl group with 10 or more and 18 or less carbons, and M represents a cation.

[0018]

R^{1b} in the general formula (b1) is an alkyl group with 9 or more and preferably 10 or more, and 14 or less and preferably 13 or less carbons.

M in the general formula (b1) is preferably a hydrogen ion, an alkali metal ion such as a sodium ion, a potassium ion, or the like, an alkaline earth metal (1/2 atom) ion such as a magnesium ion, a calcium ion, or the like, or an organic ammonium ion. The organic ammonium salt may be a salt with amine such as monoethanolamine, diethanolamine, triethanolamine, or the like. M is preferably an alkali metal ion such as a sodium ion, a potassium ion, or the like, or an alkanolammonium ion such as a monoethanolammonium ion, a diethanolammonium ion, or the like, and more preferably a sodium ion.

[0019]

Component (b1) is preferably p-alkylbenzene sulfonate having an alkyl group with 11 or more and 14 or less carbons, and more preferably sodium p-alkylbenzene sulfonate having an alkyl group with 11 or more and 14 or less carbons. Specifically, component (b1) is preferably a compound of the general formula (b1) in which R^{1b} is an alkyl group with 11 or more and 14 or less carbons and M is a sodium ion.

[0020]

R^{2b} in the general formula (b2) is an alkyl group or an alkenyl group with 10 or more, preferably 11 or more and more preferably 12 or more, and 18 or less, preferably 15 or less and more preferably 13 or less carbons. R^{2b} is exemplified by one or more groups selected from linear alkyl groups, branched alkyl groups,

linear alkenyl groups and branched alkenyl groups, and is preferably a linear alkyl group.

M in the general formula (b2) is preferably a hydrogen ion, an alkali metal ion such as a sodium ion, a potassium ion, or the like, an alkaline earth metal (1/2 atom) ion such as a magnesium ion, a calcium ion, or the like, or an organic ammonium ion. The organic ammonium salt may be a salt with amine such as monoethanolamine, diethanolamine, triethanolamine, or the like. M is preferably an alkali metal ion such as a sodium ion, a potassium ion, or the like, or an alkanolammonium ion such as a monoethanolammonium ion, a diethanolammonium ion, or the like, and more preferably a sodium ion.

[0021]

Component (b2) is preferably one or more selected from lauric acid, myristic acid, palmitic acid, isopalmitic acid, stearic acid, isostearic acid and salts of them, more preferably one or more selected from lauric acid, myristic acid, palmitic acid and salts of them, and further preferably one or more selected from lauric acid, myristic acid and salts of them.

Component (b2) is preferably a compound of the general formula (b2) in which R^{2b} is an alkyl group with 10 or more and 18 or less carbons and M is a cation, and more preferably a compound in which M is a hydrogen ion or a sodium ion.

[0022]

Component (b) is preferably an anionic surfactant containing one or more selected from a fatty acid and a salt thereof, and more preferably an anionic surfactant containing component (b2) from the viewpoint of reduction of lump residue.

Further, component (b) is preferably an anionic surfactant containing one or more selected from a fatty acid and a salt thereof and one or more selected from alkylbenzene sulfonic acid and a salt thereof, more preferably an anionic surfactant containing one or more selected from component (b1) and one or more selected from component (b2), and further preferably an anionic surfactant containing a fatty acid sodium salt and sodium alkylbenzene sulfonate from the viewpoints of formulation and reduction of lump residue.

Further, component (b) is preferably sprayed to component (d) from the viewpoint of reduction of lump residue.

[0023]

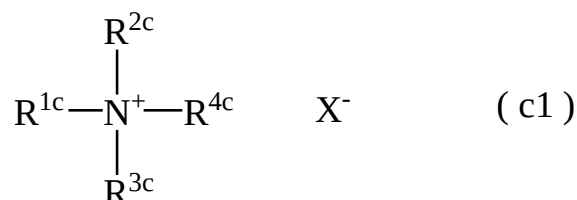
<Component (c)>

Component (c) is a cationic surfactant. Examples of component (c) include a quaternary ammonium salt-type surfactant. Component (c) may be a cationic antimicrobial agent having bactericidal properties, antimicrobial properties or sterilization properties.

The quaternary ammonium salt-type surfactant of component (c) is preferably one or more selected from

compounds represented by the following general formula (c1) and compounds represented by the following general formula (c2):

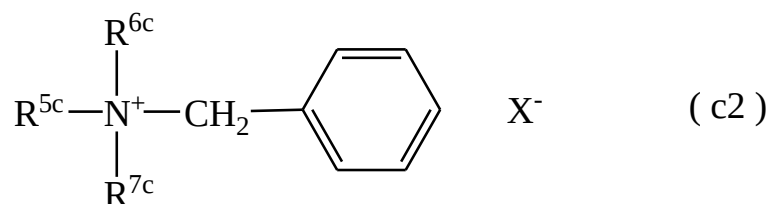
[0024]



[0025]

wherein $\text{R}^{1\text{c}}$ is an aliphatic hydrocarbon group with 8 or more and 18 or less carbons, $\text{R}^{2\text{c}}$ is a group selected from aliphatic hydrocarbon groups with 8 or more and 18 or less carbons, alkyl groups with 1 or more and 3 or less carbons and hydroxyalkyl groups with 1 or more and 3 or less carbons, $\text{R}^{3\text{c}}$ and $\text{R}^{4\text{c}}$ each independently represent a group selected from alkyl groups with 1 or more and 3 or less carbons and hydroxyalkyl groups with 1 or more and 3 or less carbons, and X^{-} is an anion; and

[0026]



[0027]

wherein $\text{R}^{5\text{c}}$ is an aliphatic hydrocarbon group with 8 or more and 18 or less carbons, $\text{R}^{6\text{c}}$ and $\text{R}^{7\text{c}}$ each independently represent a group selected from alkyl

groups with 1 or more and 3 or less carbons and hydroxyalkyl groups with 1 or more and 3 or less carbons, and X^- is an anion.

[0028]

R^{1c} in the general formula (c1) has preferably 9 or more, more preferably 10 or more and further preferably 12 or more, and preferably 16 or less carbons from the viewpoint of washing power. R^{1c} is preferably an alkyl group or an alkenyl group and preferably an alkyl group.

R^{2c} in the general formula (c1) is a group selected from aliphatic hydrocarbon groups with 8 or more and 18 or less carbons, alkyl groups with 1 or more and 3 or less carbons and hydroxyalkyl groups with 1 or more and 3 or less carbons.

When R^{2c} is an aliphatic hydrocarbon group with 8 or more and 18 or less carbons, R^{2c} is an alkyl group or an alkenyl group with preferably 8 or more, and preferably 14 or less and more preferably 12 or less carbons, and preferably an alkyl group from the viewpoint of washing power.

[0029]

R^{3c} and R^{4c} in the general formula (c1) each independently represent a group selected from alkyl groups with 1 or more and 3 or less carbons and hydroxyalkyl groups with 1 or more and 3 or less carbons. R^{3c} and R^{4c} each independently preferably represent a group selected from alkyl groups with 1 or more and 3 or

less carbons. Examples of the alkyl group with 1 or more and 3 or less carbons include a methyl group, an ethyl group and a propyl group. Examples of the hydroxyalkyl groups with 1 or more and 3 or less carbons include a hydroxymethyl group, a hydroxyethyl group and a hydroxypropyl group.

[0030]

X⁻ in the general formula (c1) is an anion. Examples of the anion include one or more anions selected from a halogen ion and an alkylsulfate ion with 1 or more and 3 or less carbons. Examples of the halogen ion include, for example, a chloride ion, a bromide ion and an iodide ion. Further, examples of the alkylsulfate ion with 1 or more and 3 or less carbons include, for example, a methylsulfate ion, an ethylsulfate ion and a propylsulfate ion.

[0031]

Examples of preferred compounds as the compound of the general formula (c1) include one or more selected from an N-alkyl-N,N,N-trimethylammonium salt whose alkyl group has 12 or more and 18 or less carbons, an N,N-dialkyl-N,N-dimethyl-ammonium salt whose alkyl group has 8 or more and 16 or less carbons, and an N-alkyl-N,N-dimethyl-N-ethylammonium salt whose alkyl group has 12 or more and 16 or less carbons.

[0032]

R^{5c} in the general formula (c2) is an aliphatic hydrocarbon group with 8 or more and 18 or less carbons. R^{5c} has preferably 8 or more, more preferably 10 or more and further preferably 12 or more, and preferably 18 or less and more preferably 16 or less carbons from the viewpoint of washing power. R^{5c} is preferably an alkyl group or an alkenyl group and more preferably an alkyl group.

[0033]

R^{6c} and R^{7c} in the general formula (c2) each independently represent a group selected from alkyl groups with 1 or more and 3 or less carbons and hydroxyalkyl groups with 1 or more and 3 or less carbons. R^{6c} and R^{7c} each independently preferably represent a group selected from alkyl groups with 1 or more and 3 or less carbons. Examples of the alkyl group with 1 or more and 3 or less carbons include a methyl group, an ethyl group and a propyl group. Examples of the hydroxyalkyl groups with 1 or more and 3 or less carbons include a hydroxymethyl group, a hydroxyethyl group and a hydroxypropyl group.

[0034]

X^- in the general formula (c2) is an anion. Examples of the anion include one or more anions selected from a halogen ion and an alkylsulfate ion with 1 or more and 3 or less carbons. Examples of the halogen ion include, for example, a chloride ion, a bromide ion and an iodide

ion. Further, examples of the alkylsulfate ion with 1 or more and 3 or less carbons include, for example, a methylsulfate ion, an ethylsulfate ion and a propylsulfate ion.

[0035]

Specific examples of the compound of the general formula (c2) include one or more compounds selected from an N-dodecyl-N,N-dimethyl-N-benzylammonium salt, an N-tridecyl-N,N-dimethyl-N-benzylammonium salt, an N-tetradecyl-N,N-dimethyl-N-benzylammonium salt, an N-pentadecyl-N,N-dimethyl-N-benzylammonium salt, an N-hexadecyl-N,N-dimethyl-N-benzylammonium salt, an N-dodecyl-N,N-diethyl-N-benzylammonium salt, an N-tridecyl-N,N-diethyl-N-benzylammonium salt, an N-tetradecyl-N,N-diethyl-N-benzylammonium salt, an N-pentadecyl-N,N-diethyl-N-benzylammonium salt, an N-hexadecyl-N,N-diethyl-N-benzylammonium salt, an N-dodecyl-N-methyl-N-ethyl-N-benzylammonium salt, an N-tridecyl-N-methyl-N-ethyl-N-benzylammonium salt, an N-tetradecyl-N-methyl-N-ethyl-N-benzylammonium salt, an N-pentadecyl-N-methyl-N-ethyl-N-benzylammonium salt, and an N-hexadecyl-N-methyl-N-ethyl-N-benzylammonium salt.

[0036]

<Component (d)>

Component (d) is an alkali agent. Examples of component (d) include one or more alkali agents selected

from alkali metal carbonates, alkali metal hydrogen carbonates, alkali metal silicates and tripolyphosphates.

The alkali metal carbonate is exemplified by one or more selected from sodium carbonate and potassium carbonate, and is preferably sodium carbonate.

Examples of the alkali metal hydrogen carbonates include one or more selected from sodium hydrogen carbonate and potassium hydrogen carbonate.

Examples of the alkali metal silicates include one or more selected from sodium silicate, and potassium silicate.

Examples of the tripolyphosphates include alkali metal salts of tripolyphosphoric acid.

[0037]

Component (d) is preferably one or more alkali agents selected from alkali metal carbonates and alkali metal hydrogen carbonates, more preferably one or more selected from alkali metal carbonates, further preferably one or more selected from sodium carbonate and potassium carbonate, and furthermore preferably sodium carbonate from the viewpoint of washing performance.

[0038]

Part or the whole of component (d) is preferably covered with component (b) from the viewpoint of further enhancing solubility of the detergent article in water. The covering layer with component (b) may be one obtained by spraying an acid precursor of component (b) to

component (d), namely, one in which part or the whole of component (d) is covered with a covering layer obtained by spraying an acid precursor of component (b). In the present invention, the acid precursor of component (b) refers to component (b) which is not in the form of a salt, but in the form of an acid.

A thickness of the covering layer with component (b) is 0.1 μm or more, preferably 0.3 μm or more, more preferably 0.5 μm or more and further preferably 1 μm or more from the viewpoint of solubility control, and 50 μm or less, preferably 30 μm or less, more preferably 20 μm or less and further preferably 10 μm or less from the viewpoint of the dissolution rate.

The thickness of the covering layer with component (b) is determined by cutting component (d) arbitrarily sampled, with a knife such as a scalpel, and measuring the cut product with a scanning electron microscope (SEM) and calculating the thickness of the cut product.

Specifically, the thickness is determined by using an image (magnification: 500 times) with observation of five cut cross sections of component (d) arbitrarily sampled, by a scanning electron microscope, thereby calculating the thickness of the covering layer with component (b) in a component (d) particle and providing the average value.

[0039]

<Composition and others>

The detergent composition of the present invention contains component (a) in the detergent composition in an amount of preferably 1 mass% or more, more preferably 3 mass% or more, further preferably 5 mass% or more and furthermore preferably 10 mass% or more from the viewpoint of washing performance, and preferably 50 mass% or less, more preferably 45 mass% or less, further preferably 40 mass% or less, furthermore preferably 25 mass% or less, furthermore preferably 20 mass% or less and furthermore preferably 18 mass% or less from the viewpoint of physical properties of powder.

[0040]

The detergent composition of the present invention contains component (b) in the detergent composition in an amount of preferably 0.1 mass% or more, more preferably 0.5 mass% or more, further preferably 1.0 mass% or more and furthermore preferably 2.0 mass% or more from the viewpoints of washing performance and solubility control, and preferably 10 mass% or less, more preferably 8.0 mass% or less, further preferably 7.0 mass% or less, furthermore preferably 6.0 mass% or less and furthermore preferably 5.0 mass% or less from the viewpoint of antimicrobial performance.

Note that, the mass of component (b) in the present invention is specified by using a value in terms a sodium salt.

[0041]

The detergent composition of the present invention contains component (c) in the detergent composition in an amount of preferably 0.1 mass% or more, more preferably 0.5 mass% or more, further preferably 0.7 mass% or more, furthermore preferably 1.5 mass% or more and furthermore preferably 2.5 mass% or more, and preferably 20 mass% or less, more preferably 15 mass% or less, further preferably 10 mass% or less and furthermore preferably 5 mass% or less from the viewpoint of antimicrobial performance.

[0042]

The detergent composition of the present invention contains component (d) in the detergent composition in an amount of more than 5 mass%, preferably 10 mass% or more, more preferably 13 mass% or more, further preferably 15 mass% or more and furthermore preferably 19 mass% or more from the viewpoint of washing performance, and preferably 50 mass% or less, more preferably 40 mass% or less, further preferably 35 mass% or less, furthermore preferably 30 mass% or less, furthermore preferably 25 mass% or less and furthermore preferably 22 mass% or less from the viewpoint of undissolved residue.

[0043]

In the detergent composition of the present invention, a proportion of a content of component (a) to a total content of surfactants contained in the detergent composition, $(a)/(\text{total content of surfactants})$, is

preferably 30 mass% or more, more preferably 40 mass% or more, further preferably 50 mass% or more and furthermore preferably 60 mass% or more from the viewpoint of washing performance, and preferably 95 mass% or less, more preferably 90 mass% or less and further preferably 85 mass% or less from the viewpoints of antimicrobial performance and solubility. The total content of surfactants contained in the detergent composition may be a total content of component (a), component (b), component (c), and component (f) described below in detail.

[0044]

A mass ratio of a content of component (a) to a content of component (b), $(a)/(b)$, in the detergent composition of the present invention is preferably 1.0 or more, more preferably 1.1 or more, further preferably 1.3 or more, furthermore preferably 2.0 or more, furthermore preferably 2.5 or more and furthermore preferably 2.9 or more from the viewpoint of washing performance, and preferably 20 or less, more preferably 18 or less, further preferably 16 or less, furthermore preferably 13 or less, furthermore preferably 10 or less, furthermore preferably 8.0 or less, furthermore preferably 5.0 or less, furthermore preferably 4.0 or less and furthermore preferably 3.5 or less from the viewpoints of washing performance and solubility.

[0045]

A mass ratio of a content of component (c) to a content of component (b), $(c)/(b)$, in the detergent composition of the present invention is preferably 0.1 or more, more preferably 0.2 or more, further preferably 0.4 or more, furthermore preferably 0.60 or more and furthermore preferably 0.70 or more from the viewpoints of washing performance and antimicrobial performance, and preferably 5 or less, more preferably 4.5 or less, further preferably 4.0 or less, furthermore preferably 3.0 or less, furthermore preferably 2.0 or less, furthermore preferably 1.0 or less and furthermore preferably 0.90 or less from the viewpoints of washing performance, solubility, and re-staining-preventing performance.

[0046]

A mass ratio of a content of component (b) to a content of component (d), $(b)/(d)$, in the detergent composition of the present invention is preferably 0.05 or more, more preferably 0.07 or more, further preferably 0.10 or more, furthermore preferably 0.15 or more, furthermore preferably 0.20 or more and furthermore preferably 0.23 or more from the viewpoints of washing performance and solubility, and preferably 1.0 or less, more preferably 0.9 or less, further preferably 0.8 or less, furthermore preferably 0.50 or less and furthermore preferably 0.30 or less from the viewpoint of washing performance.

[0047]

The detergent composition of the present invention preferably contains component (b1) as component (b) from the viewpoint of ease of breakage of undissolved residue, and preferably contains component (b2) as component (b) from the viewpoint of inhibiting formation of undissolved residue. While component (b) may contain only component (b1), it preferably contains component (b1) and component (b2) from the viewpoint of reduction of undissolved residue.

When the detergent composition of the present invention contains component (b1) and component (b2), a mass ratio of a content of component (b1) to a content of component (b2), $(b1)/(b2)$, in the detergent composition of the present invention is preferably 0.1 or more, more preferably 0.2 or more, further preferably 0.3 or more and furthermore preferably 0.5 or more, and preferably 10 or less, more preferably 5 or less, further preferably 3.3 or less, furthermore preferably 2.3 or less and furthermore preferably 1.5 or less from the viewpoint of reduction of undissolved residue.

[0048]

<Component (e)>

The detergent composition of the present invention can optionally contain (e) an oil-absorption carrier [hereinafter, referred to as component (e)].

While the kind of component (e) is not particularly limited, one having an oil absorption capacity equal to or more than 120 mL/100 g is preferable from the viewpoint of retention of the nonionic surfactant. The upper limit value is not particularly limited. In the present invention, the oil-absorption carrier is preferably one or more selected from amorphous silica, calcium silicate, a clay mineral, crystalline aluminosilicate, and amorphous aluminosilicate, and more preferably one or more selected from a clay mineral and crystalline aluminosilicate from the above viewpoint. Note that the oil absorption capacity of the oil-absorption carrier can be measured on the basis of JIS K 5101-13-2.

Component (e) is preferably a water-insoluble oil-absorption carrier. Being "water-insoluble" with respect to component (e) refers to being insoluble in an amount of 1 g or more in 100 g of water at 20°C.

[0049]

An average primary particle size of component (e) is preferably 0.1 μm or more and more preferably 1 μm or more, and preferably 10 μm or less and more preferably 5 μm or less. The average primary particle size of component (e) is measured with a laser diffraction/scattering type particle size distribution measurement apparatus (for example, HORIBA Ltd., LA-950). The average primary particle size is D50 (median size) in

a cumulative particle size distribution on a volume basis.

[0050]

Specific examples of component (e) can include amorphous aluminosilicate (oil absorption capacity: 285 mL/100 g) described in JP-A 9-132794, JP-A 7-10526, JP-A 6-227811, JP-A 8-119622 or the like.

More specifically, as the oil-absorption carrier, Fluorite R (manufactured by Tokuyama Corporation, oil absorption capacity: 400 to 500 mL/100 g) can be used as calcium silicate of component (e), Tokuseal NR (manufactured by Tokuyama Corporation, oil absorption capacity: 210 to 270 mL/100 g) or SYLOPURE (manufactured by FUJI SILYSIA CHEMICAL LTD., oil absorption capacity: 240 to 280 mL/100 g) can be used as amorphous silica of component (e), or TIXOREX25 (manufactured by Solvay Silica Korea Co., Ltd., 220 to 270 mL/100 g) can be used as amorphous aluminosilicate of component (e).

[0051]

Further, examples of the crystalline aluminosilicate include zeolite. A crystalline aluminosilicate such as zeolite A, X, or P, or the like can be contained as a specific zeolite. Suitable as the crystalline aluminosilicate is preferably zeolite A (for example, the trade name "TOYOBUILDER" manufactured by Tosoh Corporation, oil absorption capacity according to the method in JIS K 5101: 40 mL/100 g or more). Other

suitable examples include type P (for example, the trade names "Doucil A24" and "ZSE064" which are both manufactured by Crosfield, or the like, oil absorption capacity: 60 to 150 mL/100 g), type X (for example, the trade name "WessalithXD" manufactured by Degussa, oil absorption capacity: 80 to 100 mL/100 g), and a hybrid zeolite described in WO-A 98/42622.

[0052]

Examples of the clay mineral of component (e) include bentonite. The bentonite preferably has an ion-exchange capacity of 50 to 100 meq/100 g. Examples of the bentonite include one or more selected from a clay mineral of the montmorillonite group (smectitic clay) selected from the group composed of an alkali metal or alkaline earth metal montmorillonite, saponite, or hectorite, illite, attapulgite, and kaolinite.

The bentonite can be used in powdered form or granule form. For example, reference can be made to granulated products of clay minerals in JP-A 2008-189719.

[0053]

When the detergent composition of the present invention contains component (e), the detergent composition of the present invention contains component (e) in an amount of preferably 5 mass% or more, more preferably 10 mass% or more, further preferably 15 mass% or more, furthermore preferably 20 mass% or more and furthermore preferably 25 mass% or more, and preferably

40 mass% or less, more preferably 35 mass% or less and further preferably 32.5 mass% or less from the viewpoint of undissolved residue.

[0054]

<Component (f)>

The detergent composition of the present invention can optionally contain a surfactant [hereinafter, referred to as component (f)] other than component (a), component (b) and component (c) from the viewpoints of washing performance and foaming.

Examples of the surfactant other than component (a), component (b) and component (c) include one or more selected from amphoteric surfactants.

[0055]

Examples of the amphoteric surfactant of component (f) can include one or more selected from N-alkanoylaminoethyl-N,N-dimethylamine oxide, N-alkyl-N,N-dimethylamine oxide, N-alkanoylaminoethyl-N,N-dimethyl-N-carboxymethylammonium betaine, N-alkyl-N,N-dimethyl-N-carboxymethylammonium betaine, N-alkyl-N,N-dimethyl-N-sulfopropylammonium sulfobetaine, N-alkyl-N,N-dimethyl-N-(2-hydroxysulfopropyl)ammonium sulfobetaine, N-alkanoylaminoethyl-N,N-dimethyl-N-sulfopropylammonium sulfobetaine, and N-alkanoylaminoethyl-N,N-dimethyl-N-(2-hydroxysulfopropyl)ammonium sulfobetaine. The alkanoyl groups in these are, for example, for example,

lauroyl or myristoyl. Further, the alkyl groups in these are, for example, lauryl groups or myristyl groups.

[0056]

When the detergent composition of the present invention contains component (f), the detergent composition of the present invention contains component (f) in an amount of preferably 0.1 mass% or more, more preferably 0.2 mass% or more and further preferably 0.3 mass% or more, and preferably 2 mass% or less, more preferably 1.5 mass% or less and further preferably 1.2 mass% or less from the viewpoints of washing performance and foaming.

[0057]

<Component (g)>

The detergent composition of the present invention can optionally contain one or more compounds selected from inorganic sulfates and inorganic halogen compounds, as component (g). Examples of component (g) include one or more compounds selected from sodium sulfate, magnesium sulfate, sodium chloride, and magnesium chloride.

Component (g) may be a hydrate or an anhydride.

[0058]

When the detergent composition of the present invention contains component (g), the detergent composition of the present invention contains component (g) in an amount of preferably 2 mass% or more, more preferably 5 mass% or more, further preferably 10 mass%

or more and furthermore preferably 15 mass% or more, and preferably 60 mass% or less, more preferably 50 mass% or less, further preferably 40 mass% or less and furthermore preferably 30 mass% or less from the viewpoint of undissolved residue.

[0059]

<Component (h)>

The detergent composition of the present invention can optionally contain a polymer having a carboxylic acid group or a salt thereof and having a weight average molecular weight of 3,000 or more, as component (h).

Examples of component (h) include one or more polymers selected from polyacrylic acid and a salt thereof, and a copolymer of acrylic acid and maleic acid, and a salt thereof [hereinafter, referred to as component (h1)].

Examples of the polyacrylic acid and a salt thereof include one or more selected from polyacrylic acid, sodium polyacrylate, potassium polyacrylate, and the like, and preferably include one or more selected from sodium polyacrylate and potassium polyacrylate.

Examples of the copolymer of acrylic acid and maleic acid, and a salt thereof include one or more selected from a copolymer of acrylic acid and maleic acid, a sodium salt of the copolymer of acrylic acid and maleic acid, a potassium salt of the copolymer of acrylic acid and maleic acid, and the like, and preferably include one

or more selected from a sodium salt of the copolymer of acrylic acid and maleic acid, and a potassium salt of the copolymer of acrylic acid and maleic acid. A molar ratio of acrylic acid to maleic acid in the copolymer, molar number of acrylic acid/molar number of maleic acid, is preferably 1/99 or more and more preferably 10/90 or more, and preferably 99/1 or less and more preferably 90/10 or less.

[0060]

Component (h1) may be a copolymer that contains a monomer other than acrylic acid and maleic acid and copolymerizable with acrylic acid and/or maleic acid to a degree that the development of the effects of the present invention is not hindered. Examples of the monomer other than acrylic acid and maleic acid and copolymerizable with acrylic acid and/or maleic acid include a vinyl-based monomer, an acrylic-based monomer, a styrene-based monomer, and others, and more specifically include methacrylic acid, methyl acrylate, ethyl acrylate, methyl methacrylate, styrene, and others. A molar ratio of the monomer other than acrylic acid and maleic acid and copolymerizable with acrylic acid and/or maleic acid in component (h1) is preferably 0 mol% or more, and preferably 5 mol% or less, more preferably 3 mol% or less, and further preferably 0 mol% in component (h1). Therefore, the polyacrylic acid and a salt thereof and the copolymer of acrylic acid and maleic acid or a salt

thereof of the present invention may be a polymer or a copolymer that contains the monomer other than acrylic acid and maleic acid and copolymerizable with acrylic acid and/or maleic acid in a range of 0 mol% or more and 5 mol% or less in all constituent monomers.

[0061]

A weight average molecular weight of component (h) is 3,000 or more, preferably 3,500 or more, more preferably 4,000 or more, further preferably 5,000 or more, furthermore preferably 6,000 or more, furthermore preferably 7,000 or more, furthermore preferably 8,000 or more, furthermore preferably 9,000 or more and furthermore preferably 10,000 or more, and preferably 100,000 or less, more preferably 50,000 or less, further preferably 25,000 or less and furthermore preferably 15,000 or less.

This weight average molecular weight can be measured in accordance with the following method for measuring weight average molecular weight.

<Method for measuring weight average molecular weight>

The weight average molecular weight of component (h) is a weight average molecular weight (Mw) that can be measured and determined by GPC (gel permeation chromatography) on the basis of a reference standard product.

The GPC measurement conditions are shown below.

· Column:

trade name TSK-GEL guard PWXL manufactured by Tosoh Corporation

trade name TSK-GEL G4000 PWXL manufactured by Tosoh Corporation

trade name TSK-GEL G2500 PWXL manufactured by Tosoh Corporation

- Mobile phase: aqueous solution of 0.1 mol/L of potassium dihydrogen phosphate and 0.1 mol/L of sodium dihydrogen phosphate/acetonitrile = 90/10 (volume ratio)
- Detector: differential refractometer
- Column temperature: 40°C
- Flow rate: 1.0 mL/min
- Reference standard product: polyacrylic acid [manufactured by American Standard Corporation]
- Sample: From a preparation liquid in a total liquid amount of 200 mL prepared by adding ion-exchanged water to an aqueous polymer solution with a solid content of 0.8 g, 10 µL is separated and purified and poured into the column.

[0062]

When the detergent composition of the present invention contains component (h), the detergent composition of the present invention contains component (h) in an amount of preferably 0.1 mass% or more, more preferably 0.5 mass% or more, further preferably 2 mass% or more and furthermore preferably 5 mass% or more, and preferably 20 mass% or less, more preferably 15 mass% or

less, further preferably 10 mass% or less and furthermore preferably 7 mass% or less from the viewpoints of washing performance and stability.

[0063]

<Component (i)>

The detergent composition of the present invention can optionally contain polyalkylene glycol having a weight average molecular weight of 100 or more and 100,000 or less, as component (i).

Examples of component (i) include one or more selected from polyethylene glycol and polypropylene glycol.

A weight average molecular weight of component (i) is 100 or more, preferably 1,000 or more and more preferably 5,000 or more, and 100,000 or less, preferably 30,000 or less, more preferably 20,000 or less and further preferably 15,000 or less.

Here, the weight average molecular weight is a value determined by gel permeation chromatography using polystyrene as the standard product.

[0064]

When the detergent composition of the present invention contains component (i), the detergent composition of the present invention contains component (i) in an amount of preferably 0.001 mass% or more, more preferably 0.01 mass% or more, further preferably 0.1 mass% or more and furthermore preferably 0.2 mass% or

more, and preferably 5 mass% or less, more preferably 4 mass% or less, further preferably 3 mass% or less, furthermore preferably 2 mass% or less and furthermore preferably 1 mass% or less from the viewpoint of stability.

[0065]

<Component (j)>

The detergent composition of the present invention can optionally contain one or more enzymes selected from protease, lipase and amylase as component (j).

Examples of the protease include, for example, serine protease (EC3.4.21), metalloprotease (EC3.4.17 or EC3.4.24), and the like. Suitable examples of the protease include neutral or alkaline serine protease such as subtilisin (EC3.4.21.62), and the like.

Examples of the lipase include, for example, triacylglycerol lipase (EC3.1.1.3), phospholipase A2 (EC3.1.1.4), lysophospholipase (EC3.1.1.5), monoglyceride lipase (EC3.1.1.23), galactolipase (EC3.1.1.26), phospholipase A1 (EC3.1.1.32), lipoprotein lipase (EC3.1.1.34), and the like.

Examples of the amylase include, for example, α -amylase (EC3.2.1.1), β -amylase (EC3.2.1.2) and/or glucoamylase (EC3.2.1.3) and the like. The amylase is suitably exemplified by neutral or alkaline α -amylase, and is preferably one derived from microorganisms, such as bacteria, fungi, and the like.

[0066]

When the detergent composition of the present invention contains component (j), the detergent composition contains component (j) in an amount, as a mass of enzyme protein, of preferably 0.002 mass% or more, more preferably 0.004 mass% or more and further preferably 0.008 mass% or more, and preferably 0.12 mass% or less, more preferably 0.1 mass% or less, and further preferably 0.08 mass% or less from the viewpoint of washing performance.

The mass of component (j) in the present invention is specified by a calculated amount of enzyme protein.

Note that, as a method for quantifying the enzyme protein of component (j), for example, a protein assay kit, Lowry kit manufactured by Nacalai Tesque, Inc., can be used and a method in accordance with an instruction manual thereof can be employed.

[0067]

The detergent composition of the present invention can contain water. Examples of the water include ion-exchanged water, purified water and distilled water. The water is used as the balance other than component (a) to component (j) and any optional component. The water also includes water used for charging a formulation component of the detergent composition.

[0068]

The detergent composition of the present invention can optionally contain, as other component(s), other component(s) known in the field of detergents for clothing, for example, a bleaching agent (perborate, bleaching activator or the like), a re-staining-preventing agent, a reducing agent (sulfite or the like), a fluorescent brightener, a foam inhibitor (silicone or the like), an organic solvent, a fragrance, a colorant, an antimicrobial agent, and the like (provided that those corresponding to component (a) to component (j) are excluded).

[0069]

The detergent composition of the present invention may be a solid detergent composition. The detergent composition of the present invention is preferably a detergent composition in a form of one or more selected from a powder, a particle and a granule from the viewpoint of solubility. The detergent composition of the present invention may be a powder detergent composition.

[0070]

The detergent composition of the present invention can be produced by a publicly-known method. For example, a spray drying method, a dry neutralization method, a dry granulation method, a dry blending method, a fluidized bed drying method, a thin film drying method, an extrusion granulation method, a tumbling granulation

method, an agitation granulation method, a compaction granulation method, a surfactant supporting method, or a combination of methods selected from these can be applied to the production.

[0071]

A bulk density of the detergent composition of the present invention, while depending on a production method, is preferably 0.2 g/cm³ or more, more preferably 0.3 g/cm³ or more and further preferably 0.35 g/cm³ or more, and preferably 1 g/cm³ or less, more preferably 0.95 g/cm³ or less and further preferably 0.9 g/cm³ or less.

[0072]

When the detergent composition of the present invention is a powder detergent composition, an average particle size of the detergent composition of the present invention is preferably 100 µm or more, more preferably 150 µm or more and further preferably 200 µm or more, and preferably 800 µm or less, more preferably 750 µm or less and further preferably 700 µm or less.

The average particle size is determined from a mass fraction with a sieve mesh size after vibration for 5 minutes with a standard sieve according to JIS Z 8801.

[0073]

<Method for producing detergent composition>

The detergent composition of the present invention can be produced by mixing component (a), component (b),

component (c), component (d) and any other optional components.

Preferable contents in the detergent composition of the present invention can be replaced with mixing amounts and applied to the respective mixing amounts of components (a) to (d) and other optional components and the mass ratios of the mixing amounts among the components in the method for producing the detergent composition of the present invention.

The aspects described for the detergent composition of the present invention can be appropriately applied to the method for producing the detergent composition of the present invention.

[0074]

The detergent composition of the present invention can be produced by, for example, the following steps 1 to 3. Note that the detergent composition of the present invention is not limited to the following production method at all.

step 1: a step of impregnating component (e) with component (a)

step 2: a step of forming, on component (d), a covering layer with component (b)

step 3: a step of mixing component (e) impregnated with component (a), component (d) having the covering layer with component (b), and any other components

[0075]

In step 1, component (a) can be mixed with component (e) to impregnate component (e) with component (a). Note that in step 1, a carrier granule, preferably a carrier granule containing component (e) may be produced to impregnate the carrier granule with component (a).

[0076]

In step 2, a covering layer with component (b) is formed on part or the whole of component (d). An acid precursor of component (b) can be sprayed onto component (d) to form a covering layer with component (b), on part or the whole of component (d).

Examples of the acid precursor of component (b) usable in the present invention include, for example, alkylbenzene sulfonic acid, a fatty acid and the like.

The amount of the acid precursor of component (b) used is preferably 5 parts by mass or more, more preferably 10 parts by mass or more and further preferably 15 parts by mass or more, and preferably 200 parts by mass or less, more preferably 100 parts by mass or less, further preferably 50 parts by mass or less and furthermore preferably 30 parts by mass or less relative to 100 parts by mass of component (d).

[0077]

While only component (b1) may be formulated or only component (b2) may be formulated as component (b) in the method for producing the detergent composition of the present invention, formulating component (b1) and

component (b2) reduces the amount of a powder detergent composition adhered to a mixing machine, enables a powder detergent composition to be stably produced and also facilitates wrapping of a powder detergent composition in a water-soluble film.

In the method for producing the detergent composition of the present invention, when component (b1) and component (b2) are mixed as component (b), a mass ratio of a mixing amount of component (b1) to a mixing amount of component (b2), $(b1)/(b2)$, is preferably 0.1 or more, more preferably 0.2 or more, further preferably 0.3 or more and furthermore preferably 0.5 or more from the viewpoint of solubility, and preferably 10 or less, more preferably 5 or less, further preferably 3.3 or less, furthermore preferably 2.3 or less and furthermore preferably 1.5 or less from the viewpoint of solubility.

[0078]

<Detergent article>

The detergent article of the present invention includes the detergent composition of the present invention, and a water-soluble film for wrapping the detergent composition. In other words, the present invention provides a detergent article including the detergent composition of the present invention, and a water-soluble film, wherein the detergent composition is wrapped in the water-soluble film.

The detergent article of the present invention may be a detergent article containing the detergent composition of the present invention wrapped in a water-soluble film.

[0079]

In the present invention, being "water-soluble" of the water-soluble film refers to property of a film that does not appear to form any insoluble matter after 500 g of ion-exchanged water at 30°C and a Teflon® stirrer with a diameter of 8 cm are placed in a 1-L glass beaker, and 1 g of the film to be evaluated is added thereto and stirred at 100 rpm for 30 minutes.

Further, the water-soluble film has a thickness of preferably 1 µm or more, more preferably 10 µm or more, and further preferably 50 µm or more, and preferably 200 µm or less, more preferably 150 µm or less, and further preferably 100 µm or less from the viewpoints of prevention of accidental ingestion and solubility.

[0080]

The water-soluble film is preferably composed by containing a polymer. The water-soluble film can be obtained by a method known in the present technical field, for example, polymer cast molding, blow molding, extrusion molding, injection molding, or the like. Non-limiting examples of the polymer for producing the water-soluble film include polyvinyl alcohol (PVA), vinyl alcohol copolymers, polyvinyl pyrrolidone, polyalkylene

oxides, (modified) cellulose, (modified) cellulose-ethers, -esters, or -amides, polycarboxylic acids and salts thereof such as polyacrylates and others, copolymers of maleic acid/acrylic acid, polyamino acids, i.e., peptides, polyamides such as polyacrylamide and others, polysaccharides such as starch and gelatin and others, and natural rubbers such as xanthan and carragum and others. The vinyl alcohol copolymers are copolymers of vinyl alcohol and other monomers, for example, ethylene or acrylic acid. The water-soluble film preferably contains a polymer selected from the group composed of the following: polyacrylates and water-soluble acrylates, methyl cellulose, sodium carboxymethyl cellulose, dextrin, ethyl cellulose, hydroxyethyl cellulose, maltodextrin, polymethacrylates, polyvinyl alcohol, vinyl alcohol copolymers, hydroxypropyl methylcellulose (HPMC), and combinations of these. The water-soluble film more preferably contains a polymer selected from polyvinyl alcohol, vinyl alcohol copolymers, and hydroxypropyl methylcellulose. The water-soluble film further preferably contains polyvinyl alcohol, for example, Solublon available from AICELLO CORPORATION. Polymers suitable for the production of water-soluble film are described, for example, in US-B 6995126.

[0081]

In the detergent article of the present invention, a total area of the water-soluble film in contact with the detergent composition of the present invention is preferably 2 cm² or more, more preferably 5 cm² or more, further preferably 7 cm² or more, furthermore preferably 15 cm² or more and furthermore preferably 30 cm² or more from the viewpoint of further increasing product stability, and preferably 100 cm² or less, more preferably 70 cm² or less, further preferably 60 cm² or less and furthermore preferably 48 cm² or less from the same viewpoint.

[0082]

The detergent article of the present invention can be produced by any suitable production process known in the art, for example, a known detergent pouch production process. Examples of such a pouch production process are described in US-B No. 6,995,126, US-B No. 7,127,874, US-B No. 8,156,713, US-B No. 7,386,971, US-B No. 7,439,215, and US-A No. 2009/199877.

[0083]

An amount of the contained material per detergent article of the present invention is preferably 5 g or more, more preferably 8 g or more, and further preferably 10 g or more, and preferably 50 g or less, more preferably 30 g or less, and further preferably 25 g or less.

[0084]

A preferable shape and dimensions per detergent article of the present invention are such that the shape is, for example, a quadrilateral, and the length of one side thereof is preferably 1 cm or more and 5 cm or less and the thickness thereof is preferably 1 cm or more and 5 cm or less and more preferably 1 cm or more and 4 cm or less. Further, a mass per detergent article of the present invention is preferably 5 g or more, more preferably 10 g or more, and further preferably 15 g or more, and preferably 50 g or less, more preferably 40 g or less, and further preferably 30 g or less.

[0085]

Further, a preferable shape and dimensions per detergent article of the present invention other than the above are such that the shape is, for example, a rectangular parallelepiped, and the vertical length thereof is preferably 5 cm or more and 20 cm or less, the horizontal length thereof is preferably 1 cm or more and 4 cm or less, and the thickness thereof is preferably 1 cm or more and 5 cm or less and more preferably 1 cm or more and 4 cm or less. Further, a mass per detergent article of the present invention is preferably 5 g or more and more preferably 10 g or more, and preferably 50 g or less, more preferably 40 g or less, further preferably 30 g or less, and further preferably 20 g or less.

[0086]

The detergent article of the present invention can be suitably used for textile products, hard surfaces of dishes or the like, or automatic dishwashers, and are preferably used for textile products.

[0087]

When textile products are washed with the detergent article of the present invention, the fibers to be washed may be either hydrophobic fibers or hydrophilic fibers. Examples of the hydrophobic fibers include, for example, protein fibers (milk protein casein fiber, promix or the like), polyamide fibers (nylon or the like), polyester fibers (polyester or the like), polyacrylonitrile fibers (acrylic or the like), polyvinyl alcohol fibers (vinylon or the like), polyvinyl chloride fibers (polyvinyl chloride or the like), polyvinylidene chloride fibers (vinylidene or the like), polyolefin fibers (polyethylene, polypropylene or the like), polyurethane fibers (polyurethane or the like), polyvinyl chloride/polyvinyl alcohol copolymer fibers (polyclar or the like), polyalkylene paraoxybenzoate fibers (benzoate or the like), polyfluoroethylene fibers (polytetrafluoroethylene or the like), glass fibers, carbon fibers, alumina fibers, silicon carbide fibers, rock fibers, slag fibers, metal fibers (gold threads, silver threads, steel fibers) and others. Examples of the hydrophilic fibers include, for example, seed hair fibers (cotton, kapok or the like), bast fibers (hemp,

flax, ramie, cannabis, jute or the like), vein fibers (manila hemp, sisal hemp or the like), palm fibers, juncus, straw, animal hair fibers (wool, mohair, cashmere, camel hair, alpaca, vicuna, angora or the like), silk fibers (domestic silk, wild silk), feathers, cellulose fibers (rayon, polynosic, cupro, acetate or the like) and others.

The fibers are preferably fibers including cotton fiber from the viewpoint of finishing performance. From the viewpoint of finishing performance for fibers, a content of cotton fiber in the fibers is preferably 5 mass% or more, more preferably 10 mass% or more, further preferably 15 mass% or more, furthermore preferably 20 mass% or more, furthermore preferably 40 mass% or more, furthermore preferably 60 mass% or more and furthermore preferably 80 mass% or more, and preferably 100 mass% or less, and may be 100 mass%.

[0088]

In the present invention, a textile product means fabrics such as woven fabrics, knitted fabrics, nonwoven fabrics or the like using any of the above hydrophobic fibers or hydrophilic fibers, and products obtained by using them, such as undershirts, T-shirts, dress shirts, blouses, slacks, caps, handkerchiefs, towels, knitwear, socks, underwear, tights or the like.

[0089]

[Method for washing textile products]

The present invention provides a method for washing textile products, including washing textile products with a washing liquid obtained by mixing the detergent article of the present invention and water (hereinafter, referred to as the washing liquid of the present invention).

The aspects described for the detergent article of the present invention and the detergent composition of the present invention can be appropriately applied to the method for washing textile products of the present invention.

The method for washing textile products of the present invention may be a method including putting in advance into a washer tub the detergent article of the present invention and water and mixing them to prepare a detergent liquid, and then putting objects to be washed, i.e., textile products and washing the textile products. However, from the viewpoint of having the effect of the present invention, the method is preferably a method including putting the detergent article of the present invention, water, and textile products into a washer tub, thereby preparing the detergent liquid of the present invention and washing the textile products concurrently while dissolving the detergent article of the present invention in the water.

[0090]

In the washing liquid of the present invention, an amount of water during mixing of the detergent article of

the present invention and water is adjusted such that a total amount of the detergent composition of the present invention included in the detergent article of the present invention is a concentration of preferably 0.01 g or more, more preferably 0.1 g or more and further preferably 0.3 g or more, and preferably 10 g or less, more preferably 1 g or less and further preferably 0.5 g or less relative to 1 L of water from the viewpoints of attention to the environment and washing performance.

[0091]

The washing liquid of the present invention contains component (a) in the washing liquid in an amount of preferably 15 ppm or more, more preferably 30 ppm or more and further preferably 45 ppm or more from the viewpoint of washing performance, and preferably 300 ppm or less, more preferably 250 ppm or less and further preferably 200 ppm or less from the viewpoint of rinsing.

[0092]

The washing liquid of the present invention contains component (b) in the washing liquid in an amount of preferably 2 ppm or more, more preferably 3 ppm or more and further preferably 5 ppm or more from the viewpoint of solubility, and preferably 100 ppm or less, more preferably 50 ppm or less and further preferably 40 ppm or less from the viewpoint of antimicrobial performance.

[0093]

The washing liquid of the present invention contains component (c) in the washing liquid in an amount of preferably 3 ppm or more, more preferably 5 ppm or more and further preferably 8 ppm or more, and, for example, 50 ppm or less from the viewpoint of antimicrobial performance.

[0094]

The washing liquid of the present invention contains component (d) in the washing liquid in an amount of preferably 5 ppm or more, more preferably 10 ppm or more and further preferably 15 ppm or more from the viewpoint of washing performance, and preferably 500 ppm or less, more preferably 400 ppm or less and further preferably 300 ppm or less from the viewpoint of undissolved residue.

[0095]

When the washing liquid of the present invention contains component (e), the washing liquid of the present invention contains component (e) in an amount of preferably 30 ppm or more, more preferably 60 ppm or more and further preferably 100 ppm or more from the viewpoint of undissolved residue, and preferably 160 ppm or less, more preferably 150 ppm or less and further preferably 140 ppm or less from the viewpoint of streaked residue.

[0096]

When the washing liquid of the present invention contains component (f), the washing liquid of the present

invention contains component (f) in an amount of preferably 0.5 ppm or more, more preferably 1 ppm or more, further preferably 1.5 ppm or more from the viewpoints of washing performance and foaming performance, and preferably 20 ppm or less, more preferably 18 ppm or less and further preferably 16 ppm or less from the viewpoint of rinsing performance.

[0097]

When the washing liquid of the present invention contains component (g), the washing liquid of the present invention contains component (g) in an amount of preferably 20 ppm or more, more preferably 40 ppm or more and further preferably 80 ppm or more from the viewpoint of undissolved residue, and preferably 250 ppm or less, more preferably 220 ppm or less and further preferably 200 ppm or less from the viewpoint of washing performance.

[0098]

When the washing liquid of the present invention contains component (h), the washing liquid of the present invention contains component (h) in an amount of preferably 5 ppm or more, more preferably 10 ppm or more and further preferably 15 ppm or more, and, for example, 50 ppm or less from the viewpoint of particle stain washing performance.

[0099]

When the washing liquid of the present invention contains component (i), the washing liquid of the present invention contains component (i) in an amount of preferably 0.5 ppm or more, more preferably 1 ppm or more and further preferably 1.5 ppm or more, and, for example, 50 ppm or less from the viewpoints of stability and dispersibility of hydrophobic particles.

[0100]

When the washing liquid of the present invention contains component (j), the washing liquid of the present invention contains component (j) in an amount, as a mass of enzyme protein, of preferably 0.02 ppm or more, more preferably 0.04 ppm or more and further preferably 0.06 ppm or more from the viewpoint of washing performance, and preferably 1.2 ppm or less, more preferably 1.0 ppm or less and further preferably 0.80 ppm or less from the viewpoint of skin irritation.

[0101]

The recent upsizing of washing machines has resulted in a tendency of smaller bath ratios, each represented by a ratio of the liquid amount of a washing liquid (L) to the mass of textile products (kg), that is, liquid amount of washing liquid (L)/mass of textile products (kg) (hereinafter this ratio is sometimes referred to as the bath ratio). In using a washing machine for home use, the decrease of the bath ratio may cause larger friction among textile products through stirring in washing to

deteriorate the finishing performance for textile products. The bath ratio is preferably 5 or more, more preferably 10 or more and further preferably 20 or more from the viewpoint of washing performance, and preferably 100 or less, more preferably 50 or less and further preferably 30 or less from the viewpoint of washing efficiency.

[0102]

The method for washing textile products of the present invention is suitable for a method of soaking fibers in a liquid for use in scouring while the fibers are sent with a roller or the like and for a rotary washing method. The rotary washing method is a washing method in which textile products that are not fixed to a rotating device rotate together with a washing liquid about a rotational axis. The rotary washing method can be carried out with a rotary washing machine. Accordingly, in the present invention, washing of textile products is preferably performed with a rotary washing machine in terms of finishing the textile products with higher cleanliness. Specific examples of the rotary washing machine include, for example, a drum-type washing machine, a pulsator-type washing machine or an agitator-type washing machine. As these rotary washing machines, commercially available ones for home use can be used.

[0103]

In addition to the above embodiments, the present invention discloses the following aspects.

[0104]

<1>

A detergent article including a detergent composition and a water-soluble film for wrapping the detergent composition, wherein the detergent composition contains the following components (a), (b), (c), and (d), and a content of component (d) is more than 5 mass%,

component (a): a nonionic surfactant,

component (b): an anionic surfactant,

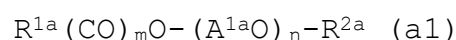
component (c): a cationic surfactant, and

component (d): an alkali agent.

[0105]

<2>

The detergent article according to <1>, wherein component (a) is one or more selected from a nonionic surfactant represented by the following general formula (a1):



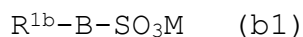
wherein R^{1a} is an aliphatic hydrocarbon group with 8 or more, preferably 10 or more and more preferably 12 or more, and 18 or less, preferably 16 or less and more preferably 14 or less carbons, and preferably a group selected from alkyl groups and alkenyl groups, R^{2a} is a hydrogen atom or a methyl group, preferably a hydrogen atom, CO is a carbonyl group, m is a number of 0 or 1,

and preferably 0, A^{1a}O group is one or more selected from alkyleneoxy groups with 2 or more and 4 or less carbons, preferably one or more selected from alkyleneoxy groups with 2 or more and 3 or less carbons, and more preferably ethyleneoxy group, and n is an average number of added moles of A^{1a}O group and is a number of 1 or more, preferably 6 or more and more preferably 10 or more, and 30 or less, preferably 25 or less, more preferably 20 or less and further preferably 15 or less.

[0106]

<3>

The detergent article according to <1> or <2>, wherein component (b) is one or more selected from a compound represented by the following general formula (b1) [hereinafter, referred to as component (b1)] and a compound represented by the following general formula (b2) [hereinafter, referred to as component (b2)]:



wherein in the formula (b1), R^{1b} represents an alkyl group with 9 or more and preferably 10 or more, and 14 or less and preferably 13 or less carbons, B represents a benzene ring, a carbon atom in R^{1b}, bonded with a carbon atom in B, is a secondary carbon atom, M represents a cation, preferably an alkali metal ion such as a sodium ion, a potassium ion, or the like, or an alkanolammonium ion such as a monoethanolammonium ion, a diethanolammonium ion, or the like, and more preferably a

sodium ion, and a sulfonic acid group is bonded at the ortho-, meta- or para-position to R^{1b} bonded to B;



wherein in the formula (b2), R^{2b} represents an alkyl group or an alkenyl group, preferably one or more selected from a linear alkyl group, a branched alkyl group, a linear alkenyl group and a branched alkenyl group, and more preferably a linear alkyl group with 10 or more, preferably 11 or more and more preferably 12 or more, and 18 or less, preferably 15 or less and more preferably 13 or less carbons, and M represents a cation, preferably an alkali metal ion such as a sodium ion, a potassium ion, or the like, or an alkanolammonium ion such as a monoethanolammonium ion, a diethanolammonium ion, or the like, and more preferably a sodium ion.

[0107]

<4>

The detergent article according to <3>, wherein component (b) contains component (b2).

[0108]

<5>

The detergent article according to <3> or <4>, wherein component (b) is an anionic surfactant containing one or more selected from a fatty acid and a salt thereof and one or more selected from alkylbenzene sulfonic acid and a salt thereof, preferably an anionic surfactant containing one or more selected from component (b1) and

one or more selected from component (b2), and more preferably an anionic surfactant containing a fatty acid sodium salt and sodium alkylbenzene sulfonate.

[0109]

<6>

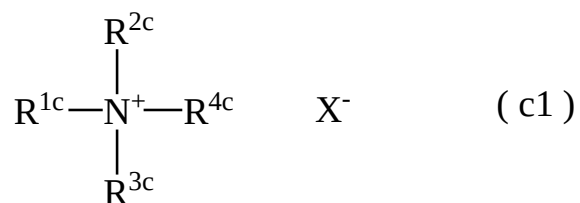
The detergent article according to any of <3> to <5>, wherein a mass ratio of a content of component (b1) to a content of component (b2), (b1)/(b2), in the detergent composition is preferably 0.1 or more, more preferably 0.2 or more, further preferably 0.3 or more and furthermore preferably 0.5 or more, and preferably 10 or less, more preferably 5 or less, further preferably 3.3 or less, furthermore preferably 2.3 or less and furthermore preferably 1.5 or less.

[0110]

<7>

The detergent article according to any of <1> to <6>, wherein component (c) is one or more selected from compounds represented by the following general formula (c1) and compounds represented by the following general formula (c2):

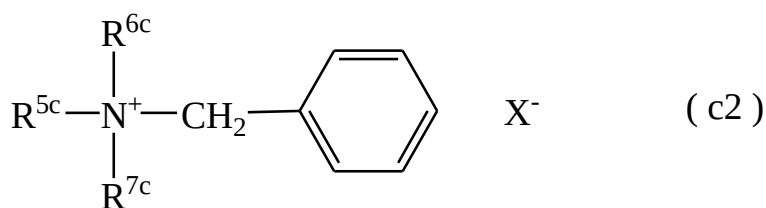
[0111]



[0112]

wherein R^{1c} is an aliphatic hydrocarbon group, preferably an alkyl group or an alkenyl group and more preferably an alkyl group with 8 or more, preferably 9 or more, more preferably 10 or more and further preferably 12 or more, and 18 or less and preferably 16 or less carbons, R^{2c} is a group selected from aliphatic hydrocarbon groups with 8 or more and 18 or less carbons, alkyl groups with 1 or more and 3 or less carbons and hydroxyalkyl groups with 1 or more and 3 or less carbons, R^{3c} and R^{4c} each independently represent a group selected from alkyl groups with 1 or more and 3 or less carbons and hydroxyalkyl groups with 1 or more and 3 or less carbons, and preferably a group selected from alkyl groups with 1 or more and 3 or less carbons, and X⁻ is an anion, and preferably one or more anions selected from a halogen ion and an alkylsulfate ion with 1 or more and 3 or less carbons;

[0113]



[0114]

wherein R^{5c} is an aliphatic hydrocarbon group, preferably an alkyl group or an alkenyl group, and more preferably an alkyl group with 8 or more, preferably 10 or more and more preferably 12 or more, and 18 or less

and preferably 16 or less carbons, R^{6c} and R^{7c} each independently represent a group selected from alkyl groups with 1 or more and 3 or less carbons and hydroxyalkyl groups with 1 or more and 3 or less carbons, and preferably a group selected from alkyl groups with 1 or more and 3 or less carbons, and X^- is an anion, and preferably one or more anions selected from a halogen ion and an alkylsulfate ion with 1 or more and 3 or less carbons.

[0115]

<8>

The detergent article according to any of <1> to <7>, wherein component (d) is one or more alkali agents selected from alkali metal carbonates, alkali metal hydrogen carbonates, alkali metal silicates and tripolyphosphates, preferably one or more alkali agents selected from alkali metal carbonates and alkali metal hydrogen carbonates, more preferably one or more selected from alkali metal carbonates, further preferably one or more selected from sodium carbonate and potassium carbonate, and furthermore preferably sodium carbonate.

[0116]

<9>

The detergent article according to any of <1> to <8>, wherein part or the whole of component (d) is covered with component (b), and part or the whole of

component (d) is preferably covered with a covering layer obtained by spraying an acid precursor of component (b).

[0117]

<10>

The detergent article according to any of <1> to <9>, wherein the detergent composition contains component (a) in an amount of preferably 1 mass% or more, more preferably 3 mass% or more, further preferably 5 mass% or more and furthermore preferably 10 mass% or more, and preferably 50 mass% or less, more preferably 45 mass% or less, further preferably 40 mass% or less, furthermore preferably 25 mass% or less, furthermore preferably 20 mass% or less and furthermore preferably 18 mass% or less.

[0118]

<11>

The detergent article according to any of <1> to <10>, wherein the detergent composition contains component (b) in an amount of preferably 0.1 mass% or more, more preferably 0.5 mass% or more, further preferably 1.0 mass% or more and furthermore preferably 2.0 mass% or more, and from the viewpoint of antimicrobial performance, preferably 10 mass% or less, more preferably 8.0 mass% or less, further preferably 7.0 mass% or less, furthermore preferably 6.0 mass% or less and furthermore preferably 5.0 mass% or less.

[0119]

<12>

The detergent article according to any of <1> to <11>, wherein the detergent composition contains component (c) in an amount of preferably 0.1 mass% or more, more preferably 0.5 mass% or more, further preferably 0.7 mass% or more, furthermore preferably 1.5 mass% or more and furthermore preferably 2.5 mass% or more, and preferably 20 mass% or less, more preferably 15 mass% or less, further preferably 10 mass% or less and furthermore preferably 5 mass% or less.

[0120]

<13>

The detergent article according to any of <1> to <12>, wherein the detergent composition contains component (d) in an amount of more than 5 mass%, preferably 10 mass% or more, more preferably 13 mass% or more, further preferably 15 mass% or more and furthermore preferably 19 mass% or more, and preferably 50 mass% or less, more preferably 40 mass% or less, further preferably 35 mass% or less, furthermore preferably 30 mass% or less, furthermore preferably 25 mass% or less and furthermore preferably 22 mass% or less.

[0121]

<14>

The detergent article according to any of <1> to <13>, wherein a proportion of a content of component (a) to a total content of surfactants contained in the

detergent composition, $(a)/(total\ content\ of\ surfactants)$, is preferably 30 mass% or more, more preferably 40 mass% or more, further preferably 50 mass% or more and furthermore preferably 60 mass% or more, and preferably 95 mass% or less, more preferably 90 mass% or less and further preferably 85 mass% or less.

[0122]

<15>

The detergent article according to any of <1> to <14>, wherein a mass ratio of a content of component (a) to a content of component (b), $(a)/(b)$, in the detergent composition is preferably 1.0 or more, more preferably 1.1 or more, further preferably 1.3 or more, furthermore preferably 2.0 or more, furthermore preferably 2.5 or more and furthermore preferably 2.9 or more, and preferably 20 or less, more preferably 18 or less, further preferably 16 or less, furthermore preferably 13 or less, furthermore preferably 10 or less, furthermore preferably 8.0 or less, furthermore preferably 5.0 or less, furthermore preferably 4.0 or less and furthermore preferably 3.5 or less.

[0123]

<16>

The detergent article according to any of <1> to <15>, wherein a mass ratio of a content of component (c) to a content of component (b), $(c)/(b)$, in the detergent composition is preferably 0.1 or more, more preferably

0.2 or more, further preferably 0.4 or more, furthermore preferably 0.60 or more and furthermore preferably 0.70 or more, and preferably 5 or less, more preferably 4.5 or less, further preferably 4.0 or less, furthermore preferably 3.0 or less, furthermore preferably 2.0 or less, furthermore preferably 1.0 or less and furthermore preferably 0.90 or less.

[0124]

<17>

The detergent article according to any of <1> to <16>, wherein a mass ratio of a content of component (b) to a content of component (d), $(b)/(d)$, in the detergent composition is preferably 0.05 or more, more preferably 0.07 or more, further preferably 0.10 or more, furthermore preferably 0.15 or more, furthermore preferably 0.20 or more and furthermore preferably 0.23 or more, and preferably 1.0 or less, more preferably 0.9 or less, further preferably 0.8 or less, furthermore preferably 0.50 or less and furthermore preferably 0.30 or less.

[0125]

<18>

The detergent article according to any of <1> to <17>, wherein the detergent composition further contains (e) an oil-absorption carrier [hereinafter, referred to as component (e)].

[0126]

<19>

The detergent article according to any of <1> to <18>, wherein component (e) is one or more selected from amorphous silica, calcium silicate, a clay mineral, crystalline aluminosilicate, and amorphous aluminosilicate, and preferably one or more selected from a clay mineral and crystalline aluminosilicate.

[0127]

<20>

The detergent article according to <18> or <19>, wherein the detergent composition contains component (e) in an amount of preferably 5 mass% or more, more preferably 10 mass% or more, further preferably 15 mass% or more, furthermore preferably 20 mass% or more and furthermore preferably 25 mass% or more, and preferably 40 mass% or less, more preferably 35 mass% or less and further preferably 32.5 mass% or less.

[0128]

<21>

The detergent article according to any of <1> to <20>, wherein the detergent composition further contains one or more compounds selected from inorganic sulfates and inorganic halogen compounds, as component (g).

[0129]

<22>

The detergent article according to <21>, wherein component (g) is one or more compounds selected from

sodium sulfate, magnesium sulfate, sodium chloride, and magnesium chloride.

[0130]

<23>

The detergent article according to <21> or <22>, wherein the detergent composition contains component (g) in an amount of preferably 2 mass% or more, more preferably 5 mass% or more, further preferably 10 mass% or more and furthermore preferably 15 mass% or more, and preferably 60 mass% or less, more preferably 50 mass% or less, further preferably 40 mass% or less and furthermore preferably 30 mass% or less.

[0131]

<24>

The detergent article according to any of <1> to <23>, wherein the detergent composition is a solid detergent composition, preferably a detergent composition in a form of one or more selected from a powder, a particle and a granule, and more preferably a powder detergent composition.

[0132]

<25>

The detergent article according to any of <1> to <24>, wherein the article is used for textile products, hard surfaces, or automatic dishwashers, and preferably for textile products.

[0133]

<26>

A method for washing textile products, including washing the textile products with a washing liquid obtained by mixing the detergent article according to any of <1> to <25> and water.

Examples

[0134]

<Formulation components>

The following components were used for examples and comparative examples.

[Component (a): nonionic surfactant]

· AEO(10): polyoxyethylene alkyl ether (number of carbons of alkyl group: 12, average number of added moles of oxyethylene: 10), EMULGEN 110, manufactured by Kao Corporation

[Component (b): anionic surfactant]

Component (b1)

· LAS: laurylbenzenesulfonic acid, NEOPELEX GS, manufactured by Kao Corporation

Component (b2)

· Fatty acid: fatty acid (number of carbons: 12 to 18), LUNAC L-55, manufactured by Kao Corporation

[Component (c): cationic surfactant]

· Benzalkonium chloride (alkyl dimethylbenzylammonium chloride, number of carbons of alkyl groups: 12 to 16), SANISOL B-50, manufactured by Kao Corporation

[Component (d): alkali agent]

· Sodium carbonate: light ash, bulk density: 600 g/L, average particle size: 100 μm , manufactured by Central Glass Co., Ltd.

[Component (e)]

· Zeolite: Zeobuilder, 4A-type, average particle size: 3.5 μm , manufactured by Zeobuilder Co., Ltd.

· Bentonite: smectite-type layered clay mineral "Odosolv K-400," median particle size 10 μm , main component

$[\text{Mg}_a\text{Al}_b(\text{Si}_2\text{O}_5)_4(\text{OH})_4]^{X-} \cdot \text{Me}^X+$, $a = 1$, $b = 3$, $X = 1$, content of sodium: 1.6%, molar ratio $[(\text{Na} + \text{K} + \text{Li})/(\text{Ca} + \text{Mg})] = 2.1$, manufactured by Kurosaki Hakudo Kogyo K.K.

[Component (g)]

· Sodium sulfate: anhydrous neutral sodium sulfate, manufactured by Shikoku Chemicals Corporation

· Sodium chloride: Nakuru N, manufactured by Nankai Salt Co., Ltd.

[Component (h): polymer]

· Polyacrylic acid: sodium polyacrylate, weight average molecular weight: 10000, trade name: POISE 536, manufactured by Kao Corporation

[Component (i): polymer]

· Polyethylene glycol: PEG13000, weight average molecular weight: 10,000, solid content: 60%, manufactured by Mitsui Chemicals, Inc.

[Component (j): polymer]

· Enzyme: protease, Savinase 8.0T, manufactured by
Novozymes
[0135]

<Preparation of detergent composition>

The above formulation components were used to prepare detergent compositions shown in Table 1 by the following method.

Sodium sulfate, sodium carbonate, 40% sodium polyacrylate, sodium chloride, and 93 kg of zeolite were mixed in a mixing tank to prepare a slurry. This slurry was supplied to a spray-dry tower (counter flow-type) by a pump, and the slurry was sprayed through a pressure spray nozzle placed near the tower top, to obtain a spray-dried particle. Next, the spray-dried particle obtained so that a formulation composition in Table 1 was achieved and the remaining sodium carbonate were mixed, the nonionic surfactant of component (a), polyethylene glycol and the cationic surfactant of component (c) were mixed, and then dry neutralization was performed with component (b). Next, bentonite was added and further, the remaining zeolite was added. Finally, the enzyme and a fragrance were blended to provide a detergent composition in the form of a powder.

Note that the values in mass% for the formulation components other than component (j) in the table are all numerical values based on effective components and the amount of formulation of component (j) (mass%) is shown

as the amount of the component itself. Further, the amount of formulation of component (b) (mass%) in the table is shown as the amount of the component after dry neutralization, namely, the amount in terms of a sodium salt.

[0136]

<Preparation of detergent articles>

Two sheets of water-soluble film (vertical length 12cm, horizontal length 2cm, thickness 76 μm , M8685, manufactured by MonoSol LLC.) made of polyvinyl alcohol were stacked, and using a heat sealer (manufactured by FUJIIMPULSE CO., LTD.) and setting the sealing condition of the heat sealer to 8, three sides of the sheets of water-soluble film were fused with the heat sealer by a width of 2 mm from the edge of each side to prepare a pouch with only one side left open. 15 g of each detergent composition in Table 1 was placed in this pouch. Thereafter, the one side of the pouch left open was fused and closed by the heat sealer to obtain a detergent article containing the detergent composition wrapped in the water-soluble film. The total area of the water-soluble film in contact with the detergent composition was 48 cm^2 . Note that the detergent article of the present invention is not limited to those produced by the above production method.

[0137]

<Evaluation of washing performance>

1. Preparation of artificially contaminated cloth

The artificial dirt of the following composition was applied to pieces of cotton/polyester blend broadcloth (cotton/polyester ratio = 35/65, purchased from Tanigashira Shoten) with a size of 6 cm × 6 cm by gravure-coating in an amount of 100 mg per piece to prepare the artificially contaminated cloth used.

· Artificial dirt

A composition containing the following A, B, C, D and E was used as artificial dirt. Each mass percentage was a proportion in the artificial dirt of the final composition, and the amount of B was adjusted such that the total was 100 mass%.

A: model sebum stain (used so that the amounts in mass% in the artificial dirt were as follows: lauric acid 0.44 mass%, myristic acid 3.15 mass%, pentadecanoic acid 2.35 mass%, palmitic acid 6.31 mass%, heptadecanoic acid 0.44 mass%, stearic acid 1.60 mass%, oleic acid 7.91 mass%, n-hexadecyl palmitate 2.22 mass%, and squalene 6.66 mass%)

B: 1,000 mL of hard water obtained by weighing 105 mg of calcium chloride dihydrate and dissolving it in distilled water

C: egg white lecithin liquid crystal 1.98 mass% (egg white lecithin liquid crystal obtained by dissolving 11.37 g of arginine hydrochloride, 4.20 g of histidine and 2.44 g of serine in 80 mL of distilled water, adjusting the pH to 5.0 with concentrated hydrochloric

acid, and then sufficiently mixing this solution and egg white lecithin)

D: Kanuma red soil 8.11 mass%

E: Carbon black 0.025 mass%

[0138]

2. Evaluation of washing performance

Four pieces of the artificially contaminated cloth produced above were washed with a Terg-O-Tometer (manufactured by Ueshima Seisakusho Co., Ltd., MS-8212) at 100 rpm for 10 minutes. Specific washing conditions were as follows. One detergent article containing each of the detergent compositions shown in Table 1 wrapped in a water-soluble film was dissolved in 1 L of ion-exchanged water, to prepare an aqueous detergent solution. Thereafter, 20 mL of this aqueous detergent solution and 580 mL of tap water were mixed to prepare a washing liquid. Four pieces of the artificially contaminated cloth and 600 mL of the washing liquid were put into the Terg-O-Tometer, and washing was performed at 100 rpm for 10 minutes. The water temperature of each washing liquid was 20°C.

After washing, rinsing with municipal water (20°C) was carried out for 1 minute. Thereafter, the artificially contaminated cloth after rinsing was subjected to dehydration treatment for 3 minutes with a twin-tub washing machine, and then left to stand for drying under conditions of 20°C and 50%RH for 3 hours.

Washing rate (%) was calculated on the basis of the following formula (1), and the average value for the four pieces was determined. Note that the reflectances at 550 nm of the original cloth of the artificially contaminated cloth and a pre-washing piece and the post-washing pieces of the artificially contaminated cloth were measured by a colorimeter (manufactured by NIPPON DENSHOKU INDUSTRIES CO., LTD., SE-2000). The results are shown in Table 1. The higher the washing rate is, the more excellent the detergent article is in washing performance.

$$\text{Washing rate (\%)} = 100 \times [(\text{reflectance of post-washing piece of artificially contaminated cloth} - \text{reflectance of pre-washing piece of artificially contaminated cloth}) / (\text{reflectance of original cloth} - \text{reflectance of pre-washing piece of artificially contaminated cloth})] \quad (1)$$

[0139]

<Evaluation of antimicrobial performance>

1. Method for testing antimicrobial properties

(1) Preparation of cloth for use in antimicrobial properties test

Test cloth was obtained by putting 30 g of cotton cloth (cotton #2003, manufactured by Tanigashira Shoten) and 600 mL of the washing liquid into a Terg-O-Tometer, performing an operation including washing at 85 rpm for 10 minutes and rinsing for 3 minutes five times in a

cumulative manner. All water used here was tap water sterilized by boiling.

(2) Antimicrobial properties test

An antimicrobial properties test was performed with *Moraxella osloensis* separated from clothing after wearing, according to JIS L 1902. The test was specifically performed as follows. A test piece (mass per piece: about 0.4 g) obtained by cutting the test cloth produced by the above method into 2-cm square was used as a specimen.

(i) *Moraxella osloensis* separated from clothing after wearing and cultured at 37°C for 24 hours by streak culture in a plate with an SCD-LP agar medium as a flat plate was scraped and collected by a platinum loop, placed in 10 mL of a nutrient (NT) medium, and pre-cultured in conditions of 37°C and 110 rpm for 24 hours. The concentration of a culture fluid obtained by pre-culture was estimated by absorption photometry, and the bacterial concentration was adjusted to about $1 \times 10^8/\text{mL}$. Thereafter, the culture fluid was further diluted with a 1/20 NT medium to adjust the bacterial concentration to $1 \times 10^5/\text{mL}$, thereby providing a test bacterial liquid.

(ii) The test bacterial liquid was accurately collected in an amount of 0.2 mL by a pipette, contacted with each specimen or reference cloth (reference cloth of JIS L 1902) which was untreated cloth, at several points per one piece of the specimen or cloth, put in a vial bottle,

and cultured at 37°C for 18 hours in a state where a lid was closed. The test bacterial liquid was inoculated and cultured on each of a plurality of the specimens and a plurality of pieces of the reference cloth.

(iii) Five pieces of the reference cloth after culture and five pieces of the reference cloth immediately after contacting were randomly selected, 20 mL of a LP diluent for washing out was added, a lid was closed, stirring was performed with a stirring tool for testing for 30 seconds, to wash out the bacteria, and the bacterial count was measured. Five of the specimens after culture were randomly selected, 20 mL of a LP diluent for washing out was added to each of the specimens, a lid was closed, stirring was performed with a stirring tool for testing for 30 seconds, to wash out the bacteria, and the bacterial count was measured.

The bacteriostatic activity value was determined by the following formula. The results are shown in Table 1. Higher bacteriostatic activity values indicate higher antimicrobial properties of detergent articles.

Bacteriostatic activity value = $\text{LogB} - \text{LogC}$

A: average value of count of bacteria recovered from reference cloth immediately after inoculation;

B: average value of count of bacteria recovered from reference cloth after culture for 18 hours; and

C: average value of count of bacteria recovered from specimen after culture for 18 hours,

provided that $\text{LogB} - \text{LogA} > 1.5$, which is a test establishment condition, is satisfied.

[0140]

<Evaluation of solubility>

The solubility of each of the detergent articles in examples and comparative examples in Table 1 was evaluated on the basis of the diameter of an undissolved residual product of the detergent composition, which was undissolved and remained after washing. The diameter of the undissolved residual product of the detergent composition was measured by the following method.

Four sets of each of trousers (manufactured by UNIQLO CO., LTD.), sweatshirts (manufactured by UNIQLO CO., LTD.), boxer pants (manufactured by UNIQLO CO., LTD.), socks (manufactured by UNIQLO CO., LTD.) and long-sleeved shirts (Heattech, manufactured by UNIQLO CO., LTD.) were prepared, and T-shirts made of cotton (YG, manufactured by GUNZE LIMITED.) were used for adjustment so that a total weight was 8.0 kg. One of the above detergent articles wrapped in the water-soluble films was placed into a drum-type washing machine (NA-VG1000L, manufactured by Panasonic Corporation), then clothing prepared in advance was put into the washing machine, and washing with tap water (municipal water of Wakayama) temperature-regulated to 5°C was performed with a standard course including washing for 9 minutes, rinsing once, and dehydration for 6 minutes.

After the washing was completed, all the clothing washed was visually confirmed, and an undissolved residual product of the detergent composition was recovered. The diameter (mm) of the residual product recovered was measured with a caliper.

Further, undissolved residue of the detergent article was evaluated according to the following indicators. The results are shown in Table 1. Higher scores can be said to mean a detergent composition and a detergent article excellent in solubility.

[Indicators of solubility]

5: no undissolved residue was confirmed at all.

4: 1 to 5 lumps of detergent composition of 1 mm or more and 5 mm or less were confirmed.

3: 6 or more lumps of detergent composition of 1 mm or more and 5 mm or less were confirmed.

2: lumps of detergent composition of 5 mm or more and 20 mm or less were confirmed.

1: lumps of detergent composition of 20 mm more were confirmed.

[0141]

[Table 1]

Detergent article	Detergent composition	Formulation components (mass%)	Example												Comparative Example					
			1-1	1-2	1-3	1-4	1-5	1-6	1-7	1-8	1-9	1-1	1-2	1-3	1-4	1-5	1-6			
			Present	Present	Present	Present	Present	Present	Present	Present	Present	Present	Present	Present	Present	Present	Present			
Evaluation		(a)	11	11	11	11	11	11	15	15	11	11	11	11	11	11	11			
		(b)	2		2			2	5											
		(b1)		2	2	3	5	3		5	2.5			3						3
		(b2)		2	2	2	2	2	4	4	2.5	2	2			2	2			2
		(c)	2	2	2	2	2	2	2	4	2.5	2	2							2
		(d)	18	18	18	25.6	25.6	25.6	19.6	19.6	25.6	18	25.6	25.5	18	5	5			5
		(e)	25	25	24.5	25	25	24.5	25	24.5	25	25	25	25	25	25	25			25
			4	4	4	4	4	4	4	4	4	4	4	4	4	4	4			4
		(g)	23.1	23.1	21.6	14.5	12.5	13	12.5	13	14.5	25.1	17.5	16.6	27.1	38.1	35.1			
		(h)	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5			5
		(i)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5			0.5
		(j)	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4			0.4
			2	2	2	2	2	2	2	2	2	2	2	2	2	2	2			2
			2	2	2	2	2	2	2	2	2	2	2	2	2	2	2			2
			100	100	100	100	100	100	100	100	100	100	100	100	100	100	100			100
		(c)/(b) (mass ratio)	1	1	0.5	0.67	0.4	0.4	0.8	0.8	1	-	-	0	-	-	-			0.67
Evaluation		Water-soluble film	Present	Present	Present	Present	Present	Present	Present	Present	Present	Present	Present	Present	Present	Present	Present			Present
		Washing performance (%)	32	31	32	35	37	35	41	40	31	31	34	35	31	24	23			
		Antimicrobial performance (bacteriostatic activity value)/Δlog	3	3	3	3	3	3	4	5	4	3	3	0	0	3	3			
		Solubility	3	4	5	3	5	5	5	5	3	1	1	3	1	3	4			

CLAIMS

[Claim 1] A detergent article comprising a detergent composition and a water-soluble film for wrapping the detergent composition, wherein the detergent composition contains the following components (a), (b), (c), and (d), and a content of the component (d) is more than 5 mass%,
component (a): a nonionic surfactant,
component (b): an anionic surfactant,
component (c): a cationic surfactant, and
component (d): an alkali agent.

[Claim 2] The detergent article according to claim 1, wherein the detergent composition comprises the component (a) in an amount of 1 mass% or more and 40 mass% or less.

[Claim 3] The detergent article according to claim 1 or 2, wherein the detergent composition comprises the component (b) in an amount of 0.1 mass% or more and 10 mass% or less.

[Claim 4] The detergent article according to any one of claims 1 to 3, wherein the component (b) comprises a fatty acid or a salt thereof.

[Claim 5] The detergent article according to any one of claims 1 to 4, wherein the component (b) comprises a

fatty acid sodium salt and a sodium alkylbenzene sulfonate.

[Claim 6] The detergent article according to any one of claims 1 to 5, wherein the detergent composition comprises the component (c) in an amount of 0.5 mass% or more and 20 mass% or less.

[Claim 7] The detergent article according to any one of claims 1 to 6, wherein a mass ratio of a content of the component (c) to a content of the component (b) in the detergent composition, $(c)/(b)$, is 0.1 or more and 5 or less.

[Claim 8] The detergent article according to any one of claims 1 to 6, wherein a mass ratio of a content of the component (c) to a content of the component (b) in the detergent composition, $(c)/(b)$, is 0.4 or more and 1 or less.

[Claim 9] The detergent article according to any one of claims 1 to 8, wherein the detergent composition comprises the component (d) in an amount of more than 5 mass% and 50 mass% or less.

[Claim 10] The detergent article according to any one of claims 1 to 9, wherein the component (d) is sprayed with an acid precursor of the component (b).

[Claim 11] A method for washing a textile product comprising washing the textile product with a detergent liquid in which the detergent article according to any one of claims 1 to 10 is mixed with water.