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一 国際調査報告（条約第21条(3)）

WO 2024/154755 A1

(54) **Title:** POWDER DETERGENT COMPOSITION

(54) 発明の名称： 粉末洗浄剤組成物

(57) **Abstract:** This powder detergent composition contains component (a) at 5.0-20.0 mass%, component (b) at 1.0-20.0 mass%, and component (c) at 0.1-5.0 mass%. Component (a): a surfactant containing polyoxyalkylene alkyl or alkenyl ether sulfate ester, α-sulfo fatty acid ester, and one or more anionic surfactants (hereinafter, component (a11)) selected from salts thereof, where the content ratio of component (a11) with respect to component (a) is 20 mass% or more (excluding component (c)). Component (b): percarbonate. Component (c): alkanoyl or alkenoyl oxybenzene sulfonic acid, or a salt thereof.

(57) 要約：下記成分（ａ）を５．０質量％以上２０．０質量％以下、下記成分（ｂ）を１．０質量％以上２０．０質量％以下、及び下記成分（ｃ）を０．１質量％以上５．０質量％以下含有する、粉末洗浄剤組成物。 成分（ａ）：ポリオキシアルキレンアルキル又はアルケニルエーテル硫酸エステル、αースルホ脂肪酸エステル、及びこれらの塩から選ばれる１種以上のアニオン界面活性剤（以下、成分（ａ１１）という）を含む界面活性剤であり、成分（ａ）中の成分（ａ１１）の含有割合が２０質量％以上である、界面活性剤（但し、成分（ｃ）を除く） 成分（ｂ）：過炭酸塩 成分（ｃ）：アルカノイル又はアルケノイルオキシベンゼンスルホン酸、又はその塩

# DESCRIPTION

## Title of the Invention: POWDER DETERGENT COMPOSITION

### Field of the Invention

[0001]

The present invention relates to a powder detergent composition and a method for washing a textile product.

### Background of the Invention

[0002]

Methods for washing textile products such as clothes and others may roughly be divided into two categories: manual washing and machine washing. In recent years, washing machines have spread also in the Asian region, and further, the spread of front loader washing machines has been on the rise there.

Further, in the Asian region, dirty clothes, especially white shirts such as school uniforms and others, to which sebum stains or yellow stains adhere, are soaked in powder detergent compositions and washed by manual rubbing before machine washing to thoroughly wash and whiten them.

[0003]

JP-A 2000-129290 discloses a detergent composition containing a percarbonate, a compound represented by the

general formula (I) or (II), and a surfactant, wherein an active oxygen concentration and an organic peroxy acid concentration one minute after 25 g of the composition is dissolved in 30 L of water at 20°C are 0.5 to 5 ppm and 1 to 20 ppm, respectively.

JP-A H3-169847 discloses a granular laundry detergent composition containing an oligomeric or low molecular weight polymeric ester composition which is useful as a soil release agent.

## Summary of the Invention

[0004]

Soaking in powder detergent compositions and washing by manual rubbing before machine washing is physically and mentally exhausting work, and there is a need for powder detergent compositions whereby dirty clothes, especially white shirts such as school uniforms and others, to which sebum stains or yellow stains adhere, are thoroughly washed and whitened by washing machines without soaking or washing by manual rubbing. In general, imparting high washing power to powder detergent compositions requires an increase in the surfactant content thereof, but when front loader washing machines are used, the increase in the surfactant content might cause foam overflow in the washer tubs, and the surfactant content of powder detergent compositions needs to be reduced. Hence, there is a need for powder

detergent compositions adapted to the spread of front loader washing machines in the Asian region which attain excellent sebum stain washing performance and yellow stain bleaching performance while suppressing foam overflow in front loader washing machines.

[0005]

The present invention provides a powder detergent composition capable of suppressing foam overflow even when used in front loader washing machines and exhibiting excellent performance when used for washing or bleaching sebum stains or yellow stains adhering to textile products in washing machines, and a method for washing a textile product.

[0006]

The present invention relates to a powder detergent composition containing the following component (a) in an amount of 5.0 mass% or more and 20.0 mass% or less, the following component (b) in an amount of 1.0 mass% or more and 20.0 mass% or less, and the following component (c) in an amount of 0.1 mass% or more and 5.0 mass% or less,

component (a): a surfactant (excluding component (c)) containing one or more anionic surfactants (hereinafter referred to as component (a11)) selected from a polyoxyalkylene alkyl or alkenyl ether sulfate, an α-sulfo fatty acid ester, and a salt of these, wherein a

content ratio of component (a11) in component (a) is 20 mass% or more,

component (b): a percarbonate, and

component (c): an alkanoyl or alkenoyloxy benzene sulfonic acid or a salt thereof.

[0007]

Further, the present invention relates to a method for washing a textile product including washing the textile product with a detergent liquid obtained by mixing the powder detergent composition of the present invention and water.

[0008]

The present invention provides a powder detergent composition capable of suppressing foam overflow even when used in front loader washing machines and exhibiting excellent performance when used for washing or bleaching sebum stains or yellow stains adhering to textile products in washing machines, and a method for washing a textile product.

Embodiments of the Invention

[0009]

[Powder detergent composition]

<Component (a)>

The powder detergent composition of the present invention contains, as component (a), a surfactant (excluding component (c)) containing one or more anionic

surfactants (hereinafter referred to as component (a11)) selected from a polyoxyalkylene alkyl or alkenyl ether sulfate, an α-sulfo fatty acid ester, and a salt of these, wherein a content ratio of component (a11) in component (a) is 20 mass% or more.

[0010]

The surfactant of component (a) contains, as component (a11), one or more anionic surfactants selected from a polyoxyalkylene alkyl or alkenyl ether sulfate, an α-sulfo fatty acid ester, and a salt of these. Component (a11) is preferably a polyoxyalkylene alkyl or alkenyl ether sulfate or a salt thereof from the viewpoint of sebum stain washing power.

[0011]

The polyoxyalkylene alkyl or alkenyl ether sulfate has an alkyl group or an alkenyl group and preferably an alkyl group with preferably 8 or more, more preferably 10 or more, and further preferably 12 or more, and preferably 18 or less, more preferably 16 or less, and further preferably 14 or less carbons from the viewpoint of sebum stain washing power.

The oxyalkylene group of the polyoxyalkylene alkyl or alkenyl ether sulfate is an ethyleneoxy group or a propyleneoxy group and preferably an ethyleneoxy group. An average number of added moles of the oxyalkylene group is preferably 0.5 or more, more preferably 1 or more, and further preferably 2 or more, and preferably 8 or less,

more preferably 6 or less, further preferably 4 or less, and furthermore preferably 3 or less from the viewpoint of sebum washing power.

If the polyoxyalkylene alkyl or alkenyl ether sulfate is a salt, examples of a counterion of the anionic group include an alkali metal ion such as a sodium ion, a potassium ion, or the like, an alkaline earth metal ion such as a calcium ion, a magnesium ion, or the like, an ammonium ion, or an alkanol amine having 1 to 3 alkanol groups with 2 or 3 carbons (for example, monoethanolamine, diethanolamine, triethanolamine, triisopropanolamine, or the like).

[0012]

The α-sulfo fatty acid ester or salt thereof is, more specifically, preferably a compound represented by the following general formula (a11):

$R^{11a}$-CH($COOR^{12a}$)-$SO_3M$ (a11)

wherein $R^{11a}$ is a hydrocarbon group with 8 or more and 18 or less carbons, $R^{12a}$ is a methyl group or an ethyl group, and M is a counterion.

[0013]

In the general formula (a11), $R^{11a}$ is a hydrocarbon group, preferably an alkyl group or an alkenyl group, and more preferably an alkyl group with preferably 7 or more, more preferably 9 or more, further preferably 11 or more, and furthermore preferably 13 or more, and preferably 17

or less and more preferably 16 or less carbons from the viewpoint of sebum stain washing power.

$R^{12a}$ is preferably a methyl group from the viewpoint of washing power.

Examples of the counterion of M include an alkali metal ion such as a sodium ion, a potassium ion, or the like, an alkaline earth metal ion such as a calcium ion, a magnesium ion, or the like, an ammonium ion, or an alkanol amine having 1 to 3 alkanol groups with 2 or 3 carbons (for example, monoethanolamine, diethanolamine, triethanolamine, triisopropanolamine, or the like).

[0014]

Component (a) may contain an anionic surfactant (excluding component (c)) other than component (a11) as component (a12).

Examples of component (a12) include one or more anionic surfactants selected from an alkylbenzene sulfonate, an alkyl or alkenyl sulfate, an olefin sulfonate, an alkane sulfonate, a saturated or unsaturated fatty acid salt, an alkyl or alkenyl ether carboxylate, an N-acyl amino acid, a phosphate mono or diester, and a sulfosuccinate ester.

These anionic surfactants have an alkyl group or an alkenyl group with, for example, 8 or more and 22 or less carbons.

Examples of counterions of the anionic groups of these anionic surfactants include an alkali metal ion

such as a sodium ion, a potassium ion, or the like, an alkaline earth metal ion such as a calcium ion, a magnesium ion, or the like, an ammonium ion, or an alkanol amine having 1 to 3 alkanol groups with 2 or 3 carbons (for example, monoethanolamine, diethanolamine, triethanolamine, triisopropanolamine, or the like).

[0015]

Component (a12) is preferably one or more anionic surfactants selected from an alkylbenzene sulfonic acid, an alkyl or alkenyl sulfate, and a salt of these, and more preferably an alkyl benzene sulfonic acid or a salt thereof from the viewpoint of sebum stain washing power.

The alkyl group of the alkylbenzene sulfonic acid has preferably 10 or more and more preferably 12 or more, and preferably 18 or less and more preferably 14 or less carbons and is preferably a linear alkyl group.

The alkyl group or alkenyl group of the alkyl or alkenyl sulfate has preferably 10 or more and more preferably 12 or more, and preferably 18 or less and more preferably 14 or less carbons.

[0016]

Component (a) may contain one or more selected from a nonionic surfactant (hereinafter referred to as component (a2)), a cationic surfactant (hereinafter referred to as component (a3)), and an amphoteric surfactant (hereinafter referred to as component (a4)).

[0017]

The nonionic surfactant of component (a2) is preferably a nonionic surfactant containing an alkyleneoxy group, wherein an average number of added moles of the alkyleneoxy group is 1 or more and 30 or less (hereinafter referred to as component (a21)).

The alkyleneoxy group of component (a21) is preferably one or more groups selected from an alkyleneoxy group with 2 or more and 4 or less carbons. The alkyleneoxy group with 2 or more and 4 or less carbons is preferably one or more groups selected from an ethyleneoxy group and a propyleneoxy group.

An average number of added moles of the alkyleneoxy group of component (a21) is 1 or more, preferably 6 or more, and more preferably 10 or more, and 30 or less, preferably 25 or less, and more preferably 20 or less from the viewpoint of washing power.

[0018]

Component (a21) is preferably a nonionic surfactant represented by the following general formula (a21):

$$R^{21a}(CO)_mO-(A^{21a}O)_n-R^{22a} \qquad (a21)$$

wherein $R^{21a}$ is an aliphatic hydrocarbon group with 8 or more and 18 or less carbons, $R^{22a}$ is a hydrogen atom or a methyl group, CO is a carbonyl group, m is a number of 0 or 1, $A^{21a}O$ group is an alkyleneoxy group with 2 or more and 4 or less carbons containing an ethyleneoxy

group, and n is an average number of added moles and a number of 1 or more and 30 or less.

[0019]

In the general formula (a21), $R^{21a}$ 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 power. $R^{21a}$ is an aliphatic hydrocarbon group, and preferably a group selected from an alkyl group and an alkenyl group.

[0020]

In the general formula (a21), $A^{21a}O$ group is an alkyleneoxy group with 2 or more and 4 or less carbons containing an ethyleneoxy group, preferably an alkyleneoxy group with 2 or more and 3 or less carbons containing an ethyleneoxy group, and more preferably an ethyleneoxy group. $A^{21a}O$ group may be an alkyleneoxy group containing an ethyleneoxy group and the other alkyleneoxy group, for example, a propyleneoxy group. The other alkyleneoxy group is preferably a propyleneoxy group. If $A^{21a}O$ group contains an ethyleneoxy group and a propyleneoxy group, ethyleneoxy groups and propyleneoxy groups may be bonded in blocks or bonded at random.

[0021]

In the general formula (a21), n is an average number of added moles of $A^{21a}O$ group and a number of 1 or more and 30 or less. In the general formula (a21), n is

1 or more, preferably 6 or more, and more preferably 10 or more, and 30 or less, preferably 25 or less, and more preferably 20 or less from the viewpoint of washing power.

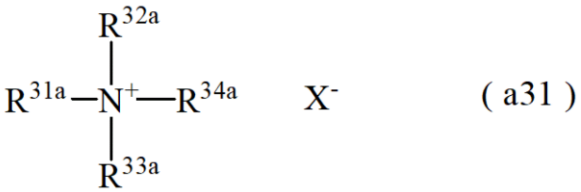
[0022]

Specific examples of a nonionic surfactant other than component (a21) 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.

[0023]

The cationic surfactant of component (a3) is preferably one or more cationic surfactants selected from (a31) a compound represented by the following general formula (a31) (hereinafter referred to as component (a31)) and (a32) a compound represented by the following general formula (a32) (hereinafter referred to as component (a32)):

[0024]



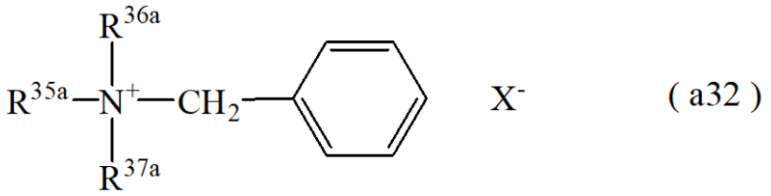
( a31 )

[0025]

wherein $R^{31a}$ is an aliphatic hydrocarbon group with 8 or more and 18 or less carbons, $R^{32a}$ is a group selected from an aliphatic hydrocarbon group with 8 or more and 18

or less carbons, an alkyl group with 1 or more and 3 or less carbons, and a hydroxyalkyl group with 1 or more and 3 or less carbons, $R^{33a}$ and $R^{34a}$ each independently represent a group selected from an alkyl group with 1 or more and 3 or less carbons and a hydroxyalkyl group with 1 or more and 3 or less carbons, and $X^-$ is an anion; and

[0026]



( a32 )

[0027]

wherein $R^{35a}$ is an aliphatic hydrocarbon group with 8 or more and 18 or less carbons, $R^{36a}$ and $R^{37a}$ each independently represent a group selected from an alkyl group with 1 or more and 3 or less carbons and a hydroxyalkyl group with 1 or more and 3 or less carbons, and $X^-$ is an anion.

[0028]

In the general formula (a31), $R^{31a}$ has 8 or more, preferably 10 or more, and more preferably 12 or more, and preferably 18 or less and more preferably 16 or less carbons from the viewpoint of washing power. $R^{31a}$ is preferably an alkyl group or an alkenyl group and preferably an alkyl group.

In the general formula (a31), $R^{32a}$ is a group selected from an aliphatic hydrocarbon group with 8 or

more and 18 or less carbons, an alkyl group with 1 or more and 3 or less carbons, and a hydroxyalkyl group with 1 or more and 3 or less carbons.

If $R^{32a}$ is an aliphatic hydrocarbon group with 8 or more and 18 or less carbons, $R^{32a}$ is preferably an alkyl group or an alkenyl group and preferably an alkyl group with 8 or more, preferably 10 or more, and more preferably 12 or more, and preferably 18 or less and more preferably 16 or less carbons from the viewpoint of washing power.

[0029]

In the general formula (a31), $R^{33a}$ and $R^{34a}$ each independently represent a group selected from an alkyl group with 1 or more and 3 or less carbons and a hydroxyalkyl group with 1 or more and 3 or less carbons. $R^{33a}$ and $R^{34a}$ preferably each independently represent a group selected from an alkyl group 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, or a propyl group. Examples of the hydroxyalkyl group with 1 or more and 3 or less carbons include a hydroxymethyl group, a hydroxyethyl group, or a hydroxypropyl group.

[0030]

In the general formula (a31), $X^-$ is an anion. Examples of the anion include halide ions, for example, a chloride ion, a bromide ion, and an iodide ion. Further,

examples include alkyl sulfate ions with 1 or more and 3 or less carbons, for example, a methyl sulfate ion, an ethyl sulfate ion, and a propyl sulfate ion.

[0031]

In the general formula (a32), $R^{35a}$ is an aliphatic hydrocarbon group with 8 or more and 18 or less carbons. $R^{35a}$ has 8 or more and preferably 10 or more, and preferably 18 or less, more preferably 16 or less, and further preferably 14 or less carbons from the viewpoint of washing power. $R^{35a}$ is preferably an alkyl group or an alkenyl group and preferably an alkyl group.

[0032]

In the general formula (a32), $R^{36a}$ and $R^{37a}$ each independently represent a group selected from an alkyl group with 1 or more and 3 or less carbons and a hydroxyalkyl group with 1 or more and 3 or less carbons. $R^{36a}$ and $R^{37a}$ preferably each independently represent a group selected from an alkyl group 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, or a propyl group. Examples of the hydroxyalkyl group with 1 or more and 3 or less carbons include a hydroxymethyl group, a hydroxyethyl group, or a hydroxypropyl group.

[0033]

In the general formula (a32), $X^-$ is an anion. Examples of the anion include halide ions, for example, a

chloride ion, a bromide ion, and an iodide ion. Further, examples include alkyl sulfate ions with 1 or more and 3 or less carbons, for example, a methyl sulfate ion, an ethyl sulfate ion, and a propyl sulfate ion.

[0034]

Examples of the amphoteric surfactant of component (a4) can include an N-alkanoylaminopropyl-N,N-dimethylamine oxide, an N-alkyl-N,N-dimethylamine oxide, an N-alkanoylaminopropyl-N,N-dimethyl-N-carboxymethyl ammonium betaine, an N-alkyl-N,N-dimethyl-N-carboxymethyl ammonium betaine, an N-alkyl-N,N-dimethyl-N-sulfopropyl ammonium sulfobetaine, an N-alkyl-N,N-dimethyl-N-(2-hydroxysulfopropyl) ammonium sulfobetaine, an N-alkanoylaminopropyl-N,N-dimethyl-N-sulfopropyl ammonium sulfobetaine, or an N-alkanoylaminopropyl-N,N-dimethyl-N-(2-hydroxysulfopropyl) ammonium sulfobetaine. The alkanoyl groups in these are, for example, lauroyl or myristoyl. Further, the alkyl groups in these are, for example, lauryl groups or myristyl groups.

[0035]

<Component (b)>

The powder detergent composition of the present invention contains a percarbonate as component (b).

Component (b) is preferably an alkali metal percarbonate, more preferably one or more selected from sodium percarbonate and potassium percarbonate, and further preferably sodium percarbonate from the

viewpoints of sebum stain washing power, yellow stain bleaching performance, and storage stability. Note that “percarbonate” is a trivial name of an adduct of a carbonate and hydrogen peroxide, and for example, the chemical formula of sodium percarbonate is expressed as $2Na_2CO_3 \cdot 3H_2O_2$.

[0036]

<Component (c)>

The powder detergent composition of the present invention contains an alkanoyl or alkenoyloxy benzene sulfonic acid or a salt thereof as component (c).

Component (c) has an alkanoyl group or an alkenoyl group and preferably an alkanoyl group with preferably 8 or more, more preferably 10 or more, and further preferably 12 or more, and preferably 18 or less, more preferably 16 or less, and further preferably 14 or less carbons from the viewpoint of yellow stain bleaching performance.

If component (c) is a salt, examples of a counterion of the anionic group include an alkali metal ion such as a sodium ion, a potassium ion, or the like, an alkaline earth metal ion such as a calcium ion, a magnesium ion, or the like, an ammonium ion, or an alkanol amine having 1 to 3 alkanol groups with 2 or 3 carbons (for example, monoethanolamine, diethanolamine, triethanolamine, triisopropanolamine, or the like).

[0037]

<Composition and others>

The powder detergent composition of the present invention contains component (a) in the composition in an amount of 5.0 mass% or more, preferably 8.0 mass% or more, and more preferably 12.0 mass% or more, and 20.0 mass% or less, preferably 17.0 mass% or less, and more preferably 15.0 mass% or less from the viewpoints of sebum stain washing power and prevention of foam overflow in washer tubs.

In the powder detergent composition of the present invention, the mass of component (a11) contained in component (a) is expressed in terms of the value of a sodium salt.

If the powder detergent composition of the present invention contains component (a12) as component (a), the mass of component (a12) is expressed in terms of the value of a sodium salt.

If the powder detergent composition of the present invention contains component (a3) as component (a), the mass of component (a3) is expressed in terms of the value of a chloride.

[0038]

In the powder detergent composition of the present invention, a content ratio of component (a11) in component (a) is 20 mass% or more, preferably 25 mass% or more, more preferably 30 mass% or more, further preferably 40 mass% or more, and furthermore preferably

50 mass% or more, and preferably 90 mass% or less, more preferably 80 mass% or less, further preferably 70 mass% or less, and furthermore preferably 60 mass% or less from the viewpoints of sebum stain washing performance and suitability to be a powder formulation.

[0039]

The powder detergent composition of the present invention contains an anionic surfactant (excluding component (c)) in the composition in an amount of preferably 1.6 mass% or more, more preferably 1.8 mass% or more, further preferably 2 mass% or more, furthermore preferably 8 mass% or more, furthermore preferably 9 mass% or more, and furthermore preferably 10 mass% or more, and preferably 18 mass% or less, more preferably 16 mass% or less, and further preferably 12 mass% or less from the viewpoints of sebum washing power and bleaching performance.

In other words, the powder detergent composition of the present invention contains components (a11) and (a12) in the composition in an amount of preferably 1.6 mass% or more, more preferably 1.8 mass% or more, further preferably 2 mass% or more, furthermore preferably 8 mass% or more, furthermore preferably 9 mass% or more, and furthermore preferably 10 mass% or more, and preferably 18 mass% or less, more preferably 16 mass% or less, and further preferably 12 mass% or less in total

from the viewpoints of sebum washing power and bleaching performance.

[0040]

If the powder detergent composition of the present invention contains one or more selected from components (a2), (a3), and (a4) as component (a), the powder detergent composition of the present invention contains the surfactant other than the anionic surfactants in the composition in an amount of preferably 0.1 mass% or more, more preferably 1 mass% or more, and further preferably 2 mass% or more, and preferably 4 mass% or less, more preferably 3 mass% or less, and further preferably 2 mass% or less from the viewpoint of stability.

In other words, if the powder detergent composition of the present invention contains one or more selected from components (a2), (a3), and (a4) as component (a), the powder detergent composition of the present invention contains components (a2), (a3), and (a4) in the composition in an amount of preferably 0.1 mass% or more, more preferably 1 mass% or more, and further preferably 2 mass% or more, and preferably 4 mass% or less, more preferably 3 mass% or less, and further preferably 2 mass% or less in total from the viewpoint of stability.

[0041]

In the powder detergent composition of the present invention, a content ratio of all surfactants (excluding

component (c)) in the powder detergent composition is 5.0 mass% or more, preferably 8.0 mass% or more, and more preferably 12.0 mass% or more, and 20.0 mass% or less, preferably 17.0 mass% or less, and more preferably 15.0 mass% or less from the viewpoints of sebum stain washing power and prevention of foam overflow in washer tubs.

In other words, the powder detergent composition of the present invention contains components (a11), (a12), (a2), (a3), and (a4) in the composition in an amount of 5.0 mass% or more, preferably 8.0 mass% or more, and more preferably 12.0 mass% or more, and 20.0 mass% or less, preferably 17.0 mass% or less, and more preferably 15.0 mass% or less in total from the viewpoints of sebum stain washing power and prevention of foam overflow in washer tubs.

[0042]

If the powder detergent composition of the present invention contains component (a12) as component (a), a mass ratio of a content of component (a11) to a content of component (a12) in component (a), (a11)/(a12), is preferably 0.3 or more, more preferably 0.35 or more, further preferably 0.5 or more, and furthermore preferably 0.6 or more, and preferably 1.5 or less, more preferably 1.3 or less, further preferably 1.0 or less, furthermore preferably 0.8 or less, and furthermore preferably 0.75 or less from the viewpoints of sebum

stain washing performance, yellow stain bleaching performance, and suitability to be a powder formulation.

[0043]

Using a mass ratio of a content of component (a11) to a content of component (a12), (a11)/(a12), in the above preferable range is preferable in that it can further improve the rate of bleaching of yellow stains by the percarbonate of component (b) and the alkanoyl or alkenoyloxy benzene sulfonic acid or salt thereof of component (c) of the present invention even if the total content of the content of component (a11) and the content of component (a12) in the powder detergent composition of the present invention is a low content of preferably 18 mass% or less, more preferably 16 mass% or less, further preferably 14 mass% or less, furthermore preferably 12 mass% or less, and furthermore preferably 10 mass% or less, and for example, 1.6 mass% or more, further 1.8 mass% or more, further 2 mass% or more, and further 8 mass% or more.

[0044]

In the powder detergent composition of the present invention, a content ratio of the anionic surfactants in component (a) (a total content ratio of components (a11) and (a12)) is preferably 50 mass% or more, more preferably 70 mass% or more, further preferably 80 mass% or more, and furthermore preferably 90 mass% or more, and preferably 100 mass% or less from the viewpoints of sebum

stain washing performance and yellow stain bleaching performance.

[0045]

The powder detergent composition of the present invention contains component (b) in the composition in an amount of 1.0 mass% or more, preferably 2.0 mass% or more, and more preferably 2.5 mass% or more, and 20.0 mass% or less, preferably 15.0 mass% or less, more preferably 10.0 mass% or less, further preferably 5.0 mass% or less, and furthermore preferably 4.0 mass% or less from the viewpoints of sebum stain washing performance, yellow stain bleaching performance, and storage stability.

[0046]

The powder detergent composition of the present invention contains component (c) in the composition in an amount of 0.1 mass% or more, preferably 0.2 mass% or more, and more preferably 0.3 mass% or more, and 5.0 mass% or less, preferably 3.0 mass% or less, more preferably 1.0 mass% or less, and further preferably 0.8 mass% or less from the viewpoint of yellow stain bleaching performance.

In the powder detergent composition of the present invention, the mass of component (c) is expressed in terms of the value of a sodium salt.

[0047]

A mass ratio of a total content of components (b) and (c) to a content of component (a) in the powder detergent composition of the present invention, [(b) + (c)]/(a), is preferably 0.2 or more, more preferably 0.25 or more, and further preferably 0.3 or more, and preferably 1.0 or less, more preferably 0.8 or less, further preferably 0.6 or less, furthermore preferably 0.5 or less, and furthermore preferably 0.4 or less from the viewpoints of sebum stain washing performance and yellow stain bleaching performance.

[0048]

A mass ratio of a total content of components (b) and (c) to a content of component (a11) in the powder detergent composition of the present invention, [(b) + (c)]/(a11), is preferably 0.2 or more, more preferably 0.5 or more, and further preferably 0.8 or more, and preferably 2.0 or less, more preferably 1.6 or less, further preferably 1.2 or less, and furthermore preferably 1.0 or less from the viewpoints of sebum stain washing performance and yellow stain bleaching performance.

[0049]

A mass ratio of a content of component (b) to a content of component (c) in the powder detergent composition of the present invention, (b)/(c), is preferably 3.0 or more, and preferably 20.0 or less, more preferably 15.0 or less, further preferably 10.0 or less,

furthermore preferably 8.0 or less, furthermore preferably 7.0 or less, and furthermore preferably 6.5 or less from the viewpoint of yellow stain bleaching performance.

[0050]

From the viewpoint of washing power, the powder detergent composition of the present invention can contain an alkali agent as component (d). Examples of component (d) include one or more alkali agents selected from an alkali metal carbonate, an alkali metal bicarbonate, an alkali metal silicate, and a tripolyphosphate.

[0051]

Examples of the alkali metal carbonate include sodium carbonate or potassium carbonate, and sodium carbonate is preferable.

Examples of the alkali metal bicarbonate include sodium bicarbonate or potassium bicarbonate.

Examples of the alkali metal silicate include sodium silicate or potassium silicate.

Examples of the tripolyphosphate include an alkali metal salt of tripolyphosphoric acid.

[0052]

From the viewpoint of washing power, component (d) is preferably one or more alkali agents selected from an alkali metal carbonate, an alkali metal bicarbonate, and an alkali metal silicate, more preferably one or more

selected from sodium carbonate, sodium bicarbonate, and sodium silicate, and furthermore preferably sodium carbonate.

[0053]

If the powder detergent composition of the present invention contains component (d), the powder detergent composition contains component (d) in an amount of preferably 2 mass% or more, more preferably 5 mass% or more, further preferably 10 mass% or more, and furthermore preferably 12 mass% or more, and preferably 30 mass% or less, more preferably 20 mass% or less, and further preferably 18 mass% or less from the viewpoint of washing power.

[0054]

From the viewpoint of fluidity of the powder detergent composition, the powder detergent composition of the present invention can contain one or more compounds selected from zeolite and bentonite as component (e).

[0055]

Zeolite is also called crystalline aluminosilicate. A crystalline aluminosilicate such as zeolite A, X, or P, or the like can be contained as a specific zeolite. An average primary particle size thereof 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. 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 “ZSEO64” 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.

[0056]

The bentonite preferably has an ion exchange capability of 50 to 100 meq/100 g. Examples of the bentonite include one or more selected from (e1) 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, (e2) illite, (e3) attapulgite, and (e4) kaolinite. The bentonite can be used in granule form. For example, reference can be made to granulated products of clay minerals in JP-A 2008-189719.

[0057]

If the powder detergent composition of the present invention contains component (e), the powder detergent composition contains component (e) in an amount of preferably 5 mass% or more, more preferably 8 mass% or

more, further preferably 10 mass% or more, and furthermore preferably 12 mass% or more, and preferably 30 mass% or less, more preferably 25 mass% or less, further preferably 20 mass% or less, and furthermore preferably 18 mass% or less from the viewpoint of fluidity of the powder detergent composition.

[0058]

The powder detergent composition of the present invention can contain one or more compounds selected from an inorganic sulfate and an inorganic halogen compound as component (f). Examples of component (f) include one or more compounds selected from sodium sulfate, magnesium sulfate, sodium chloride, and magnesium chloride. Component (f) may be a hydrate or an anhydride.

[0059]

If the powder detergent composition of the present invention contains component (f), the powder detergent composition contains component (f) in an amount of preferably 20 mass% or more, more preferably 30 mass% or more, and further preferably 40 mass% or more, and preferably 80 mass% or less, more preferably 70 mass% or less, further preferably 60 mass% or less, and furthermore preferably 50 mass% or less.

[0060]

From the viewpoint of washing power, the powder detergent composition of the present invention can contain, as component (g), a polymer having a carboxylic

acid group or a salt thereof and a weight average molecular weight of 3,000 or more.

Examples of component (g) include one or more selected from the following: a polymer selected from polyacrylic acid or a salt thereof and a copolymer of acrylic acid and maleic acid or a salt thereof (hereinafter referred to as component (g1)); and carboxymethyl cellulose or a salt thereof (hereinafter referred to as component (g2)).

Examples of the polyacrylic acid or salt thereof include polyacrylic acid, sodium polyacrylate, potassium polyacrylate, and others, and preferably include sodium polyacrylate and potassium polyacrylate.

Examples of the copolymer of acrylic acid and maleic acid or salt thereof include 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 others, and preferably include 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.

[0061]

Component (g1) 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, or the like, and more specifically include methacrylic acid, methyl acrylate, ethyl acrylate, methyl methacrylate, styrene, or the like. A molar ratio of the monomer other than acrylic acid and maleic acid and copolymerizable with acrylic acid and/or maleic acid in component (g1) 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 (g1). Therefore, the polyacrylic acid or salt thereof and the copolymer of acrylic acid and maleic acid or 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.

[0062]

A weight average molecular weight of component (g1) is preferably 30,000 or more, more preferably 35,000 or more, further preferably 40,000 or more, furthermore

preferably 50,000 or more, furthermore preferably 60,000 or more, furthermore preferably 70,000 or more, furthermore preferably 80,000 or more, and furthermore preferably 90,000 or more, and preferably 1,000,000 or less, more preferably 500,000 or less, and further preferably 200,000 or less.

A weight average molecular weight of component (g2) is preferably 100,000 or more and more preferably 300,000 or more, and preferably 2,000,000 or less, more preferably 1,000,000 or less, and further preferably 500,000 or less.

A degree of etherification of component (g2) is preferably 0.1 or more and more preferably 0.3 or more, and preferably 0.8 or less and more preferably 0.6 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 (g) 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.

[0063]

If the powder detergent composition of the present invention contains component (g), the powder detergent composition contains component (g) 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 1.5 mass% or more, and preferably 20.0 mass% or less, more preferably 10.0 mass% or less,

further preferably 5.0 mass% or less, and furthermore preferably 3.0 mass% or less from the viewpoints of washing performance and stability.

If the powder detergent composition of the present invention contains component (g), the mass of component (g) is expressed in terms of the value of a sodium salt.

[0064]

From the viewpoint of stability, the powder detergent composition of the present invention can contain a polyalkylene glycol with a weight average molecular weight of 100 or more and 100,000 or less as component (h).

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

A weight average molecular weight of component (h) is 100 or more, preferably 1,000 or more, more preferably 5,000 or more, and further preferably 10,000 or more, and 100,000 or less, preferably 50,000 or less, and more preferably 20,000 or less.

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

[0065]

If the powder detergent composition of the present invention contains component (h), the powder detergent composition contains component (h) 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 1 mass% or less, more preferably 0.7 mass% or less, and further preferably 0.5 mass% or less from the viewpoint of stability.

[0066]

The powder detergent composition of the present invention can contain water. As the water, deionized water (sometimes also referred to as ion-exchanged water) or water obtained by adding 1 mg/kg or more and 5 mg/kg or less of sodium hypochlorite to ion-exchanged water can be used. Further, tap water can also be used.

If the powder detergent composition of the present invention contains water, the composition contains the water in an amount of preferably 0.01 mass% or more, more preferably 0.1 mass% or more, and further preferably 1.0 mass% or more, and preferably 15.0 mass% or less, more preferably 10.0 mass% or less, and further preferably 5.0 mass% or less.

[0067]

The powder detergent composition of the present invention can optionally contain, as other components, other components publicly known in the field of clothes detergents, for example, bleaching agents (perborates, bleach activators, and others), recontamination inhibitors, reducing agents (sulfites and others), fluorescent whitening agents (for example, Tinopal CBS

(trade name, manufactured by Ciba Specialty Chemicals), Whitex SA (trade name, manufactured by SUMITOMO CHEMICAL COMPANY, LIMITED), and others), foam suppressants (silicone and others), organic solvents, enzymes (cellulase, proteases, peptinase, lipase, dextranase, amylases, and others), perfumes, coloring agents, and others (provided that those qualifying as components (a) to (h) are excluded).

[0068]

From the viewpoint of washing power, a pH at 25°C of 1 g of the powder detergent composition of the present invention diluted to 1000 g with ion-exchanged water is preferably 9.0 or more, more preferably 10.0 or more, and further preferably 10.5 or more, and preferably 13.0 or less, more preferably 12.0 or less, and further preferably 11.0 or less.

The pH is measured in accordance with the pH measurement method described below.

<pH measurement method>

A composite electrode for pH measurement (glass slide-in sleeve type, manufactured by HORIBA, Ltd.) is connected to a pH meter (pH/ion meter F-23, manufactured by HORIBA, Ltd.), and the power is turned on. As the internal solution of the pH electrode, a saturated potassium chloride aqueous solution (3.33 mol/L) is used. Next, a pH 4.01 standard solution (phthalate standard solution), a pH 6.86 standard solution (neutral phosphate

standard solution), and a pH 9.18 standard solution (borate standard solution) are each filled into a 100-mL beaker, and immersed in a constant temperature bath at 25°C for 30 minutes. A calibration operation is performed in the order of pH 6.86 -> pH 9.18 -> pH 4.01 by immersing the electrode for pH measurement in each standard solution adjusted to the constant temperature for 3 minutes. A sample to be measured is adjusted to 25°C, the electrode of the pH meter is immersed in the sample, and the pH one minute later is measured.

[0069]

A bulk density of the powder detergent composition of the present invention measured by the method prescribed in JIS K 3362:2008 is preferably 1,000 g/L or less, more preferably 950 g/L or less, and further preferably 900 g/L or less, and preferably 300 g/L or more, more preferably 400 g/L or more, further preferably 500 g/L or more, furthermore preferably 600 g/L or more, and furthermore preferably 800 g/L or more from the viewpoint of usability of the powder detergent composition.

[0070]

An average particle size of the powder detergent composition of the present invention is preferably 200 μm or more, more preferably 250 μm or more, and further preferably 300 μm or more, and preferably 650 μm or less, more preferably 600 μm or less, and further preferably

550 μm or less from the viewpoint of fluidity of the powder detergent composition. Here, the average particle size is determined from mass fractions by mesh size after 5 minutes of vibration using standard sieves in JIS Z 8801.

[0071]

The powder 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.

[0072]

The powder detergent composition of the present invention can suitably be used for textile products and further for washing textile products using washing machines. Especially, the powder detergent composition of the present invention can suitably be used for washing textile products using front loader washing machines as it is capable of suppressing foam overflow in washer tubs.

[0073]

Fibers washed with the powder detergent composition of the present invention may be either hydrophobic fibers or hydrophilic fibers. Examples of the hydrophobic fibers include, for example, protein fibers (milk protein casein fiber, promix, and others), polyamide fibers (nylon and others), polyester fibers (polyester and others), polyacrylonitrile fibers (acrylic and others), polyvinyl alcohol fibers (vinylon and others), polyvinyl chloride fibers (polyvinyl chloride and others), polyvinylidene chloride fibers (vinylidene and others), polyolefin fibers (polyethylene, polypropylene, and others), polyurethane fibers (polyurethane and others), polyvinyl chloride/polyvinyl alcohol copolymer fibers (polychlal and others), polyalkylene paraoxybenzoate fibers (benzoate and others), polyfluoroethylene fibers (polytetrafluoroethylene and others), glass fibers, carbon fibers, alumina fibers, silicone carbide fibers, rock wool (rock fibers), slag wool (slag fibers), metallic fibers (gold yarn, silver yarn, and steel fiber), and others. Examples of the hydrophilic fibers include, for example, seed hair fibers (cotton, kapok, and others), bast fibers (hemp, flax, ramie, cannabis, jute, and others), vein fibers (manila hemp, sisal hemp, and others), palm fibers, juncus, straw, animal hair fibers (wool, mohair, cashmere, camel hair, alpaca, vicuna, angora, and others), silk fibers (domestic silk

and wild silk), feather, cellulose fibers (rayon, polynosic, cupro, acetate, and others), or the like.

The fibers are preferably fibers containing cotton fiber from the viewpoint of finishes. 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% from the viewpoint of fibers' finishes.

[0074]

In the present invention, the term "textile product" means textiles such as woven materials, knitted materials, nonwoven fabric, and others using 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, and others.

[0075]

[Method for washing textile product]

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

The aspects described in the powder detergent composition of the present invention can be appropriately applied to the method for washing a textile product of the present invention.

[0076]

When the detergent article of the present invention and the water are mixed in the method for washing a textile product of the present invention, an amount of the water is adjusted such that a total amount of the powder detergent composition of the present invention is preferably 0.1 g or more, more preferably 0.2 g or more, and further preferably 0.3 g or more, and preferably 10 g or less, more preferably 5 g or less, and further preferably 1.0 g or less by concentration relative to 1 L of the water from the viewpoints of washing performance and rinsing performance.

[0077]

In the method for washing a textile product of the present invention, a temperature of the water is preferably 10°C or more, more preferably 20°C or more, and further preferably 30°C or more, and preferably 100°C or less, more preferably 80°C or less, and further preferably 60°C or less from the viewpoint of washing performance.

Further, a temperature of the detergent liquid of the present invention may fall within the above range. Further, a temperature of water used in the washing

method, for example, water such as water used for rinsing or the like may also fall within the above range.

[0078]

A pH at 25°C of the detergent liquid of the present invention is preferably 9.0 or more, more preferably 10.0 or more, and further preferably 10.5 or more, and preferably 13.0 or less, more preferably 12.0 or less, and further preferably 11.0 or less from the viewpoint of washing power.

The pH is measured in accordance with the above pH measurement method described in the powder detergent composition.

[0079]

In the method for washing a textile product of the present invention, a value of bath ratio expressed as a ratio of a water amount (L) of the detergent liquid containing the powder detergent composition of the present invention and the water to a mass (kg) of the textile product, in other words, a value of a water amount (L) of the detergent liquid of the present invention to a mass (kg) of the textile product, is preferably 8 or more, more preferably 10 or more, further preferably 12 or more, and furthermore preferably 15 or more, and preferably 45 or less, more preferably 40 or less, further preferably 30 or less, and furthermore preferably 20 or less from the viewpoints of washing performance and economy.

[0080]

In the method for washing a textile product of the present invention, a washing time during which the powder detergent composition of the present invention, the textile product, and the water are brought into contact (in other words, a washing time during which the detergent liquid of the present invention and the textile product are brought into contact) is preferably 1 minute or more, more preferably 3 minutes or more, and further preferably 5 minutes or more from the viewpoint of washing performance, and preferably 1 hour or less, more preferably 45 minutes or less, and further preferably 30 minutes or less from the viewpoint of damage to clothes.

[0081]

The method for washing a textile product of the present invention is suitable as a method in which fibers are immersed in a scouring liquid while being fed by rollers or the like, or a rotating washing method. The rotating washing method means a washing method in which textile products not fixed in a rotating device rotate around a rotation axis together with a detergent liquid. The rotating washing method can be performed by a rotating washing machine. Therefore, in the washing method of the present invention, the washing of the textile product is preferably performed by using a washing machine, especially a rotating washing machine, in terms of a better finish of the textile product.

Specific examples of the rotating washing machine include a front loader washing machine, a pulsator washing machine, or an agitator washing machine. As each of these rotating washing machines, a commercially available product for household use can be used. Especially, the method for washing a textile product of the present invention can suitably be used as a method for washing a textile product using a front loader washing machine as it is capable of suppressing foam overflow in washer tubs.

[0082]

The method can include rinsing and dewatering after the washing of the textile product. The rinsing and dewatering can be performed by using a washing machine. The rinsing and dewatering can be alternately performed multiple times.

The method can include drying after the rinsing and dewatering. The drying may be either natural drying or heat drying. Each drying can be performed multiple times.

Examples

[0083]

[Formulation component]

The following components were used in examples and comparative examples.

<Component (a)>

· AES: sodium polyoxyethylene lauryl ether sulfate (average number of added moles of oxyethylene group: 2 mol), component (a11), EMAL 270J, manufactured by Kao Corporation

· α-sfe: α-sulfo fatty acid ester containing sodium α-sulfo stearic acid methyl ester and sodium α-sulfo palmitic acid methyl ester at a ratio of 8/2 by mass ratio, component (a11)

· LAS-Na: sodium lauryl benzene sulfonate, NEOPELEX FS, manufactured by Kao Corporation, component (a12)

· C12EO10: polyoxyethylene lauryl ether (average number of added moles of oxyethylene group: 10 mol), EMULGEN 110, manufactured by Kao Corporation, component (a2)

· C16TMAC: compound of the general formula (a31) in which $R^{31a}$ is an alkyl group with 16 carbons, $R^{32a}$, $R^{33a}$, and $R^{34a}$ are methyl groups, and $X^-$ is a chloride ion, component (a3)

[0084]

<Component (b)>

· PC: sodium percarbonate, manufactured by FUJIFILM Wako Pure Chemical Corporation

<Component (c)>

· GA-10B: sodium dodecanoyloxy benzene sulfonate, manufactured by Nitto Kasei Co., Ltd.

<Component (d)>

· Sodium Carbonate: sodium carbonate, manufactured by FUJIFILM Wako Pure Chemical Corporation

· Sodium Bicarbonate: sodium bicarbonate, manufactured by FUJIFILM Wako Pure Chemical Corporation

· Sodium Silicate: sodium silicate, manufactured by FUJIFILM Wako Pure Chemical Corporation

<Component (e)>

· Zeolite: zeolite, synthetic zeolite A-4, manufactured by FUJIFILM Wako Pure Chemical Corporation

· Bentonite: bentonite, KUNIPIA-F, manufactured by KUNIMINE INDUSTRIES CO., LTD.

[0085]

<Component (f)>

· Sodium Sulfate: sodium sulfate, manufactured by FUJIFILM Wako Pure Chemical Corporation

<Component (g)>

· CMC: carboxymethyl cellulose, weight average molecular weight 480,000, degree of etherification 0.5, manufactured by NIPPON PAPER INDUSTRIES CO., LTD.

· Oligomer DT: sodium polyacrylate, weight average molecular weight 100,000, manufactured by Kao Corporation

<Component (h)>

· PEG: polyethylene glycol, weight average molecular weight 13,000, PEG-13000, manufactured by Mitsui Chemicals, Inc.

[0086]

<Other components>

· Water: ion-exchanged water

· CBS: fluorescent whitening agent, Tinopal CBS, manufactured by Ciba Specialty Chemicals

· Savinase 8T: enzyme (protease), manufactured by Novozymes A/S

· Perfume: perfume (methyl salicylate), manufactured by FUJIFILM Wako Pure Chemical Corporation

[0087]

[Preparation of powder detergent composition]

The powder detergent compositions shown in Table 1 were each prepared in the following manner using formulation components listed above. The formulation amounts in the table are net amounts.

Components (a), (d), (f), (g), and (h), which were components for forming spray-dried particles, were mixed to prepare a slurry, and the slurry was spray-dried to prepare base granules. The prepared base granules were put to a high-speed mixer (manufactured by Fukae Kogyo Ltd.), and components (b), (c), and (e) and other components, which were the remaining components blended later, were dry-mixed to obtain each powder detergent composition of formulation shown in Table 1. Further, each prepared powder detergent composition had a bulk density of 700 to 900 g/L measured by the method prescribed in JIS K 3362:2008, and an average particle size of 300 μm determined from mass fractions by mesh size after 5 minutes of vibration using standard sieves in JIS Z 8801.

Further, the pH at 25°C of 1 g of each prepared powder detergent composition diluted to 1000 g with ion-exchanged water is shown in Table 1.

[0088]

[Evaluation of sebum washing power]

<Preparation of model sebum stain>

A model sebum stain having the composition below was prepared, and used for the preparation of artificially contaminated cloth containing the model sebum stain.

· Composition of model sebum stain: 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 1.6 mass%, oleic acid 7.91 mass%, triolein 13.33 mass%, n-hexadecyl palmitate 2.22 mass%, squalene 6.66 mass%, and water of the balance (100 mass% in total)

[0089]

<Preparation of artificially contaminated cloth with model sebum stain>

The model sebum stain of the above 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 in an amount of 100 mg per piece by gravure-coating to prepare artificially contaminated cloth with model sebum stain.

[0090]

<Sebum stain washing test>

With five pieces of the prepared artificially contaminated cloth with model sebum stain as a set, 1 L of a detergent liquid obtained by mixing each powder detergent composition shown in Table 1 with ion-exchanged water was placed in a tergotometer (MS-8212 manufactured by Ueshima Seisakusho Co., Ltd., inner diameter 12 cm, height 17.5 cm) and the set of the artificially contaminated cloth with model sebum stain was added thereto to conduct a washing test under the following conditions:

· washing conditions

washing time: 10 minutes

concentration of powder detergent composition: 1 mass%

water hardness: 4°dH

water temperature: 30°C

rinsing: rinsing with running water for 5 minutes with tap water at 30°C

[0091]

After washing, four pieces were taken from the set of the artificially contaminated cloth with model sebum stain to measure sebum washing rates by the following method. The reflectances at 550 nm of the original cloth before contamination and the pre-washing piece and the post-washing pieces of the artificially contaminated cloth with model sebum stain were measured with a

colorimeter (manufactured by NIPPON DENSHOKU INDUSTRIES CO., LTD., SE-2000) to determine the sebum washing rates (%) by the formula below, and the average value of the four pieces was calculated. The results are shown in Table 1.

Sebum washing rate (%) = 100 × [(reflectance of post-washing artificially contaminated cloth - reflectance of pre-washing artificially contaminated cloth)/(reflectance of original cloth - reflectance of pre-washing artificially contaminated cloth)]

[0092]

[Evaluation of yellow stain bleaching power]

<Preparation of artificially contaminated cloth with model yellow stain>

As a model yellow stain, 1 g of curcumin was dissolved in 1 L of a solvent of methanol/chloroform = 1/1. The model yellow stain of the above composition was added to pieces of cotton/polyester blend broadcloth (cotton/polyester ratio = 35/65, purchased from Tanigashira Shoten) with a size of 6 cm × 6 cm in an amount of 200 μL per piece to prepare artificially contaminated cloth with model yellow stain.

[0093]

<Yellow stain bleaching test>

With five pieces of the prepared artificially contaminated cloth with model yellow stain as a set, 1 L of a detergent liquid obtained by mixing each powder

detergent composition shown in Table 1 with ion-exchanged water was placed in a tergotometer (MS-8212 manufactured by Ueshima Seisakusho Co., Ltd., inner diameter 12 cm, height 17.5 cm) and the set of the artificially contaminated cloth with model sebum stain was added thereto to conduct a washing test under the following conditions:

· washing conditions

washing time: 10 minutes

concentration of powder detergent composition: 1 mass%

water hardness: 4°dH

water temperature: 30°C

rinsing: rinsing with running water for 5 minutes with tap water at 30°C

[0094]

After washing, four pieces were taken from the set of the artificially contaminated cloth with model yellow stain to measure yellow stain bleaching rates by the following method.

The reflectances at 550 nm of the original cloth before contamination and the pre-washing piece and the post-washing pieces of the artificially contaminated cloth with model yellow stain were measured with a colorimeter (manufactured by NIPPON DENSHOKU INDUSTRIES CO., LTD., SE-2000) to determine the yellow stain bleaching rates (%) by the formula below, and the average

value of the four pieces was calculated. The results are shown in Table 1.

Yellow stain bleaching rate (%) = 100 × [(reflectance of post-washing artificially contaminated cloth - reflectance of pre-washing artificially contaminated cloth)/(reflectance of original cloth - reflectance of pre-washing artificially contaminated cloth)]

[0095]

[Evaluation of foam overflow in front loader washing machine]

4 kg of clothes and 30 g of each powder detergent composition shown in Table 1 were put to a front loader washing machine (Direct Drive (manufactured by LG Electronics)), and washing was performed by using a normal cycle. The washer tub was visually checked during washing, and if the washer tub did not overflow with a foam, the evaluation was “A,” and if the washer tub overflowed with a foam, the evaluation was “B.” The results are shown in Table 1.

[0096]

[Table 1]

| | | Example | | | | | | | | | | | | | Comparative example | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 1 | 2 | 3 | 4 | 5 |
| Powder detergent composition | Formulation composition (mass%) | | | | | | | | | | | | | | | | | | |
| | (a) (a11) AES | 4.0 | 6.0 | 8.0 | 4.0 | 4.0 | | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | | | 1.0 | 4.0 | 4.0 |
| | (a) (a11) α-sfe | | | | | | 8.0 | | | | | | | | | | | | |
| | (a) (a12) LAS-Na | 10.0 | 8.0 | 6.0 | 8.0 | 6.0 | 6.0 | 6.0 | 3.0 | 6.0 | 10.0 | 10.0 | 10.0 | 10.0 | 25.0 | 14.0 | 13.0 | 10.0 | 10.0 |
| | (a) (a2) C12EO10 | | | | | | | 4.0 | 7.0 | | | | | | | | | | |
| | (a) (a3) C16TMAC | | | | | | | | | 4.0 | | | | | | | | | |
| | (b) PC | 3.1 | 3.1 | 3.1 | 3.1 | 3.1 | 3.1 | 3.1 | 3.1 | 3.1 | 3.1 | 3.1 | 3.1 | 3.1 | 3.1 | 3.1 | 3.1 | | 3.1 |
| | (c) GA-10B | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.2 | 0.5 | 1.0 | 0.5 | 0.5 | 0.5 | 0.5 | |
| | (d) Sodium Carbonate | 14.0 | 14.0 | 14.0 | 14.0 | 14.0 | 14.0 | 14.0 | 14.0 | 14.0 | 11.0 | 14.0 | 14.0 | 14.0 | 14.0 | 14.0 | 14.0 | 14.0 | 14.0 |
| | (d) Sodium Bicarbonate | | | | | | | | | | 3.0 | | | | | | | | |
| | (d) Sodium Silicate | 2.9 | 2.9 | 2.9 | 2.9 | 2.9 | 2.9 | 2.9 | 2.9 | 2.9 | 2.9 | 2.9 | 2.9 | 2.9 | 2.9 | 2.9 | 2.9 | 2.9 | 2.9 |
| | (e) Zeolite | 13.2 | 13.2 | 13.2 | 13.2 | 13.2 | 13.2 | 13.2 | 13.2 | 13.2 | 13.2 | 13.2 | 13.2 | 13.2 | 13.2 | 13.2 | 13.2 | 13.2 | 13.2 |
| | (e) Bentonite | 1.4 | 1.4 | 1.4 | 1.4 | 1.4 | 1.4 | 1.4 | 1.4 | 1.4 | 1.4 | 1.4 | 1.4 | 1.4 | 1.4 | 1.4 | 1.4 | 1.4 | 1.4 |
| | (f) Sodium Sulfate | 44.5 | 44.5 | 44.5 | 46.5 | 48.5 | 44.5 | 44.5 | 44.5 | 44.5 | 44.5 | 44.8 | 44.5 | 44.0 | 33.5 | 44.5 | 44.5 | 47.6 | 45.0 |
| | (g) CMC | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 |
| | (g) Oligomer DT | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 |
| | (h) PEG | 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 | 0.4 | 0.4 |
| | Water | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 |
| | CBS | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
| | Savinase 8T | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 |
| | Perfume | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 |
| | Total | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| | pH[1g/1000g, 25°C] | 10.7 | 10.7 | 10.7 | 10.7 | 10.7 | 10.7 | 10.7 | 10.7 | 10.7 | 10.2 | 10.7 | 10.7 | 10.7 | 10.7 | 10.7 | 10.7 | 10.7 | 11.7 |
| | (a11)/(a) (mass%) | 29 | 43 | 57 | 33 | 40 | 57 | 29 | 29 | 29 | 29 | 29 | 29 | 29 | 0 | 0 | 7 | 29 | 29 |
| | (a11)/(a12) (mass ratio) | 0.4 | 0.8 | 1.3 | 0.5 | 0.7 | 1.3 | 0.7 | 1.3 | 0.7 | 0.4 | 0.4 | 0.4 | 0.4 | 0 | 0 | 0.1 | 0.4 | 0.4 |
| | [(a11) + (a12)]/(a) (mass%) | 100 | 100 | 100 | 100 | 100 | 100 | 71 | 50 | 71 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| | [(b) + (c)]/(a) (mass ratio) | 0.26 | 0.26 | 0.26 | 0.30 | 0.36 | 0.26 | 0.26 | 0.26 | 0.26 | 0.26 | 0.24 | 0.26 | 0.29 | 0.14 | 0.26 | 0.26 | 0.04 | 0.22 |
| | [(b) + (c)]/(a11) (mass ratio) | 0.9 | 0.6 | 0.5 | 0.9 | 0.9 | 0.5 | 0.9 | 0.9 | 0.9 | 0.9 | 0.8 | 0.9 | 1.0 | - | - | 3.6 | 0.1 | 0.8 |
| | (b)/(c) (mass ratio) | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 15.5 | 6.2 | 3.1 | 6.2 | 6.2 | 6.2 | 0 | - |
| Evaluation | Sebum washing rate (%) | 44 | 45.5 | 45.1 | 44 | 43 | 44.8 | 48 | 47 | 43 | 42 | 44 | 44 | 44 | 45 | 38 | 39.2 | 44 | 44 |
| | Yellow stain bleaching rate (%) | 55 | 55 | 55 | 58 | 60 | 55 | 52 | 50 | 50 | 52 | 55 | 57 | 60 | 49 | 55 | 55 | 44 | 44 |
| | Foam overflow in front loader washing machine | A | A | A | A | A | A | A | A | A | A | A | A | A | B | A | A | A | A |

# CLAIMS

[Claim 1]

A powder detergent composition comprising the following component (a) in an amount of 5.0 mass% or more and 20.0 mass% or less, the following component (b) in an amount of 1.0 mass% or more and 20.0 mass% or less, and the following component (c) in an amount of 0.1 mass% or more and 5.0 mass% or less,

component (a): a surfactant (excluding component (c)) containing one or more anionic surfactants (hereinafter referred to as component (a11)) selected from a polyoxyalkylene alkyl or alkenyl ether sulfate, an α-sulfo fatty acid ester, and a salt of these, wherein a content ratio of the component (a11) in the component (a) is 20 mass% or more,

component (b): a percarbonate, and

component (c): an alkanoyl or alkenoyloxy benzene sulfonic acid or a salt thereof.

[Claim 2]

The powder detergent composition according to claim 1, wherein a content ratio of an anionic surfactant in the component (a) is 50 mass% or more.

[Claim 3]

The powder detergent composition according to claim 1 or 2, wherein a content ratio of the component (a11) in the component (a) is 50 mass% or more.

[Claim 4]

The powder detergent composition according to any one of claims 1 to 3, wherein the component (a11) is a polyoxyalkylene alkyl or alkenyl ether sulfate or a salt thereof.

[Claim 5]

The powder detergent composition according to any one of claims 1 to 4, wherein a mass ratio of a total content of the components (b) and (c) to a content of the component (a), [(b) + (c)]/(a), is 0.2 or more.

[Claim 6]

The powder detergent composition according to any one of claims 1 to 5, wherein a mass ratio of a content of the component (b) to a content of the component (c), (b)/(c), is 3.0 or more.

[Claim 7]

The powder detergent composition according to any one of claims 1 to 6, wherein a pH at 25°C of 1 g of the powder detergent composition diluted to 1000 g with ion-exchanged water is 9.0 or more.

[Claim 8]

The powder detergent composition according to any one of claims 1 to 7, wherein the composition is used for textile products.

[Claim 9]

A method for washing a textile product comprising washing the textile product with a detergent liquid obtained by mixing the powder detergent composition according to any one of claims 1 to 8 and water.