DEGREASING COMPOSITION AND PRODUCTION METHOD THEREOF

Inventors: Naruhiko Nojima, Aichi (JP); Yusaku Ishihara, Aichi (JP); Hideyuki Yamamoto, Aichi (JP)

Assignee: Yuken Industry Co., Ltd., Kariya-shi, Aichi (JP)

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As a method for producing a degreasing composition in the form of a slurry, crystallization of the composition during low-temperature storage being suppressed and the composition being used for preparing a cleaning liquid having little environmental impact, provided is a method including a step of obtaining a slurry by mixing a first liquid and a powdery silicate having a particle diameter ranging from 0.2 mm to 10 mm, wherein the first liquid contains an alkaline component composed of at least one of sodium hydroxide and potassium hydroxide, an alcohol having three or fewer carbon atoms, and water; and the degreasing composition contains, with respect to the total composition, 10 mass % to 60 mass % of the alkaline component, 0.1 mass % to 5 mass % of the alcohol, 1 mass % to 50 mass % of the silicate, and 20 mass % to 50 mass % of water including hydration water of the silicate, and contains no chelating agent.
DEGREASING COMPOSITION AND PRODUCTION METHOD THEREOF

TECHNICAL FIELD

[0001] The present invention relates to a degreasing composition of a concentrated alkaline liquid, that allows labor saving and operational safety enhancement upon replenishment management in a cleaning operation in ordinary metal surface treatment, and to a production method thereof, and more specifically to a degreasing composition having excellent storage stability even at high concentration, and to a production method thereof.

BACKGROUND ART

[0002] Cleaning processes of metal materials that precede an intended surface treatment process are important processes that significantly affect the rate of defects, during a series of processing steps, in surface treatment methods such as plating, coating, and thermal treatment. In terms of suppressing impairment of product quality, therefore, a demand exists for means that facilitate management of a cleaning process, specifically management of detergent concentration in a cleaning liquid.

[0003] Detergents for degreasing conventionally used in the abovementioned cleaning processes were powder-like solid detergents including an alkaline component composed of a strong alkaline substance, and this solid detergent was dissolved in a solvent (mainly water), to yield a cleaning liquid. The cleaning liquid had good cleaning capability, but on account of the powdery form of the detergent, an on-site operator had to inevitably spend time in bringing the detergent from a detergent storage facility, and in charging and dissolving a necessary amount of the detergent into a cleaning bath. Also, the strong alkaline powder scattered during the above operation was potentially harmful to the health of the operator who inhaled the powder, and hence it was necessary to take measures towards ensuring safety.

[0004] Means has been attempted that involves replenishing an aqueous solution made of such a powder-like detergent, by way of an automatic replenishment system. In this case, however, space is required for storing a large stock solution which is obtained by dissolving the detergent. Securing this space in production sites was difficult. Therefore, a demand exists for a concentrated liquid detergent that allows reducing the volume of the stock tank, and that allows reducing the distribution costs that have become substantially onerous of late.

[0005] Such concentrated liquid detergents (referred to in the present invention as “degreasing composition”) cannot be obtained by simply dissolving a conventional powder-like alkaline detergent in a small amount of solvent. The reasons are as follows. Specifically, the alkaline component, as the essential component for securing detergency, becomes particularly likely to crystallize when the content of the alkaline component is 25 mass % or greater with respect to the total composition. Such degreasing compositions, as a result, crystallize quickly upon storage in low-temperature environments, such as in environments below freezing, even if the degreasing composition is liquid immediately after being produced. In that crystallized state, the degreasing composition cannot be used as a degreasing composition for preparing a cleaning liquid.

[0006] One means for suppressing such crystallization and securing storage stability involves blending a dispersant, such as a cationized saccharide, into the degreasing composition, as disclosed in Patent document 1.


DISCLOSURE OF THE INVENTION

Problem to be Solved by the Invention

[0008] The means disclosed in Patent document 1 above is highly effective for the purpose of suppressing crystallization. However, the substances added as a dispersant, for instance cationic starch or polyethylene glycol, cause the BOD and COD of the cleaning liquid to rise. As a result, it is difficult to increase the concentration of such dispersant components in the cleaning liquid in regions of stringent effluent regulation. This means that it is likewise difficult to increase the concentration of these dispersant components in a degreasing composition for preparing such a cleaning liquid. Accordingly, it was difficult in some instances to provide stably a cleaning liquid having high cleaning capability.

[0009] Also, metal components comprised in the target of cleaning, (hereafter also referred to as “object to be cleaned”) may dissolve in the detergent, thereby giving rise to insoluble salts of the components in the degreasing composition. This occurrence impairs the quality of the cleaning liquid. For this reason, chelating agents may be included as components in the cleaning liquid. However, blending of a chelating agent into a degreasing composition which uses a dispersant such as the above-described ones resulted, in some instances, in crystallization, despite the fact that the dispersant is blended. In such cases, the chelating agent could not be blended into the degreasing composition, and had to be added separately. This increases operation load involved in preparing the cleaning liquid, and this is undesirable in terms of reducing footprint and transport costs.

[0010] In the light of the above, it is an object of the present invention to provide a degreasing composition that uses none of the above-described dispersants, having a significant environmental impact, and that can contain a chelating agent, and to provide a production method of the degreasing composition.

Means for Solving the Problem

[0011] An aspect of the present invention provided in order to solve the above problems is a method for producing a degreasing composition in the form of slurry for preparing a cleaning liquid, the method including specifically the following four forms below.

[0012] A first degreasing composition production method according to the present invention comprises a step of obtaining a slurry by mixing a first liquid and a powdery silicate having a particle diameter ranging from 0.2 mm to 10 mm, wherein the first liquid contains an alkaline component composed of at least one of sodium hydroxide and potassium hydroxide, an alcohol having three or fewer carbon atoms and water, and the degreasing composition contains, with respect to the total composition, 10 mass % to 60 mass % of the alkaline component, 0.1 mass % to 5 mass % of the alcohol, 1 mass % to 50 mass % of the silicate, and 20 mass % to 50 mass % of water including hydration water of the silicate, and contains no chelating agent.
Herein, the term “silicate” denotes a metal salt, typically an alkali metal salt or an alkaline earth metal salt, of silicic acid, and specific examples of the silicate include, sodium silicate and potassium silicate. In the present invention, silicate content denotes the content including the hydration water of the silicate, if the silicate is a hydrate.

A second degreasing composition production method according to the present invention comprises a step of obtaining a slurry by mixing a second liquid and a powdery silicate having a particle diameter ranging from 0.2 mm to 10 mm, wherein the second liquid contains an alkali component composed of at least one of sodium hydroxide and potassium hydroxide, an alcohol having three or fewer carbon atoms, a chelating agent, and water, and the degreasing composition contains, with respect to the total composition, 10 mass % to 60 mass % of the alkali component, 0.1 mass % to 5 mass % of the alcohol, 1 mass % to 50 mass % of the chelating agent, and 20 mass % to 50 mass % of water including hydration water of the silicate.

A third degreasing composition production method according to the present invention comprises a step of obtaining a slurry by mixing a third liquid and a powdery silicate having a particle diameter ranging from 0.2 mm to 10 mm, wherein the third liquid contains an alkali component composed of at least one of sodium hydroxide and potassium hydroxide, an alcohol having three or fewer carbon atoms, a chelating agent, and water, and the degreasing composition contains, with respect to the total composition, 10 mass % to 60 mass % of the alkali component, 0.1 mass % to 5 mass % of the alcohol, 1 mass % to 50 mass % of the chelating agent, and 20 mass % to 50 mass % of water including hydration water of the silicate.

A fourth degreasing composition production method according to the present invention comprises a step of obtaining a slurry by mixing a fourth liquid and a powdery silicate having a particle diameter ranging from 0.2 mm to 10 mm, wherein the fourth liquid contains an alkali component composed of at least one of sodium hydroxide and potassium hydroxide, a chelating agent, and water, and the degreasing composition contains, with respect to the total composition, 10 mass % to 60 mass % of the alkali component, 1 mass % to 50 mass % of the silicate, 5 mass % to 50 mass % of the chelating agent, and 20 mass % to 50 mass % of water including hydration water of the silicate, and contains no alcohol having three or fewer carbon atoms.

In the above production methods, preferably, the chelating agent is EDTA. The degreasing composition may further contain a surfactant. In that case, the content of surfactant is preferably 30 mass % or less with respect to the total composition.

Preferably, the temperature of the liquid i.e. of any one of the first through fourth liquids above that is mixed with the powdery silicate is not higher than 35°C at the time when the silicate is added. Hereafter, any one from among the first through fourth liquids that is mixed with the powdery silicate will be referred to as “liquid for mixing”.

In another aspect, the present invention provides a degreasing composition for preparing a cleaning liquid. The composition includes specifically the following four forms.

A first degreasing composition according to the present invention contains, with respect to the total composition, 10 mass % to 60 mass % of an alkali component composed of at least one of sodium hydroxide and potassium hydroxide; 0.1 mass % to 5 mass % of an alcohol having three or fewer carbon atoms; 1 mass % to 50 mass % of a chelating agent; and 20 mass % to 50 mass % of water including hydration water of the silicate; and contains no chelating agent, the degreasing composition being a slurry in which at least part of the silicate is dispersed in the form of silicate particles having a particle diameter no greater than 10 mm, wherein no clumpy crystals form even when the degreasing composition is left to stand in an environment at −2°C for 24 hours.

A second degreasing composition according to the present invention contains, with respect to the total composition, 10 mass % to 60 mass % of an alkali component composed of at least one of sodium hydroxide and potassium hydroxide; 0.1 mass % to 5 mass % of an alcohol having three or fewer carbon atoms; 1 mass % to 50 mass % of a chelating agent; and 20 mass % to 50 mass % of water including hydration water of the silicate, the degreasing composition being a slurry in which at least part of the silicate is dispersed in the form of silicate particles having a particle diameter no greater than 10 mm, wherein no clumpy crystals form even when the degreasing composition is left to stand in an environment at −2°C for 24 hours.

A third degreasing composition according to the present invention contains, with respect to the total composition, 10 mass % to 60 mass % of an alkali component composed of at least one of sodium hydroxide and potassium hydroxide; more than 0.0 mass % but less than 5 mass % of an alcohol having three or fewer carbon atoms; 1 mass % to 50 mass % of a chelating agent; and 20 mass % to 50 mass % of water including hydration water of the silicate, the degreasing composition being a slurry in which at least part of the silicate is dispersed in the form of silicate particles having a particle diameter no greater than 10 mm, wherein no clumpy crystals form even when the degreasing composition is left to stand in an environment at −2°C for 24 hours.

A fourth degreasing composition according to the present invention contains, with respect to the total composition, 10 mass % to 60 mass % of an alkali component composed of at least one of sodium hydroxide and potassium hydroxide; more than 0.0 mass % up to 5 mass % of an alcohol having three or fewer carbon atoms; 1 mass % to 50 mass % of a chelating agent; 5 mass % to 50 mass % of a chelating agent; and 20 mass % to 50 mass % of water including hydration water of the silicate, the degreasing composition being a slurry in which at least part of the silicate is dispersed in the form of silicate particles having a particle diameter no greater than 10 mm, wherein no clumpy crystals form even when the degreasing composition is left to stand in an environment at −2°C for 24 hours.

Preferably, the temperature of the liquid i.e. of any one of the first through fourth liquids above that is mixed with the powdery silicate is not higher than 35°C at the time when the silicate is added. Hereafter, any one from among the first through fourth liquids that is mixed with the powdery silicate will be referred to as “liquid for mixing”.

Advantageous Effect of the Invention

According to the present invention, the prepared degreasing composition gets supersaturated with the silicate, whereby clumpy crystallization at a part of the composition and crystallization at the entirety of the composition do not readily occur during storage. Occurrence of separation between a solid phase and a liquid phase (hereafter referred to
as "solid-liquid phase separation") of the degreasing composition during storage is also less likely to occur.

[0026] Therefore, it becomes possible to enhance storage stability as well as to increase the concentration of the cleaning components in the degreasing composition, even without blending an organic dispersant having a large molecular weight, as disclosed in Patent document 1.

[0027] This allows, as a result, suppressing a rise in the COD and BOD of the cleaning liquid, caused by an organic dispersant having a large molecular weight in a case in which such a dispersant is blended in. Accordingly, a cleaning liquid which can reduce environmental impact as well as have enhanced detergency is obtained. Further, the degreasing composition does not readily crystallize even if a chelating agent is blended thereof. Therefore, it becomes possible to avoid the drawbacks (increase in storage space, addition of supplementary operations) of a configuration in which the chelating agent is supplementarily added.

MODE FOR CARRYING OUT THE INVENTION

[0028] A method for producing a slurry-like degreasing composition according to the present invention includes the four steps below.

[0029] A first method comprises a step of obtaining a slurry by mixing a first liquid and a powderly silicate having a particle diameter ranging from 0.2 mm to 10 mm, wherein the first liquid contains an alkaline component composed of at least one of sodium hydroxide and potassium hydroxide, an alcohol having three or fewer carbon atoms, and water, and the degreasing composition contains, with respect to the total composition, 10 mass % to 60 mass % of the alkaline component, 0.1 mass % to 5 mass % of the alcohol, 1 mass % to 50 mass % of the silicate, and 20 mass % to 50 mass % of water including hydration water of the silicate, and contains no chelating agent.

[0030] A second method comprises a step of obtaining a slurry by mixing a second liquid and a powderly silicate having a particle diameter ranging from 0.2 mm to 10 mm, wherein the second liquid contains an alkaline component composed of at least one of sodium hydroxide and potassium hydroxide, an alcohol having three or fewer carbon atoms, a chelating agent, and water, and the degreasing composition contains, with respect to the total composition, 10 mass % to 60 mass % of the alkaline component, 0.1 mass % to 5 mass % of the alcohol, 1 mass % to 50 mass % of the silicate, more than 0 mass % but less than 5 mass % of the chelating agent, and 20 mass % to 50 mass % of water including hydration water of the silicate.

[0031] A third method comprises a step of obtaining a slurry by mixing a third liquid and a powderly silicate having a particle diameter ranging from 0.2 mm to 10 mm, wherein the third liquid contains an alkaline component composed of at least one of sodium hydroxide and potassium hydroxide, an alcohol having three or fewer carbon atoms, a chelating agent, and water, and the degreasing composition contains, with respect to the total composition, 10 mass % to 60 mass % of the alkaline component, more than 0 mass % up to 5 mass % of the alcohol, 1 mass % to 50 mass % of the silicate, 5 mass % to 50 mass % of the chelating agent, and 20 mass % to 50 mass % of water including hydration water of the silicate.

[0032] A fourth method comprises a step of obtaining a slurry by mixing a fourth liquid and a powderly silicate having a particle diameter ranging from 0.2 mm to 10 mm, wherein the fourth liquid contains an alkaline component composed of at least one of sodium hydroxide and potassium hydroxide, a chelating agent, and water, and the degreasing composition contains, with respect to the total composition, 10 mass % to 60 mass % of the alkaline component, 1 mass % to 50 mass % of the silicate, 5 mass % to 50 mass % of the chelating agent, and 20 mass % to 50 mass % of water including hydration water of the silicate, and contains no alcohol having three or fewer carbon atoms.

[0033] As used herein, the term "slurry" denotes a suspension, comprising two phases (solid and liquid phases) wherein a solid dispersant is dispersed in a liquid. Part of the aforementioned powdery silicate ranging from 0.2 mm to 10 mm dissolves when mixed with the liquid for mixing. However, at least part of the silicate constitutes an undissolved fraction (in the present invention, this undissolved powdery fraction is referred to as "silicate particles") having a powder form with a particle diameter no greater than 10 mm. The dispersant in the slurry-like degreasing composition according to the present invention comprises such silicate particles. In addition, an undissolved fraction of chelating agent such as EDTA may be incorporated as the dispersant in the slurry-like degreasing composition according to the present invention.

[0034] Since the liquid phase of the degreasing composition according to the present invention has an appropriate viscosity, the degreasing composition contains components such as the alkaline component. Therefore, the silicate constituting the solid phase as well as the chelating agent such as EDTA, which is added as needed and then constitutes the solid phase, do not readily undergo sedimentation, even after long-term storage. Accordingly, the degreasing composition according to the present invention can maintain a slurry-like form over long periods of time. Specifically, the degreasing composition according to the present invention does not form clumpy crystals even when left to stand for 24 hours in an environment at −2°C. Herein, "clumpy crystals" denote crystals resulting from crystallization of part of the degreasing composition, the crystals having a size sufficiently larger than that of the silicate particles which are dispersed in the degreasing composition, and large enough to become an impediment for the conveyance of the degreasing composition by way of pumps or the like. The clumpy crystals have no definite specific shape, but in terms of constituting an impediment for conveyance, as described above, a crystal will be understood to be clumpy when grown to a long diameter of 30 mm or larger.

[0035] Thus, the degreasing composition according to the present invention has excellent storage stability as compared with a conventional degreasing composition which has a uniform liquid in an initial state but undergoes crystallization and/or significant increase in viscosity, or, conversely, undergoes solid-liquid phase separation, during storage.

[0036] The composition, production method and so forth of the degreasing composition are explained in detail below.

[0037] 1. Degreasing Composition

[0038] (1) Alkaline Component

[0039] The degreasing composition according to the present invention contains an alkaline component composed of at least one of sodium hydroxide and potassium hydroxide, as one component which directly elicits a cleaning function.

[0040] The alkaline component has also the function of appropriately setting the viscosity of a liquid phase, so as to prevent the degreasing composition from undergoing solid-liquid phase separation.
The aggregate content of alkaline component ranges from 10 mass % to 60 mass % with respect to the entire composition. The detergency of the cleaning liquid obtained from the degreasing composition according to the present invention (hereinafter, simply “cleaning liquid”) decreases if the content of alkaline component is too small. Also, the viscosity of the liquid phase decreases, and hence the silicate particles sediment. The properties of the degreasing composition become impaired thereby. An excessive content of alkaline component entails a relatively lower content of the silicate in the cleaning liquid, and, as a result, lower detergency. A preferred content of alkaline component ranges from 20 mass % to 60 mass %, more preferably from 40 mass % to 55 mass %.

(2) Silicate

Herein, “silicate” denotes a metal salt of silicic acid, typically a salt of an alkali metal or alkaline earth metal. Specific examples thereof include sodium metasilicate, potassium metasilicate, sodium orthosilicate, potassium orthosilicate, sodium sesquisilicate, and potassium sesquisilicate. The foregoing compounds ordinarily have hydration water. Therefore, the content of silicate in the present invention refers to content as the sum of hydration water and silicate.

The content of silicate in the degreasing composition according to the present invention ranges from 1 mass % to 50 mass % with respect to the entire composition. If the silicate content is too low, the detergency of the cleaning liquid is reduced. An excessive silicate content causes a relatively lower content of alkaline component in the cleaning liquid, which results in reduced detergency of the cleaning liquid. Also, the viscosity of the liquid phase decreases in that case, and silicate particles sediment as a result, thereby impairing the properties of the degreasing composition.

The silicate used to produce the degreasing composition according to the present invention is a powder-like solid (such a silicate is referred to as “powdery silicate” in the present invention) and the particle diameter of the powdery silicate ranges from 0.2 mm to 10 mm. A powdery silicate having this specific particle diameter distribution can be obtained by collecting silicates having a powdery form which pass through a sieve having an opening of 9.5 mm, but not through a sieve having an opening of 212 μm. A powdery silicate having a particle diameter ranging from 0.2 mm to 10 mm” denotes a “powdery silicate that passes through a sieve having an opening of 9.5 mm, but not through a sieve having an opening of 212 μm.” Accordingly, the feature “powdery silicate having a particle diameter ranging from 0.2 mm to 10 mm” is intended to exclude from the claims, among silicates having a powdery form).

Since the powdery silicate used for producing the degreasing composition according to the present invention is specified according to the above definition, the powdery silicate may accidentally include a powdery silicate having a particle diameter smaller than 0.2 mm or a powdery silicate having a particle diameter more than 10 mm. So long as the effect of the present invention can be stably obtained, a powdery silicate having such a particle diameter distribution falls within the “powdery silicate having a particle diameter ranging from 0.2 mm to 10 mm”, which is a silicate used to produce the degreasing composition according to the present invention.

When a powdery silicate having such specific particle diameter distribution is mixed with a liquid for mixing, part of the mixed powdery silicate becomes dissolved in water. Therefore, the silicate concentration in the liquid phase of the obtained degreasing composition is saturated. Silicate that is not dissolved, or remains after dissolving, i.e. silicate particles, become dispersed in the liquid phase which has an appropriate viscosity due to other contained components, such as the above-described alkaline component. The silicate particles are thus uniformly dispersed throughout the liquid phase. As a result, the degreasing composition is prevented from becoming nonuniform during storage, on account of, for instance, solid-liquid phase separation or formation of clumpy crystals, even if the content of silicate in the degreasing composition is raised to or above the saturating concentration.

In a case in which, by contrast, there is blended a silicate having, as a main component, a powder the particle diameter whereof is smaller than 0.2 mm (powdery material that passes through a sieve having an opening of 212 μm), then a substantial amount of silicate dissolves in water, and a slurry-like degreasing composition does not readily form. In this case, the silicate is dissolved, in a supersaturated state, in the liquid phase of the degreasing composition. Upon cooling of the produced degreasing composition and upon storage over long periods of time, therefore, the silicate precipitates out of the liquid phase. Then, clumpy crystals form and the viscosity of the liquid phase excessively increases since the crystals take up a significant amount of water in the form of crystallization water. The only practicable means for avoiding the above phenomenon involves reducing the content of silicate contained in the degreasing composition. Accordingly, the silicate content in SiO₂ equivalent in a blend of a powdery silicate having a particle diameter smaller than 0.2 mm becomes about half of the silicate content in a blend of a powdery silicate having a particle diameter ranging from 0.2 mm to 10 mm.

A phenomenon in which solutes such as silicate and the alkaline component precipitate upon cooling may occur, even if the silicate particles are in a dispersed state in the liquid, as in the degreasing composition of the present invention. However, since the silicate particles are homogeneously dispersed in the degreasing composition, the solutes precipitate on nuclei of the silicate particles so that the nuclei grow. Accordingly, formation of clumpy crystals and significant increases in liquid viscosity are suppressed.

As explained above, the lower limit of particle diameter of the powdery silicate is set in terms of stably forming a slurry in which silicate particles are dispersed.

By contrast, the upper limit of particle diameter of the powdery silicate is set in terms of suppressing sedimentation of silicate particles. That is, it is difficult for a solid phase comprising silicate particles having a diameter of more than 10 mm to homogeneously disperse in a liquid phase, even upon low-temperature storage. Therefore, the dispersion state of the slurry-like degreasing composition becomes non-uniform. As a result, the cleaning capability of the cleaning liquid obtained from the slurry-like degreasing composition becomes likewise nonuniform and it becomes then difficult to elicit the effect of the degreasing composition according to the present invention, i.e. making crystallization less likely even upon low-temperature storage.

(3) Chelating Agent

When producing the degreasing composition according to the present invention, a chelating agent may also be blended, in addition to the above-described alkaline component and powdery silicate. The chelating agent prevents
metal ions that leach from the object to be cleaned into the cleaning liquid from reacting with cleaning components contained in the cleaning liquid, such as a phosphoric acid-based component, and forming insoluble salts which impair the properties of the cleaning liquid (for instance, suspension, increase in liquid viscosity, crystallization and the like).

Examples of the chelating agent include amino polycarboxylic acid-based chelating agents, aromatic or aliphatic carboxylic acid-based chelating agents, amino acid-based chelating agents, ether carboxylic acid-based chelating agents, phosphonic acid-based chelating agents, hydroxycarboxylic acid-based chelating agents, polymer electrolytes (including oligomer electrolytes)-based chelating agents, polyalcohols, dimethylglyoxime, ascorbic acid, thioglycolic acid, phytic acid, glyoxylic acid, and glyoxal acid. The above-described chelating agents may be in free acid form, or in the form of a salt such as a sodium salt, a potassium salt, and an ammonium salt. The foregoing may be in the form of hydrolyzable ester derivatives thereof.

Examples of amino polycarboxylic acid-based chelating agents include ethylenediamine tetraacetic acid (EDTA), ethylenediamine diacetic acid, hydroxyethyl ethylenediamine triacetic acid (HEDTA), dihydroxy ethyl ethylenediamine tetraacetic acid (DHEDDA), nitricotinic acid (NTA), hydroxyethyl iminodiacetic acid (HIDA), β-alanine diacetic acid, cyclohexane diamine tetraacetic acid, nitrolotriacetic acid, iminodiacetic acid, N-(2-hydroxyethyl)iminodiacetic acid, diethylene triamine pentaacetic acid, N-(2-hydroxyethyl)ethylenediamine triacetic acid, glycyl ether diamine tetra acetic acid, glutamic acid diacetic acid, aspartic acid diacetic acid, methylglycine diacetic acid, imino diacetic acid, serine diacetic acid, hydroxymimino disuccinic acid, dihydroxyethyl glycine, aspartic acid, and glutamic acid, as well as salts and derivatives such as esters of the foregoing.

Examples of aromatic or aliphatic carboxylic acid-based chelating agents include oxalic acid, malonic acid, succinic acid, glutaric acid, adipic acid, pimelic acid, sebacic acid, azelanic acid, itaconic acid, acetic acid, pyruvic acid, gluconic acid, pyromellitic acid, benzopolyacrylic acids, cyclopentane tetracarboxylic acid, salicylic acid, acetylsalicylic acid, hydroxybenzoic acid, amino benzoic acid (including anthranilic acid), phthalic acid, fumaric acid, trimellitic acid, gallic acid, and hexahydropthalic acid, as well as salts and derivatives of the foregoing.

Examples of amino acid-based chelating agents include glycine, serine, alanine, lysine, cystine, cysteine, ethionine, tyrosine, and methionine, as well as salts and derivatives thereof.

Examples of ether carboxylic acid salts include carboxymethyltartrate, carboxymethyloxysuccinate, oxydisuccinate, tartaric acid monosuccinate, and tartaric acid disuccinate, as well as salts and derivatives thereof.

Examples of phosphonic acid-based chelating agents include iminomethyl phosphonate, alkyl phosphonates, and 1-hydroxyethane-1,1-diphosphonic acid, as well as salts and derivatives thereof.

Examples of hydroxy carboxylic acid-based chelating agents include malic acid, citric acid, glyceric acid, gluconic acid, peptonic acid, tartaric acid, and lactic acid, as well as salts and derivatives thereof.

Examples of polymer electrolyte (including oligomer electrolyte)-based chelating agents include acryic acid polymers, maleic anhydride polymers, α-hydroxycarboxylic polymers, itaconic acid polymers, copolymers comprising two or more types of constituent monomers of the foregoing polymers, as well as epoxysuccinic acid polymers.

Examples of polyalcohols include pyrocatechol, pyrogallol, bisphenol, and tannic acid, and derivatives thereof.

The above-described chelating agents may be used singly or in combinations of two or more types.

A preferred chelating agent among the above-described chelating agents is a chelating agent that dissolves during the production of the degreasing composition but does not readily precipitate during storage. Examples of such preferred chelating agents include EDTA. Herein, EDTA has low solubility (about 0.05 g/100 ml or less) in water at the liquid temperature (up to about 50° C.) during production of the degreasing composition. Therefore, the amount of dissolution in the degreasing composition is low even in the production state, and most EDTA is present in a dispersed state in the degreasing composition. Accordingly, the precipitation amount of EDTA is small, even upon cooling during storage, and hence EDTA does not readily cause to form clumpy crystals.

Preferably, the chelating agent has low solubility and is dispersed in the degreasing composition, in view of the following considerations. The chelating agent dispersed in the degreasing composition interacts (by way of hydrogen bonds and the like) with water, as the medium. As a result, the chelating agent causes surrounding water to gently bind to the chelating agent. This bound water does not readily interact with components other than water in the degreasing composition. As a result, there is reduced the amount of water that functions as a solvent that dissolves the silicate in the degreasing composition. Therefore, dispersing a low-solubility chelating agent into the degreasing composition results in a lower amount of dissolution of the silicate in the degreasing composition. This has the effect of reducing the amount of silicate that, although dissolved in the production stage, crystallizes during low-temperature storage, and contributes therefore to enhancing the stability of properties of the degreasing composition during storage (this function is referred to hereafter as “crystallization suppressing function”). Also, the viscosity of the liquid phase in the degreasing composition increases due to the water which is gently bound to solid particles (chelating agent). As a result, the dispersant such as silicate particles and chelating agent in the degreasing composition does not readily sediment, and solid-liquid phase separation does not readily occur (this function is referred to hereafter as “solid-liquid phase separation suppressing function”).

The content of the chelating agent is not particularly limited. When the content of chelating agent is excessive, however, the content of other components in the obtained degreasing composition becomes relatively lower. This may result in a lower dilution rate during preparation of the cleaning liquid and in lower cleaning capability of the cleaning liquid. Therefore, the content of chelating agent is preferably 50 mass % or less with respect to the total composition. When the content of chelating agent is excessively low, the above-described crystallization suppressing function and solid-liquid phase separation suppressing function elicited by the dispersed chelating agent become difficult to bring out. Therefore, the content of chelating agent is 5 mass % or more in a case in which the chelating agent is present but a lower
alcohol described below is not contained. A preferred content of chelating agent ranges in this case from 10 mass % to 40 mass %.

[0067] (4) Lower Alcohol

[0068] In a case where the chelating agent is not present, or in a case where the chelating agent is present at a content greater than 0.0 mass % but smaller than 5 mass %, the above-described crystallization suppressing function and solid-liquid phase separation suppressing function are not readily elicited (instances referred collectively to hereafter as "content of chelating agent smaller than 5 mass %"). In these cases, the degreasing composition according to the present invention comprises 0.1 mass % or more of an alcohol having three or fewer carbon atoms (referred to in the present invention as "lower alcohol").

[0069] The lower alcohol dissolves in water which is the medium and thereby lowers the freezing point of the solutes such as the silicate. Crystallization during low-temperature storage is suppressed as a result. As in the case of the chelating agent, due to interactions with water, the amount of medium that acts as a solvent of the silicate is reduced and the viscosity of the medium is increased. Also, mixing with the water that constitutes the medium has the effect of increasing the specific gravity of the liquid phase, and reducing the specific gravity difference with respect to the solid phase. This contributes to suppressing solid-liquid phase separation.

[0070] (5) Surfactant

[0071] If a lower alcohol is present in any of the foregoing instances, then the upper limit of the content thereof is preferably set to 5 mass % or less, in terms of securing stability of the degreasing composition and securing detergency in the cleaning liquid. If the content of chelating agent is smaller than 5 mass %, a particularly preferred content of the lower alcohol is 2 mass % or greater. If the content of chelating agent is 5 mass % or greater, a particularly preferred content of the lower alcohol is 0.1 mass % or greater.

[0072] The number and substitution position of hydroxyl groups in the lower alcohol is not limited, so long as the number of carbon atoms is three or fewer. Specific examples of the lower alcohol include, methanol, ethanol, ethylene glycol, propylene glycol, polyethylene glycol, hydroxyl groups are present as a plurality thereof, since this contributes to greater interaction with water and further stabilization of properties during storage.

[0073] (5) Surfactant

[0074] The degreasing composition according to the present invention may further comprise a surfactant, in addition to the above-described components. The type of surfactant is not limited. Specific examples of surfactants include anionic surfactants, cationic surfactants, nonionic surfactants, amphoteric surfactants, semi-polar surfactants and the like.

[0075] Concrete examples of anionic surfactants include polyoxyethylene alkyl sulfates, alkyl or alkyl-crown sulfates, polycrylate ethers, glycol ethers, glycerol ethers, and polyglycerol ethers. Alkyl groups are present as a plurality thereof, since this contributes to greater interaction with water and further stabilization of properties during storage.

[0076] Concrete examples of cationic surfactants include di-long-chain alkyl dimethyl quaternary ammonium salts, long-chain alkyl dimethyl quaternary ammonium salts, alkylamine hydrochloride, and quaternary ammonium salts.

[0077] Concrete examples of nonionic surfactants include polyoxyalkylene alkyl ethers, fatty acid alkyl amides, polyoxyethylene sorbitan esters, sorbitan esters, sorbitol esters, sucrose fatty acid esters, methyl glucoside esters, methyl mannoside esters, ethyl glucoside esters, N-methyl glucamides, cyclic N-methyl glucamides, alkyl glucosides, alkyl polyglycosides, alkyl glyceryl ether, polyoxyethylene alkyl ethers, sorbitan fatty acid esters, polyoxyethylene acyl esters, fatty acid glycoside esters, fatty acid alkyl glycoside esters, and alkyl methyl glucamides.

[0078] Concrete examples of amphoteric surfactants include carboxy betaine, amino carboxylic acid salts, alkyl sulfobetaines, hydroxyalkyl sulfobetaines, alkyl imidazolium betaines, alkyl betaines, and alkyl amidopropyl betaines.

[0079] Concrete examples of semi-polar surfactants include alkylamine oxides, alkylamidooamine oxides, and alkylhydroxyamine oxides.

[0080] Preferred surfactants among the foregoing are anionic surfactants, nonionic surfactants and amphoteric surfactants. Specific examples of preferred surfactants include sodium alkyl ether sulfate esters, sodium alkyl benzene sulfonate, polyoxyethylene alkyl ethers, coconut fatty acid alkylamidamides, and fatty acid amide propyl betaines.

[0081] In the present invention, the above-described surfactants may be used singly or in arbitrary combinations of two or more types.

[0082] The concentration of surfactant to be added is affected by other components in the degreasing composition, by the object to be cleaned and by the degree of soiling. Therefore, the concentration of the surfactant is appropriately set in consideration of the foregoing influences. Preferably, the content of surfactant is 30 mass % or less with respect to the total composition, since in this case the likelihood of impairment of the functionality of the degreasing composition is particularly low. More preferably, the content of surfactant is 20 mass % or less.

[0083] (6) Liquid Medium

[0084] The liquid that constitutes the medium of the degreasing composition according to the present invention is water. However, the liquid may also contain a polar organic liquid substance such as an alcohol and a ketone. In terms of the stability of the degreasing composition, the concentration of such a polar organic liquid substance is preferably about 5 mass % or less with respect to water.

[0085] (7) Other Components

[0086] Other components may be further blended, in addition to the above-described components, to produce the degreasing composition according to the present invention. The type and content of the components is not particularly limited so long as the expected effect of the degreasing composition according to the present invention is elicited. Specific examples of such other components include zeolites as metal scavengers.

[0087] A dispersant such as the one disclosed in Patent document 1 may be blended to produce the degreasing composition according to the present invention. In that case, sedimentation of the dispersed silicate is yet unlikely. However, the environmental impact of the cleaning liquid increases if an organic material having a high molecular weight is used as
the dispersant, as described above. Preferably, therefore, there is blended no dispersant that comprises an organic material of high molecular weight.

[0088] 2. Method for Producing a Degreasing Composition

[0089] To obtain the degreasing composition, the above-described powdery silicate is mixed with a liquid for mixing that contains an alkaline component and water, and also, as the case may require, a chelating agent and/or a lower alcohol.

[0090] The liquid for mixing can be classified into the following four types:

[0091] 1. a first liquid containing the alkaline component, water, and the lower alcohol;

[0092] 2. a second liquid containing the alkaline component, water, the lower alcohol, and the chelating agent, wherein the content of chelating agent exceeds 0.0 mass % but is smaller than 5 mass % with respect to the degreasing composition;

[0093] 3. a third liquid containing the alkaline component, water, the lower alcohol, and the chelating agent, wherein the content of the chelating agent ranges from 5 mass % to 50 mass % with respect to the degreasing composition; and

[0094] 4. a fourth liquid, containing the alkaline component, water, and the chelating agent.

[0095] Herein, the term “liquid” in the liquid for mixing denotes a solution or a slurry.

[0096] As described above, the feature of mixing the powdery silicate with any of the liquids for mixing refers herein to eliciting interactions (specifically, dissolution, hydrogen bonding and the like) between water and the alkaline component, and the lower alcohol and the chelating agent, which are added as the case may require, ahead of the interaction between the powdery silicate and water. Adjusting thus the liquid for mixing allows reducing as much as possible the amount of water that can interact with the powdery silicate. As a result, there is reduced the amount of dissolution of the silicate in the liquid phase of the liquids, so that clumpy crystals do not readily form during low-temperature storage.

[0097] Further, the liquid for mixing that is mixed with the silicate interacts sufficiently with the solutes and/or dispersed materials and with water as the medium. Viscosity becomes higher thereby. As a result, sedimentation of silicate particles dispersed in the liquid phase becomes less likely in the slurry obtained through mixing of the powdery silicate. Accordingly, solid-liquid phase separation is less likely as compared with an instance in which the powdery silicate is mixed ahead of other blend components.

[0098] Also, the powdery silicate is blended after dissolution of the alkaline component, which is the component that releases the greatest heat of solution. The temperature of the slurry containing the silicate particles can be controlled more easily thereby. When the alkaline component is added to the slurry, there is a risk such that the temperature of the slurry excessively rises. This may result in a higher amount of dissolution of silicate in the slurry after addition of the alkaline component. When the amount of dissolution of the silicate contained in the slurry in the production process is excessive, the degreasing composition obtained from the slurry is very likely to become supersaturated during low-temperature storage. Preferably, the temperature of the liquid for mixing at the time of addition of the silicate is not higher than 35° C., in terms of reducing as much as possible the amount of dissolution of the silicate during the production process.

[0099] The order of addition of the components during preparation of the liquid for mixing is not particularly limited. In terms of ease of operation and securing safety, it is preferable to add the alkaline component to a reactor where water is held, and adding then other components once the rise in temperature derived from the resulting heat of solution can be controlled stably.

[0100] The timing of addition of the other components, such as surfactants, is not particularly limited. Preferably, the other components are added to the above-described liquid for mixing prior to addition of the powdery silicate to the liquid for mixing, considering that the amount of medium capable of dissolving the silicate, in a liquid to which the powdery silicate is added, is preferably small; that the viscosity of the liquid is preferably high, in terms of suppressing solid-liquid phase separation; and that it is preferable for the temperature of a liquid containing the powdery silicate not to be excessively high in the production process of the degreasing composition.

[0101] 3. Cleaning Liquid

[0102] A cleaning liquid can be obtained by mixing the degreasing composition according to the present invention with a solvent such as water. The degreasing composition according to the present invention may be used as a supplementing agent for maintaining the function of the cleaning liquid.

[0103] The addition amount of alkali metal in the degreasing composition and the replenishment amount of the degreasing composition may be appropriately set in accordance with the object to be cleaned.

[0104] The silicate dispersed as solid silicate particles in the degreasing composition becomes substantially dissolved in the cleaning liquid. As a result, there is obtained a cleaning liquid containing the silicate at a higher concentration than in a cleaning liquid that is obtained from a degreasing composition in a solution state. The content of silicate in the cleaning liquid ranges preferably from 1 to 20 g/L, more preferably from 2 to 15 g/L.

[0105] The cleaning method is arbitrary. The object to be cleaned may be immersed in the cleaning liquid, or alternatively, the cleaning liquid may be blown onto the object to be cleaned, by spraying or the like. The temperature of the cleaning liquid and the cleaning time may be appropriately set. The cleaning efficiency may be increased by resorting to physical means, for instance stirring of the cleaning liquid, swinging of the object to be cleaned, or application of an ultrasonic impact to the object to be cleaned.

[0106] 4. Object to be Cleaned

[0107] The material and shape of the object to be cleaned that is cleaned using the cleaning liquid according to the present invention are not particularly limited. Ordinarily, the material comprises a metal on the surface thereof. The shape may be, for instance, a flat shape, as in a steel sheet, or may be a shape resulting from secondary processing (herein, secondary processing denotes all processing methods defined in JIS B 0122, such as plastic working, and mechanical working). Specific examples of secondary-processing products include fastening parts such as screws and bolts, press-molded parts and forgings. The size of the parts is arbitrary, and may be a large size, as in construction materials, or a small size, such as that of parts used in clocks. The items in which such secondary-processing products are used are not particularly limited, and examples of the items include transportation equipment such as automobiles and ships, as well as home appliances, building parts, and electric and electronic equipment.
EXAMPLES

Example 1

[0108] 1. Production of Degreasing Composition

[0109] Degreasing compositions were produced through blending of the various components shown in Table 1.

[0110] Specifically, sodium hydroxide and potassium hydroxide were added to a reaction vessel holding water, while stirring the liquid. Next, EDTA was added while ensuring that the liquid temperature did not rise beyond 50°C. Once it was checked that the obtained liquid was at 35°C or below, there was further added sodium metasilicate pentahydrate having a specific particle diameter distribution. This addition was performed while ensuring that the liquid temperature did not rise beyond 35°C.

[0111] As a result there was obtained a liquid composition (degreasing composition 1) in which the sodium silicate fraction was totally dissolved, in the case of the blend of test number 1. By contrast, there was obtained a slurry (degreasing composition 2) in which the sodium silicate fraction remained in a solid state, in the case of the blend of test number 2. The obtained degreasing compositions were both at 35°C or below.

<table>
<thead>
<tr>
<th>TABLE 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test number</td>
</tr>
<tr>
<td>Sodium hydroxide</td>
</tr>
<tr>
<td>Potassium hydroxide</td>
</tr>
<tr>
<td>Sodium metasilicate pentahydrate (particle diameter: 0.1 mm)</td>
</tr>
<tr>
<td>Sodium metasilicate pentahydrate (particle diameter: 0.5 to 1 mm)</td>
</tr>
<tr>
<td>EDTA</td>
</tr>
<tr>
<td>Water</td>
</tr>
</tbody>
</table>

[0112] The sodium metasilicate pentahydrate having a particle diameter of 0.1 mm in Table 1 denotes a component of a sodium metasilicate pentahydrate powder that, when sifted, passes through a stainless steel sieve having an opening of 212 μm, manufactured by Sampo Co., Ltd.

[0113] The sodium metasilicate pentahydrate having a particle diameter of 0.5 to 1 mm in Table 1 denotes a component of a sodium metasilicate pentahydrate powder (Dorai Metakeiso 5aq, by Koei Chemical Industry Co., Ltd.) that, when sifted, does not pass through a stainless steel sieve having an opening of 500 μm, manufactured by Sampo Co., Ltd.

[0114] 2. Evaluation

[0115] Containers holding the obtained degreasing compositions 1 and 2 were left to stand for 24 hours in a thermostatic bath at -2°C. Thereafter, the degreasing compositions in the containers were observed, and the state thereof, in terms of fluidity and degree of crystallization, was evaluated through comparison with the state immediately after production.

[0116] The results showed that in the degreasing composition 1 numerous clumpy crystals had formed, and hence the degreasing composition 1 could not be used as a starting material composition for preparing a detergent. By contrast, the degreasing composition 2, which was also in the form of a slurry as was the case immediately after production, exhibited no conspicuous crystal growth, nor increase in viscosity.

Example 2

[0117] Degreasing compositions were produced through blending of the various components shown in Tables 2 to 5. The blending amount of the components in Tables 2 to 5, i.e. the units of the numerical values that denote the content in the degreasing composition, are parts by weight.

[0118] Specifically, sodium hydroxide and potassium hydroxide are added to a reaction vessel that holds water, while stirring the liquid. In cases in which EDTA was incorporated, EDTA was added while ensuring that the liquid temperature did not rise beyond 50°C. In cases in which glycerin was incorporated, glycerin was added next while ensuring that the liquid temperature did not rise beyond 50°C. In cases in which the degreasing composition contained a surfactant (in the present example, polyoxyethylene polyoxypropylene trihydroxethyl ether), the surfactant was added at a stage after addition of glycerin. Once it was checked that the obtained liquid was at 35°C or less, there was further added the sodium metasilicate pentahydrate having a particle diameter of 0.5 to 1 mm, used in Example 1. This addition was performed while ensuring that the liquid temperature did not rise beyond 35°C.

[0119] In all instances, the obtained degreasing compositions were slurry-like compositions having the sodium metasilicate dispersed therein, and also EDTA dispersed therein, in cases in which EDTA was added.

<table>
<thead>
<tr>
<th>TABLE 2</th>
</tr>
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<tbody>
<tr>
<td>Component</td>
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<tr>
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</tr>
<tr>
<td>Alkaline Component</td>
</tr>
<tr>
<td>Sodium hydroxide</td>
</tr>
<tr>
<td>Potassium hydroxide</td>
</tr>
<tr>
<td>EDTA</td>
</tr>
<tr>
<td>Chelating agent</td>
</tr>
<tr>
<td>State of the composition after storage in a low temperature condition</td>
</tr>
<tr>
<td>Component</td>
</tr>
<tr>
<td>--------------------</td>
</tr>
<tr>
<td><strong>Alkaline Component</strong></td>
</tr>
<tr>
<td>Water</td>
</tr>
<tr>
<td>Sodium hydroxide</td>
</tr>
<tr>
<td>Potassium hydroxide</td>
</tr>
<tr>
<td><strong>Chelating agent</strong></td>
</tr>
<tr>
<td>EDTA</td>
</tr>
<tr>
<td><strong>Lower alcohol</strong></td>
</tr>
<tr>
<td>Glycerin</td>
</tr>
<tr>
<td><strong>Silicate</strong></td>
</tr>
<tr>
<td>Sodium metasilicate pentahydrate</td>
</tr>
</tbody>
</table>

State of the composition after storage in a low temperature condition: No phase separation, no clumpy crystallization.

<table>
<thead>
<tr>
<th>Component</th>
<th>Blend order</th>
<th>3-1</th>
<th>3-2</th>
<th>3-3</th>
<th>3-4</th>
<th>3-5</th>
<th>3-6</th>
</tr>
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<tbody>
<tr>
<td><strong>Alkaline Component</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water</td>
<td>1st</td>
<td>339.5</td>
<td>339</td>
<td>338</td>
<td>335</td>
<td>330</td>
<td>320</td>
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<tr>
<td>Sodium hydroxide</td>
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<td>120</td>
<td>120</td>
<td>120</td>
<td>120</td>
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<tr>
<td>Potassium hydroxide</td>
<td>3rd</td>
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<tr>
<td><strong>Lower alcohol</strong></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Glycerin</td>
<td>4th</td>
<td>0.5</td>
<td>1</td>
<td>2</td>
<td>5</td>
<td>10</td>
<td>20</td>
</tr>
<tr>
<td><strong>Silicate</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sodium metasilicate pentahydrate</td>
<td>5th</td>
<td>120</td>
<td>120</td>
<td>120</td>
<td>120</td>
<td>120</td>
<td>120</td>
</tr>
</tbody>
</table>

State of the composition after storage in a low temperature condition: No phase separation, no clumpy crystallization.

<table>
<thead>
<tr>
<th>Component</th>
<th>Blend order</th>
<th>4-1</th>
<th>4-2</th>
<th>4-3</th>
<th>4-4</th>
<th>4-5</th>
<th>4-6</th>
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<tbody>
<tr>
<td><strong>Alkaline Component</strong></td>
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<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water</td>
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<td>207</td>
<td>196</td>
<td>184</td>
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<tr>
<td>Sodium hydroxide</td>
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<td>437</td>
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<td>393</td>
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<tr>
<td>Potassium hydroxide</td>
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<td>65</td>
<td>61</td>
<td>58</td>
<td>54</td>
<td>51</td>
<td>48</td>
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<tr>
<td><strong>Chelating agent</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EDTA</td>
<td>4th</td>
<td>28</td>
<td>27</td>
<td>25</td>
<td>24</td>
<td>22</td>
<td>21</td>
<td>20</td>
</tr>
<tr>
<td><strong>Lower alcohol</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Glycerin</td>
<td>5th</td>
<td>18</td>
<td>17</td>
<td>17</td>
<td>15</td>
<td>14</td>
<td>14</td>
<td>13</td>
</tr>
<tr>
<td><strong>Surfactant</strong></td>
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<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Poloxymethylene polyoxypolyethylene tridecyl ether</td>
<td>6th</td>
<td>0</td>
<td>50</td>
<td>100</td>
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<td>200</td>
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<tr>
<td><strong>Silicate</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sodium metasilicate pentahydrate</td>
<td>7th</td>
<td>203</td>
<td>192</td>
<td>183</td>
<td>172</td>
<td>163</td>
<td>151</td>
<td>141</td>
</tr>
</tbody>
</table>

State of the composition after storage in a low temperature condition: No phase separation, no clumpy crystallization.
2. Evaluation Containers holding the obtained degreasing compositions 1-1 to 3-6 were left to stand for 24 hours in a thermostatic bath at \(-2^\circ\) C. Thereafter, the degreasing compositions in the containers were inspected visually to evaluate the degreasing compositions in terms of occurrence of solid-liquid phase separation and presence or absence of crystallization.

The evaluation results are given in Tables 2 to 5.

1. A degreasing composition production method being a method for producing a degreasing composition in the form of a slurry for preparing a cleaning liquid, the method comprising:

a step of obtaining a slurry by mixing a first liquid and a powdery silicate having a particle diameter ranging from 0.2 mm to 10 mm, wherein the first liquid contains an alkaline component composed of at least one of sodium hydroxide and potassium hydroxide, an alcohol having three or fewer carbon atoms, and water, and the degreasing composition contains, with respect to the total composition, 10 mass % to 60 mass % of the alkaline component, 0.1 mass % to 5 mass % of the alcohol, 1 mass % to 50 mass % of the silicate, and 20 mass % to 50 mass % of water including hydration water of the silicate, and contains no chelating agent.

2. A degreasing composition production method being a method for producing a degreasing composition in the form of a slurry for preparing a cleaning liquid, the method comprising:

a step of obtaining a slurry by mixing a second liquid and a powdery silicate having a particle diameter ranging from 0.2 mm to 10 mm, wherein the second liquid contains an alkaline component composed of at least one of sodium hydroxide and potassium hydroxide, an alcohol having three or fewer carbon atoms, a chelating agent, and water, and the degreasing composition contains, with respect to the total composition, 10 mass % to 60 mass % of the alkaline component, 0.1 mass % to 5 mass % of the alcohol, 1 mass % to 50 mass % of the silicate, more than 0.0 mass % but less than 5 mass % of the chelating agent, and 20 mass % to 50 mass % of water including hydration water of the silicate.

3. A degreasing composition production method being a method for producing a degreasing composition in the form of a slurry for preparing a cleaning liquid, the method comprising:

a step of obtaining a slurry by mixing a third liquid and a powdery silicate having a particle diameter ranging from 0.2 mm to 10 mm, wherein the third liquid contains an alkaline component composed of at least one of sodium hydroxide and potassium hydroxide, an alcohol having three or fewer carbon atoms, a chelating agent, and water, and the degreasing composition contains, with respect to the total composition, 10 mass % to 60 mass % of the alkaline component, more than 0.0 mass % up to 5 mass % of the alcohol, 1 mass % to 50 mass % of the silicate, 5 mass % to 50 mass % of the chelating agent, and 20 mass % to 50 mass % of water including hydration water of the silicate.

4. A degreasing composition production method being a method for producing a degreasing composition in the form of a slurry for preparing a cleaning liquid, the method comprising:

a step of obtaining a slurry by mixing a fourth liquid and a powdery silicate having a particle diameter ranging from 0.2 mm to 10 mm, wherein the fourth liquid contains an alkaline component composed of at least one of sodium hydroxide and potassium hydroxide, a chelating agent, and water, and the degreasing composition contains, with respect to the total composition, 10 mass % to 60 mass % of the alkaline component, 1 mass % to 50 mass % of the silicate, 5 mass % to 50 mass % of the chelating agent, and 20 mass % to 50 mass % of water including hydration water of the silicate, and contains no alcohol having three or fewer carbon atoms.

5. The degreasing composition production method according to claim 2, wherein the chelating agent is EDTA.

6. The degreasing composition production method according to claim 1, wherein the temperature of the liquid that is mixed with the powdery silicate is not higher than 35\(^\circ\) C. at the time when the silicate is added.

7. The degreasing composition production method according to claim 1, wherein the degreasing composition contains 30 mass % or less of a surfactant with respect to the total composition.

8. A degreasing composition for preparing a cleaning liquid, containing: with respect to the total composition, 10 mass % to 60 mass % of an alkaline component composed of at least one of sodium hydroxide and potassium hydroxide; 0.1 mass % to 5 mass % of an alcohol having three or fewer carbon atoms; 1 mass % to 50 mass % of a silicate; and 20 mass % to 50 mass % of water including hydration water of the silicate, and containing no chelating agent, the degreasing composition being a slurry in which at least part of the silicate is dispersed in the form of silicate particles having a particle diameter no greater than 10 mm, wherein no clumpy crystals form even when the degreasing composition is left to stand in an environment at \(-2^\circ\) C. for 24 hours.

9. A degreasing composition for preparing a cleaning liquid, containing: with respect to the total composition, 10 mass % to 60 mass % of an alkaline component composed of at least one of sodium hydroxide and potassium hydroxide; 0.1 mass % to 5 mass % of an alcohol having three or fewer carbon atoms; 1 mass % to 50 mass % of a silicate; more than 0.0 mass % but less than 5 mass % of a chelating agent; and 20 mass % to 50 mass % of water including hydration water of the silicate, the degreasing composition being a slurry in which at least part of the silicate is dispersed in the form of silicate particles having a particle diameter no greater than 10 mm, wherein no clumpy crystals form even when the degreasing composition is left to stand in an environment at \(-2^\circ\) C. for 24 hours.

10. A degreasing composition for preparing a cleaning liquid, containing: with respect to the total composition, 10 mass % to 60 mass % of an alkaline component composed of at least one of sodium hydroxide and potassium hydroxide; more than 0.0 mass % up to 5 mass % of an alcohol having three or fewer carbon atoms; 1 mass % to 50 mass % of a silicate; 5 mass % to 50 mass % of a chelating agent; and 20 mass % to 50 mass % of water including hydration water of the silicate, the degreasing composition being a slurry in which at least part of the silicate is dispersed in the form of
silicate particles having a particle diameter no greater than 10 mm, wherein no clumpy crystals form even when the degreasing composition is left to stand in an environment at –2°C for 24 hours.

11. A degreasing composition for preparing a cleaning liquid, containing: with respect to the total composition, 10 mass % to 60 mass % of an alkaline component composed of at least one of sodium hydroxide and potassium hydroxide; 1 mass % to 50 mass % of a silicate; 5 mass % to 50 mass % of a chelating agent; and 20 mass % to 50 mass % of water including hydration water of the silicate, and containing no alcohol having three or fewer carbon atoms, the degreasing composition being a slurry in which at least part of the silicate is dispersed in the form of silicate particles having a particle diameter no greater than 10 mm, wherein no clumpy crystals form even when the degreasing composition is left to stand in an environment at –2°C for 24 hours.

12. The degreasing composition according to claim 9, wherein the chelating agent is EDTA, and at least part thereof is dispersed in the slurry.

13. The degreasing composition according to claim 8, containing 30 mass % or less of a surfactant with respect to the total composition.

14. The degreasing composition production method according to claim 3, wherein the chelating agent is EDTA.

15. The degreasing composition production method according to claim 4, wherein the chelating agent is EDTA.

16. The degreasing composition production method according to claim 2, wherein the temperature of the liquid that is mixed with the powdery silicate is not higher than 35°C at the time when the silicate is added.

17. The degreasing composition production method according to claim 3, wherein the temperature of the liquid that is mixed with the powdery silicate is not higher than 35°C at the time when the silicate is added.

18. The degreasing composition production method according to claim 4, wherein the temperature of the liquid that is mixed with the powdery silicate is not higher than 35°C at the time when the silicate is added.

19. The degreasing composition production method according to claim 2, wherein the degreasing composition contains 30 mass % or less of a surfactant with respect to the total composition.

20. The degreasing composition production method according to claim 3, wherein the degreasing composition contains 30 mass % or less of a surfactant with respect to the total composition.

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