

D E S C R I P T I O N

Title of the Invention

GELATINOUS CLEANING AGENT FOR CONTACT LENSES

5

Cross-reference to Related Application

[0001] The present application claims a benefit of priority from Japanese Patent Application No. 2010-223356, filed on October 1, 2010, the entire contents of which being incorporated herein by
10 reference.

Technical Field

[0002] The present invention relates to a gelled cleaning agent for contact lenses. More specifically, the present invention
15 relates to a gelled cleaning agent for contact lenses that is suitable not only for scrubbing off oily dirt deriving from biological bodies such as eye discharge, which adhere to a contact lens when the contact lens is put on, but also for scrubbing off oily dirt (cosmetic dirt) deriving from cosmetics such as eye makeup
20 products that adhere to the contact lens.

Background Art

[0003] In general, contact lenses are categorized into the following: non-hydrous contact lenses and hydrous contact lenses.
25 For the non-hydrous contact lenses, with the aim of improving oxygen permeability, silicone-based materials are generally used for structural components of lens materials. However, in recent years, even for the hydrous contact lenses, in view of the safety of eyes, silicone-based materials having higher levels of oxygen

permeability have been used as the structural components. The surfaces of the contact lenses have a lipophilic property that is attributable to the silicone-based materials among the lens materials. Therefore, oily dirt tends to easily adhere to the
5 contact lenses due to the affinity.

[0004] The dirt adhering to the contact lenses put on eyes contains biological dirt, such as the proteins and lipids deriving from lacrimal fluids or eye discharges, as well as cosmetic dirt, which includes eye makeup products like eye shadow and mascara among other
10 things. If the contact lenses continue to be put on eyes with the dirt thereon, the water wettability of the lens surface resulting from lacrimal fluids would decrease, and then the lens surface become dry, resulting in a decrease in wearing sensation and causing disorders, such as being unable to obtain appropriately corrected
15 eyesight even in vision correction. Moreover, the dirt stuck or accumulated on the lens surface could be a hotbed for bacteria to breed, bringing about the risk of causing eye diseases. Moreover, the amount of oxygen supplied to the cornea may decrease, possibly having a harmful effect on the corneal cells. Given such a harmful
20 effect of oily dirt on contact lenses, it is desirable that the contact lenses be cleaned on regular basis and be kept clean.

[0005] As for conventional cleaning agents for contact lenses, there are those containing a surfactant or proteolytic enzyme. For example, as long as the cleaning agent is used for hydrous soft
25 contact lens (hereinafter referred to as "SCL"), there is a multipurpose solution which consists of only one type of liquid and enables the contact lenses to be cleaned, disinfected, maintained, and rinsed. Because of the convenience thereof, the multipurpose solution is widely used. However, in view of hygiene,

it is preferred that a cleaning agent should be distinguished from a disinfection, storage, or rinsing agents, and each of the agents should be used for each treatment as an individually dedicated solution. Furthermore, in order for the dirt adhering to the contact lenses to be removed efficiently and for the contact lenses to be employed more comfortably and safely, so-called "scrubbing," i.e. an operation of dropping a dedicated cleaning agent onto the contact lenses and then scrubbing the contact lenses with fingers, is quite effective. That is, if a contact lens cleaning agent suitable for scrubbing is used, the surfaces of the contact lenses can be kept cleaner.

[0006] Among the contact lens cleaning agents suitable for scrubbing is a cleaning agent containing an abrading agent as a cleaning component. For example, the following are available: a cleaning agent containing inorganic fine particles (See Patent Publication 1, or JP(KOKAI) H05-19217 A, the disclosures of which are incorporated herein by reference); and a cleaning agent containing beads such as those made of an organic polymer (See Patent Publication 2, or JP(KOHYO) 2004-511625, the disclosures of which are incorporated herein by reference). The inorganic or organic abrading agents contained in the above cleaning agents tend to separate, settle out or agglutinate, making it difficult to handle the cleaning agents. Furthermore, the lens surfaces can be damaged in some cases.

[0007] In the case of scrubbing the contact lenses by using a cleaning agent containing an abrading agent, a risk of adverse effect on the lens surfaces is apprehended due to the cleaning. Depending the condition of the surfaces of contact lenses to be cleaned, it may be even impossible to use a currently commercially

available cleaning agent that contains an abrading agent. More specifically, as for a contact lens to which hydrophilic properties and contamination resistance have been added by applying surface treatment, the effects of surface treatment may come off or be lost because of physical action of the abrading agent. Therefore, the use of a cleaning agent containing an abrading agent is not suitable.

[0008] Instead of a cleaning agent containing an abrading agent, as a cleaning agent suitable for scrubbing a contact lens to which surface treatment has been applied, the following is disclosed:

a gel cleaning agent that contains no abrading agent and uses a lower alcohol as a cleaning component (See Patent Publication 3, or JP(KOKAI) 2006-11418 A, the disclosures of which are incorporated herein by reference). The cleaning agent has an improved cleaning effect for oily dirt, including cosmetic dirt, because of the degreasing ability and solubilization ability of the lower alcohol.

Prior Art Publications

Patent Publications

[0009]

Patent Publication 1: JP(KOKAI) H05-19217 A

Patent Publication 2: Jpn(KOHO) 2004-511625 A

Patent Publication 3: JP(KOKAI) 2006-11418 A

Disclosure of the Invention

Problem to Be Solved by the Invention

[0010] The inventors of the present invention have focused on the following contact lenses: oxygen permeable hard contact lenses (also referred to as "RGPCl," hereinafter) and silicone hydrogel contact lenses (also referred to as "SHCL," hereinafter), the

surfaces of which have been modified or reformed through plasma surface reforming, graft polymerization or the like for the purpose of adding hydrophilic properties and resistance to contaminations associated with proteins and the like thereto. If such lenses are scrubbed with a cleaning agent containing an abrading agent such as those disclosed in Patent Publications 1 and 2, the effects of lens surface treatment would come off or be lost because of physical action of the abrading agent. Therefore, the use of such a cleaning agent is not suitable.

10 **[0011]** With the cleaning agent containing lower alcohol as described in Patent Publication 3, the above RGPCl or SHCL, whose lens surfaces have been modified or reformed, can be scrubbed, and oily dirt on the lens surfaces can be washed away. However, the cleaning agent as described in Patent Publication 3 has a risk of
15 adverse effect on the contact lens because of alcohol comprised as the cleaning component. Therefore, the possibility is high that the amount of alcohol contained is limited. Meanwhile, particularly in recent years, highly water-resistant waterproof cosmetics have been developed one after another. Given the above
20 developments, the cleaning agent as described in Patent Publication 3 may not be able to appropriately wash away severe cosmetic dirt, which may be caused by waterproof cosmetics that would be developed in the future adhere to the surfaces of contact lenses.

[0012] An object of the present invention is to provide a contact
25 lens cleaning agent that shows a higher cleaning effect on oily-component dirt adhering to the surfaces of contact lenses, particularly oily dirt (cosmetic dirt) caused by eye makeup products or the like adhering thereto, than a conventional contact lens cleaning agent that contains no abrading agent and is suitable for

scrubbing, and that is excellent at being handled. Another object of the present invention is to provide a contact lens cleaning agent having no adverse effect not only on the lens surfaces of a conventional RGPCL and SCL but also on the lens surfaces of RGPCL or SHCL whose lens surfaces have been reformed.

Means for Solving the Problem

[0013] As a result of intensive studies on a number of substances that can be used as cleaning components such as surfactants and organic solvents, the present inventors found that, if a contact lens is scrubbed with a cleaning agent containing a denatured silicone oil, or more specifically a polyether-denatured silicone oil whose denatured site has hydrophilicity (polysilicone-13; ABn-typed block copolymer of polydimethylsiloxane-polyalkylene oxide; or the like), the cleaning agent has no adverse effect on the lens surface and exerts a sufficient cleaning effect for, in particular, oily dirt. The present invention is one accomplished based on such findings.

[0014] Thus, according to the present invention, there is provided a gelled cleaning agent for contact lenses characterized by comprising at least a polyether-denatured silicone oil, a solubilizing agent, and a gelling agent.

[0015] Preferably, the gelled cleaning agent for contact lenses is characterized in that the polyether-denatured silicone oil is a polyalkylene oxide-denatured silicone.

[0016] Preferably, the gelled cleaning agent for contact lenses is characterized in that the polyether-denatured silicone oil is an ABn-typed block copolymer of polydimethylsiloxane-polyalkylene oxide; and the solubilizing agent is a lower alcohol and/or liquid

polyhydric alcohol.

[0017] Preferably, the gelled cleaning agent for contact lenses is characterized in that the polyalkylene oxide in the ABn-typed block copolymer of polydimethylsiloxane-polyalkylene oxide is
5 polyoxyethylene or poly(oxyethylene-oxypropylene) copolymer; the lower alcohol is ethyl alcohol, propyl alcohol, isopropyl alcohol, or benzyl alcohol; and the liquid polyhydric alcohol is at least one type of alcohol selected from a group consisting of ethylene glycol, propylene glycol, dipropylene glycol, 1,3-butanediol, and
10 glycerin.

[0018] Preferably, the gelled cleaning agent for contact lenses is characterized in that the amount of the polyether-denatured silicone oil comprised is between 0.05 and 0.50 w/w%.

15 Advantages of the Invention

[0019] The cleaning agent of the present invention contains a polyether-denatured silicone oil as a cleaning component, and therefore is highly effective in cleaning off oily dirt adhering to the surfaces of contact lenses regardless of whether the oily
20 dirt is derived from biological bodies or cosmetics compared with a conventional contact lens cleaning agent containing no abrading agent that is suitable for scrubbing. Moreover, since the cleaning agent of the present invention does not contain a component functioning as an abrading agent, the cleaning agent has only a
25 minimal impact on the surfaces of a contact lens whose surfaces have been treated by plasma surface reforming, graft polymerization or the like, while achieving an effective cleaning effect. Therefore, since the surface of a contact lens that is scrubbed with the cleaning agent of the present invention are expected to

keep clean, the water wettability of the lens surface can be maintained due to lacrimal fluid at the time of wearing the contact lens, resulting in preventing drying of the lens surface.

Therefore, the use of the cleaning agent of the present invention
5 can avoid the following and other troubles resulting from oily dirt on the surface of a contact lens: a decrease in wearing sensation of the contact lens, disabilities pertaining to vision correction, the risk of eye diseases, and a decrease in the amount of oxygen supplied to the cornea.

10 **[0020]** The dosage form of the contact lens cleaning agent of the present invention is gel so that the contact lens cleaning agent of the present invention is excellent in terms of the sense of touch at the time of scrubbing and can make the retentivity thereof on a contact lens high. Therefore, the contact lens cleaning agent
15 of the present invention has a more improved cleaning effect. Furthermore, the contact lens cleaning agent of the present invention is in the state of gel with a high viscosity so that there can be no dripping and even small amounts of the contact lens cleaning agent can sufficiently clean up the contact lens. As a
20 result, there can be an improvement in how easily the contact lens cleaning agent can be handled.

Modes for Carrying Out the Invention

[0021] According to the present invention, provided is a gelled
25 cleaning agent for contact lenses characterized by comprising a polyether-denatured silicone oil, a solubilizing agent, and a gelling agent.

[0022] The cleaning agent of the present invention, which comprises a polyether-denatured silicone oil as a cleaning component, has

an excellent cleaning effect particularly on cosmetic dirt that is attributable to high water-resistance cosmetics adhering to contact lenses, and is a gelled cleaning agent for scrubbing contact lenses.

5 **[0023]** Recent contact lenses tend to have a higher component proportion ratio of silicone-based materials among the ingredients thereof in order to improve the amount of oxygen supplied to the cornea. Since the surfaces of the lenses show hydrophobicity, oily dirt with high affinity can easily adhere thereto. Specifically,
10 as oily dirt, the following and other kinds of dirt can be included: an oily component contained in eye discharges in lacrimal fluid, cosmetics, or the like. In particular, cosmetic dirt can easily adhere to the lenses, and cannot be removed easily, thereby causing various problems. Cosmetics usually contain a wide variety of
15 silicone materials that are excellent in high water repellency, low irritant property, low toxicity and other properties. Therefore, the silicone materials in cosmetics have a high affinity with the surfaces of contact lenses comprised of the same silicone-based materials, allowing cosmetic dirt to firmly adhere
20 thereto and making it difficult to remove the dirt by washing. In particular, cosmetics such as eye makeup products have an improved water resistance (waterproof). Therefore, if a conventional cleaning agent is used for scrubbing off the dirt adhering to the lens surface, the dirt extends and spreads due to the affinity
25 between the cosmetic dirt and the hydrophobic lens surface. Not only can the dirt be removed, but the dirt would remain as an oil slick, thereby causing cloudiness on the lens surface or a decline in wearing sensation.

[0024] In order to remove the oily dirt that adheres to contact

lenses due to the affinity between the silicone material, which is one of the lens ingredients, and the oily component, the cleaning agent of the present invention comprises a denatured silicone oil that effectively acts upon the interface between the lens surfaces and the oily dirt as a cleaning component. The denatured silicone oil has a dimethylsiloxane bond as a main chain (silicone site), and has a structure in which a denatured site is introduced into a main chain (main-chain type) or side chain (side-chain type). A typical silicone oil, as represented by dimethicone, and a denatured silicone oil whose denatured site has hydrophobicity are water-insoluble. Therefore, it is difficult to blend the silicone oils into a contact lens cleaning agent that is basically made of a water solution. Moreover, even if emulsification by surfactants, or the like, enables the silicone oils to be comprised into the contact lens cleaning agent, the above silicone oils are not preferred because the silicone oils adhere to and remain on the lens surfaces as oily dirt. Thus, according to the present invention, a denatured silicone oil whose denatured site has hydrophilicity is employed. Such a hydrophilic denatured silicone oil is high in surface activity, and is expected to have an effect of removing cosmetic dirt in an effective manner as the denatured hydrophilic site separates the cosmetic dirt solubilized by the hydrophobic silicone site from the lens surfaces.

[0025] In the cleaning agent of the present invention, for the denatured silicone oil whose denatured site has hydrophilicity, polyether-denatured silicone oils are used that are referred to as: polyalkylene oxide modified siloxane, polyalkylene oxide modified polydimethylsiloxane, dimethylsiloxane-alkylene oxide copolymer, and polydimethylsiloxane-polyalkylene oxide block

copolymer. The hydrophilicity of the above compounds increases in proportion to the proportion of alkylene oxide in mean molecular weight, i.e. the content ratio (occupancy rate) of the polyether site. However, as the solubility thereof in water improves, the lipophilicity decreases. Therefore, there can be a possibility that a sufficient cleaning effect on oily dirt cannot be obtained. That is, the balance of hydrophilicity/hydrophobicity in the molecules of denatured silicone oil may have an impact on the cleaning effect for oily dirt. For example, when the occupancy rate of the polyether site is high and the silicone site is low in molecular weight as in polyalkylene oxide modified siloxane, the cleaning effect on oily dirt tends to become smaller because of low lipophilicity. In order to be effective in cleaning off the oily dirt deriving from cosmetics, particularly the oily dirt resulting from high water-resistance cosmetics, it is desirable that the polyether-denatured silicone employed develop a moderate level of lipophilicity. In order to develop such a moderate level of lipophilicity, it is preferred that the polyether-denatured silicone have a sufficient amount of hydrophobic groups (lipophilic groups) in the molecules. Accordingly, in preparing the cleaning agent of the present invention, the following are taken into consideration to appropriately select a polyether-denatured silicone oil that should be comprised: the molecular weight and occupancy rate of the silicone site, the balance of hydrophilicity/hydrophobicity, the structure of the entire molecules. A preferred polyether-denatured silicone oil comprised into the cleaning agent of the present invention is a polyalkylene oxide-denatured silicone.

[0026] The molecular structures of polyether-denatured silicone

oil are largely categorized into the following types: a main-chain type, in which case a denatured site is introduced into a main chain; a side-chain type, in which case a denatured site is introduced into a side chain; and a side-chain both-end type, in which case
5 a denatured site is introduced into both a main chain (both ends) and a side chain. As for the main-chain type, there are the following types: a one-end type, in which case a denatured site is introduced into one end of a main chain; a both-end type, in which case a denatured site is introduced into both ends of a main
10 chain; and an ABn-typed block copolymer, in which case denatured sites are alternately introduced into a main chain. As for the above molecular structures, the one-end type, the both-end type, the side-chain type, and the side-chain both-end type have a structure in which a hydrophobic silicone site is at the center, and
15 hydrophilic denatured sites are bonded to the periphery (ends, side chains) thereof, so that the above types tend to indicate the orientation because of hydrophobic interaction. In the case wherein the hydrophobic silicone sites are oriented on the hydrophobic surface, the hydrophilic denatured sites can possibly
20 be oriented in a direction opposite to the hydrophobic surface at the same time. Thus, there is a possibility that the cleaning component may not act effectively on the interface between the lens surfaces and the oily dirt. Accordingly, for example, if PEG32-methyl ether dimethicone (Both-end type: KF-6004,
25 manufactured by Shin-Etsu Chemical Co., Ltd.), PEG10-dimethicone (Side-chain type: KF-6017, manufactured by Shin-Etsu Chemical Co., Ltd.), or the like is comprised as a cleaning component, the cleaning effect thereof becomes lower than the ABn-type even though the cleaning component has a silicone site suitable for solubilization

of oily dirt. In contrast, in the case of the ABn-typed block copolymer in which denatured sites are alternately introduced into the main chain, the ABn-typed block copolymer has a less oriented structure because the denatured sites exist on the same main chain.

5 Therefore, the silicone sites and the denatured sites each have an excellent effect on the interface between the lens surfaces and the oily dirt, making it possible to remove the oily dirt in an effective manner.

[0027] Therefore, a preferred polyether-denatured silicone oil
10 comprised into the cleaning agent of the present invention is a polyether-denatured silicone oil whose molecule structure is ABn-typed block copolymer in which silicone and polyether sites coexist alternately on the same main chain. A more preferred one is ABn-typed block copolymer of polydimethylsiloxane-polyalkylene
15 oxide. Preferred specific examples that are employed in the cleaning agent of the present invention can include polysilicone-13 (Polyether site: polyoxyethylene, or poly (oxyethylene-oxypropylene) copolymer). Polysilicone-13 can include FZ-2222, FZ-2231, FZ-2233, FZ-2250 or the like, manufactured by Dow Corning
20 Toray Co., Ltd, which may be used independently, or which may be used by combining two or more of the above.

[0028] The amount of polysilicone-13 comprised is, for example, within the range of 0.0005 to 5.0 w/w%. If the amount is less than 0.0005 w/w%, a sufficient cleaning effect cannot be obtained. If
25 the amount is greater than 5.0 w/w%, the sense of touch deteriorates significantly at the time of scrubbing. Therefore, the amount is preferably within the range of 0.001 to 1.00 w/w%, or particularly preferably in the range of 0.05 to 0.50 w/w%. Incidentally, the solubility of polysilicone-13 in water is low, while

polysilicone-13 is dissolved by a suitable solubilizing agent. That is, in the cleaning agent of the present invention, the solubilizing agent is comprised to dissolve a polyether-denatured silicone oil such as polysilicone-13.

5 **[0029]** As the solubilizing agent employed in the cleaning agent of the present invention, an amphiphilic solvent is preferably employed. Specifically, lower alcohols, liquid polyhydric alcohols, or the like can be included. Lower alcohols have a disinfective effect, and are generally used as cleaning agents or disinfectants.

10 Therefore, even in the present invention, lower alcohols can be expected to improve the cleaning effect and to provide preservative and disinfective effects. Liquid polyhydric alcohols also serve as osmotic adjustment agents, and can be expected to have a

15 moisturizing effect on fingers at the time of scrubbing. As a result, for the solubilizing agent of the cleaning agent of the present invention, a lower alcohol, a liquid polyhydric alcohol, or a combination of lower and liquid polyhydric alcohols is preferably employed.

[0030] The lower alcohol, for example, includes ethyl alcohol,

20 propyl alcohol, isopropyl alcohol, benzyl alcohol, and other lower alcohols. Examples of the liquid polyhydric alcohol, for example, include ethylene glycol, propylene glycol, dipropylene glycol, 1,3-butylene glycol, glycerin, and other liquid polyhydric alcohols, which may be employed independently, or which may be

25 employed by combining two or more of the above.

[0031] As a preferred example of the solubilizing agent of the present invention, when polysilicone-13 is employed as a polyether-denatured silicone oil, given the solubilization ability and safety thereof, isopropyl alcohol as lower alcohol and

1,3-butylene glycol as liquid polyhydric alcohol are employed independently or in combination, respectively.

[0032] The amount of the solubilizing agent comprised is determined based on the solubility of a polyether-denatured silicone oil such as polysilicone-13. Therefore, the amount of the solubilizing agent comprised is not specifically restricted as long as the polyether-denatured silicone oil can be solubilized. However, with the aim of maintaining the gel state of the cleaning agent, and given the impact of scrubbing on contact lenses, the safety of eyes, and the like, the amount of the solubilizing agent comprised may be limited. When the liquid polyhydric alcohol is employed as the solubilizing agent, both solubilization and osmotic adjustment may be achieved based on an identical component. In this case, however, the amount of the solubilizing agent comprised is limited to an amount by which the osmotic pressure is within a proper range. In view of the above, the amount of the solubilizing agent comprised is, for example, within the range of 1.0 to 60.0 w/w%. If the amount is less than 1.0 w/w%, the possibility is high that the solubilization of the polyether-denatured silicone oil is insufficient. If the amount is greater than 60.0 w/w%, it is assumed that not only it is difficult to form and maintain the gel state but the optical properties of contact lenses may deteriorate significantly. For example, if the amount of the solubilizing agent comprised is large, the lens materials become soft in the case of RGPCL, while in the case of hydrous SCL/SHCL, the lens materials swell with water, or contract and deform, or cause other troubles, and therefore have serious negative impact. Accordingly, large amounts of the solubilizing agent comprised are not preferred. In view of the above, according to the present invention, the amount

of the solubilizing agent comprised is preferably within the range of 0.5 to 30.0 w/w%, or particularly preferably within the range of 1.0 to 25.0 w/w%.

[0033] In order to make an improvement in handling of the cleaning agent of the present invention, which comprises the sense of touch at the time of scrubbing, the cleaning agent of the present invention comprises a gelling agent to be in the form of a gelled cleaning agent. Since the cleaning agent is in the state of gel, there is an improvement in the retentivity of the cleaning agent on contact lenses. Moreover, in this case, the sense of slip is also provided to the cleaning agent, making it easier to scrub the contact lens and resulting in an improvement in the cleaning effect. Moreover, there is no dripping during cleaning, and small amounts of the cleaning agent are enough to clean up the contact lens. As a result, there is an improvement in how easily the cleaning agent can be handled.

[0034] Examples of the gelling agents, for example, include the following and other substances: synthetic organic polymer compounds, such as carboxyvinyl polymer, poly (meth) acrylic acid, poly (meth) acrylic acid sodium, and (meth) acrylic acid alkyl copolymer; alginic acid derivatives, such as alginate sodium; gums, such as xanthan gum and guar gum; synthetic sodium magnesium silicate. Carboxyvinyl polymer and (meth) acrylic acid alkyl copolymer are preferably employed.

[0035] The amount of the gelling agent comprised is not specifically restricted as long as the amount is enough to make and maintain the state of gel in a stable manner. For example, the amount of the gelling agent comprised is about between 0.05 and 10.0 w/w%, or preferably about between 0.1 and 5.0 w/w%.

[0036] The cleaning agent of the present invention may comprises other surfactants, together with a polyether-denatured silicone oil, such as polysilicone-13, as cleaning components. When other surfactants are additionally comprised, it makes it easier to
5 evenly solubilize the polyether-denatured silicone oil and brings about an advantage that the amount of the solubilizing agent comprised, such as lower alcohol or liquid polyhydric alcohol, can be reduced.

[0037] The surfactants are not specifically restricted as long as
10 the state of gel can be kept in a stable manner. The following are all available: anionic surface active agents, cationic surface active agents, nonionic surface active agents, and amphoteric surface active agents. The above surface active agents can be combined appropriately before being used. Of all the surface
15 active agents, an anionic surface active agent, a nonionic surface active agent, or a combination of anionic and nonionic surface active agents is preferably employed.

[0038] Examples of the anionic surface active agents, for example, include alkyl sulfate, such as sodium lauryl sulfate and
20 triethanolamine lauryl sulfate; alkyl benzene sulfonate, such as sodium dodecylbenzenesulfonate and triethanolamine dodecylbenzenesulfonate; polyoxyethylene alkyl ether sulfate, such as sodium polyoxyethylene lauryl ether sulfate and triethanolamine polyoxyethylene lauryl ether sulfate; α -olefin
25 sulfonate sodium, such as α -olefin sulfonate sodium; alkyl phosphate, such as sodium lauryl phosphate and triethanolamine lauryl phosphate; polyoxyethylene alkyl ether phosphate, such as sodium polyoxyethylene lauryl ether phosphate and triethanolamine polyoxyethylene lauryl ether phosphate, and the like.

[0039] Examples of the nonionic surface active agents, for example, include polyoxyethylene alkyl ether, such as polyoxyethylene lauryl ether; polyoxyethylene alkyl phenyl ether, such as polyoxyethylene nonylphenyl ether; polyoxyethylene
5 polyoxypropylene alkyl ether, such as polyoxyethylene polyoxypropylene cetyl ether; alkylol amide, such as polyoxyethylene polyoxypropylene blockpolymer, coconut oil fatty acid diethanolamide, and lauric acid diethanolamide; polyoxyethyleneoxystearic acid triglyceride, such as
10 polyoxyethylene hydrogenated castor oil 60; polyoxyethylene sorbitan monooleate, such as polysorbate 80, and alkyl polyglucoside, and the like.

[0040] The amount and concentration of the surfactant comprised are not specifically restricted unless the amount has an adverse
15 effect on contact lens and the concentration irritates eyes. For example, the amount of the surfactant comprised is about between 0.05 w/w% and 20.0 w/w%, or preferably about between 0.1 w/w% and 5.0 w/w%. If the amount is less than 0.05 w/w%, the contribution thereof to the solubilization of a polyether-denatured silicone
20 oil such as polysilicone-13, as well as to the cleaning effect, may be insufficient. If the amount is greater than 20.0 w/w%, it may be difficult to keep the state of gel in some cases.

[0041] For the cleaning agent of the present invention, it is preferred that an osmotic adjustment agent is comprised at the time
25 when gelling is performed to adjust the osmotic pressure according to the properties of the lens used. When the cleaning agent of the present invention is used for hydrous SCL/SHCL, the adjustment of the osmotic pressure brings about effects of preventing components of the cleaning agent from being taken into the lens, as well as

of maintaining the shape of the lens. When a lower alcohol is employed as the solubilizing agent to give preservative and disinfective effects, the adjustment of the osmotic pressure has advantages that the amount of the lower alcohol, which may have
5 an adverse effect on the lens, can be kept lower, as well as the preservative and disinfective effects can be maintained.

[0042] As for the osmotic adjustment agent, for example, in addition to ionic osmotic adjustment agents that have long been known in terms of ophthalmology, such as sodium chloride, potassium
10 chloride, sodium sulfate, and sodium phosphate, the following and other nonionic osmotic adjustment agents can be included: propylene glycol; dipropylene glycol; 1, 3-butylene glycol; glycerin; amino acids, such as trimethylglycine, glycine, and alanine; sugar alcohols, such as xylitol and mannitol; saccharides, such as
15 monosaccharides like glucose and fructose, disaccharides like trehalose, and polysaccharides containing three or more sugars (which include cyclic polysaccharides such as cyclodextrin) . An osmotic adjustment agent can be appropriately selected from among the above for use. In terms of the easiness of viscosity control
20 at the time of gelling, a nonionic osmotic adjustment agent is preferred. Propylene glycol and trimethylglycine are particularly preferred. Propylene glycol and trimethylglycine are also known as moisturizing agents. They are expected to have not only an osmotic adjustment effect but also a moisturizing effect, and thus are
25 suitable because of having favorable effects on fingers at the time of scrubbing.

[0043] As for the amount of the osmotic adjustment agent comprised, the osmotic adjustment agent is comprised to the extent that the osmotic pressure of the entire gelled cleaning agent is for example

about between 290 and 2,000 mmol/kg, or preferably about between 500 and 1,500 mmol/kg. In view of the lens of hydrous SCL/SHCL that is usually so adjusted as to have an osmotic pressure of 290 mmol/kg, the amounts of the osmotic adjustment agent comprised that lead to an osmotic pressure of less than 290 mmol/kg are not preferred because the cleaning agent components are easily taken into the lenses. If the osmotic pressure is greater than 2,000 mmol/kg, the amount of water contained in the lens decreases at the time of scrubbing due to osmotic phenomenon, causing the lens to contract in diameter. After being cleaned, the contact lens is rinsed by and dipped for storage in a contact-lens preserving agent or the like, thereby absorbing water again and recovering to an original lens diameter. However, during the above process, the contact lens deforms significantly, resulting in giving stress to the contact lens repeatedly. Accordingly, the amounts of the osmotic adjustment agent comprised that lead to an osmotic pressure of more than 2,000 mmol/kg are not preferred because the amounts may cause a decrease in the strength of the contact lens, or other troubles.

[0044] The pH of the cleaning agent of the present invention is not specifically restricted. The pH of the cleaning agent of the present invention is, for example, about between 5 and 9, preferably between 6 and 8, which is appropriately adjusted by using a buffer agent, or taking other measures. If the pH is less than 5 or greater than 9, there is a possibility that eyes are irritated, and the materials of the contact lenses are adversely affected.

[0045] As for the buffer agent, a known buffer agent can be appropriately selected for use. For example, the following and other buffer agents are included: a buffer agent that is prepared by combining tris hydroxymethyl aminomethane, hydrochloric acid,

citric acid and the like; a buffer agent that is prepared by combining phosphoric acid and sodium phosphate; a buffer agent that is prepared by combining citric acid and sodium phosphate; and a buffer agent that is prepared by combining boric acid and/or borax.

5 **[0046]** The amount of the buffer agent comprised is not specifically restricted. For example, the amount of the buffer agent comprised is about between 0.1 and 10.0 w/w%. If the amount is less than 0.1 w/w%, the stability of pH obtained is insufficient. In the case wherein the amount is greater than 10.0 w/w%, the remarkable
10 stability of the pH is not observed. Moreover, in this case, if the cleaning agent is stored at low temperatures, various problems, such as the precipitation of the buffer agent, may arise.

[0047] Since the gelling agent causes gelling, a neutralizing agent may be comprised into the cleaning agent of the present invention.
15 The neutralizing agent is not specifically restricted as long as the neutralizing agent serves to promote the gelling of the gelling agent. For example, when carboxyvinyl polymer is used as the gelling agent, a sodium hydroxide solution can be used as the neutralizing agent.

20 **[0048]** Besides the above ingredients, the following can be further comprised into the cleaning agent of the present invention as long as the object of the present invention is not impaired: preserving agents; pH control chemicals; chelating agents; viscosity modifiers; exogenous enzymes, such as proteolytic enzymes and
25 lipolytic enzymes; and various kinds of additive agent.

[0049] The cleaning agent of the present invention is prepared using various ingredients described above, as well as the polyether-denatured silicone oil, the solubilizing agent, and the gelling agent. For example, the cleaning agent of the present

invention is prepared by performing the steps of: preparing a gelling agent-comprised solution by adding a gelling agent to an aqueous solution such as water or a buffer solution; preparing a cleaning component-comprised solution by sequentially adding a solubilizing agent and a polyether-denatured silicone oil to the gelling agent-comprised solution; preparing a gelling solution by adding a neutralizing agent to the cleaning component-comprised solution; and adjusting a total quantity by adding the aqueous solution to the gelling solution, or performing other operations.

10 In preparing the cleaning agent of the present invention, an osmotic adjustment agent may be dissolved into the aqueous solution. After the solubilizing agent is added, a surfactant may be added to the gelling agent-comprised solution.

[0050] A temperature at which the cleaning agent of the present invention is prepared is not specifically restricted as long as the temperature does not allow each ingredient to be volatilized or denatured. For example, the temperature is between 10 and 40 degrees Celsius, or preferably equal to ambient temperatures. In preparing the cleaning agent of the present invention, mixing conditions, such as the time and means of mixing a solution after each ingredient is added, are not specifically restricted. Known solution-mixing conditions are widely available. However, when the gelling agent-comprised solution is prepared, mixing is performed in such a way that the gelling agent is dispersed uniformly in the aqueous solution. When the cleaning component-comprised solution is prepared, mixing is performed to the extent that the polyether-denatured silicone oil dissolves.

15
20
25

[0051] An operation of scrubbing contact lenses with the cleaning agent of the present invention is performed in a similar way to

an operation of scrubbing the contact lens with a typical contact lens cleaning agent. For example, the operation is performed by the steps of: putting an appropriate amount of the cleaning agent of the present invention in drops onto the surface of a contact lens; and then scrubbing each side of the contact lens with fingers for about 10 to 30 seconds. After being scrubbed, the contact lens may be rinsed. Depending on the type of the contact lens, with tap water or a dedicated preserving agent, the contact lens is rinsed for about 5 to 30 seconds until a residual slimy sensation associated with the cleaning agent goes away.

[0052] The cleaning agent of the present invention is highly effective in cleaning off oily dirt adhering to the surfaces of contact lenses regardless of whether the oily dirt is of biological or cosmetic origin. The cleaning effect of the cleaning agent of the present invention can be confirmed by performing the above scrubbing operation, in which a contact lens with artificially prepared oily dirt on the surface thereof is for example used, as described in the examples as mentioned below.

[0053] Contact lenses that are cleaned with the cleaning agent of the present invention are not specifically restricted. Various contact lenses can be included, such as hard contact lenses and hydrogel contact lenses. Among the above contact lenses are RGPCL and SHCL, whose lens surfaces are modified and reformed.

[0054] The present invention is specifically described by the following examples. However, the examples are not intended to limit the present invention. Incidentally, in the following examples, the unit of amounts comprised is w/w% unless otherwise specifically stated.

Examples

[0055] The cleaning agents according to examples of the present invention, and the cleaning agents according to comparative examples were prepared in accordance with the amounts of ingredients
5 comprised as shown in Table 1. The cleaning agents were evaluated in the following manner.

[0056]

1. Preparation of Cleaning Agents

To a solution that was prepared by dissolving a buffer agent,
10 EDTA·2Na, and a properly selected osmotic adjustment agent into an appropriate amount of purified water, carboxyvinyl polymer was added as a gelling agent, and was dispersed uniformly. Then, a solubilizing agent, a surfactant, and polysilicone-13 were added in that order. A water solution of sodium hydroxide was added
15 thereto as a neutralizing agent for gelling. Purified water was added to the prepared gelled solution to obtain 100g of a cleaning agent in total.

[0057]

2. Cleaning Effect Test

20 (1) Production of Artificially Dirtied Contact Lens

Test contact lenses to which cosmetics (foundation, mascara, eyeshadow (waterproof)) were adhered in advance were dipped and warmed for five hours at 55 degrees Celsius in an artificially dirtied liquid consisting of known lacrimal-fluid components
25 (protein, lipid). Then, the contact lenses were dipped in pure water for 16 hours at 70 degrees Celsius followed by being dried for six hours at 50 degrees Celsius to obtain the artificially dirtied contact lenses.

[0058]

(2) The following lenses were employed as test contact lenses:

RGPCl: SEED UV-1, manufactured by SEED CO., LTD

RGPCl (Surface Treatment): SEED S-1, manufactured by SEED CO., LTD

SCL: ACUVUE2 (Group IV), manufactured by Johnson & Johnson K.K.

5 SHCL (Surface Treatment): O2 OPTIX (Group I), manufactured by CIBA
VISION K.K.

[0059]

(3) Evaluation of Cleaning Effect

The Haze value of an artificially dirtied contact lens was
10 measured (HGM-2DP, manufactured by Suga Test Instruments Co., Ltd.)
before the artificially dirtied contact lens was cleaned. Then,
the artificially dirtied contact lens was scrubbed with fingers
with each of the cleaning agents as shown in Table 1 for about 30
seconds (about 15 seconds every side). As for the rinsing of a
15 contact lens after scrubbing, in the case of RGPCl, running water
(tap water) was used. In the cases of SCL and SHCL, a preserving
agent for soft contact lenses (SOFRINS, manufactured by SEED CO.,
LTD) was used. The contact lens was rinsed (for 10 to 20 seconds)
until a residual sensation (slimy sensation) associated with each
20 of the cleaning agents went away, and was dried naturally.

[0060]

Comprised Ingredients	Comparative Examples		
	1	2	3
polysilicone-13	-	0.25	-
solubilizing agent*1	-	-	10.0
solubilizing agent*2	-	-	-
gelling agent*3	-	-	0.60
gelling agent*4	-	-	-
surfactant*5	0.30	-	0.30
surfactant*6	1.70	-	1.70
surfactant*7	-	-	0.25
osmotic adjustment agent*8	10.0	10.0	10.0
osmotic adjustment agent*9	12.0	12.0	12.0
pH control chemical (neutralizing agent)	Proper amount	Proper amount	Proper amount
buffer agent	Proper amount	Proper amount	Proper amount
EDTA·2Na	0.10	0.10	0.10
purified water	Remainin g amount	Remaining amount	Remaining amount
pH	7.00	7.00	7.00
osmotic pressure (mmol/kg)	2,500	2,500	2,500

[0061]

- *1. isopropyl alcohol
- 5 *2. 1,3-butylene glycol
- *3. carboxyvinyl polymer
- *4. (meth) acrylic acid alkyl copolymer
- *5. α -olefin sulfonate sodium: Lipolan LB-440, by Lion

Corporation (Fineness 37%: Amount comprised after fineness conversion)

*6. alkylglucoside: Plantacare 2000 UP, by Cognis Japan (Fineness 50%: Amount comprised after fineness conversion)

5 *7. polyoxyethylene polyoxypropylene blockpolymer: Pluronic F108, by ADEKA Corporation

*8. propylene glycol

*9. trimethylglycine

[0062] The Haze values of the cleaned lenses were measured, and
10 the dirt removal rates were calculated by the following formula. Moreover, as for handling properties, including the sense of touch at the time of scrubbing, a sensory evaluation was conducted. Table 2 shows the results.

[0063]

15 Formula 1

$$\text{Dirt removal rate(\%)} = \frac{(\text{Precleaning Haze value} - \text{Postcleaning Haze value})}{(\text{Precleaning Haze value})} \times 100$$

[0064] Based on the calculated dirt removal rates (%), the cleaning effect was evaluated on a five-point scale in the following manner.

A: 90% or more

20 A-: 80% or more but less than 90%

B: 60% or more but less than 80%

B-: 40% or more but less than 60%

C: less than 40%

The sensory evaluation on the sense of touch, as well as
25 on handling properties, was conducted on a three-point scale as shown below.

A: Easy to clean, with good handling properties

B: Normal

C: Difficult to clean, with poor handling properties

[0065]

Table 2

2. Cleaning Effect Test	Examples								
	1	2	3	4	5	6	7	8	9
RGPCL	A-	A	A-	A	A	A	A	A	A
RGPCL (Surface Treatment)	A-	A	A-	A	A	A	A	A	A
Sense of touch/handling properties	A	A	A	A	A	A	A	A	A
SCL	A-	A	A-	A	A	A	A	A	A
SHCL (Surface Treatment)	A-	A	A-	A	A	A	A	A	A
Sense of touch/handling properties	A	A	A	A	A	A	A	A	A

2. Cleaning Effect Test	Comparative Examples		
	1	2 *1)	3
RGPCL	C	C	B-
RGPCL (Surface Treatment)	B-	C	B
Sense of touch/handling properties	C	C	A-
SCL	B- *2)	C *2)	B *2)
SHCL (Surface Treatment)	C	C	B-
Sense of touch/handling properties	C	C	A-

5

[0066]

*1) In the cleaning agent of Comparative Example 2, polysilicone-13 could not be solubilized.

*2) In Comparative Examples 1 to 3, because of a high osmotic

pressure of 2,500 mmol/kg, in the case of SCL with a high moisture content, the lens swelled with water or contracted in diameter at the time of cleaning, and thus deformed significantly at the time of rinsing.

- 5 **[0067]** A higher dirt removal rate (%) is preferred. A dirt removal rate of 60% or more was set as a pass mark, and all the cleaning agents according to the examples of the present invention made the pass mark.

[0068]

10 3. Assessment of Impact on Surface-treated Contact Lens

As for assessment of an impact on surface-treated contact lenses, the lens surfaces of RGPCL (SEED S-1, manufactured by SEED CO., LTD) and SHCL (O2 OPTIX, manufactured by CIBA VISION K.K.), were treated with an organic compound, resulting in providing
15 hydrophilicity thereto. The obtained lenses having hydrophilic functional surfaces were used.

[0069] The contact lenses were scrubbed with fingers by using the cleaning agents according to the examples of the present invention as shown in Table 3, and a cleaning agent containing an abrading
20 agent (O₂ CLEAN, manufactured by SEED CO., LTD), which is presented as Reference Example 1. A one-cycle process consisted of the steps of: scrubbing a contact lens with each cleaning agent; and rinsing the contact lens with running water (tap water: RGPCL), or with a preserving agent for soft contact lenses (SOFRINS, manufactured
25 by SEED CO., LTD: SCL, SHCL). The hydrophilicity of a lens surface was assessed after the 10-, 20-, and 30-cycle processes. Based on the amounts of change in the contact angle of the lens surface before and after the cycle processes, the impact on the lens surface was evaluated on a five-point scale as shown below.

[0070]

A: 10 degrees or less

A-: greater than 10 degrees but less than or equal to 20 degrees

B: greater than 20 degrees but less than or equal to 30 degrees

5 B-: greater than 30 degrees but less than or equal to 40 degrees

C: greater than 40 degrees

Table 3

3. Impact Assessment on surface-treated CL	Number of cycle processes	Examples									Ref. Examples
		1	2	3	4	5	6	7	8	9	1
RGPCL (Surface Treatment)	10	A	A	A	A	A	A	A	A	A	B
	20	A	A	A	A	A	A	A	A	A	B-
	30	A	A	A	A	A	A	A	A	A	C
SHCL (Surface Treatment)	10	A	A	A	A	A	A	A	A	A	A-
	20	A	A	A	A	A	A	A	A	A	B
	30	A	A	A	A	A	A	A	A	A	B-

10 **[0071]** Smaller amounts of change in the contact angle are preferred.

If the change in the contact-angle was 30 degrees or less, the change was set as a pass mark. All the cleaning agents according to the examples of the present invention made the pass mark.

C L A I M S

1. A gelled cleaning agent for contact lenses comprising a polyether-denatured silicone oil, a solubilizing agent, and a gelling agent.

2. The gelled cleaning agent for contact lenses according to claim 1, wherein the polyether-denatured silicone oil is a polyalkylene oxide-denatured silicone.

3. The gelled cleaning agent for contact lenses according to claim 1, wherein the polyether-denatured silicone oil is an ABn-typed block copolymer of polydimethylsiloxane-polyalkylene oxide; and the solubilizing agent is a lower alcohol and/or liquid polyhydric alcohol.

4. The gelled cleaning agent for contact lenses according to claim 3, wherein the polyalkylene oxide in the ABn-typed block copolymer of polydimethylsiloxane-polyalkylene oxide is polyoxyethylene or poly(oxyethylene-oxypropylene) copolymer; the lower alcohol is ethyl alcohol, propyl alcohol, isopropyl alcohol, or benzyl alcohol; and the liquid polyhydric alcohol is at least one type of alcohol selected from a group consisting of ethylene glycol, propylene glycol, dipropylene glycol, 1,3-butanediol, and glycerin.

5. The gelled cleaning agent for contact lenses according to any one of claims 1 to 4, wherein the amount of the polyether-denatured silicone oil comprised is between 0.05 and 0.50 w/w%.