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(54) Fiber treating composition

(57) The invention provides a fiber treating composition comprising an oil-in-water emulsion prepared by adding (c) water to a mixed solution (A) having a component (a) /component (b) in a ratio of 1/150 to 30/100 by weight under stirring and then emulsifying the mixture, wherein the component (a) is a polymer compound containing a constituent unit (a1) containing 2 to 20 carbon atoms in total and having one or more groups selected from a hydroxy group, a carboxylic acid group, a quaternary ammonium group, an amino group and an amide group (provided that a unit constituting (a2) is excluded) and a constituent unit (a2) having a C8 to C22 hydrocarbon group, wherein the molar ratio of (a1)/(a2) is 100/30 to 1000/1, and the component (b) is a hydrophobic component capable of being dissolved in an amount of 1% by weight at the maximum in 100g of water at 20°C and having a saturated vapor pressure of 1.45 kPa (11 mmHg) or less at 20°C and 0.1 MPa (1 atm).

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Description

Field of the invention

[0001] The present invention relates to a fiber treating composition comprising an oil-in-water emulsion.

Background of the invention

[0002] Silicone compounds are applied to various fields such as detergent, finisher, fiber treating agent and lubricant, and particularly the finisher for fiber products such as clothing has been widely used for the purpose of conferring an effect of improving the feeling of a subject. Many techniques wherein the silicone compound is used in combination with a polymer compound are also disclosed. JP-A 2000-129570, JP-A 2000-129577, JP-A 2000-129578, JP-A 2000-239970, JP-A 2003-89978, JP-A 5-239774, JP-A 8-260356, JP-A 9-13272, JP-A 9-111662, JP-A 11-229266, JP-A (W) Nos. 10-508911 and 10-508912, and JP-A 5-44169 disclose respectively a fiber treating composition comprising a water-soluble polymer compound generally known as a sizing base and a silicone compound.

[0003] Further, International Publication No. 00/73351 discloses specific polysaccharide derivatives, and describes that such polysaccharide derivatives can stabilize a hydrophobic compound. Polysaccharide derivatives modified at long-chain alkyl groups are disclosed, and in the Examples in this literature disclose techniques wherein the polysaccharide derivative is used in combination with a silicone compound.

Summary of the invention

[0004] The present invention relates to a fiber treating composition comprising an oil-in-water emulsion prepared by adding (c) water to a mixed solution (A) comprising (a) a polymer compound comprising a constituent unit (a1) having 2 to 20 carbon atoms in total and having at least one selected from the group consisting of a hydroxy group, a carboxylic acid group, a quaternary ammonium group, an amino group and an amide group , provided that a unit constituting (a2) is excluded, and a constituent unit (a2) having a C8 to C22 hydrocarbon group at a molar ratio of (a1)/(a2) of 100/30 to 1000/1, and (b) a hydrophobic compound capable of being dissolved in an amount of 1% by weight at the maximum in 100g of water at 20°C, having a melting point of 70°C or lower and having a saturated vapor pressure of 1.45 kPa (11 mmHg) or less at 20°C and 0.1 MPa (1 atm) at a weight ratio of component (a) /component (b) of 1/150 to 30/100, while stirring , to emulsify the mixture.

[0005] The present invention relates to a fiber treating composition comprising an oil-in-water emulsion prepared by adding (c) water to a mixed solution (A) comprising (a) a polymer compound comprising a constituent unit (a1) having 2 to 20 carbon atoms in total and having at least one selected from the group consisting of a hydroxy group, a carboxylic acid group, a quaternary ammonium group, an amino group and an amide group, provided that a unit constituting (a2) is excluded, and a constituent unit (a2) having a C8 to C22 hydrocarbon group at a molar ratio of (a1)/(a2) of 100/30 to 1000/1, and (b) a silicone compound at a weight ratio of component (a) /component (b) of 1/150 to 30/100, while stirring, to emulsify the mixture.

[0006] The present invention also provides use of the composition as a fiber treating agent and then a method of treating fiber by applying the composition to a fiber product.

Detailed description of the invention

[0007] A silicone compound is a water-insoluble compound, and the silicone compound, when applied to an aqueous composition such as a finisher used in washing of clothing in home, is emulsified with a surfactant or the like and incorporated into the aqueous composition. The aqueous composition is added often in a rinsing stage in a washing step, diluted with an excess of water and contacted with fiber products such as clothing. However, when the silicone compound emulsified with a surfactant or the like is diluted with an excess of water, the capacity of the surfactant to emulsify the silicone compound is significantly lowered to destroy the emulsion, so that the silicone compound cannot be stably present. Accordingly, the silicone compound cannot be efficiently adsorbed onto fibers, and a majority of the silicone compound in the aqueous composition may be discharged into waste water or adhere to a washing bath, thus making it difficult to give the effect of the silicone compound sufficiently to fiber products.

[0008] According to the disclosure of JP-A 2000-129570, JP-A 2000-129577, JP-A 2000-129578, JP-A 2000-239970, JP-A 2003-89978, JP-A 5-239774, JP-A 8-260356, JP-A 9-13272, JP-A 9-111662, JP-A 11-229266, JP-A (W) Nos. 10-508911 and 10-508912, and JP-A 5-44169 supra, the water-soluble polymer compound is used as a sizing base or a film-forming ingredient, and the water-soluble polymer compound is not used for the purpose of emulsifying the silicone compound, or the silicone compound described in these patent applications is emulsified by a surfactant, and thus the problem upon dilution with an excess of water cannot be solved.

[0009] The object of International Publication No. 00/73351 supra is to stabilize a solution of a silicone compound, and the problem upon dilution of an aqueous composition containing the silicone compound with an excess of water is not suggested, and an improvement in the adsorption of the silicone compound is not suggested.

[0010] The present invention provides a fiber treating composition improving the adsorption of the component (b) onto the surface of a subject such as fiber products, without destroying an emulsion of an aqueous composition containing the component (b) even upon dilution with an excess of water.

[0011] The fiber treating composition of the present invention can maintain an emulsified state even upon dilution with an excess of water, and can be adsorbed onto a subject such as fiber products to give the component (b) efficiently to the subject.

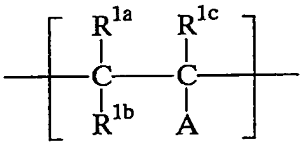
[Component (a)]

[0012] The component (a) in the present invention is a polymer compound containing a constituent unit (a1) containing 2 to 20 carbon atoms in total and having one or more groups selected from a hydroxy group, a carboxylic acid group, a quaternary ammonium group, an amino group and an amide group (provided that a unit constituting (a2) is excluded) and a constituent unit (a2) having a C8 to C22 hydrocarbon group, wherein the molar ratio of (a1)/(a2) is 100/30 to 1000/1.

[0013] The functional group selected from a hydroxy group, a carboxylic acid group, a quaternary ammonium group, an amino group and an amide group in the constitutional unit (a1) is a group having both an effect of giving water solubility to the polymer compound and an effect of adsorption onto fiber products, and the C8 to C22 hydrocarbon group in the constituent element (a2) is adsorbed onto liquid droplets of the component (b), to exhibit an effect of stabilizing a hydrophobic substance in an aqueous solution, and both components play an important role in the present invention. When the component (a) is the following compound (i), the molar ratio of (a1-1) / (a2-1) is preferably 100/30 to 150/1, preferably 100/20 to 100/1, still more preferably 100/15 to 100/3. When the component (a) is the following compound (ii), the molar ratio of (a1-2)/(a2-2) is preferably 1000/100 to 1000/1, more preferably 1000/80 to 750/1, still more preferably 1000/50 to 1000/4. By regulation in such ratio, the component (b) can be stably emulsified, and the emulsion is not destroyed even upon dilution with an excess of water, to achieve an effect of promoting adsorption onto the surface of a subject such as fiber product.

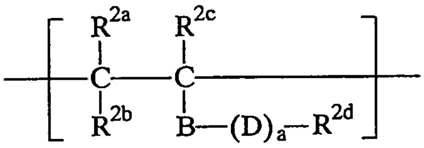
[0014] The component (a) in the present invention is at least one polymer compound selected from the following (i) and (ii) :

(i) a polymer compound containing a monomer unit (a1-1) represented by the formula (1) and a monomer unit (a2-1) represented by the formula (2), wherein the molar ratio of (a1-1)/(a2-1) is 100/30 to 150/1, and the ratio of the total monomer units (a1-1) and (a2-1) to total monomer units in the molecule is 50 to 100 mol%,



$$-\!\left[\,\overset{\displaystyle R^{1a}}{\underset{\displaystyle R^{1b}}{\overset{|}{\underset{|}{C}}}}-\overset{\displaystyle R^{1c}}{\underset{\displaystyle A}{\overset{|}{\underset{|}{C}}}}\,\right]\!-$$

(1)



$$-\!\left[\,\overset{\displaystyle R^{2a}}{\underset{\displaystyle R^{2b}}{\overset{|}{\underset{|}{C}}}}-\overset{\displaystyle R^{2c}}{\underset{\displaystyle B-(D)_a-R^{2d}}{\overset{|}{\underset{|}{C}}}}\,\right]\!-$$

(2)

wherein each of R^{1a} and R^{2a} is independently a hydrogen atom or a C1 to C3 alkyl group, each of R^{1b} and R^{2b} is a group selected independently from a hydrogen atom or $-COOM^1$ whereupon M^1 represents a hydrogen atom, an alkali metal atom or an alkaline earth metal atom, each of R^{1c} and R^{2c} is a group selected independently from a hydrogen atom, a C1 to C3 alkyl group and a hydroxyl group, R^{2d} is a C8 to C22 hydrocarbon group, A is $-COOM^2$, -OH, $-CON(R^{1d})(R^{1e})$, $-COO-R^{1f}-N^+(R^{1g})(R^{1h})(R^{1i})\cdot X^-$, $-COO-R^{1f}-N(R^{1g})(R^{1h})$, $-CON(R^{1d})-R^{1f}-N^+(R^{1g})(R^{1h})(R^{1i})\cdot X^-$, $-CON(R^{1d})-R^{1f}-N(R^{1g})(R^{1h})$, or a heterocyclic group of 5- or 6-memberred cyclic structure having at least one amino group or amide group in the cycle, M^2 represents a hydrogen atom, an alkali metal atom or an alkaline earth metal atom, R^{1d}, R^{1e}, R^{1g}, R^{1h} and R^{1i} independently represent a hydrogen atom, a C1 to C3 alkyl group or a C1 to C3 hydroxyalkyl group, R^{1f} represents a C1 to C5 alkylene group, X^- represents an organic or inorganic anionic group, B is a group selected from -O-, -COO-, -OCO- and -CONR^{2e}-whereupon R^{2e} is a hydrogen atom, a C1 to C3 alkyl group or a C1 to C3 hydroxyalkyl group, D is at least one group, for connecting B with R^{2d} , selected from a C2 to C6 divalent hydrocarbon group, a polyoxyalkylene group with 1 to 300 oxalkylene groups on the average attached and a polyglyceryl group with 1 to 10 glyceryl groups on the average attached, D being bound to R^{2d} via a group selected from an ether group, an ester group, a cationic group and an amide group, and a is a number of 0 or 1; and

(ii) a polysaccharide derivative having a monosaccharide unit, or a hydroxyalkylated (C1 to C3), carboxyalkylated (C1 to C3) or cationized monosaccharide unit (a1-2), and a monosaccharide unit (a2-2) having a monosaccharide unit or a hydroxyalkylated (C1 to C3), carboxyalkylated (C1 to C3) or cationized monosaccharide unit wherein a part or the whole of hydrogen atoms in hydroxyl groups are replaced by the formula (3), wherein the molar ratio of (a1-2) / (a2-2) is 1000/100 to 1000/1.

$$-R^{3a}-(OR^{3b})_b-E-R^{3c} \qquad (3)$$

wherein R^{3a} represents a C1 to C6 linear or branched divalent saturated hydrocarbon group which may be substituted with a hydroxy group or an oxo group, R^{3b} represents a C1 to C6 linear or branched divalent saturated hydrocarbon group which may be substituted with a hydroxy group or an oxo group, b is a number of 8 to 300, and all b'R^{3b} may be the same as or different from one another, E represents a group selected from -O-, -COO- and -OCO-, and R^{3c} represents a C8 to C22 linear or branched hydrocarbon group which may be substituted with a hydroxy group.

<Polymer compound (i)>

[0015] The polymer compound (i) is a synthetic polymer compound synthesized from polymerizable unsaturated compounds in a usual manner such as radical polymerization.

[0016] In the formula (1), each of R^{1a} and R^{1b} is preferably a hydrogen atom, and R^{1c} is preferably a hydrogen atom or a methyl group. Each of R^{1d}, R^{1e}, R^{1g}, R^{1h} and R^{1i} is preferably a hydrogen atom, methyl group, ethyl group or hydroxyethyl group, and particularly each of R^{1c}, R^{1g}, R^{1h} and R^{1i} is even more preferably a methyl group, R^{1d} is even more preferably a hydrogen atom or methyl group. R^{1f} is preferably an ethylene group or propylene group. The heterocyclic group includes a pyrrolidone group, pyridine group, piperidine group, piperazine group, imidazole group, caprolactam group etc., among which a pyrrolidone group is preferable. X^- includes a chlorine ion, sulfate ion, C1 to C3 alkyl sulfate ion, C1 to C12 fatty acid ion, and a benzene sulfonate ion optionally substituted with one to three C1 to C3 alkyl groups, among which a chlorine ion and ethyl sulfate ion are preferable.

[0017] In the formula (2), each of R^{2a} and R^{2b} is preferably a hydrogen atom, R^{2c} is preferably a hydrogen atom or a methyl group. R^{2d} is preferably a C8 to C20, more preferably C10 to C18 alkyl or alkenyl group, particularly preferably an alkyl group. B is preferably -COO- or -CONR^{2e}- whereupon R^{2e} is preferably a hydrogen atom. D is a group linking B to R^{2d}, and preferable examples of specific structures containing B and R^{2d} include $-B-[CH_2CH(OH)CH_2O]_c-(C_2H_4O)_d-(C_3H_6O)_e-R^{2d}$, $-B-C_nH_{2n}-N^+(CH_3)_2(R^{2d})\cdot X^-$, $-B-C_nH_{2n}-COO-R^{2d}$, and $-B-C_nH_{2n}-CONH-R^{2d}$. c is a number of 0 to 10, preferably a number of 0 to 5. d is a number of 0 to 300, preferably 0 to 100, more preferably a number of 0 to 75, still more preferably a number of 0 to 50, and e is a number of 0 to 300, more preferably a number of 0 to 100. When c is 0, d + e is a number of 1 to 300, preferably 1 to 100, more preferably 1 to 50, and when c is 1 to 10, preferably 1 to 5, more preferably 1 or 2, still more preferably 1, d + e is a number of 0 to 300. n is a number of 2 to 6, preferably a number of 2 or 3. X^- is the same anionic group as described above.

[0018] In the polymer compound (i) in the present invention, the constitutional unit of the formula (2) wherein a is 1 is preferable for the purpose of achieving the effect of the present invention, and it is estimated that the stability of emulsified particles is improved by arranging a spacer between the main chain of the polymer compound and the hydrophobic group R^{2d} having affinity for the component (b). In the present invention, the monomer unit of the formula (2) wherein D is $-(C_2H_4O)_d-$ and d is 5 to 40 is even more preferable.

[0019] The polymer compound (i) having the monomer unit described above can be obtained by copolymerizing monomer (a1') derived from the monomer unit (a1-1) with monomer (a2') derived from the monomer unit (a2-1) in a known method such as radical polymerization. The monomer unit (a2-1) can also be obtained by reacting R^{2d}-Z with a polymer compound wherein monomer (a2") represented by $C(R^{2a})((R^{2b})=C(R^{2c})(Y)$ has been copolymerized with monomer (a1') derived from the monomer unit (a1-1) . Y and Z are reactive groups which react with one another to form $-B-(D)_a-R^{2d}$.

[0020] Examples of the monomer (a1') derived from the monomer unit (a1-1) include (meth)acrylic acid (or its alkali metal salt, alkaline earth metal salt), (anhydrous) maleic acid (or its alkali metal salt, alkaline earth metal salt), α-hydroxyacrylic acid (or its alkali metal salt, alkaline earth metal salt), dialkyl (meth)acrylate (C1 to C3) amide, (meth) acrylic acid dialkanol (C2 to C3) amide, (meth)acrylic acid monoalkanol (C2 to C3) amide, vinyl acetate (after polymerization, vinyl acetate is saponified and converted into a vinyl alcohol skeleton), N-(meth)acryloyloxy alkyl (C1 to C3) -N,N-dialkyl (C1 to C3) amine, N-(meth)acryloyloxy alkyl (C1 to C3) -N, N-dialkanol (C1 to C3) amine, N- (meth) acryloyloxy alkyl (C1 to C3)-N,N,N-dialkyl (C1 to C3) ammonium salt (the salt is preferably a chlorine salt, methyl sulfate or ethyl sulfate), N- (meth) acryloyl aminoalkyl (C1 to C3)-N,N-dialkyl (C1 to C3) amine, N-(meth)acryloyl aminoalkyl (C1 to C3)-N,N-dialkanol (C1 to C3) amine, N-(meth)acryloyl aminoalkyl (C1 to C3)-N,N,N-dialkyl (C1 to C3) ammonium salt (the salt is preferably a chlorine salt, methyl sulfate or ethyl sulfate), N-vinyl pyrrolidone, 2-vinyl pyridine, 3-vinyl pyridine, 3-vinyl piperidine, N-vinyl imidazole, and N-vinyl-2-caprolactam.

[0021] The monomer (a2') derived from the monomer unit (a2-1) includes the following compounds.

$$CH_2{=}CHCOO\ (C_2H_4O)_d\text{-}R^{2d}$$

$$CH_2{=}C\ (CH_3)\ COO\ (C_2H_4O)_d\ \text{-}R^{2d}$$

$$CH_2{=}CHCOOC_2H_4N^+\ (CH_3)\ (R^{2d})\cdot X^-$$

$$CH_2{=}C\ (CH_3)\ COOC_2H_4N^+\ (CH_3)\ (R^{2d})\cdot X^-$$

$$CH_2{=}CHCONHC_3H_6N^+\ (CH_3)_2\ (R^{2d})\cdot X^-$$

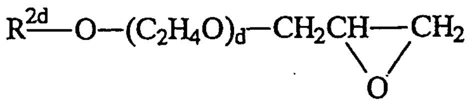
$$CH_2{=}C\ (CH_3)\ CONHC_3H_6N^+\ (CH_3)_2(R^{2d})\cdot X^-$$

$$CH_2{=}CHCOOR^{2d}$$

$$CH_2{=}C(CH_3)\ COOR^{2d}$$

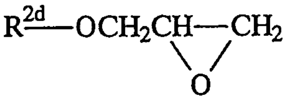
wherein R^{2d}, d and X- each have the same meaning as def ined above.

[0022] The monomer unit (a2-1) can also be obtained by copolymerizing a glycidyl ether compound represented by formula (4):



(4)

wherein R^{2d} and d each have the same meaning as defined above, with OH in a vinyl alcohol unit obtained by copolymerizing the monomer (a1') with vinyl acetate and then saponifying the product, or can be obtained by copolymerizing the monomer (a1') with a polyoxyethylene vinyl ether having about 1 to 300, preferably 1 to 100, more preferably 1 to 50 oxyethylene groups added thereto and then reacting a compound represented by formula (5):



(5)

wherein R^{2d} has the meaning as defined above, with the product. Alternatively, the monomer unit (a2-1) can also be obtained by copolymerizing the monomer (a1') with N-(meth)acryloyloxyethyl-N,N-dialkyl (C1 to C3) amine and/or N-(meth)acryloylaminopropyl-N,N-dialkyl (C1 to C3) amine and then quaternalizing the product with an alkylating agent such as a compound represented by formula R^{2d}_Cl wherein R^{2d} has the same meaning as defined above.

[0023] The polymer compound (i) is a polymer compound containing, in the molecule, the monomer units (a1-1) and (a2-1) in a total amount of 50 to 100 mol%, more preferably 55 to 100 mol%, still more preferably 60 to 100 mol%, and the monomer (a1') and the monomer (a2') or the monomer (a2") and other copolymerizable monomers may also be copolymerized therein. The copolymerizable other monomers include compounds such as ethylene, propylene, N-butylene, isobutylene, N-pentene, isoprene, 2-methyl-1-butene, N-hexene, 2-methyl-1-pentene, 3-methyl-1-pentene, 4-methyl-1-pentene, 2-ethyl-1-butene, styrene, vinyl toluene and α-methyl styrene.

[0024] The polymer compound (i) may be obtained in any polymerization method, but the radical polymerization method is particularly preferable and can be carried out in a bulk, solution or emulsion system. Radical polymerization can be initiated by heating or with an existing radical initiator for example an azo initiator such as 2,2'-azobis(2-amidinopropane) dihydrochloride or 2,2'-azobis(N,N-dimethyleneisobutylamidine) dihydrochloride, an organic peroxide such as hydrogen peroxide, benzoyl peroxide, t-butyl hydroperoxide, cumene peroxide, methyl ethyl ketone peroxide or perbenzoic acid, a persulfate such as sodium persulfate, potassium persulfate or ammonium persulfate, a redox initiator such as hydrogen peroxide-Fe^{3+}, or by irradiation with light in the presence or absence of a photosensitizer or by irradiation with radiations.

[0025] The weight-average molecular weight of the polymer compound (i) is preferably 2,000 to 200,000, more preferably 3,000 to 150, 000, still more preferably 4, 000 to 120, 000. The weight-average molecular weight can be determined by gel permeation chromatography with polyethylene glycol as standard.

<(ii) Polymer compound>

[0026] In the polymer compound (ii), the monosaccharide unit constituting the monosaccharide unit (a1-2) includes glucose, mannose, fructose, galactose, xylose etc., among which glucose is even more preferable. For the purpose of giving water solubility to the polymer compound, the monosaccharide unit is preferably a hydroxyalkylated (C1 to C3), preferably hydroxyethylated, carboxyalkylated (C1 to C3), preferably carboxymethylated or cationized monosaccharide unit.

[0027] In the polymer compound (ii), the monosaccharide unit constituting the monosaccharide unit (a2-2) includes glucose, mannose, fructose, galactose, xylose etc., among which glucose is even more preferable. For the purpose of giving water solubility to the polymer compound, the monosaccharide unit is preferably a hydroxyalkylated (C1 to C3), preferably hydroxyethylated, carboxyalkylated (C1 to C3), preferably carboxymethylated or cationized monosaccharide unit.

[0028] The monosaccharide unit (a2-2) is an unit wherein a part or the whole of hydrogen atoms in hydroxy groups of the monosaccharide unit (a1-2) are replaced by groups represented by the formula (3).

[0029] In the formula (3), R^{3a} preferably represents a C2 or C3 alkylene group which may be substituted with a hydroxy group, R^{3b} is preferably a C2 or C3 alkylene group, more preferably an ethylene group, b is preferably 8 to 120, more preferably 10 to 60, and R^{3b}s whose number is b may be the same or different. E is an ether linkage (-O-) or an ester linkage (-COO- or -OCO-), preferably an ether linkage. R^{3c} is preferably a C8 to C20, more preferably C8 to C18, still more preferably C10 to C18, even more preferably C12 to C18, linear or branched hydrocarbon group, further more preferably a linear alkyl group. Preferable examples include an octyl group, decyl group, dodecyl group, tetradecyl group, hexadecyl group, octadecyl group, isostearyl group, hexyldecyl group and octyldecyl group.

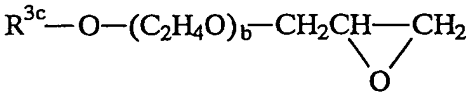
[0030] The polymer compound (ii) in the present invention is a polysaccharide derivative containing (a1-2)/(a2-2) in a molar ratio of 1000/100 to 1000/1, preferably 1000/80 to 750/1, particularly preferably 1000/50 to 1000/4. Such polysaccharide derivative is obtained by reacting a compound represented by formula (6):

$$G\text{-}(OR^{3b})_b\text{-}E\text{-}R^{3c} \qquad (6)$$

wherein G is a group reacting with a hydroxyl group to form an ether linkage or ester linkage, and R^{3b}, b, E and R^{3c} each have the same meaning as defined above, with a polysaccharide or a hydroxyl group of a hydroxyalkylated compound, a carboxyalkylated compound or a cationized compound of the polysaccharide within the above molar ratio of (a1-2)/(a2-2).

[0031] The polysaccharide used in the polymer compound (ii) includes cellulose, guar gum, starch, pullulan, dextran, fructane, mannan, agar, carrageenan, chitin, chitosan, pectin, alginic acid and hyaluronic acid, as well as derivatives thereof substituted with a methyl group, ethyl group, hydroxyethyl group, hydroxypropyl group etc. The constituent monosaccharide residue can be substituted with one or more of these substituent groups, and examples of such polysaccharide derivatives include hydroxyethyl cellulose, hydroxyethylethyl cellulose, hydroxyethyl guar gum, hydroxyethyl starch, methyl cellulose, methyl guar gum, methyl starch, ethyl cellulose, ethyl guar gum, ethyl starch, hydroxypropyl cellulose, hydroxypropyl guar gum, hydroxypropyl starch, hydroxyethylmethyl cellulose, hydroxyethylmethyl guar gum, hydroxyethylmethyl starch, hydroxypropylmethyl cellulose, hydroxypropylmethyl guar gum, hydroxypropylmethyl starch etc. Among these polysaccharides, cellulose, starch, hydroxyethyl cellulose, methyl cellulose, ethyl cellulose and hydroxypropyl cellulose are preferable, and particularly hydroxyethyl cellulose is preferable. The substituent groups on the polysaccharide derivatives can be further replaced by hydroxy groups such as hydroxyethyl group and hydroxypropyl group to form, for example, a polyoxyethylene chain etc., to attain a substitution degree of higher than 3.0 per constituent monosaccharide residue, and the substitution degree per constituent monosaccharide residue is preferably 0.1 to 10.0, particularly preferably 0.5 to 5.0. The weight-average molecular weight of these polysaccharides is preferably in the range of 10,000 to 10,000,000, more preferably 100, 000 to 5, 000, 000, still more preferably 100, 000 to 750,000.

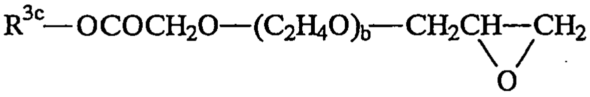
[0032] The compound represented by formula (6) is preferably the following compound.



$$R^{3c}-O-(C_2H_4O)_b-CH_2\underbrace{CH-CH_2}_{O}$$

$$R^{3c}-O-(C_2H_4O)_b-C_nH_{2n}-Cl$$

$$R^{3c}-O-(C_2H_4O)_b-C_nH_{2n}COOH$$



$$R^{3c}-OCOCH_2O-(C_2H_4O)_b-CH_2\underbrace{CH-CH_2}_{O}$$

$$R^{3c}-OCOCH_2O-(C_2H_4O)_b-C_nH_{2n}COOH$$

$$R^{3c}-OCOCH_2O-(C_2H_4O)_b-C_nH_{2n}-Cl$$

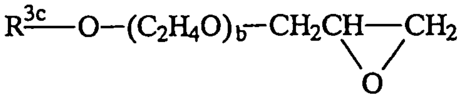
wherein b, R^{3c} and n each have the meaning as defined above.

[0033] When the polysaccharide is a carboxyalkylated saccharide, $R^{3c}-O-(C_2H_4O)_b-H$ and

$$R^{3c}-OCOCH_2O-(C_2H_4O)_b-H$$

wherein b and R^{3c} each have the same meaning as defined above, can also be utilized.

[0034] In the present invention, the compound represented by formula (6) is even more preferably a compound represented by formula (6-1):



$$R^{3c}-O-(C_2H_4O)_b-CH_2CH-CH_2 \quad (\text{epoxide } O \text{ bridging } CH \text{ and } CH_2)$$

(6-1)

wherein b and R^{3c} each have the meaning as defined above.

[0035] When the polysaccharide is a hydroxyalkylated polysaccharide, the degree of introduction of hydroxyalkyl groups (number of hydroxyalkyl groups in the monosaccharide unit) is preferably 0.01 to 3.5, more preferably 0.01 to 3.0; when the polysaccharide is a carboxyalkylated polysaccharide, the degree of introduction of carboxyalkyl groups (number of hydroxyalkyl groups in the monosaccharide unit) is preferably 0.01 to 3.0, more preferably 0.1 to 2.5; and when the polysaccharide is a cationized polysaccharide, the degree of introduction of cationic groups is preferably 0.01 to 3.0, more preferably 0.1 to 2.5.

[0036] The polymer compound (ii) in the present invention is even more preferably a compound obtained by reacting the compound represented by formula (6-1) with hydroxyethyl cellulose having a degree of introduction of hydroxyethyl groups in the range of 0.01 to 3.5 within the above molar ratio of (a1-2) / (a2-2).

[0037] The polymer compound (ii) in the present invention can be produced by a method described in International Publication No. 00/73351.

[Component (b)]

[0038] The component (b) in the present invention is the hydrophobic compound (b') or silicone compound (b").

[0039] The compound (b") is preferably a water-insoluble silicone compound. The water-insoluble compound is a compound which is dissolved in an amount of 1 g or less in 1 L deionized water at 20°C. Specific examples include silicone compounds such as dimethyl polysiloxane, quaternary ammonium-modified dimethyl polysiloxane, amino-modified dimethyl polysiloxane, amide-modified dimethyl polysiloxane, epoxy-modified dimethyl polysiloxane, carboxy-modified dimethyl polysiloxane, polyoxyalkylene-modifieddimethylpolysiloxane and fluorine-modified dimethyl polysiloxane.

[0040] The dimethyl polysiloxane in the present invention is preferably at least one compound selected from dimethyl polysiloxane, amino-modified dimethyl polysiloxane, amide-modified dimethyl polysiloxane, polyoxyalkylene (polyoxyethylene and/or polyoxypropylene, preferably polyoxyethylene) modified dimethyl polysiloxane, having a molecular weight of 1,000 to 1,000,000, preferably 3,000 to 1, 000, 000, more preferably 5, 000 to 1, 000, 000, a viscosity at 25°C of 2 to 1, 000, 000 mm^2/s, preferably 500 to 1, 000, 000 mm^2/s, still more preferably 1,000 to 1,000,000 mm^2/s. The amino-modified dimethyl polysiloxane has an amino equivalent (= molecular weight per nitrogen atom) of 1, 500 to 40, 000 g/mol, preferably 2,500 to 20,000 g/mol, more preferably 3,000 to 10,000 g/mol. The polyoxyalkylene-modified dimethyl polysiloxane has a haze A (described on pages 324 to 325 in Surfactant Handbook published by Sangyo Tosho Co., Ltd. on July 5, 1960) of 0 to 18, preferably 0 to 10, more preferably 0 to 5.

[0041] The dimethyl polysiloxane having a viscosity of 10,000 to 1,000,000 mm^2/s at 25°C in the present invention is preferably polyoxyalkylene-modified dimethyl polysiloxane having a haze A of 0 to 5.

[0042] Among those described above, the compound having flowability at 40°C can be used as a mixture with liquid paraffin, liquid isoparaffin, lower alcohol, lower fatty acid or low-molecular ester compound.

[0043] Another preferable example of the component (b) is the hydrophobic compound (b'). Mention can be made of hydrocarbons, fatty acids, perfumes etc. blended for improving feelings and values. Specific examples include:

(i) Hydrocarbons: for example hydrocarbons such as solid or liquid paraffin, liquid isoparaffin, vaseline, crystal oil, ceresin, ozokerite, montan wax, squalane and squalene.

(ii) C10 to C18, preferably C12 to C18, more preferably C14 to C18 saturated and unsaturated fatty acids; specifically, lauric acid, myristic acid, palmitic acid, palmitoleic acid, stearic acid, oleic acid and linolic acid can be mentioned, and for use in the fiber treating agent, oleic acid or palmitoleic acid is preferable.

(iii) Vegetable or animal fats and oils, or hydrogenated products thereof: olive oil, avocado oil, evening primrose oil, jojoba oil, camellia oil, academia nut oil, peppermint oil, sunflower oil, rapeseed oil, sesame oil, wheat germ oil, castor oil, safflower oil, cottonseed oil, soybean oil, jojoba oil, coconut oil, palm oil, palm kernel oil, tallow, lard, fish oil, horse oil, egg yellow oil, carnauba wax and lanolin.

(iv) Fatty esters having a molecular weight of 300 to 3000 (excluding (iii)) ; specifically, ester compounds of C10 to C18 fatty acids and C1 to C6 monovalent to hexavalent alcohols are preferable. The alcohol is preferably a monovalent alcohol selected from ethanol, isopropanol, butanol and hexanol, a divalent alcohol such as ethylene glycol, propylene glycol, diethylene glycol, dipropylene glycol, 1,6-hexane diol, and a trivalent or more alcohol such as glycerin (mono- or diester), pentaerythritol, glucose, sorbitol and sorbitan. In the present invention, isopropyl laurate, isopropyl myristate and pentaerythritol monostearate are particularly preferable.

(v) C10 to C18, preferably C12 to C18, more preferably C14 to C18 saturated or unsaturated fatty alcohols; specific examples include decyl alcohol, myristyl alcohol, palmityl alcohol, stearyl alcohol, oleyl alcohol, linol alcohol, isocetyl alcohol, isostearyl alcohol, behenyl alcohol, hexadecyl alcohol, phenylethyl alcohol, cetanol, oleyl alcohol, 2-octyl dodecanol, butyl alcohol and 2-hexyl decanol, among which oleyl alcohol, cetanol and stearyl alcohol are preferable for use in the fiber treating agent.

(vi) Ceramide or pseudo-ceramides: Specifically, the following 13 compounds can be mentioned.

Ceramide 1 : $C_{17}H_{31}COOC_{29}H_{58}CONHCH\ (CH_2OH)\ CH\ (OH)\ C_{15}H_{29}$
Ceramide 2: $C_{23}H_{47}CONHCH\ (CH_2OH)\ CH\ (OH)\ C_{15}H_{29}$
Ceramide 3: $C_{23}H_{47}CONHCH(CH_2OH)CH(OH)CH(OH)C_{14}H_{29}$
Ceramide 4: $C_{24}H_{49}CH(OH)CONHCH(CH_2OH)CH(OH)C_{15}H_{29}$
Ceramide 5: $C_{22}H_{45}CH(OH)CONHCH(CH_2OH)CH(OH)C_{15}H_{29}$
Ceramide 6: $C_{22}H_{45}CH(OH)CONHCH(CH_2OH)CH(OH)CH(OH)C_{14}H_{29}$
Ceramide 7: $HOC_2H_4OCH_2NHCO(CH_2)_6CH(CH_3)C_3H_6CH(CH_3)\ (CH_2)_6CONHCH_2OC_2H_4OH$
Ceramide 8: $HOC_2H_4OCH_2NHCO(CH_2)_{18}CONHCH_2OC_2H_4OH$
Ceramide 9: $CH_3OC_3H_6NHCO(CH_2)_6CH(CH_3)C_3H_6CH(CH_3)(CH_2)_6CONHC_3H_6OCH_3$
Ceramide 10: $CH_3OC_3H_6NHCO(CH_2)_{18}CONHC_3H_6OCH_3$
Ceramide 11: $CH_3OC_3H_6NHCO(CH_2)_8CONHC_3H_6OCH_3$
Ceramide 12: $CH_3(CH_2)_{11}OC_3H_6NHCO\ (CH_2)_8CONHC_3H_6O(CH_2)_{11}CH_3$
Ceramide 13: $CH_3CH_2CH_2CH_2CH\ (C_2H_5)\ CH_2NHCO\ (CH_2)_8\ CONHCH_2CH(C_2H_5)CH_2CH_2CH_2CH_3$

(vii) Perfume

[Component (c)]

[0044] The component (c) in the present invention is water, and deionized water or distilled water from which heavy metals occurring in a very small amount were removed can be used. Sterilized water sterilized with chlorine etc. can also be used.

[Other components]

[0045] The oil-in-water emulsion of the present invention comprises the components (a) to (c) as the essential ingredient, and for the purpose of improving the stability of the emulsion and for the purpose of promoting the adsorption of the component onto the surface of a subject, a surfactant can be used as the component (d). The usable surfactant includes a nonionic surfactant, a cationic surfactant, an anionic surfactant and an amphoteric surfactant, and from the viewpoint of the stability of the emulsion, the nonionic surfactant (d1) is preferable, and from the viewpoint of promoting adsorption onto the surface of a subject, the cationic surfactant (d2) is preferably simultaneously used.

[0046] From the viewpoint of the stability of the emulsion, the nonionic surfactant (d1) is preferably a compound represented by the formula (7):

$$R^{7a}\text{-}J\text{-}[(R^{7b}\text{-}O)_f\text{-}R^{7c}]_g \qquad (7)$$

wherein R^{7a} is a C8 to C32, preferably C10 to C28, more preferably C10 to C24, still more preferably C10 to C18, alkyl or alkenyl group, R^{7b} is a C2 or C3 alkylene group, R^{7c} is a hydrogen atom or a C1 to C3 alkyl group, J is a linking group selected from -O-, -COO-, -CON< and -N<, and when J is -O- or -COO-, g is 1, and when J is -CON< or -N<, g is 2; f is 1 to 150 on average, preferably 2 to 80, more preferably 4 to 50, and a plurality of R^{7b} and R^{7c} may be the same or different.

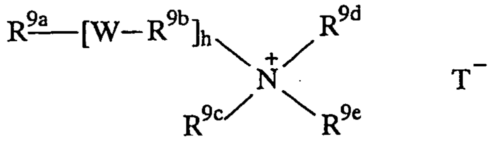
[0047] In the formula (7), R^{7a} is even more preferably a C10 to C18 alkyl group, R^{7b} is even more preferably an ethylene group, and R^{7c} is even more preferably a hydrogen atom. J is preferably -O- or -COO-, particularly preferably -O-.

[0048] The nonionic surfactant (d1) is even more preferably a compound represented by the formula (8):

$$R^{7a}\text{-}O\text{-}(C_2H_4O)_f\text{-}H \qquad (8)$$

wherein R^{7a} and f each have the same meaning as defined above.

[0049] From the viewpoint of promotion of adsorption onto the surface of an object, the cationic surfactant (d2) is preferably a compound represented by the formula (9):



$$R^{9a}-[W-R^{9b}]_h-N^{+}(R^{9c})(R^{9d})(R^{9e})\quad T^{-}$$

(9)

wherein R^{9a} is a C11 to C24 hydrocarbon group, W is a group selected from -COO- and -CONH-, R^{9b} is a C2 or C3 alkylene group; h is a number of 0 or 1; R^{9c} is a C1 to C3 alkyl group, C2 or C3 hydroxyalkyl group, or R^{9a}-[W-R^{9b}]h-; R^{9d} is a C1 to C3 alkyl group or a C2 or C3 hydroxyalkyl group; R^{9e} is a C1 to C3 alkyl group, a C2 or C3 hydroxyalkyl group or a hydrogen atom; and T^- is an organic or inorganic anion.

[0050] In the compound represented by the formula (9), R^{9a} is preferably a C14 to C18 alkyl or alkenyl group, and h is a number of 1. The cationic surfactant (d2) is preferably a mixture of compound (d2-2) wherein R^{9c} is R^{9a}- [W-R^{9b}] h- and compound (d2-1) wherein R^{9c} is a methyl group or hydroxyethyl group wherein the weight ratio of (d2-2) / (d2-1) is 100/1 to 100/10, preferably 100/2 to 100/6, for the purpose of promotion of adsorption of the oil agents. R^{9d} is preferably a methyl group or hydroxyethyl group, R^{9e} is preferably a hydrogen atom or a methyl group. T^- is a halogen ion (preferably a chlorine ion), a C1 to C3 alkyl sulfate ion, a C1 to C12 fatty acid ion, or a benzene sulfonate ion optionally substituted with a C1 to C3 alkyl group.

[0051] In the present invention, a water-soluble solvent (e) is preferably simultaneously used for the purpose of regulating the rheology of the composition and from the viewpoint of the stability of the emulsion. Preferable examples of the water-soluble solvent include ethanol, propanol, isopropanol, ethylene glycol, propylene glycol, glycerin and 1,3-butane diol, among which glycerin, ethylene glycol, propylene glycol and 1,3-butane diol are particularly preferable.

[0052] In the present invention, usual additives used in fiber treating agents, for example components such as a perfume, a preservative, a dye, a pigment, a viscosity regulator, an inorganic salt and a hydrotropic agent can be used if necessary.

[Fiber treating composition]

[0053] The content of the component (a) in the fiber treating composition of the present invention is preferably 0.01 to 10 wt%, more preferably 0.05 to 8.0 wt%, still more preferably 0.1 to 5.0 wt%. The content of the component (b) is preferably 0.1 to 50 wt%, more preferably 1.0 to 50 wt%, still more preferably 3.0 to 45 wt%. The component (a) /component (b) ratio (weight ratio) is from 1/150 to 30/100, and when the component (a) is compound (i), the ratio is preferably 1/150 to 30/100, more preferably 1/100 to 20/100, still more preferably 1/80 to 10/100. When the component (a) is compound (ii), the ratio is preferably 1/150 to 30/100, more preferably 1/100 to 15/100, still more preferably 1/80 to 1/11. The content of water as the component (c) in the fiber treating composition of the present invention is preferably 40 to 95 wt%, more preferably 50 to 90 wt%, still more preferably 60 to 90 wt%.

[0054] In the method of using the fiber treating composition of the present invention, the amount of the component (b) is preferably 0.05 to 5.0 wt%, more preferably 0.07 to 4.0 wt%, still more preferably 0.1 to 3.0 wt%, relative to fiber clothes to be treated. Specifically, the fiber treating composition of the present invention is added in an amount (wt%) within the range defined above to washing water and rinsing water including fiber products and used in treatment, whereby the component (b) can be efficiently adsorbed onto fibers. The fiber treating composition of the present invention is added preferably in an amount (wt%) within the above range under such a condition that the ratio of water to fiber products to be treated (bath ratio = water weight/fiber product weight) is 5 to 30, preferably 8 to 20.

[0055] For the purpose of improving stability, a component (d1) is preferably used as an arbitrary component in the fiber treating composition of the present invention, but attention should be paid to its use because incorporation thereof in a large amount may deteriorate the effect of the present invention. The content of the component (d1) in the composition of the present invention is preferably 0.1 to 20 wt%, more preferably 1 to 15 wt%, still more preferably 2 to 10 wt%. The ratio of [component (b) + component (a)] /component (d1) (weight ratio) is preferably from 1/1 to 50/1, more preferably 3/1 to 30/1, still more preferably 7/1 to 20/1. Component (d2) is preferably simultaneously used for the purpose of improving the adsorption of the component (b) onto the surface of a subject, but the incorporation of a large amount of component (d2), similar to component (d1), may deteriorate the effect of the present invention. The content of the component (d2) in the fiber treating composition of the present invention is preferably 0 to 20 wt%, more preferably

1 to 15 wt%, still more preferably 2 to 10 wt%. The ratio of [component (b) + component (a)]/component (d2) (weight ratio) is preferably from 1/5 to 80/1, more preferably 1/1 to 60/1, still more preferably 5/1 to 40/1. The content of component (e) in the fiber treating composition of the present invention is preferably 0.5 to 30 wt%, more preferably 1 to 20 wt%, still more preferably 4 to 15 wt%, from the viewpoint of storage stability.

[0056] The pH value of the fiber treating composition of the present invention at 20°C is adjusted preferably 2 to 8, preferably 4 to 7.5, from the viewpoint of stability. As a pH regulator, acids for example inorganic acids such as hydrochloric acid or sulfuric acid, organic acids such as citric acid, succinic acid, malic acid, fumaric acid, tartaric acid, malonic acid and maleic acid, and alkalis such as sodium hydroxide, potassium hydroxide, ammonia and derivatives thereof, amine salts such as monoethanol amine, diethanol amine and triethanol amine, and sodium carbonate and potassium carbonate are preferably used alone or as a mixture thereof, and particularly an acid selected from hydrochloric acid, sulfuric acid and citric acid and an alkali selected from sodium hydroxide and potassium hydroxide are preferably used.

[0057] The viscosity of the fiber treating composition of the present invention at 20°C is preferably 2 to 300 mPa·s, more preferably 5 to 200 mPa·s, still more preferably 10 to 150 mPa·s, from the viewpoint of handling and stability of the emulsion. Such viscosity regulation is conducted by using component (e), a usual viscosity regulator etc.

[Process for producing the fiber treating composition]

[0058] The composition of the present invention is preferably in the form of O/W emulsion in order to promote the absorption of component (b) onto the surface of a subject. An O/W emulsion composition in the form of dispersed, capsulated particles with the component (b) shelled by the component (a) is more preferable. This is because the hydroxy group in the component (a) can interact with a subject to be treated, or the alkyl group in the component (a) can interact with the component (b), to facilitate emulsification efficiently.

[0059] The process for producing the composition of the present invention is not particularly limited, but the composition can be produced by the following process.

[0060] The component (a), if necessary the components (d1), (d2) and (e), are added at ordinary temperatures to the component (c) in an amount corresponding to 15% of the necessary amount, then heated to 80°C, stirred and then cooled to 25°C (this solution is referred to as (F)). Then, the components (d1) and (d2) are added if necessary thereto under stirring and left under stirring. Thereafter, the component (b) is added slowly. When the component (b) is a solid or non-fluidized state at ordinary temperatures, it is added desirably under heating at a temperature higher than the melting point or fluidization point. In this case, the solution (F) is also desirably heated to a temperature higher than the melting point or fluidization point of the component (b). Thereafter, the resulting blend is further stirred, heated to 60°C or to a temperature higher than the melting point or fluidization point of the component (b) and then stirred to give a composition. The composition is left at the same temperature or cooled to about 40°C, and the remainder of the component (c) is added slowly to the resulting composition obtained by the above method and then stirred. If necessary, the pH is regulated, and the temperature of the blend is reduced to ordinary temperatures to give the oil-in-water emulsion of the present invention. In the production method described above, a part of the component (b) may be added together with the component (a).

[0061] In the present invention, it is preferable that the solution (F) is regulated at 20 to 75°C, preferably at 30 to 60°C, and mixed with water (c) at 20 to 90°C, preferably at 30 to 70°C. The components (d1) and (d2) may be previously added to solution (F), or previously dissolved in component (e), or solution (F) may be mixed with component (c), followed by adding the components (d1) and (d2).

[0062] According to the process described above, there is obtained an oil-in-water emulsion containing capsulated particles having a particle diameter of 0.1 to 50 μm with the component (b) shelled by the component (a).

[0063] In the present invention, a fiber treating composition containing an oil-in-water emulsion having a hydrophobic compound included therein can be provided, and according to the present invention, the hydrophobic compound can be efficiently adsorbed onto the surface of a subject without destroying the emulsion upon dilution.

Examples

[0064] The present invention is described in more detail by reference to the Examples. The Examples are described for illustrative purposes only and not intended to limit the scope of the present invention.

[0065] The compounding ingredients used in the Examples are collectively shown below. The term "%" in the Examples refers to "% by weight" unless otherwise specified.

<Compounding ingredients>

[0066]

- Component (a)

  (a-1): Quaternary ammonium salt copolymer of vinyl pyrrolidone/dimethylaminopropyl methacrylate/dimethylaminopropyl methacrylate with lauryl chloride ((a1-1)/(a2-1) = 90/10 (molar ratio), Stylize W-20 manufactured by ISP Japan)
  (a-2): Polymer compound (a-2) produced in Synthesis Example 1
  (a-3): Polysaccharide derivative (a-3) produced in Synthesis Example 2
  (a-4): Polysaccharide derivative (a-4) produced in Synthesis Example 3
  (a-5) : Polysaccharide derivative (a-5) produced in Synthesis Example 4

- Comparative Compound

  (a'-1): Sodium polyacrylate (Aqualic DL-384, weight-average molecular weight of 8000, manufactured by Nippon Shokubai Co. , Ltd.)
  (a'-2): Nonionic surfactant having 12 moles on average of ethylene oxide to 1 mole of lauryl alcohol

- Component (b)

  (b-1) : KF-96A (5000 mm^2/s) manufactured by Shin-Etsu Chemical Co., Ltd.
  (b-2): KF-96A (200,000 mm^2/s) manufactured by Shin-Etsu Chemical Co., Ltd.
  (b-3) : SH-200 (10,000 mm^2/s) manufactured by Dow Corning Toray Silicone Co., Ltd.
  (b-4): SH-200 (1, 000, 000 mm^2/s) manufactured by Dow Corning Toray Silicone Co., Ltd.
  (b-5): FZ-2203 (5000 mm^2/s) manufactured by Nippon Unicar Company Limited
  (b-6): FZ-2207 (2500 mm^2/s) manufactured by Nippon Unicar Company Limited
  (b-7): KF-6025 manufactured by Shin-Etsu Chemical Co., Ltd.
  (b-8) : KF-6016 (150 mm^2/s) manufactured by Shin-Etsu Chemical Co., Ltd.
  (b-9) : KF-6013 (400 mm^2/s) manufactured by Shin-Etsu Chemical Co., Ltd.
  (b-10): Squalane
  (b-11): Stearyl alcohol
  (b-12): Pentaerythritol monostearate
  (b-13): Oleic acid
  (b-14): The above ceramide 4

- Component (c): Water
- Component (d)

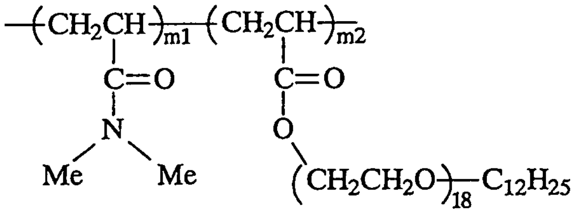
  (d1-1): Polyoxyethylene (EO = 21) lauryl ether
  (d2-2-1): N-stearoylaminopropyl-N-stearoyloxyethyl-N,N-dimethyl ammonium chloride
  (d2-1-1): N-stearoylaminopropyl-N-2-hydroxyethyl-N,N-dimethyl ammonium chloride

- Component (e)

  (e-1): Glycerin

Synthesis Example 1: Synthesis example of polymer compound (a-2)

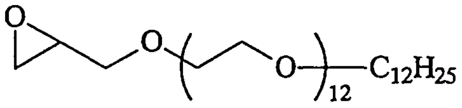
[0067] 94.2 g N,N-dimethylacrylamide, 51.7 g ALE-900 (lauroxypolyethylene glycol (EO = 18) monoacrylate, manufactured by Nippon Oil & Fats Co., Ltd.) and 200 g ethanol were mixed. A nitrogen gas was introduced into the solution (20 ml/min. , 1 hour) to degas the system, and then the solution was heated to 60°C. Thereafter, 82.8 g solution of V-65 (polymerization initiator manufactured by Wako Pure Chemical Industries, Ltd.) in ethanol (3%) was added dropwise thereto at a temperature kept at 60°C. Thereafter, the mixture was aged at 60°C for 12 hours. After the reaction was finished, the resulting reaction product was dropped into 2 kg diisopropyl ether. The resulting white solids were separated by filtration and washed with diisopropyl ether (500 g, twice) . After vacuum drying, 115 g polymer compound (a-2) represented by formula (10) was obtained. The degree of introduction of lauroxypolyethylene glycol monoacrylate [m2/ (m1 + m2)] in the resulting (a-2), as determined by NMR, was 0.054. The weight-average molecular weight was 65000.



(10)

Synthesis Example 2: Synthesis example of polysaccharide derivative (a-3)

[0068] 160 g hydroxyethyl cellulose having a weight-average molecular weight of 200,000 and a hydroxyethyl substitution degree of 2.5 (NATROZOL 250G, manufactured by Hercules), 1280 g of 80% hydrous isopropyl alcohol and 9.8 g of 48% aqueous sodium hydroxide were mixed to prepare slurry and then stirred for 30 minutes at room temperature in a nitrogen atmosphere. 31.8 g compound represented by the following formula (11):



(11)

was added thereto and reacted at 80°C for 8 hours to convert it into the corresponding polyoxyalkylene. After the reaction was finished, the reaction mixture was neutralized with acetic acid, and the reaction product was separated by filtration. The reaction product was washed twice with 700 g isopropyl alcohol and dried for one day at 60°C under reduced pressure to give 152 g polyoxyalkylated hydroxyethyl cellulose derivative (polysaccharide derivative (a-3)).

[0069] The degree of substitution with substituent groups including polyoxyalkylene group in the resulting polysaccharide derivative (a-3) was 0.014.

Synthesis Example 3: Synthesis example of polysaccharide derivative (a-4)

[0070] 80 g hydroxyethyl cellulose having a weight-average molecular weight of 500,000 and a hydroxyethyl substitution degree of 1.8 (HEC-QP4400H, manufactured by Union Carbide Corporation), 640 g of 80% hydrous isopropyl alcohol and 5.34 g of 48% aqueous sodium hydroxide were mixed to prepare slurry and then stirred for 30 minutes at room temperature in a nitrogen atmosphere. 12.78 g compound represented by the formula (11) above was added thereto and reacted at 80°C for 8 hours to convert it into the corresponding polyoxyalkylene. After the reaction was finished, the reaction mixture was neutralized with acetic acid, and the reaction product was separated by filtration. The reaction product was washed twice with 500 g isopropyl alcohol and dried for one day at 60°C under reduced pressure to give 73 g polyoxyalkylated hydroxyethyl cellulose derivative (polysaccharide derivative (a-4)).

[0071] The degree of substitution with substituent groups including polyoxyalkylene group in the resulting polysaccharide derivative (a-4) was 0.004. Synthesis Example 4: Synthesis example of polysaccharide derivative (a-5)

[0072] 80 g hydroxyethyl cellulose having a weight-average molecular weight of 1,500,000 and a hydroxyethyl substitution degree of 1.8 (HEC-QP100MH, manufactured by Union Carbide Corporation), 640 g of 80% hydrous isopropyl alcohol and 5.34 g of 48% aqueous sodium hydroxide were mixed to prepare slurry and then stirred for 30 minutes at room temperature in a nitrogen atmosphere. 12.78 g compound represented by the formula (11) above was added thereto and reacted at 80°C for 8 hours to convert it into the corresponding polyoxyalkylene. After the reaction was finished, the reaction mixture was neutralized with acetic acid, and the reaction product was separated by filtration. The reaction product was washed twice with 500 g isopropyl alcohol and dried for one day at 60°C under reduced pressure to give 72.0 g polyoxyalkylated hydroxyethyl cellulose derivative (polysaccharide derivative (a-5)).

[0073] The degree of substitution with substituent groups including polyoxyalkylene group in the resulting polysaccharide derivative (a-5) was 0.004.

Example 1

[0074] The compounding ingredients shown in Tables 1-1 and 1-2 were used to prepare fiber treating compositions having the compositions shown in Tables 1-1 and 1-2 by the method described below. Each of the resulting compositions was diluted 500-fold with water, and a suitable amount of the dilution was placed on a glass slide and the state of emulsified particles was observed with a digital microscope (KEYENCE VH-8500). The results are shown in Tables 1-1 and 1-2.

<Method of preparing the fiber treating composition>

[0075] The component (a), the components (b) and (e) in an amount of 1/5 (weight ratio), in Tables 1-1 and 1-2, were added to 15% of the component (c) (25°C) necessary for forming the compositions in Tables 1-1 and 1-2, and the mixture was stirred at 25°C for 1 hour, then the component (d) was added thereto, the mixture was stirred for additional 20 minutes, and the remainder of the component (b) was added. Then, the mixture was stirred at 25°C for 1 hour, and the resulting blend was heated to 60°C and stirred for 1 hour to give a composition. The composition obtained by the method described above was cooled to 40°C over 1 hour, and the remainder of the component (c) (40°C) was added thereto and stirred for 30 minutes, and the pH was regulated, and the temperature of the composition was reduced to 25°C over 1 hour to give a fiber treating composition containing an oil-in-water emulsion. The stirring rate is 400 rpm throughout the process.

Table 1-1

		products of the invention					comparative product 1
		1	2	3	4	5	
Fiber treating composition (%)	(a−1)	2					
	(a−2)		0.5				
	(a−3)			0.5			
	(a−4)				0.5		
	(a−5)					0.5	
	(a'−1)						2
	(b−1)	20					
	(b−2)		30			10	
	(b−3)				20		
	(b−4)			25			
	(b−5)			5			
	(b−6)				10		
	(b−7)					2	
	(b−8)					2	
	(b−9)					2	
	(d1−1)	1	1	0.5	0.5	0.5	1
	(d2−2−1)					10	
	(d2−1−1)					0.5	
	(e−1)	15	15	16	17	18	15
	(c)	Balance	Balance	Balance	Balance	Balance	Balance
Total		100	100	100	100	100	100
pH*		7	7	7	7	7	7
State of emulsified particles		Emulsified particles occurred	Emulsified particles occurred	Emulsified particles occurred	Emulsified particles occurred	Emulsified particles occurred	Emulsified particles did not occur

*: pH at 20°C, adjusted with 1/10 N aqueous sulfuric acid and 1/10 N aqueous sodium hydroxide.

Table 1-2

		products of the invention					Comparative product 4
		13	14	15	16	17	
Fiber treating composition (%)	(a−1)	2					
	(a−2)		0.5				
	(a−3)			0.5			
	(a−4)				0.5		
	(a−5)					0.5	
	(a' −1)						1
	(b−10)	20					30
	(b−11)		20				
	(b−12)				15		
	(b−13)			30	15	28	
	(b−14)					2	
	(d−1)	1	1	0.5	0.5	0.5	1
	(d−2−2)					10	
	(d−2−1)					0.5	
	(e)	15	15	16	17	18	15
	(c)	balance	balance	balance	balance	balance	balance
	Total	100	100	100	100	100	100
pH*		7	7	7	7	7	7
Observed state of emulsified particles		Emulsified particles occurred	Emulsified particles occurred	Emulsified particles occurred	Emulsified particles occurred	Emulsified particles occurred	Emulsified particles did not occur

Example 2

[0076] The components (a) to (e) shown in Tables 2-1 and 2-2 were used to prepare fiber treating compositions having the compositions shown in Tables 2-1 and 2-2 by the method described below. Each of the resulting compositions was used to treat clothes in the following manner, to determine adsorption. The results are shown in Tables 2-1 and 2-2.

<Method of preparing the fiber treating composition>

[0077] The component (a) , the component (b) in an amount of 1/5 (weight ratio) and the component (e), in Tables 2-1 and 2-2, were added to 15% of the component (c) (25°C) necessary for forming the compositions in Tables 2-1 and 2-2, the mixture was stirred at 25°C for 1 hour, the component (d1) was added thereto, the mixture was stirred for additional 20 minutes, and the remainder of the component (b) was added thereto. Then, the mixture was stirred at 25°C for 1 hour, and the resulting blend was heated to 60°C and stirred for 1 hour to give a composition. The composition obtained by the method described above was cooled to 40°C over 30 minutes, and the component (c) (40°C) in an amount from which the amount for forming a composition containing 30% of the component (d2) had been removed was added to the composition and stirred for 30 minutes. A separately prepared composition (40°C) containing 30% of the component (d2) was added to the composition and stirred for 30 minutes, and the pH was regulated, and the temperature of the composition was reduced to 25°C over 1 hour to give a fiber treating composition containing an oil-in-water emulsion. The stirring rate is 400 rpm throughout the process.

<Method of measuring adsorption>

[0078] 3 g of each composition was added to 2250 ml hard water of 4° at 20°C (0.6 g component (b) was added) and stirred for 1 minute (with a mini washing machine). Thereafter, about 16 g x 8 cotton knit clothes (about 150 g in total) were added thereto and treated therewith for 5 minutes. After the treatment, the clothes were dehydrated (3 minutes) and air-dried overnight. After drying, the treated clothes were cut into 1 g pieces, and 5 mL hexane (or 5 ml isopropyl alcohol (IPA) for Product 9 of the invention) and an internal standard were added to each piece, which was then treated for 15 minutes with a bath sonicator. The extract (hexane or IPA) was quantitatively determined by capillary GC.
Column: DB-1HT, 15 m
Conditions: 100°C → 10°C/min. → 340°C → kept at 340°C for 36 min.

Table 2-1

		Products of the invention							Comparative products	
		6	7	8	9	10	11	12	2	3
Fiber treating composition (%)	(a−1)	2								
	(a−2)		0.5							
	(a−3)			0.5			0.5			
	(a−4)				0.5			0.5		
	(a−5)					0.5				
	(a'−1)								2	
	(a'−2)									2
	(b−1)	20							20	
	(b−2)		10				15			
	(b−3)			20	15					
	(b−4)					15		12		
	(b−5)			10			2	2		20
	(b−6)					5				
	(b−7)				2		1			
	(b−8)				2					
	(b−9)				1		1			
	(d1−1)	0.5	0.5		0.5	0.5	0.5	0.5	0.5	0.5
	(d2−2−1)		15			5		5		
	(d2−1−1)		0.5			0.1		0.1		
	(e−1)	15	15	15	15	15	15	15	15	15
	(c)	balance	balance	balance	balance	balance	balance	balance	balance	balance
Total,		100	100	100	100	100	100	100	100	100
pH*		7	7	7	7	7	7	7	7	7
Adsorption (%)		80	60	80	80	80	80	80	15	20

*: pH at 20°C, adjusted with 1/10 N aqueous sulfuric acid and 1/10 N aqueous sodium hydroxide.

Table 2-2

		Products of the invention					Comparative products	
		18	19	20	21	22	5	6
Fiber treating composition (%)	(a−1)	2						
	(a−2)		0.5					
	(a−3)			0.5				
	(a−4)				0.5			
	(a−5)					0.5		
	(a'−1)						2	
	(a'−2)							2
	(b−10)	30	15				20	
	(b−11)		15					
	(b−12)				15			
	(b−13)			30	15	28		20
	(b−14)					2		
	(d−1)	0.5	0.5		0.5	0.5	0.5	0.5
	(d−2-2)		15			5		
	(d−2-1)		0.5			0.1		
	(e)	16	16	16	16	16	16	16
	(c)	Balance	Balance	Balance	Balance	Balance	Balance	Balance
	Total	100	100	100	100	100	100	100
pH*		7	7	7	7	7	7	7
Adsorption(%)		80	60	80	80	80	15	20

Claims

1. A fiber treating composition comprising an oil-in-water emulsion prepared by adding (c) water to a mixed solution (A) comprising (a) a polymer compound comprising a constituent unit (a1) having 2 to 20 carbon atoms in total and having at least one selected from the group consisting of a hydroxy group, a carboxylic acid group, a quaternary ammonium group, an amino group and an amide group , provided that a unit constituting (a2) is excluded, and a constituent unit (a2) having a C8 to C22 hydrocarbon group at a molar ratio of (a1)/(a2) of 100/30 to 1000/1, and (b) a hydrophobic compound capable of being dissolved in an amount of 1% by weight at the maximum in 100g of water at 20°C, having a melting point of 70°C or lower and having a saturated vapor pressure of 1.45 kPa (11 mmHg) or less at 20°C and 0.1 MPa (1 atm) at a weight ratio of component (a) /component (b) of 1/150 to 30/100, while stirring , to emulsify the mixture.

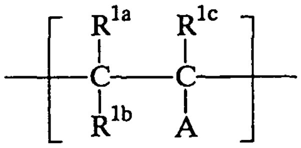
2. A fiber treating composition comprising an oil-in-water emulsion prepared by adding (c) water to a mixed solution (A) comprising (a) a polymer compound comprising a constituent unit (a1) having 2 to 20 carbon atoms in total and having at least one selected from the group consisting of a hydroxy group, a carboxylic acid group, a quaternary ammonium group, an amino group and an amide group, provided that a unit constituting (a2) is excluded, and a constituent unit (a2) having a C8 to C22 hydrocarbon group at a molar ratio of (a1) / (a2) of 100/30 to 1000/1, and (b) a silicone compound at a weight ratio of component (a) /component (b) of 1/150 to 30/100, while stirring, to emulsify the mixture.

3. The composition according to claim 1, wherein the component (b) is at least one compound selected from the group consisting of a C10 to C18 saturated or unsaturated fatty acid, a fatty ester having a molecular weight of 300 to 3000, a C10 to C18 saturated or unsaturated fatty alcohol, and ceramide.

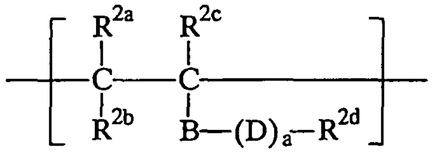
4. The composition according to any one of claims 1 to 3, wherein the mixed solution (A) further comprises a water-soluble solvent (e).

5. The composition according to any one of claims 1 to 4, wherein the component (a) is at least one selected from the following (i) and (ii):

(i) a polymer compound comprising a monomer unit (a1-1) represented by the formula (1) and a monomer unit (a2-1) represented by the formula (2) at a molar ratio of (a1-1) / (a2-1) of 100/30 to 150/1 at a ratio of the total monomer units (a1-1) and (a2-1) to the total monomer units in the molecule being 50 to 100 mol%,



$$-\left[\overset{R^{1a}}{\underset{R^{1b}}{\overset{|}{\underset{|}{C}}}}-\overset{R^{1c}}{\underset{A}{\overset{|}{\underset{|}{C}}}}\right]- \qquad (1)$$



$$-\left[\overset{R^{2a}}{\underset{R^{2b}}{\overset{|}{\underset{|}{C}}}}-\overset{R^{2c}}{\underset{B-(D)_a-R^{2d}}{\overset{|}{\underset{|}{C}}}}\right]- \qquad (2)$$

wherein each of R^{1a} and R^{2a} is independently a hydrogen atom or a C1 to C3 alkyl group, each of R^{1b} and R^{2b} is a group selected independently from a hydrogen atom or $-COOM^1$ whereupon M^1 represents a hydrogen atom, an alkali metal atom or an alkaline earth metal atom, each of R^{1c} and R^{2c} is a group selected independently from a hydrogen atom, a C1 to C3 alkyl group and a hydroxyl group, R^{2d} is a C8 to C22 hydrocarbon group, A is $-COOM^2$, -OH, $-CON (R^{1d}) (R^{1e})$, $-COO-R^{1f}-N^+(R^{1g}) (R^{1h}) (R^{1i}) \cdot X^-$, $-COO-R^{1f} - N (R^{1g}) (R^{1h})$, $-CON (R^{1d}) -R^{1f}-N^+(R^{1g}) (R^{1h}) (R^{1i}) \cdot X^-$, $-CON (R^{1d}) -R^{1f}-N(R^{1g}) (R^{1h})$, or a heterocyclic group of 5- or 6-membered cyclic structure having at least one amino group or amide group in the cycle, M^2 represents a hydrogen atom, an alkali metal atom or an alkaline earth metal atom, R^{1d}, R^{1e}, R^{1g}, R^{1h} and R^{1i} independently represent a hydrogen atom, a C1 to C3 alkyl group or a C1 to C3 hydroxyalkyl group, R^{1f} represents a C1 to C5 alkylene group, X^- represents an organic or inorganic anionic group, B is a group selected from -O-, -COO-, -OCO- and $-CONR^{2e}$-whereupon R^{2e} is a hydrogen atom, a C1 to C3 alkyl group or a C1 to C3 hydroxyalkyl group, D is at least one group, for connecting between B and R^{2d}, selected from a C2 to C6 divalent hydrocarbon group, a polyoxyalkylene group having an polyoxyalkylene group with 1 to 300 oxalkylene groups on the average attached and a polyglyceryl group with 1 to 10 glyceryl groups on the average attached, D being bound to R^{2d} via a group selected from an ether group, an ester group, a cationic group and an amide group, and a is a number of 0 or 1; and

(ii) a polysaccharide derivative having (a1-2) a monosaccharide unit, or a hydroxyalkylated (C1 to C3), carboxyalkylated (C1 to C3) or cationized monosaccharide unit, and (a2-2)a monosaccharide unit having a monosaccharide unit or a hydroxyalkylated (C1 to C3), carboxyalkylated (C1 to C3) or cationized monosaccharide unit wherein a part or the whole of hydrogen atoms in hydroxyl groups are replaced by the formula (3), at a molar ratio of (a1-2) / (a2-2) of 1000/100 to 1000/1,

$$-R^{3a}-(OR^{3b})_b-E-R^{3c} \qquad (3)$$

wherein R^{3a} represents a C1 to C6 linear or branched divalent saturated hydrocarbon group which may be substituted with a hydroxy group or an oxo group, R^{3b} represents a C1 to C6 linear or branched divalent saturated hydrocarbon group which may be substituted with a hydroxy group or an oxo group, b is a number of 8 to 300, and R^{3b}S whose number is b may be the same or different, E represents a group selected from -O-, -COO- and -OCO-, and R^{3c} represents a C8 to C22 linear or branched hydrocarbon group which may be substituted with a hydroxy group.

6. The composition according to any one of claims 1 to 5, which comprises 0.01 to 10 wt% component (a), 0.1 to 50 wt% component (b) and 40 to 95 wt% water (c), wherein the ratio of the component (a)/component (b) is 1/300 to 10/1.

7. The composition according to any one of claims 1 to 6, which comprises capsulated particles having a particle diameter of 0.1 to 50 μm with the component (a) with component (b) shelled by component (a).

8. Use of the composition of any one of claims 1 to 7 as a fiber treating agent.

9. A method of treating fibers, comprising applying the composition of claim 1 or 2 onto a fiber product.