US 20250257523A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2025/0257523 A1**

Takayama et al. (43) **Pub. Date: Aug. 14, 2025**

(54) **TREATMENT AGENT FOR POLYESTER-BASED SYNTHETIC FIBERS, COMPOSITION CONTAINING TREATMENT AGENT FOR POLYESTER-BASED SYNTHETIC FIBERS, FIRST TREATMENT AGENT FOR POLYESTER-BASED SYNTHETIC FIBERS, COMPOSITION CONTAINING FIRST TREATMENT AGENT FOR POLYESTER-BASED SYNTHETIC FIBERS, SECOND TREATMENT AGENT FOR POLYESTER-BASED SYNTHETIC FIBERS, COMPOSITION CONTAINING SECOND TREATMENT AGENT FOR POLYESTER-BASED SYNTHETIC FIBERS, DILUTED SOLUTION OF TREATMENT AGENT FOR POLYESTER-BASED SYNTHETIC FIBERS, METHOD**

(71) Applicant: **Takemoto Oil & Fat Co., Ltd.**, Gamagori-Shi (JP)

(72) Inventors: **Yoshihiro Takayama**, Gamagori-Shi (JP); **Tomoya Okada**, Gamagori-Shi (JP); **Yutaka Kimura**, Gamagori-Shi (JP)

(73) Assignee: **Takemoto Oil & Fat Co., Ltd.**, Gamagori-Shi (JP)

(21) Appl. No.: **19/110,670**

(22) PCT Filed: **Sep. 12, 2023**

(86) PCT No.: **PCT/JP2023/033112**

§ 371 (c)(1),
(2) Date: **Mar. 11, 2025**

(30) **Foreign Application Priority Data**

Sep. 13, 2022 (JP) 2022-145558

Publication Classification

(51) **Int. Cl.**

D06M 13/17	(2006.01)
D06M 13/192	(2006.01)
D06M 13/292	(2006.01)
D06M 101/32	(2006.01)

(52) **U.S. Cl.**

CPC ***D06M 13/17*** (2013.01); ***D06M 13/192*** (2013.01); ***D06M 13/292*** (2013.01); *D06M 2101/32* (2013.01); *D10B 2331/04* (2013.01)

(57) **ABSTRACT**

Disclosed is a polyester synthetic fiber treatment agent that contains 5% by mass or more of a (poly) oxyalkylene derivative, 1% by mass or more of an organic acid compound, and 5% by mass or more of an organic phosphoric acid ester compound. A 5% by mass water-diluted liquid of the polyester synthetic fiber treatment agent (containing no solvent) has a pH at 25° C. of 5.5 or more and 8.5 or less. The organic acid compound is at least one selected from the group consisting of an organic acid, an organic acid salt, and an organic acid anhydride. The organic phosphoric acid ester compound is at least one selected from the group consisting of an organic phosphoric acid ester and a salt thereof having a hydrocarbon group with 16 or more and 20 or less carbon atoms in a molecule.

TREATMENT AGENT FOR POLYESTER-BASED SYNTHETIC FIBERS, COMPOSITION CONTAINING TREATMENT AGENT FOR POLYESTER-BASED SYNTHETIC FIBERS, FIRST TREATMENT AGENT FOR POLYESTER-BASED SYNTHETIC FIBERS, COMPOSITION CONTAINING FIRST TREATMENT AGENT FOR POLYESTER-BASED SYNTHETIC FIBERS, SECOND TREATMENT AGENT FOR POLYESTER-BASED SYNTHETIC FIBERS, COMPOSITION CONTAINING SECOND TREATMENT AGENT FOR POLYESTER-BASED SYNTHETIC FIBERS, DILUTED SOLUTION OF TREATMENT AGENT FOR POLYESTER-BASED SYNTHETIC FIBERS, METHOD

TECHNICAL FIELD

[0001] The present invention relates to a polyester synthetic fiber treatment agent, a composition containing polyester synthetic fiber treatment agent, a first component of polyester synthetic fiber treatment agent, a composition containing first component of polyester synthetic fiber treatment agent, a second component of polyester synthetic fiber treatment agent, a composition containing second component of polyester synthetic fiber treatment agent, a diluted liquid of a polyester synthetic fiber treatment agent, a method for treating polyester synthetic fiber, and a polyester synthetic fiber.

BACKGROUND ART

[0002] A synthetic fiber treatment agent may be adhered to the fiber surface, for example, in a spinning and drawing process and a finishing process of synthetic fibers from the viewpoint of, for example, friction reduction, antistatic properties, and bundling properties of the synthetic fibers.

[0003] Known synthetic fiber treatment agents are disclosed in Patent Documents 1 to 5. Patent Document 1 discloses a polyester synthetic fiber treatment agent containing a specific alkali metal salt of alkyl phosphoric acid ester having an alkyl group, a specific surfactant, and a specific metal salt of phosphoric acid in predetermined proportions, in which the alkali metal salt of alkyl phosphoric acid ester has an acid value of 0.1 to 90 KOH mg/g. Patent Document 2 discloses a polyester synthetic fiber treatment agent containing a specific alkyl phosphoric acid ester, a specific surfactant, and a specific monovalent aliphatic alcohol having an alkyl group in predetermined proportions. Patent Document 3 discloses a fiber treatment agent for manufacturing a spun yarn which contains as essential components a component A including polyvinyl alcohol or a derivative thereof and a component B including a specific potassium salt of alkyl phosphoric acid ester or potassium salt of polyoxyalkylene alkyl phosphoric acid ester having an alkyl group, in which the component A and the component B are blended in predetermined proportions. Patent Document 4 discloses a polyolefin synthetic fiber treatment agent containing a specific organic acid, two kinds of salts of alkyl phosphoric acid esters, and a polyoxyalkylene derivative in predetermined proportions, in which the aqueous liquid has a pH of 3 or more and less than 7. Patent Document 5 discloses a polyolefin synthetic fiber treatment agent containing fumaric acid, a specific nonionic surfactant, a dialkyl sulfosuccinic acid salt having 8 to 16 carbon atoms, and a polyglycerin fatty acid ester in predetermined proportions.

CITATION LIST

Patent Literature

[0004] Patent Document 1: Japanese Patent No. 5796922

[0005] Patent Document 2: Japanese Patent No. 5796923

[0006] Patent Document 3: Japanese Patent No. 5651033

[0007] Patent Document 4: Japanese Patent No. 6057489

[0008] Patent Document 5: Japanese Laid-Open Patent Publication No. 2018-31090

SUMMARY OF INVENTION

Technical Problem

[0009] In the known synthetic fiber treatment agent, the emulsion stability upon diluting the synthetic fiber treatment agent to form a water-diluted liquid is deteriorated, whereby deposits and the like may be generated. Further, the adhesion of the fiber surface to which the synthetic fiber treatment agent has been applied may be increased, resulting in pinning defects. Furthermore, the strength of the fiber to which the synthetic fiber treatment agent has been applied may be reduced, resulting in poor process passability.

Solution to Problem

[0010] As a result of research to solve the problems described above, the inventors of the present application have found that a polyester synthetic fiber treatment agent is suitable in which a (poly)oxyalkylene derivative (A), a specific organic acid compound (B), and a specific organic phosphoric acid ester compound (C) are contained and the pH is defined.

[0011] Aspects for solving the above problems will be described.

[0012] A polyester synthetic fiber treatment agent according to a first aspect is characterized by containing 5% by mass or more of a (poly)oxyalkylene derivative (A), 1% by mass or more of an organic acid compound (B), and 5% by mass or more of an organic phosphoric acid ester compound (C). A 5% by mass water-diluted liquid of the polyester synthetic fiber treatment agent (containing no solvent) has a pH at 25° C. of 5.5 or more and 8.5 or less. The organic acid compound (B) is at least one selected from the group consisting of an organic acid, an organic acid salt, and an organic acid anhydride. The organic phosphoric acid ester compound (C) is at least one selected from the group consisting of an organic phosphoric acid ester and a salt thereof having a hydrocarbon group with 16 or more and 20 or less carbon atoms in a molecule.

[0013] In a second aspect, the polyester synthetic fiber treatment agent according to the first aspect is characterized in that the organic acid compound (B) is at least one selected from the group consisting of mono- to pentabasic carboxylic acids in which the number of carbon atoms, excluding carboxy group-derived carbon atoms, is 0 or more and 9 or less, salts of mono- to pentabasic carboxylic acids in which

the number of carbon atoms, excluding carboxy group-derived carbon atoms, is 0 or more and 9 or less, and di- to pentabasic carboxylic anhydrides in which the number of carbon atoms, excluding carboxy group-derived carbon atoms, is 0 or more and 9 or less.

[0014] In a third aspect, the polyester synthetic fiber treatment agent according to the first or second aspect is characterized in that the (poly)oxyalkylene derivative (A) contains at least one selected from the group consisting of polyoxyalkylene alkylamine and polyoxyalkylene alkenylamine.

[0015] In a fourth aspect, the polyester synthetic fiber treatment agent according to any one of the first to third aspects is characterized in that assuming that the sum of the contents of the (poly)oxyalkylene derivative (A), the organic acid compound (B), and the organic phosphoric acid ester compound (C) is 100 parts by mass, the polyester synthetic fiber treatment agent contains the (poly)oxyalkylene derivative (A) and the organic acid compound (B) in total in an amount of 20 parts by mass or more and 80 parts by mass or less, and contains the organic phosphoric acid ester compound (C) in an amount of 20 parts by mass or more and 80 parts by mass or less.

[0016] In a fifth aspect, the polyester synthetic fiber treatment agent according to any one of the first to fourth aspects is characterized in that the polyester synthetic fiber treatment agent is prepared as a set including first and second components of polyester synthetic fiber treatment agent. The first component of polyester synthetic fiber treatment agent contains the (poly)oxyalkylene derivative (A). The second component of polyester synthetic fiber treatment agent contains the organic phosphoric acid ester compound (C). Either one or both of the first and second components of polyester synthetic fiber treatment agent contain the organic acid compound (B).

[0017] In a sixth aspect, the polyester synthetic fiber treatment agent according to any one of the first to fifth aspects is characterizes in that the polyester synthetic fiber is a polyester short fiber.

[0018] In a seventh aspect, the polyester synthetic fiber treatment agent according to any one of the first to sixth aspects is characterized in that the polyester synthetic fiber is a fiber for spun yarn production.

[0019] A composition containing polyester synthetic fiber treatment agent according to an eighth aspect is characterized by containing the polyester synthetic fiber treatment agent according to any one of the first to seventh aspects and a solvent(S). The solvent (S) has a boiling point of 105° C. or lower at atmospheric pressure.

[0020] A first component of polyester synthetic fiber treatment agent according to a ninth aspect is characterized by containing a (poly)oxyalkylene derivative (A) and is used in combination with a second component of polyester synthetic fiber treatment agent or a composition containing second component of polyester synthetic treatment agent. The second component of polyester synthetic fiber treatment agent contains an organic phosphoric acid ester compound (C). The composition containing second component of polyester synthetic fiber treatment agent contains the second component of polyester synthetic fiber treatment agent, which contains an organic phosphoric acid ester compound (C), and a solvent(S). Either one or both of the first and second components of polyester synthetic fiber treatment agent contain an organic acid compound (B). A 5% by mass water-diluted liquid of a mixture (containing no solvent) of the first component of polyester synthetic fiber treatment agent and the second component of polyester synthetic fiber treatment agent has a pH at 25° C. of 5.5 or more and 8.5 or less. The mixture (containing no solvent) of the first component of polyester synthetic fiber treatment agent and the second component of polyester synthetic fiber treatment agent contains 5% by mass or more of the (poly)oxyalkylene derivative (A), 1% by mass or more of the organic acid compound (B), and 5% by mass or more of the organic phosphoric acid ester compound (C). The organic acid compound (B) is at least one selected from the group consisting of an organic acid, an organic acid salt, and an organic acid anhydride. The organic phosphoric acid ester compound (C) is at least one selected from the group consisting of an organic phosphoric acid ester and a salt thereof having a hydrocarbon group with 16 or more and 20 or less carbon atoms in a molecule. The solvent(S) has a boiling point of 105° C. or lower at atmospheric pressure.

[0021] A composition containing first component of polyester synthetic fiber treatment agent according to a tenth aspect is characterized by containing the first component of polyester synthetic fiber treatment agent according to the ninth aspect and a solvent(S). The solvent(S) has a boiling point of 105° C. or lower at atmospheric pressure.

[0022] A second component of polyester synthetic fiber treatment agent according to an eleventh aspect is characterized by containing an organic phosphoric acid ester compound (C) and is used in combination with a first component of polyester synthetic fiber treatment agent or a composition containing first component of polyester synthetic fiber treatment agent. The first component of polyester synthetic fiber treatment agent contains a (poly)oxyalkylene derivative (A). The composition containing first component of polyester synthetic fiber treatment agent contains the first component of polyester synthetic fiber treatment agent, which contains a (poly)oxyalkylene derivative (A), and a solvent(S). Either one or both of the first and second components of polyester synthetic fiber treatment agent contain an organic acid compound (B). A 5% by mass water-diluted liquid of a mixture (containing no solvent) of the first component of polyester synthetic fiber treatment agent and the second component of polyester synthetic fiber treatment agent has a pH at 25° C. of 5.5 or more and 8.5 or less. The mixture (containing no solvent) of the first component of polyester synthetic fiber treatment agent and the second component of polyester synthetic fiber treatment agent contains 5% by mass or more of the (poly)oxyalkylene derivative (A), 1% by mass or more of the organic acid compound (B), and 5% by mass or more of the organic phosphoric acid ester compound (C). The organic acid compound (B) is at least one selected from the group consisting of an organic acid, an organic acid salt, and an organic acid anhydride. The organic phosphoric acid ester compound (C) is at least one selected from the group consisting of an organic phosphoric acid ester and a salt thereof having a hydrocarbon group with 16 or more and 20 or less carbon atoms in a molecule. The solvent(S) has a boiling point of 105° C. or lower at atmospheric pressure.

[0023] A composition containing second component of polyester synthetic fiber treatment agent according to a twelfth aspect is characterized by containing the second component of polyester synthetic fiber treatment agent

according to the eleventh aspect and a solvent(S). The solvent(S) has a boiling point of 105° C. or lower at atmospheric pressure.

[0024] A diluted liquid of polyester synthetic fiber treatment agent according to a thirteenth aspect is characterized by containing the polyester synthetic fiber treatment agent according to any one of the first to seventh aspects and has a concentration of the polyester synthetic fiber treatment agent of 0.1% by mass or more and 10% by mass or less.

[0025] A method for treating polyester synthetic fiber according to a fourteenth aspect is characterized by applying to a polyester synthetic fiber a diluted liquid of polyester synthetic fiber treatment agent prepared by adding the polyester synthetic fiber treatment agent according to any one of the first to seventh aspects to water.

[0026] A method for treating polyester synthetic fiber according to a fifteenth aspect is characterized by applying to a polyester synthetic fiber a diluted liquid of polyester synthetic fiber treatment agent prepared by adding the composition containing polyester synthetic fiber treatment agent according to the eighth aspect to water.

[0027] A method for treating polyester synthetic fiber according to a sixteenth aspect is characterized by applying to a polyester synthetic fiber a diluted liquid of polyester synthetic fiber treatment agent prepared by adding to water the first component of polyester synthetic fiber treatment agent according to the ninth aspect or the composition containing first component of polyester synthetic fiber treatment agent-according to the tenth aspect and the second component of polyester synthetic fiber treatment agent according to the eleventh aspect or the composition containing second component of polyester synthetic fiber treatment agent-according to the twelfth aspect.

[0028] A polyester synthetic fiber according to a seventeenth aspect is characterized by including the polyester synthetic fiber treatment agent according to any one of the first to seventh aspects adhered thereto.

Advantageous Effects of Invention

[0029] The present invention succeeds in improving the emulsion stability upon diluting the synthetic fiber treatment agent to form a water-diluted liquid. Further, it is possible to reduce the adhesion of the fiber surface to which the synthetic fiber treatment agent has been applied, and it is also possible to prevent a decrease in fiber strength.

DESCRIPTION OF EMBODIMENTS

First Embodiment

[0030] A first embodiment that embodies a polyester synthetic fiber treatment agent (hereinafter referred to as "treatment agent" in some cases) of the present invention will now be described. The treatment agent of the present embodiment contains a (poly)oxyalkylene derivative (A), an organic acid compound (B), and an organic phosphoric acid ester compound (C), and a 5% by mass water-diluted liquid of the treatment agent has a pH at 25° C. of 5.5 or more and 8.5 or less.

((Poly)oxyalkylene Derivative (A))

[0031] The (poly)oxyalkylene derivative (A) used in the treatment agent of the present embodiment serves as a surfactant and improves the stability of the treatment agent, thereby improving each function of the treatment agent.

[0032] Examples of the (poly)oxyalkylene derivative (A) include a (poly)oxyalkylene derivative having a (poly)oxyalkylene structure in which an alkylene oxide is added to an alcohol or a carboxylic acid; an ether ester compound having a (poly)oxyalkylene structure in which an alkylene oxide is added to an ester compound of a carboxylic acid and a polyhydric alcohol; a (poly)oxyalkylene derivative having a (poly)oxyalkylene structure in which an alkylene oxide is added to an aliphatic amine, which is an amine compound; a (poly)oxyalkylene derivative having a (poly)oxyalkylene structure in which an alkylene oxide is added to a fatty acid amide; and a block copolymer having a polyoxyethylene chain and a polyoxypropylene chain.

[0033] Among these derivatives, polyoxyalkylene alkyl ether, polyoxyalkylene alkenyl ether, polyoxyalkylene alkyl ester, polyoxyalkylene alkenyl ester, polyoxyalkylene alkylphenyl ether, polyoxyalkylene polyhydric alcohol fatty acid ester, polyoxyalkylene alkylamine, and polyoxyalkylene alkenylamine are preferable. From the viewpoint of further improving the emulsion stability upon diluting the treatment agent to form a water-diluted liquid, polyoxyalkylene alkylamine and polyoxyalkylene alkenylamine are more preferable.

[0034] Specific examples of an alcohol used as a raw material of the (poly)oxyalkylene derivative (A) include: (1) linear alkyl alcohols, such as methanol, ethanol, propanol, butanol, pentanol, hexanol, octanol, nonanol, decanol, undecanol, dodecanol, tridecanol, tetradecanol, pentadecanol, hexadecanol, heptadecanol, octadecanol, nonadecanol, eicosanol, heneicosanol, docosanol, tricosanol, tetracosanol, pentacosanol, hexacosanol, heptacosanol, octacosanol, nonacosanol, and triacontanol; (2) branched alkyl alcohols, such as isopropanol, isobutanol, isohexanol, 2-ethylhexanol, isononanol, isodecanol, isododecanol, isotridecanol, isotetradecanol, isotriacontanol, isohexadecanol, isoheptadecanol, isooctadecanol, isononadecanol, isoeicosanol, isoheneicosanol, isodocosanol, isotricosanol, isotetracosanol, isopentacosanol, isohexacosanol, isoheptacosanol, isooctacosanol, isonononacosanol, and isopentadecanol; (3) linear alkenyl alcohols, such as tetradecenol, hexadecenol, heptadecenol, octadecenol, and nonadecenol; (4) branched alkenyl alcohols, such as isohexadecenol and isooctadecenol; (5) cyclic alkyl alcohols, such as cyclopentanol and cyclohexanol; and (6) aromatic alcohols, such as phenol, nonylphenol, benzyl alcohol, monostyrenated phenol, distyrenated phenol, and tristyrenated phenol.

[0035] Specific examples of a carboxylic acid used as a raw material of the (poly)oxyalkylene derivative (A) include: (1) linear alkyl carboxylic acids, such as octylic acid, nonanoic acid, decanoic acid, undecanoic acid, dodecanoic acid, tridecanoic acid, tetradecanoic acid, pentadecanoic acid, hexadecanoic acid, heptadecanoic acid, octadecanoic acid, nonadecanoic acid, eicosanoic acid, heneicosanoic acid, and docosanoic acid; (2) branched alkyl carboxylic acids, such as 2-ethylhexanoic acid, isododecanoic acid, isotridecanoic acid, isotetradecanoic acid, isohexadecanoic acid, and isooctadecanoic acid; (3) linear alkenyl carboxylic acids, such as octadecenoic acid, octadecadienoic acid, and octadecatrienoic acid; (4) aromatic carboxylic acids, such as benzoic acid; (5) hydroxycarboxylic acids, such as ricinoleic acid; and (6) naturally occurring fatty acids, such as castor oil fatty acid, sesame oil fatty acid,

tall oil fatty acid, soybean oil fatty acid, rapeseed oil fatty acid, palm oil fatty acid, palm kernel fatty acid, and coconut oil fatty acid.

[0036] An alkylene oxide used as a raw material for forming the (poly)oxyalkylene structure of the (poly)oxyalkylene derivative (A) is preferably an alkylene oxide having 2 or more and 4 or less carbon atoms. Specific examples of the alkylene oxide include ethylene oxide, propylene oxide, and butylene oxide. The number of moles of alkylene oxide added is appropriately set, and is preferably 0.1 moles or more and 250 moles or less, more preferably 1 mole or more and 200 moles or less, and still more preferably 2 moles or more and 150 moles or less. Any combination of the upper and lower limits described above may be used. The number of moles of alkylene oxide added represents the number of moles of the alkylene oxide relative to 1 mole of the compound to be added in the prepared raw materials. As the alkylene oxide, one kind of alkylene oxide may be used alone, or two or more kinds of alkylene oxides may be used in combination as appropriate. When two or more kinds of alkylene oxides are used, the addition form thereof may be any of block addition, random addition, and a combination of block addition and random addition, and is not particularly limited.

[0037] Specific examples of a polyhydric alcohol used as a raw material of the (poly)oxyalkylene derivative (A) include ethylene glycol, propylene glycol, 1,3-propanediol, 1,2-butanediol, 1,3-butanediol, 1,4-butanediol, 2-methyl-1, 2-propanediol, 1,5-pentanediol, 1,6-hexanediol, 2,5-hexanediol, 2-methyl-2,4-pentanediol, 2,3-dimethyl-2,3-butanediol, glycerin, 2-methyl-2-hydroxymethyl-1,3-propanediol, trimethylolpropane, sorbitan, pentaerythritol, and sorbitol.

[0038] Specific examples of an aliphatic amine used as a raw material of the (poly)oxyalkylene derivative (A) include methylamine, ethylamine, butylamine, octylamine, decylamine, laurylamine, octadecylamine, octadecenylamine, and coco amine.

[0039] Specific examples of a fatty acid amide used as a raw material of the (poly)oxyalkylene derivative (A) include octylic acid amide, lauric acid amide, palmitic acid amide, stearic acid amide, oleic acid amide, behenic acid amide, and lignoceric acid amide.

[0040] The block copolymer having a polyoxyethylene chain and a polyoxypropylene chain is not particularly limited as long as it has a polyoxypropylene chain with low hydrophilicity and a polyoxyethylene chain with high hydrophilicity, and has a surfactant action. The number of polyoxyethylene chains and polyoxypropylene chains in the molecule is not particularly limited, and may be, for example, a block copolymer including one polyoxypropylene chain and one polyoxyethylene chain, or may be a poloxamer surfactant including a polyoxypropylene chain and two polyoxyethylene chains sandwiching the polyoxypropylene chain. Further, an ether compound prepared by adding a polyoxyethylene chain and a polyoxypropylene chain to a polyhydric alcohol may be used. The number of moles of ethylene oxide added to form the polyoxyethylene chain is not particularly limited, and is, for example, 5 moles or more and 200 moles or less. The additional number of moles of propylene oxide added to form the polyoxypropylene chain is not particularly limited, and is, for example, 5 moles or more and 100 moles or less.

[0041] Specific examples of the (poly)oxyalkylene derivative (A) include polyoxyethylene decylamine, polyoxyethylene dodecylamine, (polyoxyethylene) (polyoxypropylene) dodecylamine, polyoxyethylene octadecylamine, (polyoxyethylene) (polyoxypropylene) octadecylamine, polyoxyethylene decyl ether, (polyoxyethylene) (polyoxypropylene) decyl ether, polyoxyethylene dodecyl ether, (polyoxyethylene) (polyoxypropylene) C9-C11 alkyl ether, polyoxyethylene C12-C13 alkyl ether, (polyoxyethylene) (polyoxypropylene) C12-C13 alkyl ether, polyoxyethylene C12-C14 alkyl ether, (polyoxyethylene) (polyoxypropylene) tridecyl ether, polyoxyethylene tridecyl ether, (polyoxyethylene) (polyoxypropylene) C11-C14 alkyl ether, polyoxyethylene C11-C14 alkyl ether, polyoxyethylene octadecyl ether, polyoxyethylene oleyl ether, polyoxyethylene tetracosyl ether, polyoxyethylene octacosyl ether, (polyoxyethylene) (polyoxypropylene) cured castor oil, (polyoxyethylene) (polyoxypropylene) propylene glycol, (polyoxyethylene) (polyoxypropylene) butyl ether, polyoxyethylene lauryl ester, coconut fatty acid-polyoxyethylene, polyoxypropylene oleyl ester, and polyoxyethylene nonylphenyl ether.

[0042] As the (poly)oxyalkylene derivative (A), one kind of (poly)oxyalkylene derivative may be used alone, or two or more kinds of (poly)oxyalkylene derivatives may be used in combination as appropriate.

[0043] The lower limit of the content of the (poly)oxyalkylene derivative (A) in the treatment agent is preferably 5% by mass or more, and more preferably 10% by mass or more. When the content of the (poly)oxyalkylene derivative (A) is 5% by mass or more, it is possible to improve the emulsion stability upon diluting the treatment agent to form a water-diluted liquid. The upper limit of the content of the (poly)oxyalkylene derivative (A) is preferably 90% by mass or less, and more preferably 85% by mass or less. When the content of the (poly)oxyalkylene derivative (A) is 90% by mass or less, the adhesion of the fiber surface to which the treatment agent has been applied can be reduced. Any combination of the upper and lower limits described above may be used.

(Organic Acid Compound (B))

[0044] Examples of the organic acid compound (B) used in the treatment agent of the present embodiment include organic acids, organic acid salts, and organic acid anhydrides. The use of the organic acid compound (B) can particularly prevent a decrease in strength of the fiber to which the treatment agent has been applied.

[0045] Examples of the organic acid include a compound having a carboxyl group, alkyl phosphoric acid other than the ingredient (C) as described below, alkyl sulfonic acid, and alkyl sulfuric acid.

[0046] The compound having a carboxyl group may be a monobasic acid or a polybasic acid. The number of carbon atoms other than the carboxy group-derived carbon atoms is not particularly limited. Examples of the compound having a carboxyl group include monovalent fatty acid, hydroxy fatty acid, polycarboxylic acid (polybasic acid), amino acid, and aminocarboxylic acid.

[0047] As the fatty acid, a known fatty acid can be appropriately used, and a saturated fatty acid or an unsaturated fatty acid may be used. Further, the fatty acid may have a linear structure or a branched-chain structure.

[0048] Specific examples of the saturated fatty acid include formic acid, acetic acid, propionic acid, butyric acid, valeric acid, hexanoic acid (caproic acid), octylic acid (2-ethylhexanoic acid), octanoic acid (caprylic acid),

nonanoic acid, decanoic acid (capric acid), dodecanoic acid (lauric acid), tetradecanoic acid (myristic acid), hexadecanoic acid (palmitic acid), octadecanoic acid (stearic acid), eicosanoic acid (arachidic acid), docosanoic acid (behenic acid), and tetracosanoic acid.

[0049] Specific examples of the unsaturated fatty acid include crotonic acid, myristoleic acid, palmitoleic acid, oleic acid, vaccenic acid, eicosenoic acid, linoleic acid, α-linolenic acid, γ-linolenic acid, and arachidonic acid.

[0050] Specific examples of the polycarboxylic acid (polybasic acid) include: (1) dibasic acids, such as oxalic acid, malonic acid, succinic acid, glutaric acid, fumaric acid, maleic acid, adipic acid, and sebacic acid; (2) tribasic acids, such as aconitic acid; (3) aromatic dicarboxylic acids, such as benzoic acid, terephthalic acid, isophthalic acid, and 2,6-naphthalenedicarboxylic acid; (4) aromatic tricarboxylic acids, such as trimellitic acid, and (5) aromatic tetracarboxylic acids, such as pyromellitic acid.

[0051] Specific examples of the hydroxy fatty acid include citric acid, lactic acid, malic acid, tartaric acid, gluconic acid, glycolic acid, and ricinoleic acid.

[0052] Specific examples of the amino acid include alanine, valine, leucine, isoleucine, methionine, phenylalanine, tryptophan, proline, glycine, serine, threonine, cysteine, tyrosine, asparagine, glutamine, lysine, arginine, histidine, aspartic acid, and glutamic acid.

[0053] Specific examples of the aminocarboxylic acid include ethylenediaminetetraacetic acid (edetic acid), hydroxyethyl ethylenediamine triacetic acid, dihydroxyethyl ethylenediamine diacetic acid, 1,3-propanediamine tetraacetic acid, diethylenetriamine pentaacetic acid, triethylenetetramine hexaacetic acid, nitrilotriacetic acid, hydroxyethyl imino diacetic acid, L-aspartic acid-N,N-diacetic acid, and ethylenediamine disuccinic acid.

[0054] Specific examples of the alkyl sulfonic acid include lauryl sulfonic acid (dodecyl sulfonic acid), myristyl sulfonic acid, cetyl sulfonic acid, oleyl sulfonic acid, stearyl sulfonic acid, tetradecane sulfonic acid, dodecyl benzenesulfonic acid, and secondary alkyl sulfonic acid (C13-15).

[0055] Specific examples of the alkyl sulfuric acid include lauryl sulfuric acid ester, oleyl sulfuric acid ester, and stearyl sulfuric acid ester.

[0056] Specific examples of the alkyl phosphoric acid include lauryl phosphoric acid ester and octyl phosphoric acid ester.

[0057] When an organic acid salt is used, the salt is, for example, in the form of amine salts or metal salts.

[0058] Examples of the metal salt include alkali metal salts and alkaline earth metal salts. Specific examples of the alkali metal forming the alkali metal salts include sodium, potassium, and lithium. Examples of the alkaline earth metal forming the alkaline earth metal salts include metals corresponding to a group 2 element, such as calcium, magnesium, beryllium, strontium, and barium.

[0059] The amine forming the amine salt may be any of a primary amine, a secondary amine, and a tertiary amine. Specific examples of the amine forming the amine salt include: (1) aliphatic amines, such as methylamine, dimethylamine, trimethylamine, ethylamine, diethylamine, triethylamine, N—N-diisopropylethylamine, butylamine, dibutylamine, 2-methylbutylamine, tributylamine, octylamine, and dimethyllaurylamine; (2) aromatic amines or heterocyclic amines, such as aniline, N-methylbenzylamine, pyridine, morpholine, piperazine, and derivatives thereof; (3) alkanolamines, such as monoethanolamine, N-methylethanolamine, diethanolamine, triethanolamine, isopropanolamine, diisopropanolamine, triisopropanolamine, dibutylethanolamine, butyldiethanolamine, octyldiethanolamine, and lauryldiethanolamine; (4) arylamines, such as N-methylbenzylamine; (5) polyoxyalkylene alkylaminoethers, such as polyoxyethylene laurylaminoether and polyoxyethylene steryl aminoether; and (6) ammonia.

[0060] Specific examples of the organic acid anhydride include fumaric anhydride, maleic anhydride, acetic anhydride, propionic anhydride, succinic anhydride, phthalic anhydride, oxalic anhydride, and benzoic anhydride.

[0061] As the organic acid compound (B), one kind of organic acid compound may be used alone, or two or more kinds of organic acid compounds may be used in combination as appropriate.

[0062] Among these compounds, preferred are mono- to pentabasic carboxylic acids in which the number of carbon atoms other than the carboxy group-derived carbon atoms is 0 or more and 9 or less, salts of mono- to pentabasic carboxylic acids in which the number of carbon atoms other than the carboxy group-derived carbon atoms, is 0 or more and 9 or less, and di- to pentabasic carboxylic anhydrides in which the number of carbon atoms other than the carboxy group-derived carbon atoms, is 0 or more and 9 or less, from the viewpoint of achieving improvement of emulsion stability when diluting the treatment agent to form a water-diluted liquid.

[0063] The lower limit of the content of the organic acid compound (B) in the treatment agent is preferably 1% by mass or more, and more preferably 3% by mass or more. When the content of the organic acid compound (B) is 1% by mass or more, it is possible to adjust the pH of the treatment agent to an appropriate range and prevent a decrease in strength of the fiber to which the treatment agent has been applied. The upper limit of the content of the organic acid compound (B) is preferably 25% by mass or less, and more preferably 20% by mass or less. When the content of the organic acid compound (B) is 25% by mass or less, it is possible to adjust the pH of the treatment agent to an appropriate range and improve the emulsion stability upon diluting the treatment agent to form a water-diluted liquid. Any combination of the upper and lower limits described above may be used.

(Organic Phosphoric Acid Ester Compound (C))

[0064] Examples of the organic phosphoric acid ester compound (C) used in the treatment agent of the present embodiment include an organic phosphoric acid ester and a salt thereof having a hydrocarbon group with 16 or more and 20 or less carbon atoms in a molecule. The use of the organic phosphoric acid ester compound (C) can reduce the adhesion of the fiber surface to which the treatment agent has been applied.

[0065] The hydrocarbon group may be saturated or unsaturated. The hydrocarbon group may be a linear hydrocarbon group or a branched hydrocarbon group. The unsaturated hydrocarbon group may be an alkenyl group having one double bond as an unsaturated carbon bond or may be an alkadienyl group or an alkatrienyl group having two or more double bonds. Further, the unsaturated hydrocarbon group may be an alkynyl group having one triple bond as an unsaturated carbon bond or may be an alkadiynyl group having two or more triple bonds.

[0066] Specific examples of the saturated hydrocarbon group include a hexadecyl group, a heptadecyl group, an octadecyl group, a nonadecyl group, an icosyl group, an isohexadecyl group, an isoheptadecyl group, an isooctadecyl group, an isononadecyl group, and an isoicosyl group.

[0067] Specific examples of the unsaturated hydrocarbon group having one double bond in the hydrocarbon group include a hexadecenyl group, a heptadecenyl group, an octadecenyl group, a nonadecenyl group, an icosenyl group, an isohexadecenyl group, an isoheptadecenyl group, an isooctadecenyl group, an isononadecenyl group, and an isoicosenyl group.

[0068] The phosphoric acid forming the organic phosphoric acid ester compound is not particularly limited, and may be orthophosphoric acid or polyphosphoric acid, such as diphosphoric acid. When a salt of an organic phosphoric acid ester is used, examples of the salt include a phosphoric acid ester amine salt and a phosphoric acid ester metal salt. Specific examples of the salt include those exemplified in the description of the organic acid compound (B).

[0069] Specific examples of the organic phosphoric acid ester compound (C) include cetyl phosphoric acid ester, cetyl phosphoric acid ester, stearyl phosphoric acid ester, stearyl phosphoric acid ester salt, arachidyl phosphoric acid ester, and arachidyl phosphoric acid ester salt.

[0070] The acid value of the organic phosphoric acid ester compound (C) is not particularly limited.

[0071] As the organic phosphoric acid ester compound (C), one kind of organic phosphoric acid ester compound may be used alone, or two or more kinds of organic phosphoric acid ester compounds may be used in combination as appropriate.

[0072] The lower limit of the content of the organic phosphoric acid ester compound (C) in the treatment agent is preferably 5% by mass or more, more preferably 10% by mass or more, and still more preferably 20% by mass. When the content of the organic phosphoric acid ester compound (C) is 5% by mass or more, the adhesion of the fiber surface to which the treatment agent has been applied can be reduced. The upper limit of the content of the organic phosphoric acid ester compound (C) is preferably 90% by mass or less, more preferably 85% by mass or less, and still more preferably 80% by mass or less. When the content of the organic phosphoric acid ester compound (C) is 90% by mass or less, it is possible to improve the emulsion stability upon diluting the treatment agent to form a water-diluted liquid. Any combination of the upper and lower limits described above may be used.

[0073] Preferably, assuming that the sum of the amounts of the (poly)oxyalkylene derivative (A), the organic acid compound (B), and the organic phosphoric acid ester compound (C) contained in the treatment agent is 100 parts by mass, the treatment agent contains the (poly)oxyalkylene derivative (A) and the organic acid compound (B) in total in an amount of 20 parts by mass or more and 80 parts by mass or less, and contains the organic phosphoric acid ester compound (C) in an amount of 20 parts by mass or more and 80 parts by mass or less. The amounts are defined as the ranges described above, whereby the effects of the present invention can be further improved. Any combination of the upper and lower limits described above may be used.

(pH of Treatment Agent)

[0074] The lower limit of the pH at 25° C. of a 5% by mass water-diluted liquid of the treatment agent is 5.5 or more. When the pH is 5.5 or more, it is possible to improve the emulsion stability upon diluting the treatment agent to form a water-diluted liquid. The upper limit of the pH at 25° C. of a 5% by mass water-diluted liquid of the treatment agent is 8.5 or less. When the pH is 8.5 or less, it is possible to prevent a decrease in strength of the fiber to which the treatment agent has been applied. Any combination of the upper and lower limits described above may be used.

(Storage Form)

[0075] The treatment agent may be prepared as a one-component treatment agent containing the ingredients (A) to (C) described above. Alternatively, the treatment agent may be prepared as a two-component treatment agent as described below from the viewpoint of improving the formulation stability.

[0076] The two-component treatment agent is prepared as a set including a first component of polyester synthetic fiber treatment agent (hereinafter referred to as "first treatment agent") containing the (poly)oxyalkylene derivative (A) and a second component of polyester synthetic fiber treatment agent (hereinafter referred to as "second treatment agent") containing the organic phosphoric acid ester compound (C). Either one or both of the first treatment agent and the second treatment agent contain the organic acid compound (B).

[0077] The two-component treatment agent is constituted of the first treatment agent and the second treatment agent that are separate from each other before use, for example, during storage or during distribution. In use, the first treatment agent and the second treatment agent are mixed with each other to prepare the two-component treatment agent.

(Solvent)

[0078] The treatment agent of the present embodiment may be mixed as necessary with a solvent to prepare a composition containing polyester synthetic fiber treatment agent (hereinafter referred to as "treatment agent-containing composition") and be stored or distributed in the form of the treatment agent-containing composition.

[0079] The solvent has a boiling point of 105° C. or lower at atmospheric pressure. The term "atmospheric pressure" as used herein refers to standard atmospheric pressure (101325 Pa=1 atm). Examples of the solvent include water and an organic solvent. Specific examples of the organic solvent include lower alcohols, such as ethanol and propanol, and low polarity solvents, such as hexane. The solvent may be used either alone or in combination of two or more types as appropriate. Among these, a polarity solvent, such as water or a lower alcohol, is preferable from the viewpoint of excellent dispersibility or solubility of the respective ingredients, and water is more preferable from the viewpoint of excellent handling ability.

[0080] Assuming that the sum of the amounts of the treatment agent and the solvent contained in the treatment agent-containing composition is 100 parts by mass, the amount of the treatment agent contained in the treatment agent-containing composition is preferably 10 parts by mass or more.

[0081] The effects of the treatment agent of the first embodiment will now be described.

[0082] (1-1) The treatment agent of the first embodiment contains the (poly)oxyalkylene derivative (A), the organic acid compound (B), and the organic phosphoric acid ester compound (C), and a 5% by mass water-diluted liquid of the treatment agent has a pH at 25° C. of 5.5 or more and 8.5 or less.

[0083] Therefore, it is possible to improve the emulsion stability upon diluting the treatment agent to form a water-diluted liquid. This reduces the occurrence of deposits and/or precipitates from the emulsified liquid, thereby reducing the uneven quality of the fiber due to the uneven adhesion of the treatment agent. Further, it is possible to reduce the adhesion of the fiber surface to which the treatment agent has been applied and prevent a decrease in fiber strength. This reduces the uneven quality of the processed product due to poor process passability.

[0084] (1-2) The treatment agent of the first embodiment may be prepared as a set including the first treatment agent containing the (poly)oxyalkylene derivative (A) and the second treatment agent containing the organic phosphoric acid ester compound (C). Either one or both of the first treatment agent and the second treatment agent contain the organic acid compound (B). With such a configuration, the formulation stability, particularly the storage stability, of the treatment agent can be improved.

Second Embodiment

[0085] Next, a second embodiment that embodies a first treatment agent of the present invention will be described, focusing on the differences from the above embodiment.

[0086] The first treatment agent of the present embodiment contains a (poly)oxyalkylene derivative (A). The first treatment agent is combined in use with a second treatment agent containing an organic phosphoric acid ester compound (C) or a composition containing second component of polyester synthetic fiber treatment agent that contains the second treatment agent, which contains an organic phosphoric acid ester compound (C), and a solvent(S) (hereinafter referred to as "second treatment agent-containing composition"). The organic acid compound (B) is contained in either one or both of the first treatment agent and the second treatment agent. A 5% by mass water-diluted liquid of a mixture of the first treatment agent and the second treatment agent has a pH at 25° C. of 5.5 or more and 8.5 or less.

[0087] When the mixture of the first treatment agent and the second treatment agent is formed using the second treatment agent-containing composition prepared using water as the solvent(S), the pH is measured by a method as described below.

[0088] When the mixture of the first treatment agent and the second treatment agent is 5% by mass or more of water-diluted liquid of the treatment agent, the mixture is diluted to form a 5% by mass water-diluted liquid of the treatment agent, and then the pH at 25° C. is measured.

[0089] When the mixture of the first treatment agent and the second treatment agent is a less than 5% by mass water-diluted liquid of the treatment agent, the mixture is dried or concentrated to form a 5% by mass water-diluted liquid of the treatment agent, and the pH at 25° C. is measured.

[0090] When the mixture of the first treatment agent and the second treatment agent is formed using the second treatment agent-containing composition that contains a solvent other than water as the solvent(S), the pH is measured by a method as described below.

[0091] After the solvent is removed from the mixture of the first treatment agent and the second treatment agent, the mixture is diluted to form a 5% by mass water-diluted liquid of the treatment agent, and the pH at 25° C. is measured. The removal of the solvent from the mixture can be conducted by heat-treating the mixture at 105° C. for 2 hours.

[0092] The (poly)oxyalkylene derivative (A), the organic acid compound (B), the organic phosphoric acid ester compound (C), and the solvent(S) are the same as the respective components described in the first embodiment.

(Solvent)

[0093] The first treatment agent of the present embodiment may be mixed as necessary with a solvent to prepare a composition containing first component of polyester synthetic fiber treatment agent (hereinafter referred to as "first treatment agent-containing composition") and be stored or distributed in the form of the first treatment agent-containing composition.

[0094] The solvent can be the same as exemplified in the first embodiment. Assuming that the sum of the amounts of the first treatment agent and the solvent contained in the first treatment agent-containing composition is 100 parts by mass, the amount of the first treatment agent contained in the first treatment agent-containing composition is preferably 10 parts by mass or more.

[0095] The effects of the first treatment agent of the second embodiment will now be described. The second embodiment has the following effects in addition to the effects of the above embodiments.

[0096] (2-1) The first treatment agent according to the second embodiment contains the (poly)oxyalkylene derivative (A) and is combined in use with the second treatment agent containing the organic phosphoric acid ester compound (C). Therefore, the formulation stability, particularly the storage stability, of the first treatment agent can be improved. Adjusting the mixing rate of the first treatment agent and the second treatment agent allows for adjustment of the ingredients in the prepared treatment agent. In addition, only the first treatment agent can be distributed separately from the second treatment agent.

Third Embodiment

[0097] Next, a third embodiment that embodies a second treatment agent of the present invention will be described, focusing on the differences from the above embodiment.

[0098] The second treatment agent of the present embodiment contains an organic phosphoric acid ester compound (C). The second treatment agent is combined in use with a first treatment agent containing a (poly)oxyalkylene derivative (A) or a first treatment agent-containing composition that contains the first treatment agent, which contains a (poly)oxyalkylene derivative (A), and a solvent(S). The organic acid compound (B) is contained in either one or both of the first treatment agent and the second treatment agent. A 5% by mass water-diluted liquid of a mixture of the first treatment agent and the second treatment agent has a pH at 25° C. of 5.5 or more and 8.5 or less. When the mixture of the first treatment agent and the second treatment agent is formed using the first treatment agent-containing composi-

tion prepared using the solvent(S), the pH is measured in a similar manner to that described in the second embodiment.

[0099] The (poly)oxyalkylene derivative (A), the organic acid compound (B), the organic phosphoric acid ester compound (C), and the solvent(S) are the same as the respective components described in the first embodiment.

(Solvent)

[0100] The second treatment agent of the present embodiment may be mixed as necessary with a solvent to prepare the second treatment agent-containing composition and be stored or distributed in the form of the second treatment agent-containing composition.

[0101] The solvent can be the same as exemplified in the first embodiment. Assuming that the sum of the amounts of the second treatment agent and the solvent contained in the second treatment agent-containing composition is 100 parts by mass, the amount of the second treatment agent contained in the second treatment agent-containing composition is preferably 10 parts by mass or more.

[0102] The effects of the second treatment agent of the third embodiment will now be described. The third embodiment has the following effects in addition to the effects of the above embodiments.

[0103] (3-1) The second treatment agent according to the third embodiment contains the organic phosphoric acid ester compound (C) and is combined in use with the first treatment agent containing the (poly)oxyalkylene derivative (A). Therefore, the formulation stability, particularly the storage stability, of the second treatment agent can be improved. Adjusting the mixing rate of the second treatment agent and the first treatment agent allows for adjustment of the ingredients in the prepared treatment agent. In addition, only the second treatment agent can be distributed separately from the first treatment agent.

Fourth Embodiment

[0104] Next, a fourth embodiment that embodies a method for treating a polyester synthetic fiber of the present invention (hereinafter referred to as ""fiber treatment method") will be described.

[0105] The fiber treatment method of the present embodiment is characterized in that in a case of a one-component treatment agent, a diluted liquid containing a solvent and the treatment agent of the first embodiment is applied to a polyester synthetic fiber. The diluted liquid is prepared by, for example, adding the treatment agent or the treatment agent-containing composition of the first embodiment to a solvent. The diluted liquid is preferably prepared by adding the treatment agent or the treatment agent-containing composition of the first embodiment to water.

[0106] The fiber treatment method of the present embodiment is characterized in that in a case of a two-component treatment agent, a diluted liquid of the treatment agent containing a solvent, the first treatment agent of the second embodiment, and the second treatment agent of the third embodiment is applied to a polyester synthetic fiber. The diluted liquid is prepared by, for example, adding, to a solvent, the first treatment agent or the first treatment agent-containing composition, and the second treatment agent or the second treatment agent-containing composition. The diluted liquid is preferably prepared by adding, to water, the first treatment agent or the first treatment agent-containing composition and the second treatment agent or the second treatment agent-containing composition. The ratio of the first treatment agent content and the second treatment agent content is preferably such that as a mass ratio of nonvolatile contents, first treatment agent/second treatment agent=95/5 to 5/95. The ratio is defined as the ranges described above, whereby the ease of handling can be improved. The term "nonvolatile content" as used herein refers to residue after sufficient removal of volatile matter by heat treating an object at 105° C. for 2 hours, that is, to absolutely dry matter.

[0107] The solvent used in the diluted liquid production can be the same as exemplified in the first embodiment. The concentration of the treatment agent in the diluted liquid is preferably 0.1% by mass or more and 10% by mass or less from the viewpoint of, for example, the ease of handling the diluted liquid.

[0108] By using the first treatment agent and the second treatment agent in combination, the mixing ratio of the agents can be changed as desired. Accordingly, even if production conditions differ due to differences in production facilities or differences in climate such as temperature and humidity, the mixing ratio can be adjusted finely such that it is easy to prepare the treatment agent or the diluted liquid for always imparting optimum fiber characteristics or fiber production characteristics.

[0109] To emulsify the treatment agent, the respective treatment agents or treatment agent-containing compositions may be mixed with the solvent and stirred using a known stirrer, for example, a homomixer, a homogenizer, a colloid mill, or a line mixer.

[0110] The fiber treatment method includes applying to a fiber the diluted liquid prepared as described above, for example, in at least one of a spinning step, a drawing step, and a finishing step of polyester synthetic fibers.

[0111] Examples of the fiber to which the diluted liquid is applied include a polyester synthetic fiber. Specific examples of the polyester synthetic fiber include polyethylene terephthalate (PET), polytrimethylene terephthalate, polybutylene terephthalate, polyethylene naphthalate, polylactic acid, and a composite fiber containing these polyester resins.

[0112] Use of the fiber is not particularly limited, and example thereof include for spinning, for spun yarn production, short fibers, long fibers, nonwoven fabrics, or for wadding. Short fibers correspond to fibers generally called staples, and do not include long fibers generally called filaments. The length of the short fibers is not particularly limited as long as the short fibers correspond to that of short fibers in the art, and is, for example, 100 mm or less. Preferably, the diluted liquid of the present invention is applied to a polyester short fiber or a polyester synthetic fiber for producing spun yarns.

[0113] The proportion of adhering the diluted liquid to the fiber is not particularly limited, and the diluted liquid is adhered such that a final solids content is preferably 0.01% by mass or more and 10% by mass or less, and more preferably 0.1% by mass or more and 3% by mass or less with respect to the fiber. With such a configuration, the effects of the respective ingredients can be effectively exerted. The method for adhering the diluted liquid is not particularly limited. A known method such as a roller lubricating method, a guide lubricating method using a metering pump, an immersion lubricating method, or a spray

lubricating method in accordance with, for example, the type, form, and use of the fiber. When an immersion lubricating method is used, the immersion time is preferably 1 minute or longer and 5 minutes or shorter.

[0114] The fiber to which the diluted liquid has been applied may be dried or heat-treated using a known method. Water and other solvents are volatilized by the drying or heat treatment, resulting in formation of the fiber to which the ingredients contained in the treatment agent or the first treatment agent and the second treatment agent are adhered.

[0115] The effects of the fiber treatment method of the fourth embodiment will now be described. The fourth embodiment has the following effects in addition to the effects of the above embodiments.

[0116] (4-1) The fiber treatment method of the fourth embodiment includes applying the diluted liquid to a fiber, for example, in a spinning step, a drawing step, or a finishing step. In particular, a diluted liquid having excellent emulsion stability can be prepared by adding, to water, the treatment agent or the treatment agent-containing composition of the first embodiment. Alternatively, a diluted liquid having excellent emulsion stability can be prepared by adding, to water, the first treatment agent or the first treatment agent-containing composition and the second treatment agent or the second treatment agent-containing composition. Therefore, it is possible to effectively exert the effects of the ingredients when used for spinning yarns, producing spun yarns, short fibers, long fibers, and nonwoven fabrics, or wadding.

[0117] The above embodiments may be modified as described below. The embodiments described above and the following modifications can be implemented in combination with each other within a range in which there is no technical contradiction.

[0118] The method for preparing a diluted liquid of a treatment agent of each of the embodiments as described above is not particularly limited, and a method other than the preparation method described in the fourth embodiment may be used.

[0119] To maintain the quality of each of the treatment agents, each of the compositions, or each of the diluted liquids within a range in which the effects of the present invention are not impaired, an ingredient usually used for treatment agents, such as another solvent, a stabilizer, an antistatic agent, a binder, an antioxidant, an ultraviolet absorber, an organic acid, a surfactant other than the above-described surfactants may be further added, as another ingredient, to each of the treatment agents, each of the compositions, or each of the diluted liquids in the embodiments described above. The proportion of the other ingredient usually used in the treatment agent other than the solvent is preferably 10% by mass or less in each treatment agent from the viewpoint of efficiently exerting the effects of the present invention. In addition, the other ingredients may be stored separately from the treatment agents described above.

EXAMPLES

[0120] Examples will be given below to describe the features and effects of the present invention more specifically, but the present invention is not restricted to these examples. In the following description of working examples and comparative examples, part(s) indicates part(s) by mass and % indicates % by mass unless otherwise noted.

Experimental Part 1 (Preparation of One-Component Treatment Agent)

Example 1-1

[0121] As shown in Table 1, prepared was a treatment agent of Example 1-1 containing 25 parts (%) of polyoxyethylene (10 (indicates the number of moles of alkylene oxide added. the same applies hereinafter)) decylamine (A-1) as the (poly)oxyalkylene derivative (A), 10 parts (%) of polyoxyethylene (5) decyl ether (A-10), 7 parts (%) of (polyoxyethylene) (polyoxypropylene) (r+s=10, "r" represents the number of moles of ethylene oxide added, and "s" represents the number of moles of propylene oxide added (the same applies hereinafter)) tridecyl ether (A-21), 8 parts (%) of oxalic acid/potassium salt of oxalic acid=50/50 (mass ratio) (B-1) as the organic acid compound (B), 50 parts (%) of cetyl phosphoric acid ester and potassium salt thereof (C-3) as the organic phosphoric acid ester compound (C), and 3 parts of polydimethylsiloxane (D-1) as the other ingredient (D) relative to 100 parts in total of the ingredients (A) to (C).

Examples 1-2 to 1-28 and Comparative Examples 1-1 to 1-10

[0122] The treatment agents of Examples 1-2 to 1-28 and Comparative Examples 1-1 to 1-10 were prepared to contain the (poly)oxyalkylene derivative (A), the organic acid compound (B), the organic phosphoric acid ester compound (C), and the other ingredient (D) in the proportions shown in Table 1, in a similar manner to the treatment agent of Example 1-1.

[0123] The kind and content of the (poly)oxyalkylene derivative (A), the kind and content of the organic acid compound (B), the kind and content of the organic phosphoric acid ester compound (C), and the kind and content of the other ingredient (D) are shown in the column "(poly) oxyalkylene derivative (A)", the column "organic acid compound (B)", the column "organic phosphoric acid ester compound (C)", and the column ""other ingredient (D)" of Table 1, respectively. The content of the other ingredient (D) refers to the amount (part) when the sum of the amounts of the (poly)oxyalkylene derivative (A), the organic acid compound (B), and the organic phosphoric acid ester compound (C) contained in the treatment agent is taken as 100 parts.

(pH of treatment agent)

[0124] The treatment agent of each example was diluted with hot water at about 70° C. to prepare a 5% water-diluted liquid of the treatment agent. The pH at 25° C. of the prepared 5% water-diluted liquid was measured. The measured values are shown in the column "pH of 5% water-diluted liquid" in Table 1.

TABLE 1

One-component treatment agent	(Poly)oxyalkylene derivative (A)						Organic acid compound (B)				Organic phosphoric acid ester compound (C)				Other ingredient (D)
	Kind	Part	Kind	Part	Kind	Part	Kind	Part	Kind	Part	Kind	Part	Kind	Part	Kind
Example 1-1	A-1	25	A-10	10	A-21	7	B-1	8	—	—	C-3	50	—	—	D-1
Example 1-2	A-1	25	A-10	10	A-21	7	B-1	8	—	—	C-3	50	—	—	—
Example 1-3	A-2	10	A-11	1.5	A-38	0.5	B-2	8	—	—	C-6	80	—	—	D-1
Example 1-4	A-2	20	A-12	4.5	A-24	0.5	B-3	5	—	—	C-5	70	—	—	D-2
Example 1-5	A-3	35	A-13	10	A-27	8	B-4	7	—	—	C-6	40	—	—	D-2
Example 1-6	A-3	35	A-14	20	A-26	15	B-5	10	—	—	C-1	20	—	—	—
Example 1-7	A-4	40	A-15	7	A-35	20	B-6	3	—	—	C-12	30	—	—	—
Example 1-8	A-4	18	A-16	2	—	—	B-7	10	—	—	C-5	65	C-7	5	D-1
Example 1-9	A-5	29.5	A-17	2.5	A-23	2.5	B-8	5.5	—	—	C-14	60	—	—	D-1
Example 1-10	A-6	36	A-18	15	A-30	5	B-9	4	—	—	C-2	40	—	—	D-1
Example 1-11	A-7	15	A-19	15	—	—	B-10	20	—	—	C-7	50	—	—	—
Example 1-12	A-8	37	A-20	20	A-32	20	B-11	3	—	—	C-2	20	—	—	—
Example 1-13	A-9	35	A-10	20	A-33	10	B-12	1	B-3	4	C-8	30	—	—	—
Example 1-14	A-2	20	A-39	35	—	—	B-12	2	B-18	3	C-5	40	—	—	—
Example 1-15	A-2	30	A-35	5	A-35	10	B-12	0.5	B-8	4.5	C-5	50	—	—	—
Example 1-16	A-2	40	A-28	10	A-21	10	B-12	10	—	—	C-11	30	—	—	D-2
Example 1-17	A-2	15	A-22	4	A-29	1	B-13	10	—	—	C-3	70	—	—	—
Example 1-18	A-2	20	A-26	5	A-36	5	B-14	10	—	—	C-2	40	C-14	20	D-1
Example 1-19	A-2	25	A-25	22	—	—	B-15	3	—	—	C-10	50	—	—	D-2
Example 1-20	A-2	20	A-30	2.5	—	—	B-16	7.5	—	—	C-13	70	—	—	—
Example 1-21	A-3	40	A-31	15	—	—	B-17	15	—	—	C-14	30	—	—	—
Example 1-22	A-3	22	A-37	35	—	—	B-18	3	—	—	C-13	40	—	—	D-2
Example 1-23	A-3	30	A-28	10	—	—	B-19	20	—	—	C-9	40	—	—	—
Example 1-24	A-4	35	A-34	20	—	—	B-20	15	—	—	C-13	30	—	—	—
Example 1-25	A-4	10	A-24	5	—	—	B-21	15	—	—	C-5	70	—	—	D-1
Example 1-26	A-17	20	A-29	7	—	—	B-6	8	—	—	C-3	65	—	—	—
Example 1-27	A-2	1	A-16	5	—	—	B-9	9	—	—	C-6	85	—	—	—
Example 1-28	A-1	45	A-17	30	A-26	10	B-4	5	—	—	C-4	10	—	—	—
Comparative Example 1-1	A-3	20	A-12	9	A-24	1	—	—	—	—	C-5	70	—	—	—
Comparative Example 1-2	A-6	19.5	A-17	20	A-35	20	B-4	0.5	—	—	C-9	60	—	—	—
Comparative Example 1-3	A-2	30	A-16	25	—	—	B-15	15	—	—	C-6	30	—	—	—
Comparative Example 1-4	—	—	—	—	—	—	B-13	30	—	—	C-1	70	—	—	—
Comparative Example 1-5	A-9	30	A-11	34	A-32	34	B-12	2	—	—	—	—	—	—	—
Comparative Example 1-6	A-2	9.05	A-39	21.11	—	—	—	—	—	—	C-14	69.85	—	—	D-9
Comparative Example 1-7	A-2	9.33	A-39	21.76	—	—	—	—	—	—	C-14	68.91	—	—	D-3
Comparative Example 1-8	—	—	A-13	100	—	—	—	—	—	—	—	—	—	—	D-4

TABLE 1-continued

Comparative Example 1-9	—	—	A-31	87.5	—	—	B-18	12.5	—	—	—	—	—	—	D-5
Comparative Example 1-10	—	—	A-30	94.59	—	—	B-7	5.41	—	—	—	—	—	—	D-7

	One-component treatment agent	Other ingredient (D)			pH of 5% water-diluted liquid	Emulsion stability	Adherence	Fiber strength
		Part relative to 100 parts in total of (A) to (C)	Kind	Part relative to 100 parts in total of (A) to (C)				
Example 1-1		3	—		8.2	◎	◎	◎
Example 1-2		—	—	—	8.2	◎	◎	◎
Example 1-3		5	—	—	8.5	◎	◎	◎
Example 1-4		3	—	—	8.1	◎	◎	◎
Example 1-5		4	—	—	7.8	◎	◎	◎
Example 1-6		—	—	—	5.7	◎	◎	◎
Example 1-7		—	—	—	6.9	◎	◎	◎
Example 1-8		3	—	—	6.1	◎	◎	◎
Example 1-9		3	D-2	2	8.3	◎	◎	◎
Example 1-10		1	D-2	1	7.5	◎	◎	◎
Example 1-11		—	—	—	5.5	◎	◎	◎
Example 1-12		—	—	—	7.3	◎	◎	◎
Example 1-13		—	—	—	7.4	◎	◎	◎
Example 1-14		—	—	—	8.1	◎	◎	◎
Example 1-15		—	—	—	7.6	◎	◎	◎
Example 1-16		1	—	—	7.9	◎	◎	◎
Example 1-17		—	—	—	7.8	◎	◎	◎
Example 1-18		1	—	—	7.8	◎	◎	◎
Example 1-19		5	—	—	6.0	◎	◎	◎
Example 1-20		—	—	—	7.7	◎	◎	◎
Example 1-21		—	—	—	8.1	◎	◎	◎
Example 1-22		2	—	—	7.9	◎	◎	◎
Example 1-23		—	—	—	8.0	○	◎	◎
Example 1-24		—	—	—	7.7	○	◎	◎
Example 1-25		2	—	—	8.2	○	◎	◎
Example 1-26		—	—	—	7.8	○	◎	◎
Example 1-27		—	—	—	7.3	○	◎	◎
Example 1-28		—	—	—	5.6	◎	○	◎
Comparative Example 1-1		—	—	—	9.6	◎	◎	X
Comparative Example 1-2		—	—	—	8.9	◎	◎	X
Comparative Example 1-3		—	—	—	3.3	X	◎	○
Comparative Example 1-4		—	—	—	6.9	X	◎	◎
Comparative Example 1-5		—	—	—	5.8	◎	X	◎

TABLE 1-continued

Comparative Example 1-6	0.50	—	—	9.5	◎	◎	X
Comparative Example 1-7	3.63	—	—	9.6	◎	◎	X
Comparative Example 1-8	135.14	D-5	35.14	7.3	◎	X	◎
Comparative Example 1-9	75	D-6	75	6.1	◎	X	◎
Comparative Example 1-10	75.68	D-8	94.59	6.6	◎	X	◎

[0125] Details of the (poly)oxyalkylene derivative (A), the organic acid compound (B), the organic phosphoric acid ester compound (C), and the other ingredient (D) described in Table 1 are as follows.

((Poly) Oxyalkylene Derivative (A))

[0126] A-1 to A-39 described in Table 2 below were used.

TABLE 2

Kind	Addition form	(Poly)oxyalkylene derivative (A)
A-1	—	Polyoxyethylene (10) decylamine
A-2	—	Polyoxyethylene (10) dodecylamine
A-3	—	Polyoxyethylene (12) dodecylamine
A-4	—	Polyoxyethylene (15) dodecylamine
A-5	Random	(Polyoxyethylene) (polyoxypropylene) (r + s = 15) dodecylamine
A-6	Block	(Polyoxyethylene) (polyoxypropylene) (r + s = 15) dodecylamine
A-7	—	Polyoxyethylene (4) octadecylamine
A-8	—	Polyoxyethylene (10) octadecylamine
A-9	Block	(Polyoxyethylene) (polyoxypropylene) (r + s = 15) octadecylamine
A-10	—	Polyoxyethylene (5) decyl ether
A-11	Block	(Polyoxyethylene) (polyoxypropylene) (r + s = 7) decyl ether
A-12	—	Polyoxyethylene (4) dodecyl ether
A-13	—	Polyoxyethylene (7) dodecyl ether
A-14	—	Polyoxyethylene (9) dodecyl ether
A-15	Random	(Polyoxyethylene) (polyoxypropylene) (r + s = 8) C9-C11 alkyl ether
A-16	—	Polyoxyethylene (3) C12-C13 alkyl ether
A-17	—	Polyoxyethylene (10) C12-C13 alkyl ether
A-18	Random	(Polyoxyethylene) (polyoxypropylene) (r + s = 8) C12-C13 alkyl ether
A-19	Random	(Polyoxyethylene) (polyoxypropylene) (r + s = 10) C12-C13 alkyl ether
A-20	—	Polyoxyethylene (5) C12-C14 alkyl ether
A-21	Random	(Polyoxyethylene) (polyoxypropylene) (r + s = 10) tridecyl ether
A-22	—	Polyoxyethylene (10 mol) tridecyl ether
A-23	Random	(Polyoxyethylene) (polyoxypropylene) (r + s = 8) tridecyl ether
A-24	Random	(Polyoxyethylene) (polyoxypropylene) (r + s = 8) C11-C14 alkyl ether
A-25	—	Polyoxyethylene (10) C11-C14 alkyl ether
A-26	—	Polyoxyethylene (5) octadecyl ether
A-27	—	Polyoxyethylene (10) octadecyl ether
A-28	—	Polyoxyethylene (5) oleyl ether
A-29	—	Polyoxyethylene (8) oleyl ether
A-30	—	Polyoxyethylene (10) tetracosyl ether
A-31	—	Polyoxyethylene (10) octacosyl ether
A-32	Random	(Polyoxyethylene) (polyoxypropylene) (r + s = 20) cured castor oil
A-33	Block	(Polyoxyethylene) (polyoxypropylene) (r + s = 50) propylene glycol
A-34	Block	(Polyoxyethylene) (polyoxypropylene) (r + s = 100) propylene glycol
A-35	Random	(Polyoxyethylene) (polyoxypropylene) (r + s = 50) butyl ether
A-36	—/—	Polyoxyethylene (10) lauryl ester/polyoxyethylene (10 mol) coconut fatty acid ester = 50/50
A-37	—	Polyoxypropylene (10) oleyl ester
A-38	—	Polyoxyethylene (10) coconut fatty acid ester
A-39	—	Polyoxyethylene (10) nonylphenyl ether

(Organic Acid Compound (B))

[0127] B-1 to B-21 described in Table 3 below were used.

TABLE 3

Kind	Organic acid compound (B)	Number of carboxy groups	Number of carbon atoms excluding carbon atoms in carboxy group
B-1	Oxalic acid/potassium salt of oxalic acid = 50/50 (mass ratio)	2	0
B-2	Malonic acid/sodium salt of malonic acid = 67/33 (mass ratio)	2	1
B-3	Succinic acid	2	2
B-4	Adipic acid	2	4
B-5	Sebacic acid	2	8
B-6	Aspartic acid/diethanolamine salt of aspartic acid = 67/33 (mass ratio)	2	2
B-7	Fumaric anhydride	2	2
B-8	Maleic anhydride	2	2
B-9	Malic acid	2	2
B-10	Citric acid/potassium salt of citric acid = 67/33 (mass ratio)	3	3
B-11	Nitrilotriacetic acid	3	3
B-12	Ethylenediaminetetraacetic acid/ethylene diamine tetraacetic acid sodium salt = 50/50 (mass ratio)	4	6
B-13	Ethylenediamine disuccinic acid/ethylenediamine disuccinic acid sodium salt = 50/50 (mass ratio)	4	6
B-14	Diethylenetriamine pentaacetic acid/diethylenetriamine pentaacetic acid sodium salt = 60/40 (mass ratio)	5	9
B-15	Formic acid	1	0
B-16	Acetic acid/sodium salt of acetic acid = 67/33 (mass ratio)	1	1
B-17	Capric acid	1	9
B-18	Lactic acid	1	2
B-19	Lauric acid	1	12
B-20	Oleic acid	1	18
B-21	Octyl phosphoric acid	0	8

(Organic Phosphoric Acid Ester Compound (C))

[0128] C-1 to C-14 described in Table 4 below were used. Each of the organic phosphoric acid ester compounds (C) described in Table 4 below is prepared by partially neutralizing various organic phosphoric acid esters with KOH, and is a mixture of an organic phosphoric acid ester and a potassium salt of an organic phosphoric acid ester. The same applies to organic phosphoric acid ester compounds of D-5 and D-6 as described below.

TABLE 4

Kind	Compound name	Acid value measured from organic phosphoric acid ester compound (C) [KOH-mg/g]
C-1	Cetyl phosphoric acid ester and potassium salt thereof	0.1
C-2	Cetyl phosphoric acid ester and potassium salt thereof	12.5
C-3	Cetyl phosphoric acid ester and potassium salt thereof	37.5
C-4	Stearyl phosphoric acid ester and potassium salt thereof	0.1
C-5	Stearyl phosphoric acid ester and potassium salt thereof	12.5
C-6	Stearyl phosphoric acid ester and potassium salt thereof	37.5
C-7	Arachidyl phosphoric acid ester and potassium salt thereof	12.5
C-8	Cetyl phosphoric acid ester and potassium salt thereof/stearyl phosphoric acid ester and potassium salt thereof = 70/30	0.1
C-9	Cetyl phosphoric acid ester and potassium salt thereof/stearyl phosphoric acid ester and potassium salt thereof = 70/30	12.5
C-10	Cetyl phosphoric acid ester and potassium salt thereof/stearyl phosphoric acid ester and potassium salt thereof = 70/30	37.5
C-11	Cetyl phosphoric acid ester and potassium salt thereof/stearyl phosphoric acid ester and potassium salt thereof = 30/70	0.1
C-12	Cetyl phosphoric acid ester and potassium salt thereof/stearyl phosphoric acid ester and potassium salt thereof = 30/70	12.5
C-13	Cetyl phosphoric acid ester and potassium salt thereof/stearyl phosphoric acid ester and potassium salt thereof = 30/70	37.5
C-14	Stearyl phosphoric acid ester and potassium salt thereof	10

[0129] The method for measuring the acid value of the organic phosphoric acid ester compound (C) is as follows.

[0130] The organic phosphoric acid ester compound (C) is dissolved in a mixed solvent of ethanol/xylene=1/2 (volume ratio), the resulting mixture was titrated with a 0.1 mol/L potassium hydroxide methanol standard solution by a potentiometric method, and the acid value was calculated from Numerical formula 1 below. The results are shown in the column "acid value measured from organic phosphoric acid ester compound (C)" in Table 4.

[Numerical formula 1]

$$\text{Acid value } (KOH \text{ mg/g}) = R \times f \times 56.11 \times 0.1/S$$

[0131] In Numerical formula 1,

[0132] f represents the factor of 0.1 mol/L potassium hydroxide methanol standard solution;

[0133] S represents the amount (g) collected of organic phosphoric acid ester compound (C); and

[0134] R represents the amount (mL) used of 0.1 mol/L potassium hydroxide methanol standard solution up to inflection point.

(Other Ingredient (D))

[0135] D-1: polydimethylsiloxane

[0136] D-2: amino-modified polydimethylsiloxane

[0137] D-3: stearyl alcohol

[0138] D-4: polyvinyl alcohol (degree of polymerization: 300, degree of saponification: 80)

[0139] D-5: hexyl phosphoric acid ester and potassium salt thereof

[0140] D-6: dodecyl phosphoric acid ester and potassium salt thereof

[0141] D-7: sodium salt of ditetradecyl sulfosuccinic acid ester

[0142] D-8: tetraglycerin monooctadecanoate

[0143] D-9: dipotassium hydrogenphosphate salt

Experimental Part 2 (Emulsion Stability)

[0144] Each of the treatment agents prepared in Experimental Part 1 was diluted with hot water at about 70° C. to prepare a 1% diluted liquid of the treatment agent. The prepared 1% diluted liquid was left to stand at 50° C. for 24 hours, and the appearance of the diluted liquid after being left to stand was visually observed and evaluated according to criteria described below. The results are shown in the column "emulsion stability" in Table 1.

Evaluation Criteria for Emulsion Stability

[0145] ◎ (good): No deposit is generated and no occurrence of precipitates is observed in the lower part.

[0146] ○ (acceptable): Deposits are generated or occurrence of precipitates is observed in the lower part, but the deposits or precipitates are eliminated by manual stirring using a stirring rod.

[0147] x (poor): Deposits are generated or occurrence of precipitates is observed in the lower part, and the deposits or precipitates are not eliminated by manual stirring using a stirring rod.

Experimental Part 3 (Adherence)

[0148] 5 g of each of the treatment agents prepared in Experimental Part 1 was put in a glass petri dish (inner diameter: 9.5 cm). The treatment agent was uniformly spread in the glass petri dish. The temperature was adjusted for 24 hours under the conditions of 30° C. and 70% RH, and the appearance of the treatment agent after the temperature adjustment was visually observed and evaluated according to criteria described below. The results are shown in the column "adherence" in Table 1.

Evaluation Criteria for Adherence

[0149] ◎ (good): A treatment agent after temperature adjustment has a solid appearance, and is not sticky even when touched with a hand.

[0150] ○ (acceptable): A treatment agent after temperature adjustment has a solid appearance, but is sticky when touched with a hand.

[0151] x (poor): A treatment agent after temperature adjustment has a liquid or gel-like appearance, and is sticky when touched with a hand.

Experimental Part 4 (Fiber Strength)

[0152] Each of the treatment agents prepared in Experimental Part 1 was diluted with hot water at about 70° C. to prepare a 0.5% diluted liquid of the treatment agent. The prepared diluted liquid was allowed to adhere to a polyester fiber (1.3 denier×38 mm), to which no treatment agent has been applied, by a spray method such that the amount of the treatment agent to be adhered to the polyester fiber was 0.15%. The treatment agent adhered polyester fiber was dried in a dryer at 80° C. for 2 hours, and then the initial strength of the fiber was measured with a stretch measuring machine. Further, the strength of the fiber after the fiber was placed in an atmosphere at 50° C. and 80% RH for 3 months was also measured with the stretch measuring machine. The strength after 3 months was compared with the initial strength, and evaluated according to criteria described below. The results are shown in the column "fiber strength" in Table 1.

Evaluation Criteria for Fiber Strength

[0153] ◎ (good): Strength after 3 months is 95% or more of initial strength

[0154] ○ (acceptable): Strength after 3 months is 90% or more and less than 95% of initial strength

[0155] x (poor): Strength after 3 months is less than 90% of initial strength

Experimental Part 5 (Preparation of First Treatment Agent of Two-Component Treatment Agent)

(First Treatment Agent (I-A-1))

[0156] As shown in Table 5, prepared was a first treatment agent (I-A-1) containing 50 parts (%) of polyoxyethylene (10) decylamine (A-1) shown in Table 2 as the (poly) oxyalkylene derivative (A), 20 parts (%) of polyoxyethylene (5) decyl ether (A-10), 14 parts (%) of (polyoxyethylene) (polyoxypropylene) (r+s=10) tridecyl ether (A-21), and 16

parts (%) of oxalic acid/potassium salt of oxalic acid=50/50 (mass ratio) (B-1) as the organic acid compound (B).

(First Treatment Agents (I-A-2) to (I-A-27), First Treatment Agents (I-B-1) to (I-B-27), and First Treatment Agent (I-C 1))

[0157] These treatment agents were prepared to contain the (poly)oxyalkylene derivative (A) and the organic acid compound (B) in proportions shown in Table 5, in a similar manner to the first treatment agent (I-A-1).

[0158] The kind and content of the (poly)oxyalkylene derivative (A) and the kind and content of the organic acid compound (B) are shown in the column "(poly)oxyalkylene derivative (A)" and the column "organic acid compound (B)" of Table 5, respectively.

TABLE 5

First treatment agent	(Poly)oxyalkylene derivative (A)						Organic acid compound (B)				Formulation stability of first treatment agent
	Kind	Part	Kind	Part	Kind	Part	Kind	Part	Kind	Part	
I-A-1	A-1	50	A-10	20	A-21	14	B-1	16	—	—	○
I-A-2	A-2	50	A-11	7.5	A-38	2.5	B-2	40	—	—	○
I-A-3	A-2	66.67	A-12	15	A-24	1.67	B-3	16.67	—	—	○
I-A-4	A-3	58.33	A-13	16.67	A-27	13.33	B-4	11.67	—	—	○
I-A-5	A-3	43.75	A-14	25	A-26	18.75	B-5	12.5	—	—	○
I-A-6	A-4	57.14	A-15	10	A-35	28.57	B-6	4.29	—	—	○
I-A-7	A-4	60	A-16	6.67	—	—	B-7	33.33	—	—	○
I-A-8	A-5	73.75	A-17	6.25	A-23	6.25	B-8	13.75	—	—	○
I-A-9	A-6	60	A-18	25	A-30	8.33	B-9	6.67	—	—	○
I-A-10	A-7	30	A-19	30	—	—	B-10	40	—	—	○
I-A-11	A-8	46.25	A-20	25	A-32	25	B-11	3.75	—	—	○
I-A-12	A-9	50	A-10	28.57	A-33	14.29	B-12	1.43	B-3	5.71	○
I-A-13	A-2	33.33	A-39	58.33	—	—	B-12	3.33	B-18	5	○
I-A-14	A-2	60	A-35	10	A-35	20	B-12	1	B-8	9	○
I-A-15	A-2	57.13	A-28	14.29	A-21	14.29	B-12	14.29	—	—	○
I-A-16	A-2	50	A-22	13.33	A-29	3.33	B-13	33.33	—	—	○
I-A-17	A-2	50	A-26	12.5	A-36	12.5	B-14	25	—	—	○
I-A-18	A-2	50	A-25	44	—	—	B-15	6	—	—	○
I-A-19	A-2	66.67	A-30	8.33	—	—	B-16	25	—	—	○
I-A-20	A-3	57.14	A-31	21.43	—	—	B-17	21.43	—	—	○
I-A-21	A-3	36.67	A-37	58.33	—	—	B-18	5	—	—	○
I-A-22	A-3	50	A-28	16.67	—	—	B-19	33.33	—	—	○
I-A-23	A-4	50	A-34	28.57	—	—	B-20	21.43	—	—	○
I-A-24	A-4	33.33	A-24	16.67	—	—	B-21	50	—	—	○
I-A-25	A-17	57.14	A-29	20	—	—	B-6	22.86	—	—	○
I-A-26	A-2	6.67	A-16	33.33	—	—	B-9	60	—	—	○
I-A-27	A-1	50	A-17	33.33	A-26	11.11	B-4	5.56	—	—	○
I-B-1	A-1	59.52	A-10	23.81	A-21	16.67	—	—	—	—	○
I-B-2	A-2	83.33	A-11	12.50	A-38	4.17	—	—	—	—	○
I-B-3	A-2	80	A-12	18	A-24	2	—	—	—	—	○
I-B-4	A-3	66.04	A-13	18.87	A-27	15.09	—	—	—	—	○
I-B-5	A-3	50	A-14	29	A-26	21.43	—	—	—	—	○
I-B-6	A-4	59.70	A-15	10.45	A-35	29.85	—	—	—	—	○
I-B-7	A-4	90	A-16	10	—	—	—	—	—	—	○
I-B-8	A-5	85.51	A-17	7.25	A-23	7.25	—	—	—	—	○
I-B-9	A-6	64.29	A-18	26.79	A-30	8.93	—	—	—	—	○
I-B-10	A-7	50	A-19	50	—	—	—	—	—	—	○
I-B-11	A-8	48.05	A-20	25.97	A-32	25.97	—	—	—	—	○
I-B-12	A-9	53.85	A-10	30.77	A-33	15.38	—	—	—	—	○
I-B-13	A-2	36.36	A-39	63.64	—	—	—	—	—	—	○
I-B-14	A-2	66.67	A-35	11.11	A-35	22.22	—	—	—	—	○
I-B-15	A-2	66.67	A-28	16.67	A-21	16.67	—	—	—	—	○
I-B-16	A-2	75	A-22	20	A-29	5	—	—	—	—	○
I-B-17	A-2	66.67	A-26	16.67	A-36	16.67	—	—	—	—	○
I-B-18	A-2	53.19	A-25	46.81	—	—	—	—	—	—	○
I-B-19	A-2	88.89	A-30	11.11	—	—	—	—	—	—	○
I-B-20	A-3	72.73	A-31	27.27	—	—	—	—	—	—	○
I-B-21	A-3	38.6	A-37	61.4	—	—	—	—	—	—	○
I-B-22	A-3	75	A-28	25	—	—	—	—	—	—	○
I-B-23	A-4	63.64	A-34	36.36	—	—	—	—	—	—	○
I-B-24	A-4	66.67	A-24	33.33	—	—	—	—	—	—	○
I-B-25	A-17	74.07	A-29	25.93	—	—	—	—	—	—	○
I-B-26	A-2	16.67	A-16	83.33	—	—	—	—	—	—	○
I-B-27	A-1	52.95	A-17	35.29	A-26	11.76	—	—	—	—	○
I-C-1	A-1	55.55	A-10	22.22	A-21	15.56	B-1	6.67	—	—	○

Experimental Part 6 (Preparation of Second Treatment Agent of Two-Component Treatment Agent)

(Second treatment agent (II-A-1))

[0159] As shown in Table 6, prepared was a second treatment agent (II-A-1) containing 100 parts (%) of cetyl phosphoric acid ester and potassium salt thereof (C-1) as the organic phosphoric acid ester compound (C).

(Second Treatment Agents (II-A-2) to (II-A-16), Second Treatment Agents (II-B-1) to (II-B-27), and Second Treatment Agent (II-C-1))

[0160] These treatment agents were prepared to contain the organic phosphoric acid ester compound (C) and the organic acid compound (B) in proportions shown in Table 6, in a similar manner to the second treatment agent (II-A-1).

[0161] The kind and content of the organic phosphoric acid ester compound (C) and the kind and content of the organic acid compound (B) are shown in the column ""organic phosphoric acid ester compound (C)" and the column "organic acid compound (B)"" of Table 6, respectively.

TABLE 6

Second treatment	Organic acid compound (B)				Organic phosphoric acid ester compound (C)				Formulation stability of second treatment
agent	Kind	Part	Kind	Part	Kind	Part	Kind	Part	agent
II-A-1	—	—	—	—	C-1	100	—	—	○
II-A-2	—	—	—	—	C-2	100	—	—	○
II-A-3	—	—	—	—	C-3	100	—	—	○
II-A-4	—	—	—	—	C-4	100	—	—	○
II-A-5	—	—	—	—	C-5	100	—	—	○
II-A-6	—	—	—	—	C-6	100	—	—	○
II-A-7	—	—	—	—	C-7	100	—	—	○
II-A-8	—	—	—	—	C-8	100	—	—	○
II-A-9	—	—	—	—	C-9	100	—	—	○
II-A-10	—	—	—	—	C-10	100	—	—	○
II-A-11	—	—	—	—	C-11	100	—	—	○
II-A-12	—	—	—	—	C-12	100	—	—	○
II-A-13	—	—	—	—	C-13	100	—	—	○
II-A-14	—	—	—	—	C-14	100	—	—	○
II-A-15	—	—	—	—	C-5	92.86	C-7	7.14	○
II-A-16	—	—	—	—	C-2	66.67	C-14	33.33	○
II-B-1	B-1	13.79	—	—	C-3	86.21	—	—	○
II-B-2	B-2	9.09	—	—	C-6	90.91	—	—	○
II-B-3	B-3	6.67	—	—	C-5	93.33	—	—	○
II-B-4	B-4	14.89	—	—	C-6	85.11	—	—	○
II-B-5	B-5	33.33	—	—	C-1	66.67	—	—	○
II-B-6	B-6	9.09	—	—	C-12	90.91	—	—	○
II-B-7	B-7	12.50	—	—	C-5	81.25	C-7	6.25	○
II-B-8	B-8	8.4	—	—	C-14	91.6	—	—	○
II-B-9	B-9	9.09	—	—	C-2	90.91	—	—	○
II-B-10	B-10	28.57	—	—	C-7	71.43	—	—	○
II-B-11	B-11	13.04	—	—	C-2	86.96	—	—	○
II-B-12	B-12	2.86	B-3	11.43	C-8	85.71	—	—	○
II-B-13	B-12	4.44	B-18	6.67	C-5	88.89	—	—	○
II-B-14	B-12	0.91	B-8	8.18	C-5	90.91	—	—	○
II-B-15	B-12	25	—	—	C-11	75	—	—	○
II-B-16	B-13	13	—	—	C-3	88	—	—	○
II-B-17	B-14	14.29	—	—	C-2	57.14	C-14	28.57	○
II-B-18	B-15	5.66	—	—	C-10	94.34	—	—	○
II-B-19	B-16	9.68	—	—	C-13	90.32	—	—	○
II-B-20	B-17	33.33	—	—	C-14	66.67	—	—	○
II-B-21	B-18	6.98	—	—	C-13	93.02	—	—	○
II-B-22	B-19	33.33	—	—	C-9	66.67	—	—	○
II-B-23	B-20	33.33	—	—	C-13	66.67	—	—	○
II-B-24	B-21	17.65	—	—	C-5	82.35	—	—	○
II-B-25	B-6	10.96	—	—	C-3	89.04	—	—	○
II-B-26	B-9	9.57	—	—	C-6	90.43	—	—	○
II-B-27	B-4	33.33	—	—	C-4	66.67	—	—	○
II-C-1	B-1	9.09	—	—	C-3	90.91	—	—	○

Experimental Part 7 (Evaluation of Formulation Stability)

Evaluation of Formulation Stability of First Treatment Agent

[0162] Each of the first treatment agents described in Experimental Part 5 was stored at 25° C. for 3 days. The formulation stability was evaluated according to criteria described below. The results are shown in the column "formulation stability" in Table 5.

Evaluation of Formulation Stability of Second Treatment Agent

[0163] A second treatment agent-containing composition containing the second treatment agent described in Experimental Part 6 and water as the solvent(S) at a mass ratio of the second treatment agent:water=40:60 was stored at 25° C. for 3 days. The formulation stability was evaluated according to criteria described below. The results are shown in the column of "formulation stability" in Table 6.

Evaluation Criteria for Formulation Stability (First Treatment Agent and Second Treatment Agent-Containing Composition)

[0164] ○ (good): Neither gelation nor solidification occurs.

[0165] x (poor): Gelation or solidification occurs.

Experimental Part 8 (Preparation of Treatment Agent from First Treatment Agent and Second Treatment Agent)

Example 2-A-1

[0166] In addition to 50% (parts) of the first treatment agent (I-A-1) and 50% (parts) of the second treatment agent (II-A-3) as shown in Table 7, 1 part of the treatment agent (III-1) as the other treatment agent (D) shown in Table 8 was added to 100 parts in total of the first treatment agent and the second treatment agent to prepare a treatment agent of Example 2-A-1.

(Examples (2-A-2) to (2-A-28), Examples (2-B-1) to (2-B-28), and Examples (2-C-1) to (2-C-2))

[0167] In a similar manner to Example 2-A-1, the first treatment agent and the second treatment agent as shown in Table 7, and as necessary the other treatment agent (D) shown in Table 8 were mixed to prepare a treatment agent of each of the Examples.

[0168] The kind and mass ratio of the first treatment agent, the kind and mass ratio of the second treatment agent, and the kind and mass ratio of the other treatment agent (D) are shown in the column "first treatment agent (I)", the column "second treatment agent (II)", and the column "other treatment agent (D)" of Table 7, respectively. The content of the other treatment agent (D) refers to the amount (part) when the sum of the amounts of the first treatment agent and the second treatment agent is taken as 100 parts.

(Measurement of pH)

[0169] The first treatment agent and the second treatment agent shown in Table 7 were mixed with each other and diluted with hot water at about 70° C. to prepare a 5% water-diluted liquid of the treatment agent. In an example of using the other treatment agent (D), the first treatment agent, the second treatment agent, and the other treatment agent (D) were mixed with one another, and the mixture was then diluted with hot water at about 70° C. to prepare a 5% water-diluted liquid of the treatment agent. The pH at 25° C. of the 5% water-diluted liquid prepared in each example was measured. The measured values are shown in the column "pH of 5% water-diluted liquid" in Table 7.

TABLE 7

Two-component treatment agent	First treatment agent (I) Kind	Part	Second treatment agent (II) Kind	Part	Other treatment agent (D) Kind	Part relative to 100 parts in total of first and second treatment agents	pH of 5% water-diluted liquid	Emulsion stability	Adherence	Fiber strength
Example 2-A-1	I-A-1	50	II-A-3	50	III-1	3	8.2	◎	◎	◎
Example 2-A-2	I-A-1	50	II-A-3	50	—	—	8.2	◎	◎	◎
Example 2-A-3	I-A-2	20	II-A-6	80	III-1	5	8.5	◎	◎	◎
Example 2-A-4	I-A-3	30	II-A-5	70	III-2	3	8.1	◎	◎	◎
Example 2-A-5	I-A-4	60	II-A-6	40	III-2	4	7.8	◎	◎	◎
Example 2-A-6	I-A-5	80	II-A-1	20	—	—	5.7	◎	◎	◎
Example 2-A-7	I-A-6	70	II-A-12	30	—	—	6.9	◎	◎	◎
Example 2-A-8	I-A-7	30	II-A-15	70	III-1	3	6.1	◎	◎	◎
Example 2-A-9	I-A-8	40	II-A-14	60	III-3	5	8.3	◎	◎	◎
Example 2-A-10	I-A-9	60	II-A-2	40	III-4	2	7.5	◎	◎	◎
Example 2-A-11	I-A-10	50	II-A-7	50	—	—	5.5	◎	◎	◎
Example 2-A-12	I-A-11	80	II-A-8	20	—	—	7.3	◎	◎	◎
Example 2-A-13	I-A-12	70	II-A-2	30	—	—	7.4	◎	◎	◎
Example 2-A-14	I-A-13	60	II-A-5	40	—	—	8.1	◎	◎	◎
Example 2-A-15	I-A-14	50	II-A-5	50	—	—	7.6	◎	◎	◎
Example 2-A-16	I-A-15	70	II-A-11	30	III-2	1	7.9	◎	◎	◎
Example 2-A-17	I-A-16	30	II-A-3	70	—	—	7.8	◎	◎	◎
Example 2-A-18	I-A-17	40	II-A-16	60	III-1	1	7.8	◎	◎	◎
Example 2-A-19	I-A-18	50	II-A-10	50	III-2	5	6.0	◎	◎	◎
Example 2-A-20	I-A-19	30	II-A-13	70	—	—	7.7	◎	◎	◎
Example 2-A-21	I-A-20	70	II-A-14	30	—	—	8.1	◎	◎	◎
Example 2-A-22	I-A-21	60	II-A-13	40	III-2	2	7.9	◎	◎	◎

TABLE 7-continued

Two-component treatment agent	First treatment agent (I) Kind	Part	Second treatment agent (II) Kind	Part	Other treatment agent (D) Kind	Part relative to 100 parts in total of first and second treatment agents	pH of 5% water-diluted liquid	Emulsion stability	Adherence	Fiber strength
Example 2-A-23	I-A-22	60	II-A-9	40	—	—	8.0	○	◎	◎
Example 2-A-24	I-A-23	70	II-A-13	30	—	—	7.7	○	◎	◎
Example 2-A-25	I-A-24	30	II-A-5	70	III-1	2	8.2	○	◎	◎
Example 2-A-26	I-A-25	35	II-A-3	65	—	—	7.8	○	◎	◎
Example 2-A-27	I-A-26	15	II-A-6	85	—	—	7.3	○	◎	◎
Example 2-A-28	I-A-27	90	II-A-4	10	—	—	5.6	◎	○	◎
Example 2-B-1	I-B-1	42	II-B-1	58	III-1	3	8.2	◎	◎	◎
Example 2-B-2	I-B-1	42	II-B-1	58	—	—	8.2	◎	◎	◎
Example 2-B-3	I-B-2	12	II-B-2	88	III-1	5	8.5	◎	◎	◎
Example 2-B-4	I-B-3	25	II-B-3	75	III-2	3	8.1	◎	◎	◎
Example 2-B-5	I-B-4	53	II-B-4	47	III-2	4	7.8	◎	◎	◎
Example 2-B-6	I-B-5	70	II-B-5	30	—	—	5.7	◎	◎	◎
Example 2-B-7	I-B-6	67	II-B-6	33	—	—	6.9	◎	◎	◎
Example 2-B-8	I-B-7	20	II-B-7	80	III-1	3	6.1	◎	◎	◎
Example 2-B-9	I-B-8	34.5	II-B-8	65.5	III-3	5	8.3	◎	◎	◎
Example 2-B-10	I-B-9	56	II-B-9	44	III-4	2	7.5	◎	◎	◎
Example 2-B-11	I-B-10	30	II-B-10	70	—	—	5.5	◎	◎	◎
Example 2-B-12	I-B-11	77	II-B-11	23	—	—	7.3	◎	◎	◎
Example 2-B-13	I-B-12	65	II-B-12	35	—	—	7.4	◎	◎	◎
Example 2-B-14	I-B-13	55	II-B-13	45	—	—	8.1	◎	◎	◎
Example 2-B-15	I-B-14	45	II-B-14	55	—	—	7.6	◎	◎	◎
Example 2-B-16	I-B-15	60	II-B-15	40	III-2	1	7.9	◎	◎	◎
Example 2-B-17	I-B-16	20	II-B-16	80	—	—	7.8	◎	◎	◎
Example 2-B-18	I-B-17	30	II-B-17	70	III-1	1	7.8	◎	◎	◎
Example 2-B-19	I-B-18	45	II-B-18	55	III-2	5	6.0	◎	◎	◎
Example 2-B-20	I-B-19	22.5	II-B-19	77.5	—	—	7.7	◎	◎	◎
Example 2-B-21	I-B-20	55	II-B-20	45	—	—	8.1	◎	◎	◎
Example 2-B-22	I-B-21	57	II-B-21	43	III-2	2	7.9	◎	◎	◎
Example 2-B-23	I-B-22	40	II-B-22	60	—	—	8.0	○	◎	◎
Example 2-B-24	I-B-23	55	II-B-23	45	—	—	7.7	○	◎	◎
Example 2-B-25	I-B-24	15	II-B-24	85	III-1	2	8.2	○	◎	◎
Example 2-B-26	I-B-25	27	II-B-25	73	—	—	7.8	○	◎	◎
Example 2-B-27	I-B-26	6	II-B-26	94	—	—	7.3	○	◎	◎
Example 2-B-28	I-B-27	85	II-B-27	15	—	—	5.6	◎	○	◎
Example 2-C-1	I-C-1	45	II-C-1	55	III-1	3	8.2	◎	◎	◎
Example 2-C-2	I-C-1	45	II-C-1	55	—	—	8.2	◎	◎	◎

[0170] As the other treatment agent (D) described in Table 7, the treatment agents (III-1) to (III-4) described in Table 8 below were used. The treatment agents (III-1) to (III-4) were prepared to contain the other treatment agent (D) in proportions shown in Table 8.

TABLE 8

	Other treatment agent (D) Kind	Part	Kind	Part
III-1	D-1	100	—	—
III-2	D-2	100	—	—
III-3	D-1	60	D-2	40
III-4	D-1	50	D-2	50

Experimental Part 9 (Evaluation of Two-Component Treatment Agent)

[0171] The resulting treatment agents of the examples were used to evaluate the emulsion stability, adherence, and fiber strength in a similar manner to Example 1. The diluted liquid of treatment agent used in the evaluation of the emulsion stability and fiber strength was prepared by mixing the first treatment agent, the second treatment agent, and as necessary, the other treatment agent (D) with one another, and then diluting the mixture with water, in a similar manner as described in the section "Measurement of pH" of Experimental Part 8. The results are shown in the column "emulsion stability", the column "adherence", and the column "fiber strength" of Table 7, respectively.

[0172] As is apparent from the evaluation results of the examples relative to the comparative examples in the tables, it is possible to improve the emulsion stability upon diluting the treatment agent of the present invention to form a water-diluted liquid. Further, it is possible to reduce the adhesion of the fiber surface to which the treatment agent has been applied, and it is also possible to prevent a decrease in fiber strength.

[0173] The present disclosure also encompasses the following embodiments.

Additional Embodiment 1

[0174] A polyester synthetic fiber treatment agent comprising a (poly)oxyalkylene derivative (A), an organic acid compound (B), and an organic phosphoric acid ester compound (C), wherein

[0175] a 5% by mass water-diluted liquid of the polyester synthetic fiber treatment agent has a pH at 25° C. of 5.5 or more and 8.5 or less,

[0176] the organic acid compound (B) is at least one selected from the group consisting of an organic acid, an organic acid salt, and an organic acid anhydride,

[0177] the organic phosphoric acid ester compound (C) is at least one selected from the group consisting of an organic phosphoric acid ester and a salt thereof having a hydrocarbon group with 16 or more and 20 or less carbon atoms in a molecule.

Additional Embodiment 2

[0178] The polyester synthetic fiber treatment agent according to additional embodiment 1, wherein the organic acid compound (B) is at least one selected from the group consisting of mono- to pentabasic carboxylic acids in which the number of carbon atoms, excluding carboxy group-derived carbon atoms, is 0 or more and 9 or less, salts of mono- to pentabasic carboxylic acids in which the number of carbon atoms, excluding carboxy group-derived carbon atoms, is 0 or more and 9 or less, and di- to pentabasic carboxylic anhydrides in which the number of carbon atoms, excluding carboxy group-derived carbon atoms, is 0 or more and 9 or less.

Additional Embodiment 3

[0179] The polyester synthetic fiber treatment agent according to additional embodiment 1, wherein the (poly) oxyalkylene derivative (A) contains at least one selected from the group consisting of polyoxyalkylene alkylamine and polyoxyalkylene alkenylamine.

Additional Embodiment 4

[0180] The polyester synthetic fiber treatment agent according to additional embodiment 1, wherein assuming that the sum of the contents of the (poly)oxyalkylene derivative (A), the organic acid compound (B), and the organic phosphoric acid ester compound (C) is 100 parts by mass, the polyester synthetic fiber treatment agent contains the (poly)oxyalkylene derivative (A) and the organic acid compound (B) in total in an amount of 20 parts by mass or more and 80 parts by mass or less, and contains the organic phosphoric acid ester compound (C) in an amount of 20 parts by mass or more and 80 parts by mass or less.

Additional Embodiment 5

[0181] The polyester synthetic fiber treatment agent according to additional embodiment 1, wherein

[0182] the polyester synthetic fiber treatment agent is prepared as a set including first and second components of polyester synthetic fiber treatment agent,

[0183] the first component of polyester synthetic fiber treatment agent contains the (poly)oxyalkylene derivative (A),

[0184] the second component of polyester synthetic fiber treatment agent contains the organic phosphoric acid ester compound (C),

[0185] either one or both of the first and second components of polyester synthetic fiber treatment agent contain the organic acid compound (B).

Additional Embodiment 6

[0186] The polyester synthetic fiber treatment agent according to additional embodiment 1, wherein the polyester synthetic fiber is a polyester short fiber.

Additional Embodiment 7

[0187] The polyester synthetic fiber treatment agent according to additional embodiment 1, wherein the polyester synthetic fiber is a fiber for spun yarn production.

Additional Embodiment 8

[0188] A composition containing polyester synthetic fiber treatment agent, comprising the polyester synthetic fiber treatment agent according to any one of additional embodiments 1 to 7 and a solvent(S).

[0189] The solvent(S) has a boiling point of 105° C. or lower at atmospheric pressure.

Additional Embodiment 9

[0190] A first component of polyester synthetic fiber treatment agent, comprising a (poly)oxyalkylene derivative (A), wherein

[0191] the first component of polyester synthetic fiber treatment agent is used in combination with a second component of polyester synthetic fiber treatment agent or a composition containing second component of polyester synthetic fiber treatment agent,

[0192] the second component of polyester synthetic fiber treatment agent contains an organic phosphoric acid ester compound (C),

[0193] the composition containing second component of polyester synthetic fiber treatment agent contains the second component of polyester synthetic fiber treatment agent, which contains an organic phosphoric acid ester compound (C), and a solvent(S),

[0194] either one or both of the first and second components of polyester synthetic fiber treatment agent contain an organic acid compound (B),

[0195] a 5% by mass water-diluted liquid of a mixture of the first component of polyester synthetic fiber treatment agent and the second component of polyester synthetic fiber treatment agent has a pH at 25° C. of 5.5 or more and 8.5 or less,

[0196] the organic acid compound (B) is at least one selected from the group consisting of an organic acid, an organic acid salt, and an organic acid anhydride,

[0197] the organic phosphoric acid ester compound (C) is at least one selected from the group consisting of an organic phosphoric acid ester and a salt thereof having a hydrocarbon group with 16 or more and 20 or less carbon atoms in a molecule, and

[0198] the solvent(S) has a boiling point of 105° C. or lower at atmospheric pressure.

Additional Embodiment 10

[0199] A composition containing first component of polyester synthetic fiber treatment agent, comprising the first component of polyester synthetic fiber treatment agent according to additional embodiment 9 and a solvent(S).

[0200] The solvent(S) has a boiling point of 105° C. or lower at atmospheric pressure.

Additional Embodiment 11

[0201] A second component of polyester synthetic fiber treatment agent, comprising an organic phosphoric acid ester compound (C), wherein

[0202] the second component of polyester synthetic fiber treatment agent is used in combination with a first component of polyester synthetic fiber treatment agent or a composition containing first component of polyester synthetic fiber treatment agent,

[0203] the first component of polyester synthetic fiber treatment agent contains a (poly)oxyalkylene derivative (A),

[0204] the composition containing first component of polyester synthetic fiber treatment agent contains the first component of polyester synthetic fiber treatment agent, which contains a (poly)oxyalkylene derivative (A), and a solvent(S),

[0205] either one or both of the first and second components of polyester synthetic fiber treatment agent contain an organic acid compound (B),

[0206] a 5% by mass water-diluted liquid of a mixture of the first component of polyester synthetic fiber treatment agent and the second component of polyester synthetic fiber treatment agent has a pH at 25° C. of 5.5 or more and 8.5 or less,

[0207] the organic acid compound (B) is at least one selected from the group consisting of an organic acid, an organic acid salt, and an organic acid anhydride,

[0208] the organic phosphoric acid ester compound (C) is at least one selected from the group consisting of an organic phosphoric acid ester and a salt thereof having a hydrocarbon group with 16 or more and 20 or less carbon atoms in a molecule, and

[0209] the solvent(S) has a boiling point of 105° C. or lower at atmospheric pressure.

Additional Embodiment 12

[0210] A composition containing second component of polyester synthetic fiber treatment agent, comprising the second component of polyester synthetic fiber treatment agent according to additional embodiment 11 and a solvent (S).

[0211] The solvent(S) has a boiling point of 105° C. or lower at atmospheric pressure.

Additional Embodiment 13

[0212] A diluted liquid of polyester synthetic fiber treatment agent, comprising the polyester synthetic fiber treatment agent according to any one of additional embodiments 1 to 7, wherein the diluted liquid has a concentration of the polyester synthetic fiber treatment agent of 0.1% by mass or more and 10% by mass or less.

Additional Embodiment 14

[0213] A method for treating polyester synthetic fiber, comprising applying to a polyester synthetic fiber a diluted liquid of polyester synthetic fiber treatment agent prepared by adding the polyester synthetic fiber treatment agent according to any one of additional embodiments 1 to 7 to water.

Additional Embodiment 15

[0214] A method for treating polyester synthetic fiber, comprising applying to a polyester synthetic fiber a diluted liquid of a polyester synthetic fiber treatment agent prepared by adding the composition containing polyester synthetic fiber treatment agent according to additional embodiment 8 to water.

Additional Embodiment 16

[0215] A method for treating polyester synthetic fiber, comprising applying to a polyester synthetic fiber a diluted liquid of a polyester synthetic fiber treatment agent prepared by adding to water the first component of polyester synthetic fiber treatment agent according to additional embodiment 9 or the composition containing first component of polyester synthetic fiber treatment agent-according to additional embodiment 10 and the second component of polyester synthetic fiber treatment agent according to additional embodiment 11 or the composition containing second component of polyester synthetic fiber treatment agent according to additional embodiment 12.

Additional Embodiment 17

[0216] A polyester synthetic fiber to which the polyester synthetic fiber treatment agent according to any one of additional embodiments 1 to 7 adheres.

1. A polyester synthetic fiber treatment agent comprising:

5% by mass or more of a (poly)oxyalkylene derivative (A);

1% by mass or more of an organic acid compound (B); and

5% by mass or more of an organic phosphoric acid ester compound (C), wherein

a 5% by mass water-diluted liquid of the polyester synthetic fiber treatment agent (containing no solvent) has a pH at 25° C. of 5.5 or more and 8.5 or less,

the organic acid compound (B) is at least one selected from the group consisting of an organic acid, an organic acid salt, and an organic acid anhydride,

the organic phosphoric acid ester compound (C) is at least one selected from the group consisting of an organic phosphoric acid ester and a salt thereof having a hydrocarbon group with 16 or more and 20 or less carbon atoms in a molecule.

2. The polyester synthetic fiber treatment agent according to claim **1**, wherein the organic acid compound (B) is at least one selected from the group consisting of mono- to pentabasic carboxylic acids in which the number of carbon atoms, excluding carboxy group-derived carbon atoms, is 0 or more and 9 or less, salts of mono- to pentabasic carboxylic acids in which the number of carbon atoms, excluding carboxy group-derived carbon atoms, is 0 or more and 9 or less, and di- to pentabasic carboxylic anhydrides in which the number of carbon atoms, excluding carboxy group-derived carbon atoms, is 0 or more and 9 or less.

3. The polyester synthetic fiber treatment agent according to claim **1**, wherein the (poly)oxyalkylene derivative (A) contains at least one selected from the group consisting of polyoxyalkylene alkylamine and polyoxyalkylene alkenylamine.

4. The polyester synthetic fiber treatment agent according to claim **1**, wherein assuming that the sum of the contents of the (poly)oxyalkylene derivative (A), the organic acid com-

pound (B), and the organic phosphoric acid ester compound (C) is 100 parts by mass, the polyester synthetic fiber treatment agent contains the (poly)oxyalkylene derivative (A) and the organic acid compound (B) in total in an amount of 20 parts by mass or more and 80 parts by mass or less, and contains the organic phosphoric acid ester compound (C) in an amount of 20 parts by mass or more and 80 parts by mass or less.

5. The polyester synthetic fiber treatment agent according to claim **1**, wherein

the polyester synthetic fiber treatment agent is prepared as a set including first and second components of polyester synthetic fiber treatment agent,

the first component of polyester synthetic fiber treatment agent contains the (poly)oxyalkylene derivative (A),

the second component of polyester synthetic fiber treatment agent contains the organic phosphoric acid ester compound (C),

either one or both of the first and second components of polyester synthetic fiber treatment agent contain the organic acid compound (B).

6. The polyester synthetic fiber treatment agent according to claim **1**, wherein the polyester synthetic fiber is a polyester short fiber.

7. The polyester synthetic fiber treatment agent according to claim **1**, wherein the polyester synthetic fiber is a fiber for spun yarn production.

8. A composition containing polyester synthetic fiber treatment agent, comprising the polyester synthetic fiber treatment agent according to claim **1** and a solvent(S), wherein the solvent(S) has a boiling point of 105° C. or lower at atmospheric pressure.

9. A first component of polyester synthetic fiber treatment agent, comprising a (poly)oxyalkylene derivative (A), wherein

the first component of polyester synthetic fiber treatment agent is used in combination with a second component of polyester synthetic fiber treatment agent or a composition containing second component of polyester synthetic fiber treatment agent,

the second component of polyester synthetic fiber treatment agent contains an organic phosphoric acid ester compound (C),

the composition containing second component of polyester synthetic fiber treatment agent contains the second component of polyester synthetic fiber treatment agent, which contains an organic phosphoric acid ester compound (C), and a solvent(S),

either one or both of the first and second components of polyester synthetic fiber treatment agent contain an organic acid compound (B),

a 5% by mass water-diluted liquid of a mixture (containing no solvent) of the first component of polyester synthetic fiber treatment agent and the second component of polyester synthetic fiber treatment agent has a pH at 25° C. of 5.5 or more and 8.5 or less,

the mixture (containing no solvent) of the first agent component of synthetic fiber treatment agent and the second component of polyester synthetic fiber treatment agent contains 5% by mass or more of the (poly)oxyalkylene derivative (A), 1% by mass or more of the organic acid compound (B), and 5% by mass or more of the organic phosphoric acid ester compound (C),

the organic acid compound (B) is at least one selected from the group consisting of an organic acid, an organic acid salt, and an organic acid anhydride,

the organic phosphoric acid ester compound (C) is at least one selected from the group consisting of an organic phosphoric acid ester and a salt thereof having a hydrocarbon group with 16 or more and 20 or less carbon atoms in a molecule, and

the solvent(S) has a boiling point of 105° C. or lower at atmospheric pressure.

10. A composition containing first component of polyester synthetic fiber treatment agent, comprising the first component of polyester synthetic fiber treatment agent according to claim **9** and a solvent(S), wherein the solvent(S) has a boiling point of 105° C. or lower at atmospheric pressure.

11. A second component of polyester synthetic fiber treatment agent, comprising an organic phosphoric acid ester compound (C), wherein

the second component of polyester synthetic fiber treatment agent is used in combination with a first component of polyester synthetic fiber treatment agent or a composition containing first component of polyester synthetic fiber treatment agent,

the first component of polyester synthetic fiber treatment agent contains a (poly)oxyalkylene derivative (A),

the composition containing first component of polyester synthetic fiber treatment agent contains the first component of polyester synthetic fiber treatment agent, which contains a (poly)oxyalkylene derivative (A), and a solvent(S),

either one or both of the first and second components of polyester synthetic fiber treatment agent contain an organic acid compound (B),

a 5% by mass water-diluted liquid of a mixture (containing no solvent) of the first component of polyester synthetic fiber treatment agent and the second component of polyester synthetic fiber treatment agent has a pH at 25° C. of 5.5 or more and 8.5 or less, the mixture (containing no solvent) of the first component of polyester synthetic fiber treatment agent and the second component of polyester synthetic fiber treatment agent contains 5% by mass or more of the (poly)oxyalkylene derivative (A), 1% by mass or more of the organic acid compound (B), and 5% by mass or more of the organic phosphoric acid ester compound (C),

the organic acid compound (B) is at least one selected from the group consisting of an organic acid, an organic acid salt, and an organic acid anhydride,

the organic phosphoric acid ester compound (C) is at least one selected from the group consisting of an organic phosphoric acid ester and a salt thereof having a hydrocarbon group with 16 or more and 20 or less carbon atoms in a molecule, and

the solvent(S) has a boiling point of 105° C. or lower at atmospheric pressure.

12. A composition containing second component of polyester synthetic fiber treatment agent, comprising the second component of polyester synthetic fiber treatment agent according to claim **11** and a solvent(S), wherein the solvent (S) has a boiling point of 105° C. or lower at atmospheric pressure.

13. A diluted liquid of polyester synthetic fiber treatment agent, comprising the polyester synthetic fiber treatment agent according to claim **1**, wherein the diluted liquid has a

concentration of the polyester synthetic fiber treatment agent of 0.1% by mass or more and 10% by mass or less.

14. A method for treating polyester synthetic fiber, comprising applying to a polyester synthetic fiber a diluted liquid of polyester synthetic fiber treatment agent prepared by adding the polyester synthetic fiber treatment agent according to claim **1** to water.

15. A method for treating polyester synthetic fiber, comprising applying to a polyester synthetic fiber a diluted liquid of a polyester synthetic fiber treatment agent prepared by adding the composition containing polyester synthetic fiber treatment agent according to claim **8** to water.

16. (canceled)

17. A polyester synthetic fiber to which the polyester synthetic fiber treatment agent according to claim **1** adheres.

* * * * *