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(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, THIRD TREATMENT AGENT FOR POLYESTER-BASED SYNTHETIC FIBERS, COMPOSITION CONTAINING THIRD TREATMENT AGENT FOR POLYESTER-BASED SYNTHETIC FIBERS, DILUTED SOLUTION OF TREATMENT AGENT FOR POLYESTER-BASED SYNTHETIC FIBERS, METHOD FOR TREATING POLYESTER-BASED SYNTHETIC FIBER, AND POLYESTER-BASED SYNTHETIC FIBER**

(57) The present invention addresses the problem of providing: a treatment agent for polyester-based synthetic fibers, which makes it possible to improve emulsion stability when a treatment agent for synthetic fibers is prepared into a water-diluted solution, to reduce the adhesiveness of the surfaces of fibers when the treatment agent for synthetic fibers is applied to the fibers, and to prevent the decrease in strength of the fibers; and others. The treatment agent for polyester-based synthetic fibers according to the present invention comprises 5% by mass or more of a (poly)oxyalkylene derivative (A), 1% by mass or more of an inorganic acid compound (B), and 5% by mass or more of an organic phosphate ester compound (C). A 1%-by-mass water-diluted solution of the treatment agent for polyester-based synthetic fibers has a **pH** value of 5.5 to 8.5 inclusive at 25°C. The inorganic acid compound (B) comprises at least one component selected from sulfuric acid, nitric acid, hydrochloric acid and salts thereof. The organic phosphate ester compound (C) comprises at least one component selected from an organic phosphate ester having an alkyl group having 16 to 20 carbon atoms inclusive in the

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molecule thereof and salts thereof.

Description

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 third component of polyester synthetic fiber treatment agent, a composition containing third 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 and 2. Patent Document 1 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 2 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.

CITATION LIST

PATENT LITERATURE

[0004]

Patent Document 1: Japanese Patent No. 5796923
Patent Document 2: Japanese Patent No. 5651033

SUMMARY OF INVENTION

TECHNICAL PROBLEM

[0005] 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 spinning 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

[0006] 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 inorganic acid compound (B), and a specific organic phosphoric acid ester compound (C) are contained and the pH is defined.

[0007] Aspects for solving the above problems will be described.

[0008] 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 inorganic acid compound (B), and 5% by mass or more of an organic phosphoric acid ester compound (C). A 1% 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 inorganic acid compound (B) is at least one selected from the group consisting of sulfuric acid, nitric acid, hydrochloric acid, and salts thereof. 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 an alkyl group with 16 or more and 20 or less carbon atoms in a molecule.

[0009] In a second aspect, the polyester synthetic fiber treatment agent according to the first aspect is characterized in

that assuming that the sum of the contents of the (poly)oxyalkylene derivative (A), the inorganic 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 inorganic 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.

[0010] In a third aspect, the polyester synthetic fiber treatment agent according to the first or second aspect is characterized in that the polyester synthetic fiber treatment agent is prepared as a set including first and second components of two-component polyester synthetic fiber treatment agent. The first component of two-component polyester synthetic fiber treatment agent contains the (poly)oxyalkylene derivative (A). The second component of two-component polyester synthetic fiber treatment agent contains the organic phosphoric acid ester compound (C). Either one or both of the first and second components of two-component polyester synthetic fiber treatment agent contain the inorganic acid compound (B).

[0011] In a fourth aspect, the polyester synthetic fiber treatment agent according to the first or second aspect is characterized in that the polyester synthetic fiber treatment agent is prepared as a set including first, second, and third components of three-component polyester synthetic fiber treatment agent. The first component of three-component polyester synthetic fiber treatment agent contains the (poly)oxyalkylene derivative (A). The second component of three-component polyester synthetic fiber treatment agent contains the organic phosphoric acid ester compound (C). The third component of three-component polyester synthetic fiber treatment agent contains the inorganic acid compound (B).

[0012] 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 is a polyester short fiber.

[0013] In a sixth aspect, the polyester synthetic fiber treatment agent according to any one of the first to fifth aspects is characterized in that the polyester synthetic fiber is a fiber for spun yarn production.

[0014] A composition containing polyester synthetic fiber treatment agent according to a seventh aspect is characterized by containing the polyester synthetic fiber treatment agent according to any one of the first to sixth aspects and a solvent (S). The solvent (S) has a boiling point of 105°C or lower at atmospheric pressure.

[0015] A first component of two-component polyester synthetic fiber treatment agent according to an eighth aspect is characterized by containing a (poly)oxyalkylene derivative (A), and is used in combination with a second component of two-component polyester synthetic fiber treatment agent or a composition containing second component of two-component polyester synthetic fiber treatment agent. The second component of two-component polyester synthetic fiber treatment agent contains an organic phosphoric acid ester compound (C). The composition containing second component of two-component polyester synthetic fiber treatment agent contains the second component of two-component polyester synthetic fiber treatment agent, which contains an organic phosphoric acid ester compound (C), and the following solvent (S). Either one or both of the first and second components of two-component polyester synthetic fiber treatment agent contain an inorganic acid compound (B). A 1% by mass water-diluted liquid of a mixture (containing no solvent) of the first and second components of two-component 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 and second components of two-component polyester synthetic fiber treatment agent contains 5% by mass or more of the (poly)oxyalkylene derivative (A), 1% by mass or more of the inorganic acid compound (B), and 5% by mass or more of the organic phosphoric acid ester compound (C). The inorganic acid compound (B) is at least one selected from the group consisting of sulfuric acid, nitric acid, hydrochloric acid, and salts thereof. 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 an alkyl 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.

[0016] A composition containing first component of two-component polyester synthetic fiber treatment agent according to a ninth aspect is characterized by containing the first component of two-component polyester synthetic fiber treatment agent according to the eighth aspect and a solvent (S). The solvent (S) has a boiling point of 105°C or lower at atmospheric pressure.

[0017] A second component of two-component polyester synthetic fiber treatment agent according to a tenth aspect is characterized by containing an organic phosphoric acid ester compound (C). The second component of two-component polyester synthetic fiber treatment agent is used in combination with a first component of two-component polyester synthetic fiber treatment agent or a composition containing first component of two-component polyester synthetic fiber treatment agent. The first component of two-component polyester synthetic fiber treatment agent contains a (poly) oxyalkylene derivative (A). The composition containing first component of two-component polyester synthetic fiber treatment agent contains the first component of two-component 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 two-component polyester synthetic fiber treatment agent contain an inorganic acid compound (B). A 1% by mass water-diluted liquid of a mixture (containing no solvent) of the first and second components of two-component 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 and second components of two-component polyester synthetic fiber treatment agent contains 5% by mass or more of the (poly)

oxyalkylene derivative (A), 1% by mass or more of the inorganic acid compound (B), and 5% by mass or more of the organic phosphoric acid ester compound (C). The inorganic acid compound (B) is at least one selected from the group consisting of sulfuric acid, nitric acid, hydrochloric acid, and salts thereof. 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 an alkyl 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.

[0018] A composition containing second component of two-component polyester synthetic fiber treatment agent according to an eleventh aspect is characterized by containing the second component of two-component polyester synthetic fiber treatment agent according to the tenth aspect and a solvent (S). The solvent (S) has a boiling point of 105°C or lower at atmospheric pressure.

[0019] A first component of three-component polyester synthetic fiber treatment agent according to a twelfth aspect is characterized by containing a (poly)oxyalkylene derivative (A) and is used in combination with a second component of three-component polyester synthetic fiber treatment agent or a composition containing second component of three-component polyester synthetic fiber treatment agent and a third component of three-component polyester synthetic fiber treatment agent or a composition containing third component of three-component polyester synthetic fiber treatment agent. The second component of three-component polyester synthetic fiber treatment agent contains an organic phosphoric acid ester compound (C). The composition containing second component of three-component polyester synthetic fiber treatment agent contains the second component of three-component polyester synthetic fiber treatment agent, which contains an organic phosphoric acid ester compound (C), and a solvent (S). The third component of three-component polyester synthetic fiber treatment agent contains an inorganic acid compound (B). The composition containing third component of three-component polyester synthetic fiber treatment agent contains the third component of three-component polyester synthetic fiber treatment agent, which contains an inorganic acid compound (B), and a solvent (S). A 1% by mass water-diluted liquid of a mixture (containing no solvent) of the first, second, and third components of three-component 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, second, and third components of three-component polyester synthetic fiber treatment agent contains 5% by mass or more of the (poly)oxyalkylene derivative (A), 1% by mass or more of the inorganic acid compound (B), and 5% by mass or more of the organic phosphoric acid ester compound (C). The inorganic acid compound (B) is at least one selected from the group consisting of sulfuric acid, nitric acid, hydrochloric acid, and salts thereof. 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 an alkyl 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.

[0020] A composition containing first component of three-component polyester synthetic fiber treatment agent according to a thirteenth aspect is characterized by containing the first component of three-component polyester synthetic fiber treatment agent according to the twelfth aspect and a solvent (S). The solvent (S) has a boiling point of 105°C or lower at atmospheric pressure.

[0021] A second component of three-component polyester synthetic fiber treatment agent according to a fourteenth aspect is characterized by containing an organic phosphoric acid ester compound (C) and is used in combination with a first component of three-component polyester synthetic fiber treatment agent or a composition containing first component of three-component polyester synthetic fiber treatment agent and a third component of three-component polyester synthetic fiber treatment agent or a composition containing third component of three-component polyester synthetic fiber treatment agent. The first component of three-component polyester synthetic fiber treatment agent contains a (poly) oxyalkylene derivative (A). The composition containing first component of three-component polyester synthetic fiber treatment agent contains the first component of three-component polyester synthetic fiber treatment agent, which contains a (poly)oxyalkylene derivative (A), and a solvent (S). The third component of three-component polyester synthetic fiber treatment agent contains an inorganic acid compound (B). The composition containing third component of three-component polyester synthetic fiber treatment agent contains the third component of three-component polyester synthetic fiber treatment agent, which contains an inorganic acid compound (B), and a solvent (S). A 1% by mass water-diluted liquid of a mixture (containing no solvent) of the first, second, and third components of three-component 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, second, and third components of three-component polyester synthetic fiber treatment agent contains 5% by mass or more of the (poly)oxyalkylene derivative (A), 1% by mass or more of the inorganic acid compound (B), and 5% by mass or more of the organic phosphoric acid ester compound (C). The inorganic acid compound (B) is at least one selected from the group consisting of sulfuric acid, nitric acid, hydrochloric acid, and salts thereof. 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 an alkyl 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.

[0022] A composition containing second component of three-component polyester synthetic fiber treatment agent according to a fifteenth aspect is characterized by containing the second component of three-component polyester

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

[0023] A third component of three-component polyester synthetic fiber treatment agent according to a sixteenth aspect is characterized by containing an inorganic acid compound (B) and is used in combination with a first component of three-component polyester synthetic fiber treatment agent or a composition containing first component of three-component polyester synthetic fiber treatment agent and a second component of three-component polyester synthetic fiber treatment agent or a composition containing second component of three-component polyester synthetic fiber treatment agent. The first component of three-component polyester synthetic fiber treatment agent contains a (poly)oxyalkylene derivative (A). The composition containing first component of three-component polyester synthetic fiber treatment agent contains the first component of three-component polyester synthetic fiber treatment agent, which contains a (poly)oxyalkylene derivative (A), and a solvent (S). The second component of three-component polyester synthetic fiber treatment agent contains an organic phosphoric acid ester compound (C). The composition containing second component of three-component polyester synthetic fiber treatment agent contains the second component of three-component polyester synthetic fiber treatment agent, which contains an organic phosphoric acid ester compound (C), and a solvent (S). A 1% by mass water-diluted liquid of a mixture (containing no solvent) of the first, second, and third components of three-component 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, second, and third components of three-component polyester synthetic fiber treatment agent contains 5% by mass or more of the (poly)oxyalkylene derivative (A), 1% by mass or more of the inorganic acid compound (B), and 5% by mass or more of the organic phosphoric acid ester compound (C). The inorganic acid compound (B) is at least one selected from the group consisting of sulfuric acid, nitric acid, hydrochloric acid, and salts thereof. 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 an alkyl 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.

[0024] A composition containing third component of three-component polyester synthetic fiber treatment agent according to a seventeenth aspect is characterized by containing the third component of three-component polyester synthetic fiber treatment agent according to the sixteenth aspect and a solvent (S). The solvent (S) has a boiling point of 105°C or lower at atmospheric pressure.

[0025] A diluted liquid of polyester synthetic fiber treatment agent according to an eighteenth aspect is characterized by containing the polyester synthetic fiber treatment agent according to any one of the first to sixth 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.

[0026] A method for treating polyester synthetic fiber according to a nineteenth 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 sixth aspects to water in at least one of a spinning step, a drawn step, and a finishing step of polyester synthetic fibers.

[0027] A method for treating polyester synthetic fiber according to a twentieth 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 seventh aspect to water in at least one of a spinning step, a drawn step, and a finishing step of polyester synthetic fibers.

[0028] A method for treating polyester synthetic fiber according to a twenty-first 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 two-component polyester synthetic fiber treatment agent according to the eighth aspect or the composition containing first component of two-component polyester synthetic fiber treatment agent according to the ninth aspect and the second component of two-component polyester synthetic fiber treatment agent according to the tenth aspect or the composition containing second component of two-component polyester synthetic fiber treatment agent according to the eleventh aspect in at least one of a spinning step, a drawn step, and a finishing step of polyester synthetic fibers.

[0029] A method for treating polyester synthetic fiber according to a twenty-second 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 three-component polyester synthetic fiber treatment agent according to the twelfth aspect or the composition containing first component of three-component polyester synthetic fiber treatment agent according to the thirteenth aspect, the second component of three-component polyester synthetic fiber treatment agent according to the fourteenth aspect or the composition containing second component of three-component polyester synthetic fiber treatment agent according to the fifteenth aspect and the third component of three-component polyester synthetic fiber treatment agent according to the sixteenth aspect or the composition containing third component of three-component polyester synthetic fiber treatment agent according to the seventeenth aspect in at least one of a spinning step, a drawn step, and a finishing step of polyester synthetic fibers.

[0030] A polyester synthetic fiber according to a twenty-third aspect is characterized by including the polyester synthetic fiber treatment agent according to any one of the first to sixth aspects adhered thereto.

ADVANTAGEOUS EFFECTS OF INVENTION

[0031] 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 >

[0032] 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 inorganic acid compound (B), and an organic phosphoric acid ester compound (C), and a 1% 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))

[0033] 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.

[0034] 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.

[0035] 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.

[0036] 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, isononacosanol, 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.

[0037] 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; and (5) hydroxycarboxylic acids, such as ricinoleic acid.

[0038] 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.

[0039] 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.

[0040] Specific examples of an aliphatic amine used as a raw material of the (poly)oxyalkylene derivative (A) include methylamine, ethylamine, butylamine, octylamine, laurylamine, octadecylamine, octadecenylamine, and coco amine.

[0041] 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.

[0042] 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 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.

[0043] Specific examples of the (poly)oxyalkylene derivative (A) include a salt of phosphoric acid and: a compound prepared by adding ethylene oxide to decyl alcohol and then adding propylene oxide to the decyl alcohol; a compound prepared by adding ethylene oxide to C12-13 branched alcohol; a compound prepared by randomly adding ethylene oxide and propylene oxide to C12-13 branched alcohol; a compound prepared by randomly adding ethylene oxide and propylene oxide to C11-14 alcohol; a compound prepared by randomly adding ethylene oxide and propylene oxide to C12-13 branched alcohol and then adding ethylene oxide thereto; a compound prepared by randomly adding ethylene oxide and propylene oxide to tridecyl alcohol; a compound prepared by adding propylene oxide to isodecyl alcohol and then adding ethylene oxide thereto; a compound prepared by randomly adding ethylene oxide and propylene oxide to isodecyl alcohol; a compound prepared by randomly adding ethylene oxide to isotridecyl alcohol and then adding propylene oxide thereto; a compound prepared by adding ethylene oxide to dodecyl alcohol; a compound prepared by adding ethylene oxide to dodecyl alcohol and then adding propylene oxide thereto; a compound prepared by reacting ethylene oxide with dodecylamine; a compound prepared by adding ethylene oxide to octadecyl alcohol; a compound prepared by adding ethylene oxide to lauric acid; a compound prepared by adding ethylene oxide to coco alkyl amine; a compound prepared by adding propylene oxide to diglycerin and then adding ethylene oxide thereto; a compound prepared by adding propylene oxide to propylene glycol and then adding ethylene oxide thereto; a compound prepared by adding ethylene oxide to nonylphenol; or a compound prepared by reacting ethylene oxide with dodecylamine.

[0044] 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.

[0045] 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.

(Inorganic acid compound (B))

[0046] Examples of the inorganic acid compound (B) used in the treatment agent of the present embodiment include sulfuric acid, nitric acid, hydrochloric acid, and salts thereof. The use of the inorganic acid compound (B) can particularly prevent a decrease in strength of the fiber to which the treatment agent has been applied.

[0047] As a salt of an inorganic acid, a salt exhibiting neutrality or acidity in an aqueous solution is preferable, and a salt exhibiting acidity is more preferable. Specific examples of the salt of the inorganic acid include sodium hydrogen sulfate, potassium hydrogen sulfate, potassium sulfate, sodium sulfate, and aluminum sulfate.

[0048] As the inorganic acid compound (B), one kind of inorganic acid compound may be used alone, or two or more kinds of inorganic acid compounds may be used in combination as appropriate.

[0049] The lower limit of the content of the inorganic acid compound (B) in the treatment agent is preferably 1% by mass

or more, and more preferably 2% by mass or more. When the content of the inorganic 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 inorganic acid compound (B) is preferably 10% by mass or less, and more preferably 7% by mass or less. When the content of the inorganic acid compound (B) is 10% 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. Further, it is possible to reduce the metal friction on the treatment agent-applied fiber in a wet state. Any combination of the upper and lower limits described above may be used.

(Organic phosphoric acid ester compound (C))

[0050] 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 an alkyl 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.

[0051] The alkyl group forming the organic phosphoric acid ester compound may have, for example, a linear or branched-chain structure. Specific examples of the alkyl 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.

[0052] 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, a phosphoric acid ester ammonium salt, and a phosphoric acid ester metal salt.

[0053] 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.

[0054] 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; and (5) polyoxyalkylene alkylaminoethers, such as polyoxyethylene laurylaminoether and polyoxyethylene steryl aminoether.

[0055] Specific examples of the organic phosphoric acid ester compound (C) include cetyl phosphoric acid ester, cetyl phosphoric acid ester salt, stearyl phosphoric acid ester, and stearyl phosphoric acid ester salt.

[0056] The acid value of the organic phosphoric acid ester compound (C) is not particularly limited.

[0057] 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.

[0058] 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.

[0059] Preferably, assuming that the sum of the amounts of the (poly)oxyalkylene derivative (A), the inorganic 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 inorganic 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)

[0060] The lower limit of the pH at 25°C of a 1% by mass water-diluted liquid of the treatment agent is 5.5 or more, and preferably 5.6 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 1% by mass water-diluted liquid of the treatment agent is 8.5 or less, and preferably 8.3 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)

[0061] 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 or a three-component treatment agent as described below from the viewpoint of improving the formulation stability.

[0062] The two-component treatment agent is prepared as a set including a first component of two-component polyester synthetic fiber treatment agent (hereinafter referred to as "first-of-two-component treatment agent") containing the (poly) oxyalkylene derivative (A) and a second component of two-component polyester synthetic fiber treatment agent (hereinafter referred to as "second-of-two-component treatment agent") containing the organic phosphoric acid ester compound (C). Either one or both of the first-of-two-component treatment agent and the second-of-two-component treatment agent contain the inorganic acid compound (B).

[0063] The two-component treatment agent is constituted of the first-of-two-component treatment agent and the second-of-two-component treatment agent that are separate from each other before use, for example, during storage or during distribution. In use, the first-of-two-component treatment agent and the second-of-two-component treatment agent are mixed with each other to prepare the two-component treatment agent.

[0064] The three-component treatment agent is prepared as a set including a first component of three-component polyester synthetic fiber treatment agent (hereinafter referred to as "first-of-three-component treatment agent") containing the (poly)oxyalkylene derivative (A), a second component of three-component polyester synthetic fiber treatment agent (hereinafter referred to as "second-of-three-component treatment agent") containing the organic phosphoric acid ester compound (C), and a third component of three-component polyester synthetic fiber treatment agent (hereinafter referred to as "third-of-three-component treatment agent") containing the inorganic acid compound (B).

[0065] The three-component treatment agent is constituted of the first-of-three-component treatment agent, the second-of-three-component treatment agent, and the third-of-three-component treatment agent that are separate from one another before use, for example, during storage or during distribution. In use, the first-of-three-component treatment agent, the second-of-three-component treatment agent, and the third-of-three-component treatment agent are mixed with one another to prepare the three-component treatment agent.

(Solvent)

[0066] 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.

[0067] 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.

[0068] 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.

[0069] The effects of the treatment agent of the first embodiment will now be described.

[0070] (1-1) The treatment agent of the first embodiment contains the (poly)oxyalkylene derivative (A), the inorganic acid compound (B), and the organic phosphoric acid ester compound (C), and a 1% 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.

[0071] 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.

[0072] Also, it is possible to reduce the metal friction on the treatment agent-applied fiber in a wet state. This enables the production efficiency to be improved.

[0073] (1-2) The treatment agent of the first embodiment may be prepared as a set including the first-of-two-component treatment agent containing the (poly)oxyalkylene derivative (A) and the second-of-two-component treatment agent containing the organic phosphoric acid ester compound (C). Either one or both of the first-of-two-component treatment agent and the second-of-two-component treatment agent contain the inorganic acid compound (B). With such a configuration, the formulation stability, particularly the storage stability, of the treatment agent can be improved.

[0074] (1-3) The treatment agent of the first embodiment may be prepared as a set including the first-of-three-component treatment agent containing the (poly)oxyalkylene derivative (A), the second-of-three-component treatment agent containing the organic phosphoric acid ester compound (C), and the third-of-three-component treatment agent containing the inorganic acid compound (B). With such a configuration, the formulation stability, particularly the storage stability, of the treatment agent can be improved.

< Second Embodiment >

[0075] Next, a second embodiment that embodies a first-of-two-component treatment agent of the present invention will be described, focusing on the differences from the above embodiment.

[0076] The first-of-two-component treatment agent of the present embodiment contains a (poly)oxyalkylene derivative (A). The first-of-two-component treatment agent is combined in use with a second-of-two-component treatment agent containing an organic phosphoric acid ester compound (C), or a composition containing second-of-two-component polyester synthetic fiber treatment agent that contains the second-of-two-component treatment agent, which contains an organic phosphoric acid ester compound (C), and a solvent (S) (hereinafter referred to as "second-of-two-component treatment agent-containing composition"). The inorganic acid compound (B) is contained in either one or both of the first-of-two-component treatment agent and the second-of-two-component treatment agent. A 1% by mass water-diluted liquid of a mixture of the first-of-two-component treatment agent and the second-of-two-component treatment agent has a pH at 25°C of 5.5 or more and 8.5 or less.

[0077] When the mixture of the first-of-two-component treatment agent and the second-of-two-component treatment agent is formed using the second-of-two-component treatment agent-containing composition prepared using water as the solvent (S), the pH is measured by a method as described below.

[0078] When the mixture of the first-of-two-component treatment agent and the second-of-two-component treatment agent is 1% by mass or more of water-diluted liquid of the treatment agent, the mixture is diluted to form a 1% by mass water-diluted liquid of the treatment agent, and then the pH at 25°C is measured.

[0079] When the mixture of the first-of-two-component treatment agent and the second-of-two-component treatment agent is a less than 1% by mass water-diluted liquid of the treatment agent, the mixture is dried or concentrated to form a 1% by mass water-diluted liquid of the treatment agent, and the pH at 25°C is measured.

[0080] When the mixture of the first-of-two-component treatment agent and the second-of-two-component treatment agent is formed using the second-of-two-component 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.

[0081] After the solvent is removed from the mixture of the first-of-two-component treatment agent and the second-of-two-component treatment agent, the mixture is diluted to form a 1% 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.

[0082] The (poly)oxyalkylene derivative (A), the inorganic 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)

[0083] The first-of-two-component treatment agent of the present embodiment may be mixed as necessary with a solvent to prepare a composition containing first-of-two-component polyester synthetic fiber treatment agent (hereinafter referred to as "first-of-two-component treatment agent-containing composition") and be stored or distributed in the form of the first-of-two-component treatment agent-containing composition.

[0084] The solvents can be the same as exemplified in the first embodiment. Assuming that the sum of the amounts of the first-of-two-component treatment agent and the solvent contained in the first-of-two-component treatment agent-containing composition is 100 parts by mass, the amount of the first-of-two-component treatment agent contained in the first-of-two-component treatment agent-containing composition is preferably 10 parts by mass or more.

[0085] The effects of the first-of-two-component 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 embodiment.

[0086] (2-1) The first-of-two-component treatment agent according to the second embodiment contains the (poly) oxyalkylene derivative (A) and is combined in use with the second-of-two-component treatment agent containing the organic phosphoric acid ester compound (C). Therefore, the formulation stability, particularly the storage stability, of the first-of-two-component treatment agent can be improved. Adjusting the mixing rate of the first-of-two-component treatment agent and the second-of-two-component treatment agent allows for adjustment of the ingredients in the prepared treatment agent. In addition, only the first-of two-component treatment agent can be distributed separately from the second-of-two-component treatment agent.

< Third Embodiment >

[0087] Next, a third embodiment that embodies a second-of-two-component treatment agent of the present invention will be described, focusing on the differences from the above embodiments.

[0088] The second-of-two-component treatment agent of the present embodiment contains an organic phosphoric acid ester compound (C). The second-of-two-component treatment agent is combined in use with a first-of-two-component treatment agent containing a (poly)oxyalkylene derivative (A), or a first-of-two-component treatment agent-containing composition that contains the first-of-two-component treatment agent, which contains a (poly)oxyalkylene derivative (A), and a solvent (S). The inorganic acid compound (B) is contained in either one or both of the first-of-two-component treatment agent and the second-of-two-component treatment agent. A 1% by mass water-diluted liquid of a mixture of the first-of-two-component treatment agent and the second-of-two-component treatment agent has a pH at 25°C of 5.5 or more and 8.5 or less. When the mixture of the first-of-two-component treatment agent and the second-of-two-component treatment agent is formed using the first-of-two-component treatment agent-containing composition prepared using the solvent (S), the pH is measured in a similar manner to that described in the second embodiment.

[0089] The (poly)oxyalkylene derivative (A), the inorganic 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)

[0090] The second-of-two-component treatment agent of the present embodiment may be mixed as necessary with a solvent to prepare the second-of-two-component treatment agent-containing composition and be stored or distributed in the form of the second-of-two-component treatment agent-containing composition.

[0091] The solvents can be the same as exemplified in the first embodiment. Assuming that the sum of the amounts of the second-of-two-component treatment agent and the solvent contained in the second-of-two-component treatment agent-containing composition is 100 parts by mass, the amount of the second-of-two-component treatment agent contained in second-of-two-component treatment agent-containing composition is preferably 10 parts by mass or more.

[0092] The effects of the second-of-two-component 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.

[0093] (3-1) The second-of-two-component treatment agent according to the third embodiment contains the organic phosphoric acid ester compound (C) and is combined in use with the first-of-two-component treatment agent containing the (poly)oxyalkylene derivative (A). Therefore, the formulation stability, particularly the storage stability, of the second-of-two-component treatment agent can be improved. Adjusting the mixing rate of the second-of-two-component treatment agent and the first-of-two-component treatment agent allows for adjustment of the ingredients in the prepared treatment agent. In addition, only the second-of-two-component treatment agent can be distributed separately from the first-of-two-component treatment agent.

< Fourth Embodiment >

[0094] Next, a fourth embodiment that embodies a first-of-three-component treatment agent of the present invention will be described, focusing on the differences from the above embodiments.

[0095] The first-of-three-component treatment agent of the present embodiment contains a (poly)oxyalkylene derivative (A). The first-of-three-component treatment agent is combined in use with a second-of-three-component treatment agent containing an organic phosphoric acid ester compound (C) or a composition containing second-of-three-component polyester synthetic fiber treatment agent (hereinafter referred to as "second-of-three-component treatment agent-containing composition") containing the second-of-three-component treatment agent, which contains an organic phosphoric acid ester compound (C), and a solvent (S), and a third-of-three-component treatment agent containing an inorganic acid compound (B) or a composition containing third-of-three-component polyester synthetic fiber treatment agent (hereinafter referred to as "third-of-three-component treatment agent-containing composition") containing the third-of-three-component treatment agent, which contains an inorganic acid compound (B), and the solvent (S).

[0096] A 1% by mass water-diluted liquid of a mixture of the first-of-three-component treatment agent, the second-of-three-component treatment agent, and the third-of-three-component treatment agent has a pH at 25°C of 5.5 or more and 8.5 or less. When the mixture of the first-of-three-component treatment agent, the second-of-three-component treatment agent, and the third-of-three-component treatment agent is formed using the second-of-three-component treatment agent-containing composition or the third-of-three-component treatment agent-containing composition prepared using the solvent (S), the pH is measured in a similar manner to that described in the second embodiment.

[0097] The (poly)oxyalkylene derivative (A), the inorganic 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)

[0098] The first-of-three-component treatment agent of the present embodiment may be mixed as necessary with a solvent to prepare a composition containing first-of-three-component polyester synthetic fiber treatment agent (hereinafter referred to as "first-of-three-component treatment agent-containing composition") and be stored or distributed in the form of the first-of-three-component treatment agent-containing composition.

[0099] The solvent (S) can be the same as exemplified in the first embodiment. Assuming that the sum of the amounts of the first-of-three-component treatment agent and the solvent contained in the first-of-three-component treatment agent-containing composition is 100 parts by mass, the amount of the first-of-three-component treatment agent contained in the first-of-three-component treatment agent-containing composition is preferably 10 parts by mass or more.

[0100] The effects of the first-of-three-component treatment agent of the fourth embodiment will now be described. The fourth embodiment has the following effects in addition to the effects of the above embodiments.

[0101] (4-1) The first-of-three-component treatment agent according to the fourth embodiment contains the (poly) oxyalkylene derivative (A) and is combined in use with the second-of-three-component treatment agent containing the organic phosphoric acid ester compound (C) and the third-of-three-component treatment agent containing the inorganic acid compound (B). Therefore, the formulation stability, particularly the storage stability, of the first-of-three-component treatment agent can be improved. Adjusting the mixing rate of the first-of-three-component treatment agent, the second-of-three-component treatment agent, and the third-of-three-component treatment agent allows for adjustment of the ingredients in the prepared treatment agent. In addition, only the first-of-three-component treatment agent can be distributed separately from the second-of-three-component treatment agent and the third-of-three-component treatment agent.

< Fifth Embodiment >

[0102] Next, a fifth embodiment that embodies a second-of-three-component treatment agent of the present invention will be described, focusing on the differences from the above embodiments.

[0103] The second-of-three-component treatment agent of the present embodiment contains an organic phosphoric acid ester compound (C). The second-of-three-component treatment agent is combined in use with a first-of-three-component treatment agent containing a (poly)oxyalkylene derivative (A) or a first-of-three-component treatment agent-containing composition containing the first-of-three-component treatment agent, which contains a (poly)oxyalkylene derivative (A), and a solvent (S), and a third-of-three-component treatment agent containing an inorganic acid compound (B) or a third-of-three-component treatment agent-containing composition containing the third-of-three-component treatment agent, which contains an inorganic acid compound (B), and the solvent (S).

[0104] A 1% by mass water-diluted liquid of a mixture of the first-of-three-component treatment agent, the second-of-three-component treatment agent, and the third-of-three-component treatment agent has a pH at 25°C of 5.5 or more and 8.5 or less. When the mixture of the first-of-three-component treatment agent, the second-of-three-component treatment agent, and the third of three-component treatment agent is formed using the first-of-three-component treatment agent-containing composition or the third-of-three-component treatment agent-containing composition prepared using the solvent (S), the pH is measured in a similar manner to that described in the second embodiment.

[0105] The (poly)oxyalkylene derivative (A), the inorganic 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)

[0106] The second-of-three-component treatment agent of the present embodiment may be mixed as necessary with a solvent (S) to prepare the second-of-three-component treatment agent-containing composition and be stored or distributed in the form of the second-of-three-component treatment agent-containing composition.

[0107] The solvent (S) can be the same as exemplified in the first embodiment. Assuming that the sum of the amounts of the second-of-three-component treatment agent and the solvent contained in the second-of three-component treatment

agent-containing composition is 100 parts by mass, the amount of the second-of-three-component treatment agent contained in the second-of three-component treatment agent-containing composition is preferably 10 parts by mass or more.

[0108] The effects of the second-of three-component treatment agent of the fifth embodiment will now be described. The fifth embodiment has the following effects in addition to the effects of the above embodiments.

[0109] (5-1) The second-of three-component treatment agent according to the fifth embodiment contains the organic phosphoric acid ester compound (C) and is combined in use with the first-of-three-component treatment agent containing the (poly)oxyalkylene derivative (A) and the third-of-three-component treatment agent containing the inorganic acid compound (B). Therefore, the formulation stability, particularly the storage stability, of the second-of three-component treatment agent can be improved. Adjusting the mixing rate of the second-of three-component treatment agent, the first-of-three-component treatment agent, and the third-of-three-component treatment agent allows for adjustment of the ingredients in the prepared treatment agent. In addition, only the second-of-three-component treatment agent can be distributed separately from the first-of-three-component treatment agent and the third-of-three-component treatment agent.

< Sixth Embodiment >

[0110] Next, a sixth embodiment that embodies a third-of-three-component treatment agent of the present invention will be described, focusing on the differences from the above embodiments.

[0111] The third-of-three-component treatment agent of the present embodiment contains an inorganic acid compound (B). The third-of-three-component treatment agent is combined in use with a first-of-three-component treatment agent containing a (poly)oxyalkylene derivative (A) or a first-of-three-component treatment agent-containing composition containing the first-of-three-component treatment agent, which contains a (poly)oxyalkylene derivative (A), and a solvent (S), and a second-of-three-component treatment agent containing an organic phosphoric acid ester compound (C) or a second-of-three-component treatment agent-containing composition containing the second-of-three-component treatment agent, which contains an organic phosphoric acid ester compound (C), and the solvent (S).

[0112] A 1% by mass water-diluted liquid of a mixture of the first-of-three-component treatment agent, the second-of-three-component treatment agent, and the third-of-three-component treatment agent has a pH at 25°C of 5.5 or more and 8.5 or less. When the mixture of the first-of-three-component treatment agent, the second-of-three-component treatment agent, and the third-of-three-component treatment agent is formed using the first-of-three-component treatment agent-containing composition or the second-of-three-component treatment agent-containing composition prepared using the solvent (S), the pH is measured in a similar manner to that described in the second embodiment.

[0113] The (poly)oxyalkylene derivative (A), the inorganic 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)

[0114] The third-of-three-component treatment agent of the present embodiment may be mixed as necessary with a solvent (S) to prepare the third-of-three-component treatment agent-containing composition and be stored or distributed in the form of the third-of-three-component treatment agent-containing composition.

[0115] The solvent (S) can be the same as exemplified in the first embodiment. Assuming that the sum of the amounts of the third-of-three-component treatment agent and the solvent contained in the third-of-three-component treatment agent-containing composition is 100 parts by mass, the amount of the third-of-three-component treatment agent contained in the third-of-three-component treatment agent-containing composition is preferably 10 parts by mass or more.

[0116] The effects of the third-of-three-component treatment agent of the sixth embodiment will now be described. The sixth embodiment has the following effects in addition to the effects of the above embodiments.

[0117] (6-1) The third-of-three-component treatment agent according to the sixth embodiment contains the inorganic acid compound (B) and is combined in use with the first-of-three-component treatment agent containing the (poly) oxyalkylene derivative (A) and the second-of-three-component treatment agent containing the organic phosphoric acid ester compound (C). Therefore, the formulation stability, particularly the storage stability, of the third-of-three-component treatment agent can be improved. Adjusting the mixing rate of the third-of-three-component treatment agent, the first-of-three-component treatment agent, and the second-of-three-component treatment agent allows for adjustment of the ingredients in the prepared treatment agent. In addition, only the third-of-three-component treatment agent can be distributed separately from the first-of-three-component treatment agent and the second-of-three-component treatment agent.

< Seventh Embodiment >

[0118] Next, a seventh 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.

[0119] 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.

[0120] 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-of-two-component treatment agent of the second embodiment, and the second-of-two-component 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-of-two-component treatment agent or the first-of-two-component treatment agent-containing composition, and the second-of-two-component treatment agent or the second-of-two-component treatment agent-containing composition. The diluted liquid is preferably prepared by adding, to water, the first-of-two-component treatment agent or the first-of-two-component treatment agent-containing composition and the second-of-two-component treatment agent or the second-of-two-component treatment agent-containing composition. The ratio of the first-of-two-component treatment agent content and the second-of-two-component treatment agent content is preferably such that as a mass ratio of nonvolatile contents, the first-of-two-component treatment agent / the second-of-two-component 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.

[0121] The fiber treatment method of the present embodiment is characterized in that in a case of a three-component treatment agent, a diluted liquid of the treatment agent containing a solvent, the first-of-three-component treatment agent of the fourth embodiment, the second-of-three-component treatment agent of the fifth embodiment, and the third-of-three-component treatment agent of the sixth embodiment is applied to a polyester synthetic fiber. The diluted liquid is prepared by, for example, adding, to a solvent, the first-of-three-component treatment agent or the first-of-three-component treatment agent-containing composition, the second-of-three-component treatment agent or the second-of-three-component treatment agent-containing composition, and the third-of-three-component treatment agent or the third-of-three-component treatment agent-containing composition. The diluted liquid is preferably prepared by adding, to water, the first-of-three-component treatment agent or the first-of-three-component treatment agent-containing composition, the second-of-three-component treatment agent or the second-of-three-component treatment agent-containing composition, and the third-of-three-component treatment agent or the third-of-three-component treatment agent-containing composition.

[0122] 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, ease of handling the diluted liquid.

[0123] By using the first-of-two-component treatment agent and the second-of-two-component treatment agent in combination or the first-of-three-component treatment agent, the second-of-three-component treatment agent, and the third-of-three-component 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.

[0124] To emulsify the treatment agents, 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.

[0125] 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.

[0126] 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.

[0127] 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.

[0128] 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.

[0129] 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 fibers to which the ingredients contained in the treatment agent, or the first component of the treatment agent, the second component of the treatment agent, and the third component of the treatment agent are adhered.

[0130] The effects of the fiber treatment method of the seventh embodiment will now be described. The seventh embodiment has the following effects in addition to the effects of the above embodiments.

[0131] (7-1) The fiber treatment method of the seventh 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-of-two-component treatment agent or the first-of-two-component treatment agent-containing composition and the second-of-two-component treatment agent or the second-of-two-component treatment agent-containing composition. Alternatively, a diluted liquid having excellent emulsion stability can be prepared by adding, to water, the first-of-three-component treatment agent or the first-of-three-component treatment agent-containing composition, the second-of-three-component treatment agent or the second-of-three-component treatment agent-containing composition, and the third-of-three-component treatment agent or the third-of-three-component 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.

[0132] 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.

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

· 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, or 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

[0133] 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.

[0134] Experimental Part 1 (Preparation of one-component treatment agent)

(Example 1-1)

[0135] As shown in Table 1, prepared was a treatment agent of Example 1-1 containing about 67.2 parts (%) of (poly) oxyalkylene derivative (A-1) shown in Table 2 as the (poly)oxyalkylene derivative (A), about 3.9 parts (%) of sulfuric acid (B-1) as the inorganic acid compound (B), about 28.8 parts (%) of stearyl phosphoric acid ester and potassium salt thereof (C-4) as the organic phosphoric acid ester compound (C), and 1 part of amino-modified polydimethylsiloxane (D-2) as the other ingredient (D) relative to 100 parts in total of the ingredients (A) to (C).

(Examples 1-2 to 1-21, Comparative Examples 1-1 to 1-9)

[0136] Treatment agents of Examples 1-2 to 1-21 and Comparative Examples 1-1 to 1-9 were prepared to contain the

(poly)oxyalkylene derivative (A), the inorganic 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.

[0137] The kind and content of the (poly)oxyalkylene derivative (A), the kind and content of the inorganic 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 "inorganic 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 inorganic 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)

[0138] The treatment agent of each example was diluted with hot water at about 70°C to prepare a 1% water-diluted liquid as the treatment agent. The pH at 25°C of the prepared 1% water-diluted liquid was measured. The measured values are shown in the column "pH of 1% water-diluted liquid" in Table 1.

[Table 1]

One-component treatment agent	(Poly)oxyalkylene derivative (A)		Inorganic acid compound (B)		Organic phosphoric acid ester compound (C)		Other ingredient (D)		pH of 1% water-diluted liquid	Evaluation			
	Kind	Part	Kind	Part	Kind	Part	Kind	Part relative to 100 parts in total of (A) to (C)		Metal friction in wet state	Adhesion	Fiber strength	Emulsion stability
Example 1-1	A-1	67.2	B-1	3.9	C-4	28.8	D-2	1	6.9	◎	◎	◎	◎
Example 1-2	A-2	28.2	B-2	6.0	C-8	65.8	-	-	6.8	◎	◎	◎	◎
Example 1-3	A-3	48.3	B-1	3.4	C-3	48.3	-	-	7.1	◎	◎	◎	◎
Example 1-4	A-12	66.5	B-4	5.0	C-4	28.5	D-1 D-2	1.5 1	7.5	◎	◎	◎	◎
Example 1-5	A-3	48.5	B-1	2.9	C-2	48.5	-	-	6.7	◎	◎	◎	◎
Example 1-6	A-4	28.2	B-2	5.9	C-6	65.9	D-1 D-2	1 1	7.1	◎	◎	◎	◎
Example 1-7	A-5	68.6	B-3	2.1	C-4	29.4	-	-	8.2	◎	◎	◎	◎
Example 1-8	A-6	48.7	B-1	2.6	C-7	48.7	-	-	6.9	◎	◎	◎	◎
Example 1-9	A-14	28.6	B-1	4.8	C-6	66.7	D-3	3	7	◎	◎	◎	◎
Example 1-10	A-10	48.8	B-1	2.4	C-9	48.8	-	-	7.1	◎	◎	◎	◎
Example 1-11	A-8	66.9	B-1	4.5	C-6	28.6	-	-	5.7	◎	◎	◎	◎
Example 1-12	A-9	22.8	B-1	3.5	C-4	73.7	D-1 D-8	2 5	7	◎	◎	◎	◎
Example 1-13	A-11	65.5	B-5	6.5	C-1	28.1	-	-	8.5	◎	◎	◎	◎
Example 1-14	A-7	48.9	B-1	2.2	C-5	48.9	-	-	7.4	◎	◎	◎	◎
Example 1-15	A-18	28.2	B-2	5.9	C-10	65.9	-	-	7.2	◎	◎	◎	◎
Example 1-16	A-13	22.7	B-1	3.4	C-4	73.9	D-1 D-7	2 0.3	7.2	◎	◎	◎	◎
Example 1-17	A-15	28.9	B-3	3.6	C-6	67.5	-	-	7.1	◎	◎	◎	◎
Example 1-18	A-16	68.1	B-4	2.7	C-8	29.2	-	-	8.4	◎	◎	◎	◎
Example 1-19	A-17	28.2	B-1	6.1	C-1	65.7	-	-	5.6	◎	◎	◎	◎
Example 1-20	A-1	9.7	B-1	3.4	C-5	87.0	-	-	7.1	◎	○	◎	◎
Example 1-21	A-2	88.0	B-1	2.2	C-3	9.8	-	-	6.9	◎	◎	◎	○
Comparative Example 1-1	A-17	28.3	B-2	5.7	rc-2	66.0	-	-	7.3	◎	◎	◎	×
Comparative Example 1-2	A-16	29.8	B-2	0.7	rc-1	69.5	-	-	7.1	◎	×	◎	◎
Comparative Example 1-3	A-7	31.1	-	-	C-10	68.9	D-5	3.6	9.6	-	◎	×	◎
Comparative Example 1-4	A-12	100.0	-	-	-	-	D-4 D-6	135 35	7.3	-	×	◎	◎
Comparative Example 1-5	-	-	B-1	3.4	C-9	96.6	-	-	7	◎	◎	◎	×
Comparative Example 1-6	A-14	70.0	-	-	C-4	30.0	-	-	10.2	-	◎	×	◎
Comparative Example 1-7	A-9	95.7	B-1	4.3	-	-	-	-	7.1	◎	×	◎	◎
Comparative Example 1-8	A-12	66.6	B-1	4.9	C-8	28.5	-	-	4.9	◎	◎	○	×
Comparative Example 1-9	A-17	30.0	B-4	0.5	C-10	69.5	-	-	9.5	◎	◎	×	◎

[0139] Details of the (poly)oxyalkylene derivative (A), the inorganic 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))

[0140] A-1 to A-18 described in Table 2 below were used.

[Table 2]

	A-1	A-2	A-3	A-4	A-5	A-6	A-7	A-8	A-9	A-10	A-11	A-12	A-13	A-14	A-15	A-16	A-17	A-18
Ingredient 1											30							
Ingredient 2			30							65								
Ingredient 3	65	50	30	30	28								65	2				
Ingredient 4															3			
Ingredient 5		20																
Ingredient 6								28										
Ingredient 7												30		23				
Ingredient 8														10				
Ingredient 9																65		
Ingredient 10															30			
Ingredient 11																		100
Ingredient 12				30	28			28	60	35	20	32		15			25	
Ingredient 13																	25	
Ingredient 14			40	40			30	39				38					50	
Ingredient 15															67			
Ingredient 16	13										42			50				
Ingredient 17		30																
Ingredient 18						50												
Ingredient 19	22				37	50							35					
Ingredient 20																35		
Ingredient 22											8							
Ingredient 23					7			5										
Ingredient 24							70											
Ingredient 25									40									
Total	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100

[0141] Details of the ingredients 1 to 25 shown in Table 2 are as follows.

Ingredient 1: compound prepared by adding 2 moles of ethylene oxide to 1 mole of decyl alcohol and then adding 5 moles of propylene oxide
Ingredient 2: compound prepared by adding 10 moles of ethylene oxide to 1 mol of C12-13 branched alcohol
Ingredient 3: compound prepared by randomly adding 6 moles of ethylene oxide and 2 moles of propylene oxide to 1 mol of C12-13 branched alcohol
Ingredient 4: compound prepared by randomly adding 4 moles of ethylene oxide and 4 moles of propylene oxide to 1 mol of C11-14 alcohol
Ingredient 5: compound prepared by randomly adding 4 moles of ethylene oxide and 2 moles of propylene oxide to 1 mol of C12-13 branched alcohol, and then adding 2 moles of ethylene oxide
Ingredient 6: compound prepared by randomly adding 6 moles of ethylene oxide and 2 moles of propylene oxide to 1 mol of tridecyl alcohol
Ingredient 7: compound prepared by adding 3 moles of propylene oxide to 1 mole of isodecyl alcohol and then adding 4 moles of ethylene oxide
Ingredient 8: compound prepared by randomly adding 5 moles of ethylene oxide and 2 moles of propylene oxide to 1 mol of isodecyl alcohol
Ingredient 9: compound prepared by adding 5 moles of ethylene oxide to 1 mole of isotridecyl alcohol and then adding 5 moles of propylene oxide
Ingredient 10: compound prepared by adding 4 moles of ethylene oxide to 1 mole of dodecyl alcohol
Ingredient 11: compound prepared by adding 7 moles of ethylene oxide to 1 mole of dodecyl alcohol
Ingredient 12: compound prepared by adding 10 moles of ethylene oxide to 1 mol of dodecyl alcohol
Ingredient 13: compound prepared by adding 5 moles of ethylene oxide to 1 mole of dodecyl alcohol, and then adding 5 moles of propylene oxide
Ingredient 14: compound prepared by reacting 10 moles of ethylene oxide with 1 mol of dodecylamine
Ingredient 15: compound prepared by reacting 12 moles of ethylene oxide with 1 mol of dodecylamine
Ingredient 16: compound prepared by reacting 15 moles of ethylene oxide with 1 mol of dodecylamine
Ingredient 17: compound prepared by adding 10 moles of ethylene oxide to 1 mol of octadecyl alcohol
Ingredient 18: compound prepared by adding 10 moles of ethylene oxide to 1 mol of lauric acid
Ingredient 19: compound prepared by adding 10 moles of ethylene oxide to 1 mole of coco alkyl amine
Ingredient 20: compound prepared by adding 15 moles of ethylene oxide to 1 mole of coco alkyl amine
Ingredient 22: compound prepared by adding 84 moles of propylene oxide to 1 mol of diglycerin, and then adding 23 moles of ethylene oxide
Ingredient 23: compound prepared by adding 43 moles of propylene oxide to 1 mol of propylene glycol, and then adding 6 moles of ethylene oxide
Ingredient 24: compound in which 10 moles of ethylene oxide is added to 1 mol of nonylphenol
Ingredient 25: salt of compound prepared by reacting 10 moles of ethylene oxide with 1 mol of dodecylamine and phosphoric acid

(Inorganic acid compound (B))

[0142]

B-1: sulfuric acid
B-2: nitric acid
B-3: hydrochloric acid
B-4: potassium hydrogen sulfate
B-5: potassium sulfate

(Organic phosphoric acid ester compound (C))

[0143] C-1 to C-10 described in Table 3 below were used. As the compounds corresponding to the comparative examples, rc-1 and rc-2 were used. Each of the organic phosphoric acid ester compounds (C) described in Table 3 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-6 and D-8 as described below.

[Table 3]

Kind	Organic phosphoric acid ester compound (C)	Acid value measured from organic phosphoric acid ester compound (C) [KOH-mg/g]
C-1	Cetyl phosphoric acid ester and potassium salt thereof	12.5
C-2	Cetyl phosphoric acid ester and potassium salt thereof	37.5
C-3	Stearyl phosphoric acid ester and potassium salt thereof	5
C-4	Stearyl phosphoric acid ester and potassium salt thereof	12.5
C-5	Stearyl phosphoric acid ester and potassium salt thereof	37.5
C-6	Cetyl phosphoric acid ester and potassium salt thereof/-stearyl phosphoric acid ester and potassium salt thereof = 70/30	12.5
C-7	Cetyl phosphoric acid ester and potassium salt thereof/-stearyl phosphoric acid ester and potassium salt thereof = 70/30	37.5
C-8	Cetyl phosphoric acid ester and potassium salt thereof/-stearyl phosphoric acid ester and potassium salt thereof = 30/70	12.5
C-9	Cetyl phosphoric acid ester and potassium salt thereof/-stearyl phosphoric acid ester and potassium salt thereof = 30/70	37.5
C-10	Stearyl phosphoric acid ester and potassium salt thereof	10
rc-1	Octyl phosphoric acid ester and potassium salt thereof	27.5
rc-2	Docosyl phosphoric acid ester and potassium salt thereof	5

[0144] The method for measuring the acid value of the organic phosphoric acid ester compound (C) is as follows.

[0145] 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 3.

[Numerical formula 1]

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

[0146] In Numerical formula 1,

f represents the factor of 0.1 mol/L potassium hydroxide methanol standard solution;
S represents the amount (g) collected of organic phosphoric acid ester compound (C); and
R represents the amount (mL) used of 0.1 mol/L potassium hydroxide methanol standard solution up to inflection point.

(Other ingredient (D))

[0147]

D-1: polydimethylsiloxane
D-2: amino-modified polydimethylsiloxane
D-3: potassium oleate
D-4: polyvinyl alcohol (average degree of polymerization: 300, degree of saponification: 80)
D-5: stearyl alcohol
D-6: hexyl phosphoric acid ester and potassium salt thereof (acid value 10.0 [KOH-mg/g])
D-7: potassium lactate

D-8 (rc-1): octyl phosphoric acid ester and potassium salt thereof (acid value: 27.5 [KOH-mg/g])

Experimental Part 2 (Metal friction in wet state)

[0148] Each of the treatment agents prepared in Experimental Part 1 was diluted with hot water at about 70°C to prepare a 5% diluted liquid of the treatment agent. 80 mL of the prepared 5% diluted liquid was placed in a metal container (60 mm in length, 230 mm in width, and 20 mm in height) and fixed. To a bottom surface of a 1 kg weight (30 mm in length, 90 mm in width, and 45 mm in height), a polyester spunbonded nonwoven fabric having the same size as the bottom surface (30 mm in length, 90 mm in width, and 45 mm in height) was attached. The nonwoven fabric-attached weight was placed in the metal container containing the diluted liquid. For each measurement sample, the tension at the time of pulling was measured at a horizontal velocity of 100 mm/min in an atmosphere at 20°C and 60% RH using a tensile tester (Autograph, manufactured by Shimadzu Corporation, model: AGS-X) equipped with a load cell having a maximum load capacity of 50 N. The friction was measured within 12 hours from the adjustment of the 5% diluted liquid, from the viewpoint of reproducibility or accuracy. The results are shown in the column "metal friction in wet state" in Table 1. The hyphen "-" in Table 1 indicates that the evaluation is not performed because the B ingredient (i.e., inorganic acid compound (B)) is not contained.

· Evaluation criteria for metal friction in wet state

[0149]

◎ (good): A ratio M/N of friction N in the case of not containing the B ingredient to friction M at the time of measurement is 0.98 or less.
× (poor): A ratio M/N of friction N in the case of not containing the B ingredient to friction M at the time of measurement is more than 0.98.

Experimental Part 3 (Adherence)

[0150] 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

[0151]

◎ (good): A treatment agent after temperature adjustment has a solid appearance, and is not sticky even when touched with a hand.
◦ (acceptable): A treatment agent after temperature adjustment has a solid appearance, but is sticky when touched with a hand.
× (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
◦(acceptable): Strength after 3 months is 90% or more and less than 95% of initial strength
× (poor): Strength after 3 months is less than 90% of initial strength

Experimental Part 5 (Emulsion stability)

[0154] 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

[0155]

◎ (good): No deposit is generated and no occurrence of precipitates is observed in the lower part.
◦ (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.
× (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 6 (Preparation of first-of-two-component treatment agent)

(First-of-two-component treatment agent (I-A-1))

[0156] As shown in Table 4, prepared was a first-of-two-component treatment agent (I-A-1) containing 94.5 parts (%) of (poly)oxyalkylene derivative (A-1) shown in Table 2 as the (poly)oxyalkylene derivative (A) and 5.5 parts (%) of sulfuric acid (B-1) as the inorganic acid compound (B).

(First-of-two-component treatment agents (I-A-2) to (I-A-21), first-of-two-component treatment agents (I-B-1) to (I-B-18), and first-of-two-component treatment agents (I-C-1) to (I-C-2))

[0157] These treatment agents were prepared to contain the (poly)oxyalkylene derivative (A) and the inorganic acid compound (B) in proportions shown in Table 4, in a similar manner to the first-of-two-component treatment agent (I-A-1).
[0158] The kind and content of the (poly)oxyalkylene derivative (A) and the kind and content of the inorganic acid compound (B) are shown in the column "(poly)oxyalkylene derivative (A)" and the column "inorganic acid compound (B)" of Table 4, respectively.

[Table 4]

Classification	(Poly)oxyalkylene derivative (A)		Inorganic acid compound (B)		Formulation stability of first-of-two-component treatment agent
	Kind	Part	Kind	Part	
Two-component I-A-1	A-1	94.5	B-1	5.5	○
Two-component I-A-2	A-2	82.4	B-2	17.6	○
Two-component I-A-3	A-3	93.5	B-1	6.5	○
Two-component I-A-4	A-12	93.0	B-4	7.0	○
Two-component I-A-5	A-3	94.3	B-1	5.7	○
Two-component I-A-6	A-4	82.6	B-2	17.4	○
Two-component I-A-7	A-5	97.1	B-3	2.9	○

(continued)

Classification	(Poly)oxyalkylene derivative (A)		Inorganic acid compound (B)		Formulation stability of first-of-two-component treatment agent
	Kind	Part	Kind	Part	
Two-component I-A-8	A-6	94.9	B-1	5.1	○
Two-component I-A-9	A-14	85.7	B-1	14.3	○
Two-component I-A-10	A-10	95.2	B-1	4.8	○
Two-component I-A-11	A-8	93.7	B-1	6.3	○
Two-component I-A-12	A-9	86.8	B-1	13.2	○
Two-component I-A-13	A-11	91.0	B-5	9.0	○
Two-component I-A-14	A-7	95.6	B-1	4.4	○
Two-component I-A-15	A-18	82.6	B-2	17.4	○
Two-component I-A-16	A-13	87.0	B-1	13.0	○
Two-component I-A-17	A-15	89.0	B-3	11.0	○
Two-component I-A-18	A-16	96.2	B-4	3.8	○
Two-component I-A-19	A-17	82.2	B-1	17.8	○
Two-component I-A-20	A-1	74.1	B-1	25.9	○
Two-component I-A-21	A-2	97.5	B-1	2.5	○
Two-component I-B-1	A-1	100	-	-	○
Two-component I-B-2	A-2	100	-	-	○
Two-component I-B-3	A-3	100	-	-	○
Two-component I-B-4	A-4	100	-	-	○
Two-component I-B-5	A-5	100	-	-	○
Two-component I-B-6	A-6	100	-	-	○
Two-component I-B-7	A-7	100	-	-	○
Two-component I-B-8	A-8	100	-	-	○
Two-component I-B-9	A-9	100	-	-	○
Two-component I-B-10	A-10	100	-	-	○
Two-component I-B-11	A-11	100	-	-	○
Two-component I-B-12	A-12	100	-	-	○
Two-component I-B-13	A-13	100	-	-	○
Two-component I-B-14	A-14	100	-	-	○
Two-component I-B-15	A-15	100	-	-	○
Two-component I-B-16	A-16	100	-	-	○
Two-component I-B-17	A-17	100	-	-	○
Two-component I-B-18	A-18	100	-	-	○
Two-component I-C-1	A-1	95.8	B-1	4.2	○
Two-component I-C-2	A-2	95.6	B-2	4.4	○

Experimental Part 7 (Preparation of second-of-two-component treatment agent)

(Second-of-two-component treatment agent (II-A-1))

[0159] As shown in Table 5, prepared was a second-of-two-component 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-of-two-component treatment agents (II-A-2) to (II-A-10), second-of-two-component treatment agents (II-B-1) to (II-B-21), and second-of-two-component treatment agents (II-C-1) to (II-C-2))

[0160] These treatment agents were prepared to contain the organic phosphoric acid ester compound (C) and the inorganic acid compound (B) in proportions shown in Table 5, in a similar manner to the second-of-two-component 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 inorganic acid compound (B) are shown in the column "organic phosphoric acid ester compound (C)" and the column "inorganic acid compound (B)" of Table 5, respectively.

[Table 5]

Classification	Organic phosphoric acid ester compound (C)		Inorganic acid compound (B)		Formulation stability of second-of-two-component treatment agent
	Kind	Part	Kind	Part	
Two-component II-A-1	C-1	100	-	-	○
Two-component II-A-2	C-2	100	-	-	○
Two-component II-A-3	C-3	100	-	-	○
Two-component II-A-4	C-4	100	-	-	○
Two-component II-A-5	C-5	100	-	-	○
Two-component II-A-6	C-6	100	-	-	○
Two-component II-A-7	C-7	100	-	-	○
Two-component II-A-8	C-8	100	-	-	○
Two-component II-A-9	C-9	100	-	-	○
Two-component II-A-10	C-10	100	-	-	○
Two-component II-B-1	C-4	88.0	B-1	12.0	○
Two-component II-B-2	C-8	91.6	B-2	8.4	○
Two-component II-B-3	C-3	93.5	B-1	6.5	○
Two-component II-B-4	C-4	85.0	B-4	15.0	○
Two-component II-B-5	C-2	94.3	B-1	5.7	○
Two-component II-B-6	C-6	91.7	B-2	8.3	○
Two-component II-B-7	C-4	93.5	B-3	6.5	○
Two-component II-B-8	C-7	94.9	B-1	5.1	○
Two-component II-B-9	C-6	93.3	B-1	6.7	○
Two-component II-B-10	C-9	95.2	B-1	4.8	○
Two-component II-B-11	C-6	86.4	B-1	13.6	○
Two-component II-B-12	C-4	95.5	B-1	4.5	○
Two-component II-B-13	C-1	81.3	B-5	18.7	○
Two-component II-B-14	C-5	95.6	B-1	4.4	○
Two-component II-B-15	C-10	91.7	B-2	8.3	○
Two-component II-B-16	C-4	95.6	B-1	4.4	○

(continued)

Classification	Organic phosphoric acid ester compound (C)		Inorganic acid compound (B)		Formulation stability of second-of-two-component treatment agent
	Kind	Part	Kind	Part	
Two-component II-B-17	C-6	95.0	B-3	5.0	○
Two-component II-B-18	C-8	91.5	B-4	8.5	○
Two-component II-B-19	C-1	91.5	B-1	8.5	○
Two-component II-B-20	C-5	96.3	B-1	3.7	○
Two-component II-B-21	C-3	81.3	B-1	18.7	○
Two-component II-C-1	C-4	96.7	B-1	3.3	○
Two-component II-C-2	C-8	93.3	B-2	6.7	○

Experimental Part 8 (Evaluation of formulation stability)

· Evaluation of formulation stability of first-of-two-component treatment agent

[0162] A first-of-two-component treatment agent-containing composition containing the first-of-two-component treatment agent and water as the solvent (S) at a mass ratio of the first-of-two-component treatment agent : water = 95 : 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 4.

· Evaluation of formulation stability of second-of-two-component treatment agent

[0163] A second-of-two-component treatment agent-containing composition containing the second-of-two-component treatment agent and water as the solvent (S) at a mass ratio of the second-of-two-component 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 "formulation stability" in Table 5.

· Evaluation criteria for formulation stability (first-of-two-component treatment agent-containing composition and second-of-two-component treatment agent-containing composition)

[0164]

◦ (good): No gelation occurs.
× (poor): Gelation occurs.

[0165] Experimental Part 9 (Preparation of treatment agent from first-of-two-component treatment agent and second-of-two-component treatment agent)

(Example 2-A-1)

[0166] In addition to 71.2% (parts) of the first-of-two-component treatment agent (I-A-1) and 28.8% (parts) of the second-of-two-component treatment agent (II-A-4) as shown in Table 6, 1 part of the treatment agent (two-component III-1) as the other treatment agent (D) shown in Table 7 was added relative to 100 parts in total of the first-of-two-component treatment agent and the second-of-two-component treatment agent to prepare a treatment agent of Example 2-A-1.

(Examples (2-A-2) to (2-A-21), Examples (2-B-1) to (2-B-21), and Examples (2-W-1) to (2-W-2))

[0167] In a similar manner to Example 2-A-1, the first-of-two-component treatment agent and the second-of-two-component treatment agent as shown in Table 6, and as necessary the other treatment agent (D) shown in Table 7 were mixed to prepare a treatment agent of each of the examples.

[0168] The kind and mass ratio of the first-of-two-component treatment agent, the kind and mass ratio of the second-of-two-component treatment agent, and the kind and mass ratio of the other treatment agent (D) are shown in the column

"first-of-two-component treatment agent", the column "second-of-two-component treatment agent", and the column "other treatment agent (D)" of Table 6, respectively. The content of the other treatment agent (D) refers to the amount (part) when the sum of the amounts of the first-of-two-component treatment agent and the second-of-two-component treatment agent is taken as 100 parts.

(Measurement of pH)

[0169] The first-of-two-component treatment agent and the second-of-two-component treatment agent shown in Table 6 were mixed with each other and diluted with hot water at about 70°C to prepare a 1% water-diluted liquid of the treatment agent. In an example of using the other treatment agent (D), the first-of-two-component treatment agent, the second-of-two-component treatment agent were mixed with the other treatment agent (D), and the mixture was then diluted with hot water at about 70°C to form a 1% water-diluted liquid of the treatment agent. The pH at 25°C of the 1% water-diluted liquid prepared in each example was measured. The measured values are shown in the column of "pH of 1% water-diluted liquid" in Table 6.

[Table 6]

Two-component treatment agent	First-of-two-component treatment agent		Second-of-two-component treatment agent		Other treatment agent (D)		pH of 1% water-diluted liquid	Evaluation			
	Kind	Part	Kind	Part	Kind	Part relative to 100 parts in total of first and second treatment agents		Metal friction in wet state	Adhesion	Fiber strength	Emulsion stability
Example 2-A-1	Two-component I-A-1	71.2	Two-component II-A-4	28.8	Two-component III-1	1	6.9	◎	◎	◎	◎
Example 2-A-2	Two-component I-A-2	34.2	Two-component II-A-8	65.8	-	-	6.8	◎	◎	◎	◎
Example 2-A-3	Two-component I-A-3	51.7	Two-component II-A-3	48.3	-	-	7.1	◎	◎	◎	◎
Example 2-A-4	Two-component I-A-4	71.5	Two-component II-A-4	28.5	Two-component III-2	2.5	7.5	◎	◎	◎	◎
Example 2-A-5	Two-component I-A-5	51.5	Two-component II-A-2	48.5	-	-	6.7	◎	◎	◎	◎
Example 2-A-6	Two-component I-A-6	34.1	Two-component II-A-6	65.9	Two-component III-3	2	7.1	◎	◎	◎	◎
Example 2-A-7	Two-component I-A-7	70.6	Two-component II-A-4	29.4	-	-	8.2	◎	◎	◎	◎
Example 2-A-8	Two-component I-A-8	51.3	Two-component II-A-7	48.7	-	-	6.9	◎	◎	◎	◎
Example 2-A-9	Two-component I-A-9	33.3	Two-component II-A-6	66.7	Two-component III-4	3	7	◎	◎	◎	◎
Example 2-A-10	Two-component I-A-10	51.2	Two-component II-A-9	48.8	-	-	7.1	◎	◎	◎	◎
Example 2-A-11	Two-component I-A-11	71.4	Two-component II-A-6	28.6	-	-	5.7	◎	◎	◎	◎
Example 2-A-12	Two-component I-A-12	26.3	Two-component II-A-4	73.7	Two-component III-5	7	7	◎	◎	◎	◎
Example 2-A-13	Two-component I-A-13	71.9	Two-component II-A-1	28.1	-	-	8.5	◎	◎	◎	◎
Example 2-A-14	Two-component I-A-14	51.1	Two-component II-A-5	48.9	-	-	7.4	◎	◎	◎	◎
Example 2-A-15	Two-component I-A-15	34.1	Two-component II-A-10	65.9	-	-	7.2	◎	◎	◎	◎
Example 2-A-16	Two-component I-A-16	26.1	Two-component II-A-4	73.9	Two-component III-6	2.3	7.2	◎	◎	◎	◎

Example 2-A-17	Two-component I-A-17	32.5	Two-component II-A-6	67.5	-	-	7.1	◎	◎	◎	◎
Example 2-A-18	Two-component I-A-18	70.8	Two-component II-A-8	29.2	-	-	8.4	◎	◎	◎	◎
Example 2-A-19	Two-component I-A-19	34.3	Two-component II-A-1	65.7	-	-	5.6	◎	◎	◎	◎
Example 2-A-20	Two-component I-A-20	13.0	Two-component II-A-5	87.0	-	-	7.1	◎	○	◎	◎
Example 2-A-21	Two-component I-A-21	90.2	Two-component II-A-3	9.8	-	-	6.9	◎	◎	◎	○
Example 2-B-1	Two-component I-B-1	67.2	Two-component II-B-1	32.8	Two-component III-1	1	6.9	◎	◎	◎	◎
Example 2-B-2	Two-component I-B-2	28.2	Two-component II-B-2	71.8	-	-	6.8	◎	◎	◎	◎
Example 2-B-3	Two-component I-B-3	48.3	Two-component II-B-3	51.7	-	-	7.1	◎	◎	◎	◎
Example 2-B-4	Two-component I-B-12	66.5	Two-component II-B-4	33.5	Two-component III-2	2.5	7.5	◎	◎	◎	◎
Example 2-B-5	Two-component I-B-3	48.5	Two-component II-B-5	51.5	-	-	6.7	◎	◎	◎	◎
Example 2-B-6	Two-component I-B-4	28.2	Two-component II-B-6	71.8	Two-component III-3	2	7.1	◎	◎	◎	◎
Example 2-B-7	Two-component I-B-5	68.6	Two-component II-B-7	31.4	-	-	8.2	◎	◎	◎	◎
Example 2-B-8	Two-component I-B-6	48.7	Two-component II-B-8	51.3	-	-	6.9	◎	◎	◎	◎
Example 2-B-9	Two-component I-B-14	28.6	Two-component II-B-9	71.4	Two-component III-4	3	7	◎	◎	◎	◎
Example 2-B-10	Two-component I-B-10	48.8	Two-component II-B-10	51.2	-	-	7.1	◎	◎	◎	◎
Example 2-B-11	Two-component I-B-8	66.9	Two-component II-B-11	33.1	-	-	5.7	◎	◎	◎	◎
Example 2-B-12	Two-component I-B-9	22.8	Two-component II-B-12	77.2	Two-component III-5	7	7	◎	◎	◎	◎
Example 2-B-13	Two-component I-B-11	65.5	Two-component II-B-13	34.5	-	-	8.5	◎	◎	◎	◎
Example 2-B-14	Two-component I-B-7	48.9	Two-component II-B-14	51.1	-	-	7.4	◎	◎	◎	◎
Example 2-B-15	Two-component I-B-18	28.2	Two-component II-B-15	71.8	-	-	7.2	◎	◎	◎	◎
Example 2-B-16	Two-component I-B-13	22.7	Two-component II-B-16	77.3	Two-component III-6	2.3	7.2	◎	◎	◎	◎
Example 2-B-17	Two-component I-B-15	28.9	Two-component II-B-17	71.1	-	-	7.1	◎	◎	◎	◎
Example 2-B-18	Two-component I-B-16	68.1	Two-component II-B-18	31.9	-	-	8.4	◎	◎	◎	◎
Example 2-B-19	Two-component I-B-17	28.2	Two-component II-B-19	71.8	-	-	5.6	◎	◎	◎	◎
Example 2-B-20	Two-component I-B-1	9.7	Two-component II-B-20	90.3	-	-	7.1	◎	○	◎	◎
Example 2-B-21	Two-component I-B-2	88.0	Two-component II-B-21	12.0	-	-	6.9	◎	◎	◎	○
Example 2-W-1	Two-component I-C-1	70.2	Two-component II-C-1	29.8	Two-component III-1	1	6.9	◎	◎	◎	◎
Example 2-W-2	Two-component I-C-2	29.5	Two-component II-C-2	70.5	-	-	6.8	◎	◎	◎	◎

[0170] As the other treatment agent (D) described in Table 6, the treatment agents (two-component III-1) to (two-component III-6) described in Table 7 below were used. The treatment agents (two-component III-1) to (two-component III-6) were prepared to contain the other treatment agent (D) in proportions shown in Table 7.

[Table 7]

Classification	Other treatment agent (D)			
	Kind	Part	Kind	Part
Two-component III-1	D-2	100	-	-
Two-component III-2	D-1	60	D-2	40
Two-component III-3	D-1	50	D-2	50
Two-component III-4	D-3	100	-	-
Two-component III-5	D-1	28.6	D-8	71.4
Two-component III-6	D-1	87.0	D-7	13.0

Experimental Part 10 (Evaluation of two-component treatment agent)

[0171] The resulting treatment agents of the examples were used to evaluate the metal friction in wet state, adherence, fiber strength, and emulsion stability in a similar manner to Example 1. The diluted liquid of treatment agent used in the evaluation of the metal friction in wet state, adherence, and emulsion stability was prepared by mixing the first-of-two-component treatment agent, the second-of-two-component 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 9. The results are shown in the column "metal friction in wet state", the column "adherence", the column "fiber strength", and the column "emulsion stability" of Table 6, respectively.

Experimental Part 11 (Preparation of first-of-three-component treatment agent)

(First-of-three-component treatment agent (I-1))

[0172] As shown in Table 8, prepared was a first-of-three-component treatment agent (I-1) containing 100 parts (%) of (poly)oxyalkylene derivative (A-1) shown in Table 2 as the (poly)oxyalkylene derivative (A).

(First-of-three-component treatment agents (1-2) to (1-18))

[0173] These treatment agents were prepared to contain the (poly)oxyalkylene derivative (A) in proportions shown in Table 8, in a similar manner to the first-of-three-component treatment agent (I-1).

[0174] The kind and content of the (poly)oxyalkylene derivative (A) are shown in the column "(poly)oxyalkylene derivative (A)" in Table 8.

[Table 8]

Classification	(Poly)oxyalkylene derivative (A)		Formulation stability of first-of-three-component treatment agent
	Kind	Part	
Three-component I-1	A-1	100	○
Three-component I-2	A-2	100	○
Three-component I-3	A-3	100	○
Three-component I-4	A-4	100	○
Three-component I-5	A-5	100	○
Three-component I-6	A-6	100	○
Three-component I-7	A-7	100	○
Three-component I-8	A-8	100	○
Three-component I-9	A-9	100	○
Three-component I-10	A-10	100	○
Three-component I-11	A-11	100	○

(continued)

Classification	(Poly)oxyalkylene derivative (A)		Formulation stability of first-of-three-component treatment agent
	Kind	Part	
Three-component I-12	A-12	100	○
Three-component I-13	A-13	100	○
Three-component I-14	A-14	100	○
Three-component I-15	A-15	100	○
Three-component I-16	A-16	100	○
Three-component I-17	A-17	100	○
Three-component I-18	A-18	100	○

Experimental Part 12 (Preparation of second-of-three-component treatment agent)

(Second-of-three-component treatment agent (II-1))

[0175] As shown in Table 9, prepared was a second-of-three-component treatment agent (11-1) containing 100 parts (%) of cetyl phosphoric acid ester and potassium salt thereof (C-1) as the organic phosphoric acid ester compound (C).

(Second-of-three-component treatment agents (II-2) to (11-10))

[0176] These treatment agents were prepared to contain the organic phosphoric acid ester compound (C) in proportions shown in Table 9, in a similar manner to the second-of-three-component treatment agent (II-1).

[0177] The kind and content of the organic phosphoric acid ester compound (C) are shown in the column "organic phosphoric acid ester compound (C)" in Table 9.

[Table 9]

Classification	Organic phosphoric acid ester compound (C)		Formulation stability of second-of-three-component treatment agent
	Kind	Part	
Three-component II-1	C-1	100	○
Three-component II-2	C-2	100	○
Three-component II-3	C-3	100	○
Three-component II-4	C-4	100	○
Three-component II-5	C-5	100	○
Three-component II-6	C-6	100	○
Three-component II-7	C-7	100	○
Three-component II-8	C-8	100	○
Three-component II-9	C-9	100	○
Three-component II-10	C-10	100	○

Experimental Part 13 (Preparation of third-of-three-component treatment agent)

(Third-of-three-component treatment agent (III-1))

[0178] As shown in Table 10, prepared was a third-of-three-component treatment agent (III-1) containing 100 parts (%) of sulfuric acid (B-1) as the inorganic acid compound (B).

(Third-of-three-component treatment agents (III-2) to (III-5))

[0179] These treatment agents were prepared to contain the inorganic acid compound (B) in proportions shown in Table 10, in a similar manner to the third-of-three-component treatment agent (III-1).

[0180] The kind and content of the inorganic acid compound (B) are shown in the column "inorganic acid compound (B)" in Table 10.

[Table 10]

Classification	Inorganic acid compound (B)		Formulation stability of third-of-three-component treatment agent
	Kind	Part	
Three-component III-1	B-1	100	○
Three-component III-2	B-2	100	○
Three-component III-3	B-3	100	○
Three-component III-4	B-4	100	○
Three-component III-5	B-5	100	○

Experimental Part 14 (Evaluation of formulation stability)

· Evaluation of formulation stability of first-of-three-component treatment agent

[0181] A first-of-three-component treatment agent-containing composition containing the first-of-three-component treatment agent and water as the solvent (S) at a mass ratio of the first-of-two-component treatment agent : water = 95 : 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 of "formulation stability" in Table 8.

· Evaluation of formulation stability of second-of-three-component treatment agent

[0182] A second-of-three-component treatment agent-containing composition containing the second-of-three-component treatment agent and water as the solvent (S) at a mass ratio of the second-of-three-component 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 9.

· Evaluation of formulation stability of third-of-three-component treatment agent

[0183] A third-of-three-component treatment agent-containing composition containing the third-of-three-component treatment agent and water as the solvent (S) at a mass ratio of the third-of-three-component treatment agent : water = 50 : 50 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 10.

· Evaluation criteria for formulation stability (first-of-three-component treatment agent-containing composition, second-of-three-component treatment agent-containing composition, and third-of-three-component treatment agent-containing composition)

[0184]

o (good): No gelation occurs.
× (poor): Gelation occurs.

[0185] Experimental Part 15 (Preparation of treatment agent from first-of-three-component treatment agent, second-of-three-component treatment agent, and third-of-three-component treatment agent)

(Example 3-1)

[0186] In addition to 67.2% (parts) of the first-of-three-component treatment agent (I-1), 3.9% (parts) of the second-of-

three-component treatment agent (II-1), and 28.8% (parts) of the third-of-three-component treatment agent (III-4) as shown in Table 11, 1 part of the treatment agent (three-component IV-2) as the other treatment agent (D) shown in Table 12 was added relative to 100 parts in total of the first-of-three-component treatment agent, the second-of-three-component treatment agent, and the third-of-three-component treatment agent to prepare a treatment agent of Example 3-1.

(Examples (3-2) to (3-21))

[0187] In a similar manner to Example 3-1, the first-of-three-component treatment agent, the second-of-three-component treatment agent, and the third-of-three-component treatment agent as shown in Table 11, and as necessary the other treatment agent (D) shown in Table 12 were mixed to prepare a treatment agent of each of the examples.

[0188] The kind and mass ratio of the first-of-three-component treatment agent, the kind and mass ratio of the second-of-three-component treatment agent, the kind and mass ratio of the third-of-three-component treatment agent, and the kind and mass ratio of the other treatment agent (D) are shown in the column "first-of-three-component treatment agent", the column "second-of-three-component treatment agent", the column "third-of-three-component treatment agent", and the column "other treatment agent (D)" of Table 11, respectively. The content of the other treatment agent (D) refers to the amount (part) when the sum of the amounts of the first-of-three-component treatment agent, the second-of-three-component treatment agent, and the third-of-three-component treatment agent is taken as 100 parts.

(Measurement of pH)

[0189] The first-of-three-component treatment agent, the second-of-three-component treatment agent, and the third-of-three-component treatment agent shown in Table 11 were mixed with one another and diluted with hot water at about 70°C to prepare a 1% water-diluted liquid of the treatment agent. In an example of using the other treatment agent (D), the first-of-three-component treatment agent, the second-of-three-component treatment agent, and the third-of-three-component treatment agent were mixed with the other treatment agent (D), and the mixture was then diluted with hot water at about 70°C to prepare a 1% water-diluted liquid of the treatment agent. The pH at 25°C of the 1% water-diluted liquid prepared in each example was measured. The measured values are shown in the column "pH of 1% water-diluted liquid" in Table 11.

[Table 11]

Three-component treatment agent	First-of-three-component treatment agent		Third-of-three-component treatment agent		Second-of-three-component treatment agent		Other treatment agent (D)		pH of 1% water-diluted liquid	Evaluation			
	Kind	Part	Kind	Part	Kind	Part	Kind	Part relative to 100 parts in total of first to third treatment agents		Metal friction in wet state	Adhesion	Fiber strength	Emulsion stability
Example 3-1	Three-component I-1	67.2	Three-component III-1	3.9	Three-component II-4	28.8	Three-component IV-1	1	6.9	◎	◎	◎	◎
Example 3-2	Three-component I-2	28.2	Three-component III-2	6.0	Three-component II-8	65.8	-	-	6.8	◎	◎	◎	◎
Example 3-3	Three-component I-3	48.3	Three-component III-1	3.4	Three-component II-3	48.3	-	-	7.1	◎	◎	◎	◎
Example 3-4	Three-component I-12	66.5	Three-component III-4	5.0	Three-component II-4	28.5	Three-component IV-2	2.5	7.5	◎	◎	◎	◎
Example 3-5	Three-component I-3	48.5	Three-component III-1	2.9	Three-component II-2	48.5	-	-	6.7	◎	◎	◎	◎
Example 3-6	Three-component I-4	28.2	Three-component III-2	5.9	Three-component II-6	65.9	Three-component IV-3	2	7.1	◎	◎	◎	◎
Example 3-7	Three-component I-5	68.6	Three-component III-3	2.1	Three-component II-4	29.4	-	-	8.2	◎	◎	◎	◎
Example 3-8	Three-component I-6	48.7	Three-component III-1	2.6	Three-component II-7	48.7	-	-	6.9	◎	◎	◎	◎

Example 3-9	Three-component I-14	28.6	Three-component III-1	4.8	Three-component II-6	66.7	Three-component IV-4	3	7	◎	◎	◎	◎
Example 3-10	Three-component I-10	48.8	Three-component III-1	2.4	Three-component II-9	48.8	-	-	7.1	◎	◎	◎	◎
Example 3-11	Three-component I-8	66.9	Three-component III-1	4.5	Three-component II-6	28.6	-	-	5.7	◎	◎	◎	◎
Example 3-12	Three-component I-9	22.8	Three-component III-1	3.5	Three-component II-4	73.7	Three-component IV-5	7	7	◎	◎	◎	◎
Example 3-13	Three-component I-11	65.5	Three-component III-5	6.5	Three-component II-1	28.1	-	-	8.5	◎	◎	◎	◎
Example 3-14	Three-component I-7	48.9	Three-component III-1	2.2	Three-component II-5	48.9	-	-	7.4	◎	◎	◎	◎
Example 3-15	Three-component I-18	28.2	Three-component III-2	5.9	Three-component II-10	65.9	-	-	7.2	◎	◎	◎	◎
Example 3-16	Three-component I-13	22.7	Three-component III-1	3.4	Three-component II-4	73.9	Three-component IV-6	2.3	7.2	◎	◎	◎	◎
Example 3-17	Three-component I-15	28.9	Three-component III-3	3.6	Three-component II-6	67.5	-	-	7.1	◎	◎	◎	◎
Example 3-18	Three-component I-16	68.1	Three-component III-4	2.7	Three-component II-8	29.2	-	-	8.4	◎	◎	◎	◎
Example 3-19	Three-component I-17	28.2	Three-component III-1	6.1	Three-component II-1	65.7	-	-	5.6	◎	◎	◎	◎
Example 3-20	Three-component I-1	9.7	Three-component III-1	3.4	Three-component II-5	87.0	-	-	7.1	◎	○	◎	◎
Example 3-21	Three-component I-2	88.0	Three-component III-1	2.2	Three-component II-3	9.8	-	-	6.9	◎	◎	◎	○

[0190] As the other treatment agent (D) described in Table 11, the treatment agents (three-component IV-1) to (three-component IV-6) described in Table 12 below were used. The treatment agents (three-component IV-1) to (three-component IV-6) were prepared to contain the other treatment agent (D) in the proportions shown in Table 12.

[Table 12]

Classification	Other treatment agent (D)			
	Kind	Part	Kind	Part
Three-component IV-1	D-2	100	-	-
Three-component IV-2	D-1	60	D-2	40
Three-component IV-3	D-1	50	D-2	50
Three-component IV-4	D-3	100	-	-
Three-component IV-5	D-1	28.6	D-8	71.4
Three-component IV-6	D-1	87.0	D-7	13.0

Experimental Part 16 (Evaluation of three-component treatment agent)

[0191] The resulting treatment agents of the examples were used to evaluate the metal friction in wet state, adherence, fiber strength, and emulsion stability in a similar manner to Example 1. The diluted liquid of treatment agent used in the evaluation of the metal friction in wet state, fiber strength, and emulsion stability was prepared by mixing the first-of-three-component treatment agent, the second-of-three-component treatment agent, the third-of-three-component treatment agent, and as necessary, the other treatment agent (D) with one another, and then diluting the mixture with water, in a similar manner to the method described in the section "measurement of pH" of Experimental Part 15. The results are shown in the column "metal friction in wet state", the column "adherence", the column "fiber strength", and the column "emulsion stability" of Table 11, respectively.

[0192] 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.

[0193] The present disclosure also encompasses the following embodiments.

(Additional Embodiment 1)

[0194] A polyester synthetic fiber treatment agent comprising a (poly)oxyalkylene derivative (A), an inorganic acid compound (B), and an organic phosphoric acid ester compound (C), wherein

a 1% 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,
the inorganic acid compound (B) is at least one selected from the group consisting of sulfuric acid, nitric acid, hydrochloric acid, and salts thereof, and
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 an alkyl group with 16 or more and 20 or less carbon atoms in a molecule.

(Additional Embodiment 2)

[0195] 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 inorganic 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 inorganic 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 3)

[0196] The polyester synthetic fiber treatment agent according to additional embodiment 1, wherein

the polyester synthetic fiber treatment agent is prepared as a set including first and second components of two-component polyester synthetic fiber treatment agent,
the first component of two-component polyester synthetic fiber treatment agent contains the (poly)oxyalkylene derivative (A),
the second component of two-component polyester synthetic fiber treatment agent contains the organic phosphoric acid ester compound (C),
either one or both of the first and second components of two-component polyester synthetic fiber treatment agent contain the inorganic acid compound (B).

(Additional Embodiment 4)

[0197] The polyester synthetic fiber treatment agent according to additional embodiment 1, wherein

the polyester synthetic fiber treatment agent is prepared as a set including first, second, and third components of three-component polyester synthetic fiber treatment agent,
the first component of three-component polyester synthetic fiber treatment agent contains the (poly)oxyalkylene derivative (A),
the second component of three-component polyester synthetic fiber treatment agent contains the organic phosphoric acid ester compound (C), and
the third component of three-component polyester synthetic fiber treatment agent contains the inorganic acid compound (B).

(Additional Embodiment 5)

[0198] The polyester synthetic fiber treatment agent according to additional embodiment 1, wherein the polyester synthetic fiber is a polyester short fiber.

(Additional Embodiment 6)

[0199] 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 7)

[0200] A composition containing polyester synthetic fiber treatment agent, comprising the polyester synthetic fiber treatment agent according to any one of additional embodiments 1 to 6 and a solvent (S).

[0201] The solvent (S) has a boiling point of 105°C or lower at atmospheric pressure.

(Additional Embodiment 8)

[0202] A first component of two-component polyester synthetic fiber treatment agent, comprising a (poly)oxyalkylene derivative (A), wherein

the first component of two-component polyester synthetic fiber treatment agent is used in combination with a second component of two-component polyester synthetic fiber treatment agent or a composition containing second component of two-component polyester synthetic fiber treatment agent,
the second component of two-component polyester synthetic fiber treatment agent contains an organic phosphoric acid ester compound (C),
the composition containing second component of two-component polyester synthetic fiber treatment agent contains the second component of two-component 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 two-component polyester synthetic fiber treatment agent contain an inorganic acid compound (B),
a 1% by mass water-diluted liquid of a mixture of the first and second components of two-component polyester synthetic fiber treatment agent has a pH at 25°C of 5.5 or more and 8.5 or less,
the inorganic acid compound (B) is at least one selected from the group consisting of sulfuric acid, nitric acid, hydrochloric acid, and salts thereof,
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 an alkyl 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.

(Additional Embodiment 9)

[0203] A composition containing first component of two-component polyester synthetic fiber treatment agent, comprising the first component of two-component polyester synthetic fiber treatment agent according to additional embodiment 8 and a solvent (S). [0187] The solvent (S) has a boiling point of 105°C or lower at atmospheric pressure.

(Additional Embodiment 10)

[0204] A second component of two-component polyester synthetic fiber treatment agent, comprising an organic phosphoric acid ester compound (C), wherein

the second component of two-component polyester synthetic fiber treatment agent is used in combination with a first component of two-component polyester synthetic fiber treatment agent or a composition containing first component of two-component polyester synthetic fiber treatment agent,
the first component of two-component polyester synthetic fiber treatment agent contains a (poly)oxyalkylene derivative (A),
the composition containing first component of two-component polyester synthetic fiber treatment agent contains the first component of two-component 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 two-component polyester synthetic fiber treatment agent contain an inorganic acid compound (B),
a 1% by mass water-diluted liquid of a mixture of the first and second components of two-component polyester synthetic fiber treatment agent has a pH at 25°C of 5.5 or more and 8.5 or less,
the inorganic acid compound (B) is at least one selected from the group consisting of sulfuric acid, nitric acid, hydrochloric acid, and salts thereof,
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 an alkyl 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.

(Additional Embodiment 11)

[0205] A composition containing second component of two-component polyester synthetic fiber treatment agent, comprising the second component of two-component polyester synthetic fiber treatment agent according to additional embodiment 10 and a solvent (S).

[0206] The solvent (S) has a boiling point of 105°C or lower at atmospheric pressure.

(Additional Embodiment 12)

[0207] A first component of three-component polyester synthetic fiber treatment agent, comprising a (poly)oxyalkylene derivative (A), wherein

the first component of three-component polyester synthetic fiber treatment agent is used in combination with a second component of three-component polyester synthetic fiber treatment agent or a composition containing second component of three-component polyester synthetic fiber treatment agent and a third component of three-component polyester synthetic fiber treatment agent or a composition containing third component of three-component polyester synthetic fiber treatment agent,
the second component of three-component polyester synthetic fiber treatment agent contains an organic phosphoric acid ester compound (C),
the composition containing second component of three-component polyester synthetic fiber treatment agent contains the second component of three-component polyester synthetic fiber treatment agent, which contains an organic phosphoric acid ester compound (C), and a solvent (S),
the third component of three-component polyester synthetic fiber treatment agent contains an inorganic acid compound (B),
the composition containing third component of three-component polyester synthetic fiber treatment agent contains the third component of three-component polyester synthetic fiber treatment agent, which contains an inorganic acid compound (B), and a solvent (S),
a 1% by mass water-diluted liquid of a mixture of the first, second, and third components of three-component polyester synthetic fiber treatment agent has a pH at 25°C of 5.5 or more and 8.5 or less,
the inorganic acid compound (B) is at least one selected from the group consisting of sulfuric acid, nitric acid, hydrochloric acid, and salts thereof,
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 an alkyl 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.

(Additional Embodiment 13)

[0208] A composition containing first component of three-component polyester synthetic fiber treatment agent, comprising the first component of three-component polyester synthetic fiber treatment agent according to additional embodiment 12 and a solvent (S).

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

(Additional Embodiment 14)

[0210] A second component of three-component polyester synthetic fiber treatment agent, comprising an organic phosphoric acid ester compound (C), wherein

the second component of three-component polyester synthetic fiber treatment agent is used in combination with a first component of three-component polyester synthetic fiber treatment agent or a composition containing first component of three-component polyester synthetic fiber treatment agent and a third component of three-component polyester synthetic fiber treatment agent or a composition containing third component of three-component polyester synthetic fiber treatment agent,
the first component of three-component polyester synthetic fiber treatment agent contains a (poly)oxyalkylene derivative (A),
the composition containing first component of three-component polyester synthetic fiber treatment agent contains the

first component of three-component polyester synthetic fiber treatment agent, which contains a (poly)oxyalkylene derivative (A), and a solvent (S),
the third component of three-component polyester synthetic fiber treatment agent contains an inorganic acid compound (B),
the composition containing third component of three-component polyester synthetic fiber treatment agent contains the third component of three-component polyester synthetic fiber treatment agent, which contains an inorganic acid compound (B), and a solvent (S),
a 1% by mass water-diluted liquid of a mixture of the first, second, and third components of three-component polyester synthetic fiber treatment agent has a pH at 25°C of 5.5 or more and 8.5 or less,
the inorganic acid compound (B) is at least one selected from the group consisting of sulfuric acid, nitric acid, hydrochloric acid, and salts thereof,
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 an alkyl 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.

(Additional Embodiment 15)

[0211] A composition containing second component of three-component polyester synthetic fiber treatment agent, comprising: the second component of three-component polyester synthetic fiber treatment agent according to additional embodiment 14 and a solvent (S).
[0212] The solvent (S) has a boiling point of 105°C or lower at atmospheric pressure.

(Additional Embodiment 16)

[0213] A third component of three-component polyester synthetic fiber treatment agent, comprising an inorganic acid compound (B), wherein

the third component of three-component polyester synthetic fiber treatment agent is used in combination with a first component of three-component polyester synthetic fiber treatment agent or a composition containing first component of three-component polyester synthetic fiber treatment agent and a second component of three-component polyester synthetic fiber treatment agent or a composition containing second component of three-component polyester synthetic fiber treatment agent,
the first component of three-component polyester synthetic fiber treatment agent contains a (poly)oxyalkylene derivative (A),
the composition containing first component of three-component polyester synthetic fiber treatment agent contains the first component of three-component polyester synthetic fiber treatment agent, which contains a (poly)oxyalkylene derivative (A), and a solvent (S),
the second component of three-component polyester synthetic fiber treatment agent contains an organic phosphoric acid ester compound (C),
the composition containing second component of three-component polyester synthetic fiber treatment agent contains the second component of three-component polyester synthetic fiber treatment agent, which contains an organic phosphoric acid ester compound (C), and a solvent (S),
a 1% by mass water-diluted liquid of a mixture of the first, second, and third components of three-component polyester synthetic fiber treatment agent has a pH at 25°C of 5.5 or more and 8.5 or less,
the inorganic acid compound (B) is at least one selected from the group consisting of sulfuric acid, nitric acid, hydrochloric acid, and salts thereof,
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 an alkyl 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.

(Additional Embodiment 17)

[0214] A composition containing third component of three-component polyester synthetic fiber treatment agent, comprising the third component of three-component polyester synthetic fiber treatment agent according to additional embodiment 16 and a solvent (S).
[0215] The solvent (S) has a boiling point of 105°C or lower at atmospheric pressure.

(Additional Embodiment 18)

[0216] 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 6, 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 19)

[0217] 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 6 to water in at least one of a spinning step, a drawn step, and a finishing step of polyester synthetic fibers.

(Additional Embodiment 20)

[0218] 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 composition containing polyester synthetic fiber treatment agent according to additional embodiment 7 to water in at least one of a spinning step, a drawn step, and a finishing step of polyester synthetic fibers.

(Additional Embodiment 21)

[0219] 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 to water the first component of two-component polyester synthetic fiber treatment agent according to additional embodiment 8 or the composition containing first component of two-component polyester synthetic fiber treatment agent according to additional embodiment 9 and the second component of two-component polyester synthetic fiber treatment agent according to additional embodiment 10 or the composition containing second component of two-component polyester synthetic fiber treatment agent according to additional embodiment 11 in at least one of a spinning step, a drawn step, and a finishing step of polyester synthetic fibers.

(Additional Embodiment 22)

[0220] 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 to water the first component of three-component polyester synthetic fiber treatment agent according to additional embodiment 12 or the composition containing first component of three-component polyester synthetic fiber treatment agent according to additional embodiment 13, the second component of three-component polyester synthetic fiber treatment agent according to additional embodiment 14 or the composition containing second component of three-component polyester synthetic fiber treatment agent according to additional embodiment 15, and the third component of three-component polyester synthetic fiber treatment agent according to additional embodiment 16 or the composition containing third component of three-component polyester synthetic fiber treatment agent according to additional embodiment 17 in at least one of a spinning step, a drawn step, and a finishing step of polyester synthetic fibers.

(Additional Embodiment 23)

[0221] A polyester synthetic fiber to which the polyester synthetic fiber treatment agent according to any one of additional embodiments 1 to 6 adheres.

Claims

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 inorganic acid compound (B); and
5% by mass or more of an organic phosphoric acid ester compound (C), wherein
a 1% 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 inorganic acid compound (B) is at least one selected from the group consisting of sulfuric acid, nitric acid, hydrochloric acid, and salts thereof, and
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 an alkyl 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 assuming that the sum of the contents of the (poly)oxyalkylene derivative (A), the inorganic 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 inorganic 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.

3. 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 two-component polyester synthetic fiber treatment agent,
the first component of two-component polyester synthetic fiber treatment agent contains the (poly)oxyalkylene derivative (A),
the second component of two-component polyester synthetic fiber treatment agent contains the organic phosphoric acid ester compound (C),
either one or both of the first and second components of two-component polyester synthetic fiber treatment agent contain the inorganic acid compound (B).

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

the polyester synthetic fiber treatment agent is prepared as a set including first, second, and third components of three-component polyester synthetic fiber treatment agent,
the first component of three-component polyester synthetic fiber treatment agent contains the (poly)oxyalkylene derivative (A),
the second component of three-component polyester synthetic fiber treatment agent contains the organic phosphoric acid ester compound (C), and
the third component of three-component polyester synthetic fiber treatment agent contains the inorganic acid compound (B).

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

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

7. A composition containing polyester synthetic fiber treatment agent, comprising the polyester synthetic fiber treatment agent according to any one of claims 1 to 6 and a solvent (S), wherein the solvent (S) has a boiling point of 105°C or lower at atmospheric pressure.

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

the first component of two-component polyester synthetic fiber treatment agent is used in combination with a second component of two-component polyester synthetic fiber treatment agent or a composition containing second component of two-component polyester synthetic fiber treatment agent,
the second component of two-component polyester synthetic fiber treatment agent contains an organic phosphoric acid ester compound (C),
the composition containing second component of two-component polyester synthetic fiber treatment agent contains the second component of two-component 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 two-component polyester synthetic fiber treatment agent contain an inorganic acid compound (B),

a 1% by mass water-diluted liquid of a mixture (containing no solvent) of the first and second components of two-component 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 and second components of two-component polyester synthetic fiber treatment agent contains 5% by mass or more of the (poly)oxyalkylene derivative (A), 1% by mass or more of the inorganic acid compound (B), and 5% by mass or more of the organic phosphoric acid ester compound (C),
the inorganic acid compound (B) is at least one selected from the group consisting of sulfuric acid, nitric acid, hydrochloric acid, and salts thereof,
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 an alkyl 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.

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

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

the second component of two-component polyester synthetic fiber treatment agent is used in combination with a first component of two-component polyester synthetic fiber treatment agent or a composition containing first component of two-component polyester synthetic fiber treatment agent,
the first component of two-component polyester synthetic fiber treatment agent contains a (poly)oxyalkylene derivative (A),
the composition containing first component of two-component polyester synthetic fiber treatment agent contains the first component of two-component 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 two-component polyester synthetic fiber treatment agent contain an inorganic acid compound (B),
a 1% by mass water-diluted liquid of a mixture (containing no solvent) of the first and second components of two-component 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 and second components of two-component polyester synthetic fiber treatment agent contains 5% by mass or more of the (poly)oxyalkylene derivative (A), 1% by mass or more of the inorganic acid compound (B), and 5% by mass or more of the organic phosphoric acid ester compound (C),
the inorganic acid compound (B) is at least one selected from the group consisting of sulfuric acid, nitric acid, hydrochloric acid, and salts thereof,
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 an alkyl 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.

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

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

the first component of three-component polyester synthetic fiber treatment agent is used in combination with a second component of three-component polyester synthetic fiber treatment agent or a composition containing second component of three-component polyester synthetic fiber treatment agent and a third component of three-component polyester synthetic fiber treatment agent or a composition containing third component of three-component polyester synthetic fiber treatment agent,
the second component of three-component polyester synthetic fiber treatment agent contains an organic phosphoric acid ester compound (C),
the composition containing second component of three-component polyester synthetic fiber treatment agent contains the second component of three-component polyester synthetic fiber treatment agent, which contains an organic phosphoric acid ester compound (C), and a solvent (S),

the third component of three-component polyester synthetic fiber treatment agent contains an inorganic acid compound (B),
the composition containing third component of three-component polyester synthetic fiber treatment agent contains the third component of three-component polyester synthetic fiber treatment agent, which contains an inorganic acid compound (B), and a solvent (S),
a 1% by mass water-diluted liquid of a mixture (containing no solvent) of the first, second, and third components of three-component 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, second, and third components of three-component polyester synthetic fiber treatment agent contains 5% by mass or more of the (poly)oxyalkylene derivative (A), 1% by mass or more of the inorganic acid compound (B), and 5% by mass or more of the organic phosphoric acid ester compound (C),
the inorganic acid compound (B) is at least one selected from the group consisting of sulfuric acid, nitric acid, hydrochloric acid, and salts thereof,
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 an alkyl 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.

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

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

the second component of three-component polyester synthetic fiber treatment agent is used in combination with a first component of three-component polyester synthetic fiber treatment agent or a composition containing first component of three-component polyester synthetic fiber treatment agent and a third component of three-component polyester synthetic fiber treatment agent or a composition containing third component of three-component polyester synthetic fiber treatment agent,
the first component of three-component polyester synthetic fiber treatment agent contains a (poly)oxyalkylene derivative (A),
the composition containing first component of three-component polyester synthetic fiber treatment agent contains the first component of three-component polyester synthetic fiber treatment agent, which contains a (poly)oxyalkylene derivative (A), and a solvent (S),
the third component of three-component polyester synthetic fiber treatment agent contains an inorganic acid compound (B),
the composition containing third component of three-component polyester synthetic fiber treatment agent contains the third component of three-component polyester synthetic fiber treatment agent, which contains an inorganic acid compound (B), and a solvent (S),
a 1% by mass water-diluted liquid of a mixture (containing no solvent) of the first, second, and third components of three-component 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, second, and third components of three-component polyester synthetic fiber treatment agent contains 5% by mass or more of the (poly)oxyalkylene derivative (A), 1% by mass or more of the inorganic acid compound (B), and 5% by mass or more of the organic phosphoric acid ester compound (C),
the inorganic acid compound (B) is at least one selected from the group consisting of sulfuric acid, nitric acid, hydrochloric acid, and salts thereof,
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 an alkyl 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.

15. A composition containing second component of three-component polyester synthetic fiber treatment agent, comprising: the second component of three-component polyester synthetic fiber treatment agent according to claim 14 and a solvent (S), wherein the solvent (S) has a boiling point of 105°C or lower at atmospheric pressure.

16. A third component of three-component polyester synthetic fiber treatment agent, comprising an inorganic acid

compound (B), wherein

the third component of three-component polyester synthetic fiber treatment agent is used in combination with a first component of three-component polyester synthetic fiber treatment agent or a composition containing first component of three-component polyester synthetic fiber treatment agent and a second component of three-component polyester synthetic fiber treatment agent or a composition containing second component of three-component polyester synthetic fiber treatment agent,
the first component of three-component polyester synthetic fiber treatment agent contains a (poly)oxyalkylene derivative (A),
the composition containing first component of three-component polyester synthetic fiber treatment agent contains the first component of three-component polyester synthetic fiber treatment agent, which contains a (poly)oxyalkylene derivative (A), and a solvent (S),
the second component of three-component polyester synthetic fiber treatment agent contains an organic phosphoric acid ester compound (C),
the composition containing second component of three-component polyester synthetic fiber treatment agent contains the second component of three-component polyester synthetic fiber treatment agent, which contains an organic phosphoric acid ester compound (C), and a solvent (S),
a 1% by mass water-diluted liquid of a mixture (containing no solvent) of the first, second, and third components of three-component 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, second, and third components of three-component polyester synthetic fiber treatment agent contains 5% by mass or more of the (poly)oxyalkylene derivative (A), 1% by mass or more of the inorganic acid compound (B), and 5% by mass or more of the organic phosphoric acid ester compound (C),
the inorganic acid compound (B) is at least one selected from the group consisting of sulfuric acid, nitric acid, hydrochloric acid, and salts thereof,
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 an alkyl 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.

17. A composition containing third component of three-component polyester synthetic fiber treatment agent, comprising the third component of three-component polyester synthetic fiber treatment agent according to claim 16 and a solvent (S), wherein the solvent (S) has a boiling point of 105°C or lower at atmospheric pressure.

18. A diluted liquid of polyester synthetic fiber treatment agent, comprising the polyester synthetic fiber treatment agent according to any one of claims 1 to 6, 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.

19. 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 claims 1 to 6 to water in at least one of a spinning step, a drawn step, and a finishing step of polyester synthetic fibers.

20. 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 composition containing polyester synthetic fiber treatment agent according to claim 7 to water in at least one of a spinning step, a drawn step, and a finishing step of polyester synthetic fibers.

21. 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 to water the first component of two-component polyester synthetic fiber treatment agent according to claim 8 or the composition containing first component of two-component polyester synthetic fiber treatment agent according to claim 9 and the second component of two-component polyester synthetic fiber treatment agent according to claim 10 or the composition containing second component of two-component polyester synthetic fiber treatment agent according to claim 11 in at least one of a spinning step, a drawn step, and a finishing step of polyester synthetic fibers.

22. 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 to water the first component of three-component

polyester synthetic fiber treatment agent according to claim 12 or the composition containing first component of three-component polyester synthetic fiber treatment agent according to claim 13, the second component of three-component polyester synthetic fiber treatment agent according to claim 14 or the composition containing second component of three-component polyester synthetic fiber treatment agent according to claim 15, and the third component of three-component polyester synthetic fiber treatment agent according to claim 16 or the composition containing third component of three-component polyester synthetic fiber treatment agent according to claim 17 in at least one of a spinning step, a drawn step, and a finishing step of polyester synthetic fibers.

23. A polyester synthetic fiber to which the polyester synthetic fiber treatment agent according to any one of claims 1 to 6 adheres.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2023/033113

A. CLASSIFICATION OF SUBJECT MATTER

D06M 15/53(2006.01)i; ***D06M 11/11***(2006.01)i; ***D06M 11/55***(2006.01)i; ***D06M 11/64***(2006.01)i; ***D06M 13/165***(2006.01)i; ***D06M 13/17***(2006.01)i; ***D06M 13/292***(2006.01)i; *D06M 101/32*(2006.01)n
FI: D06M15/53; D06M11/11; D06M11/55; D06M11/64; D06M13/165; D06M13/17; D06M13/292; D06M101:32

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

D06M15/53; D06M11/11; D06M11/55; D06M11/64; D06M13/165; D06M13/17; D06M13/292; D06M101/32

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Published examined utility model applications of Japan 1922-1996
Published unexamined utility model applications of Japan 1971-2023
Registered utility model specifications of Japan 1996-2023
Published registered utility model applications of Japan 1994-2023

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 2002-302871 A (NIPPON ESTER CO LTD) 18 October 2002 (2002-10-18) entire text	1-23
A	JP 2009-270213 A (NICCA CHEMICAL CO LTD) 19 November 2009 (2009-11-19) entire text	1-23
A	WO 2022/138688 A1 (TAKEMOTO OIL & FAT CO LTD) 30 June 2022 (2022-06-30) entire text, all drawings	1-23
A	JP 2018-178352 A (TAKEMOTO OIL & FAT CO LTD) 15 November 2018 (2018-11-15) entire text	1-23
A	JP 2017-210693 A (TAKEMOTO OIL & FAT CO LTD) 30 November 2017 (2017-11-30) entire text	1-23

☐ Further documents are listed in the continuation of Box C. ☑ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
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"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
07 November 2023	**21 November 2023**
Name and mailing address of the ISA/JP **Japan Patent Office (ISA/JP)** **3-4-3 Kasumigaseki, Chiyoda-ku, Tokyo 100-8915** **Japan**	Authorized officer Telephone No.

Form PCT/ISA/210 (second sheet) (January 2015)

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/JP2023/033113

Patent document cited in search report	Publication date (day/month/year)	Patent family member(s)	Publication date (day/month/year)
JP 2002-302871 A	18 October 2002	(Family: none)	
JP 2009-270213 A	19 November 2009	(Family: none)	
WO 2022/138688 A1	30 June 2022	KR 10-2023-0036166 A entire text, all drawings CN 115997055 A TW 202231958 A AR 124458 A JP 2022-102613 A	
JP 2018-178352 A	15 November 2018	(Family: none)	
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Form PCT/ISA/210 (patent family annex) (January 2015)

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 5796923 B **[0004]**
- JP 5651033 B **[0004]**