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(54) **Processing agents and methods for synthetic fibers**

Behandlungsstoffe und Herstellungsverfahren für synthetische Fasern

Agents de traitement et une méthode pour fibres synthétiques

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DescriptionBackground of the Invention

[0001] This invention relates to agents for the processing of synthetic fibers and methods of processing synthetic fibers.

[0002] With the recent increase in the speed of spinning and fabrication processes for synthetic fibers, occurrence of fluffs and breaking in produced yarns, as well as uneven dyeing of the fabric is becoming even more frequent. In order to prevent such occurrence of fluffs, yarn breaking and uneven dyeing, it has been known to increase the content of a functional improvement agent serving as a processing agent for the synthetic fibers to be applied thereto or to increase the amount of such a processing agent to be applied but such prior art attempts have not been sufficient in view of the recent increase in the speed. It is therefore an object of this invention to provide improved processing agents and methods for synthetic fibers capable of sufficiently preventing the occurrence of fluffs, yarn breaking and uneven dyeing.

[0003] It has been known to use processing agents containing a lubricant and a functional improvement agent for synthetic fibers. Known examples of processing agents containing a functional improvement agent for preventing the occurrence of fluffs, yarn breaking and uneven dyeing include those described in Japanese Patent Publications. Tokkai 1-298281, 2-47372, 60-181368, 2000-136448, 60-9971, 1-306684, 2-269878 and 62-85076 and US patents 6,432, 144B1 and 5,472,623A. These processing agents are not sufficiently capable of the occurrence of fluffs, yarn breaking and uneven dyeing in view of the requirement of the recent years due to increased processing speed.

[0004] EP 0 953 673 discloses a method of processing synthetic fibers which are subjected to a heat treatment. The method comprises the step of applying an agent containing a polyether compound, a straight-chain polyether modified polyorganosiloxane compound of a specified kind, and an ionic surfactant to the synthetic fibers.

[0005] JP 02 269878 discloses a method of processing polyester fibers comprising the application of an agent comprising: a polyether compound obtained from propylene oxide and ethylene oxide in a specified ratio and a monohydric alcohol of specified molecular weight; a mixture of specified anionic surfactants; and a polyoxyethylene/polyoxypropylene-modified silicone.

Summary of the Invention

[0006] The present invention is based on the discovery by the present inventors, as a result of their studies for providing processing agents and methods for synthetic fibers capable of sufficiently preventing the occurrence of fluffs, yarn breaking and uneven dyeing, that use should be made of an agent containing four specified components at specified ratios and that a specified amount of an aqueous solution of such an agent should be applied to the synthetic fibers.

[0007] The present invention therefore provides a processing agent for synthetic fibers having the features set out in Claim 1. Preferred features of the processing agent are set out in the dependent Claims 2 and 3. The present also provides a method of processing synthetic fibers according to Claim 4. Preferred features of the method are set out in Claim 5.

[0008] The invention firstly relates to a processing agent for synthetic fibers characterized as containing Component A, Component B, Component C and Component D as defined below in a total amount of 70 weight % or more, containing 55-92 weight parts of Component A, 0.3-5 weight parts of Component B, 0.1-3 weight parts of Component C and 0.6-44 weight parts of Component D for 100 weight parts of the total of Components A, B, C and D;

where Component A is one or more alkyleneoxide addition compounds simultaneously satisfying Conditions 1, 2 and 3, said Condition 1 being the condition of having a number average molecular weight of 1000-12000 and being obtainable by adding alkylene oxide(s) with 2-4 carbon atoms to monohydric-trihydric aliphatic alcohol(s) with 1-24 carbon atoms, said Condition 2 being the condition of having polyoxyalkylene groups comprising oxyalkylene units of which 10-80 weight % are oxyethylene units, and said Condition 3 being the condition of containing 30 weight % or more of alkyleneoxide addition compounds obtainable by adding ethylene oxide and propylene oxide to monohydric aliphatic alcohol (s) with 6-24 carbon atoms at a weight ratio of 35/65-80/20, and wherein said Component A contains Component E and Component F in a total of 60 weight % or more and at a weight ratio of 40/60-80/20;

wherein said Component E is an alkyleneoxide addition compound with number average molecular weight of 1000-12000 which is obtainable by adding ethylene oxide and propylene oxide to monohydric-trihydric aliphatic alcohol(s) with 6-13 carbon atoms carbon atoms at a weight ratio of 35/65-80/20; and

wherein said Component F is an alkyleneoxide addition compound with number average molecular weight of 1000-4000 which is obtainable by adding ethylene oxide and propylene oxide to monohydric aliphatic alcohol(s) with 14-16 carbon atoms and containing 70 mole % or more of straight-chain aliphatic alcohol(s) at a weight ratio of 35/65-80/20

wherein said Component B is a polyoxyalkylene-modified silicone having polyoxyalkylene groups comprising oxyalkylene units which are oxyethylene units and/or oxypropylene units and containing polyoxyalkylene groups and silicone chains at a weight ratio of 25/75-90/10, wherein 25 weight % or more of the oxyalkylene units which Component B contains are oxyethylene units ;

wherein said Component C is a phenol antioxidants; and

wherein said Component D contains a nonionic surfactant as an emulsifier in an amount of 20 weight % or more, an anionic surfactant as an antistatic agent in an amount of 1-20 weight %, and an aliphatic ester compound(s) shown by formula R1-X-R2 and/or aliphatic ester compound(s) shown by formula R3-R4 as a lubricant coadjuvant in a total amount of 25-60 weight %,

where R1 and R3 are each the residual group obtainable by removing the hydrogen atom from an aliphatic monohydric alcohol with 8-18 carbon atoms, R2 is the residual group obtainable by removing the hydrogen atom from an aliphatic monocarboxylic acid with 8-18 carbon atoms, R4 is the residual group obtainable by removing the hydroxyl group from an aliphatic monocarboxylic acid with 8-18 carbon atoms and X is the residual group obtainable by removing all hydroxyl groups from a (poly)alkyleneglycol having a (poly)oxyalkylenegroup formed with a total of 1-10 oxyethylene units and/or oxypropylene units.

[0009] The invention secondly relates to a method of processing synthetic fibers characterized as applying a processing agent for synthetic fibers according to this invention to synthetic fibers at a rate of 0.1-3 weight % with respect to the synthetic fibers.

[0010] The processing agent for synthetic fibers according to this invention (hereinafter referred to simply as the processing agent of this invention) will be explained next more in detail. As explained summarily above, the processing agent of this invention is characterized as containing four specified kinds of components (Components A-D) and Component A is one or more selected from alkyleneoxide addition compounds which simultaneously satisfy three specified conditions (Conditions 1-3).

[0011] Condition 1 on Component A is a requirement that the alkyleneoxide addition compounds, which Component A is, should have a number average molecular weight of 1000-12000 and be obtainable by adding alkylene oxide(s) with 2-4 carbon atoms to monohydric-trihydric aliphatic alcohol(s) with 1-24 carbon atoms. Examples of such monohydric-trihydric aliphatic alcohols with 1-24 carbon atoms include (1) monohydric straight-chain saturated aliphatic alcohols such as methyl alcohol, ethyl alcohol, propyl alcohol, butyl alcohol, pentyl alcohol, hexyl alcohol, heptyl alcohol, octyl alcohol, nonyl alcohol, decyl alcohol, undecyl alcohol, dodecyl alcohol, tridecyl alcohol, tetradecyl alcohol, pentadecyl alcohol, hexadecyl alcohol, heptadecyl alcohol, octadecyl alcohol, nonadecyl alcohol, eicosyl alcohol, heneicosyl alcohol, docosyl alcohol, tricosyl alcohol and tetracosyl alcohol; (2) monohydric branched-chain saturated aliphatic alcohols such as isopropyl alcohol, isobutyl alcohol, isopentyl alcohol, 2-methyl-pentyl alcohol, 2-ethyl-hexyl alcohol, 2-propyl-heptyl alcohol, 2-butyl-octyl alcohol, 2-pentyl-nonyl alcohol, 2-hexyl-decyl alcohol, 2-heptyl-undecyl alcohol, 2-octyl-dodecyl alcohol, 2-nonyl-tridecyl alcohol, 2-decyl-tridecyl alcohol, 2-undecyl-pentadecyl alcohol and 2-dodecyl-hexadecyl alcohol; (3) monohydric straight-chain unsaturated aliphatic alcohols such as 10-undecenyl alcohol, 9c-tetradecenyl alcohol, 9c-hexadecenyl alcohol, 9c-octadecenyl alcohol, 9t-octadecenyl alcohol, 9c,12c-octadecadienyl alcohol, 9c,12c,15c-octadecatrienyl alcohol, 9c-eicosenyl alcohol, 5,8,11,14-eicosatetraenyl alcohol, 13c-docosenyl alcohol and 13t-docosenyl alcohol; (4) dihydric aliphatic alcohols such as ethylene glycol, 1,2-propane diol, 1,3-propane diol, 1,4-butane diol, 1,6-hexane diol and neopentyl glycol; and (5) trihydric aliphatic alcohols such as glycerol and trimethylol propane.

[0012] Examples of alkylene oxides with 2-4 carbon atoms in Condition 1 include ethylene oxide, propylene oxide, 1,2-butylene oxide and 1,4 butylene oxide, but ethylene oxide and propylene oxide are preferred. These alkylene oxides may be used singly or as a mixture. If they are used as a mixture, the form of addition of alkylene oxides to monohydric-trihydric aliphatic alcohol(s) with 1-24 carbon atoms may be random addition, block addition or random-block addition.

[0013] The number average molecular weight of alkyleneoxide addition compounds satisfying Condition 1 as described above is in the range of 1000-12000, and preferably 1000-10000.

[0014] Condition 2 on Component A is a requirement that the alkyleneoxide addition compounds should have poly-oxyalkylene groups comprising oxyalkylene units of which 10-80 weight % are oxyethylene units.

[0015] Condition 3 on Component A is a requirement of containing 30 weight % or more of alkyleneoxide addition compounds obtainable by adding ethylene oxide and propylene oxide to monohydric aliphatic alcohol(s) with 6-24 carbon atoms at weight ratio of 35/65-80/20. Examples of such monohydric aliphatic alcohols with 6-24 carbon atoms include (1) monohydric straight-chain saturated aliphatic alcohols such as hexyl alcohol, heptyl alcohol, octyl alcohol, nonyl alcohol, decyl alcohol, undecyl alcohol, dodecyl alcohol, tridecyl alcohol, tetradecyl alcohol, pentadecyl alcohol, hexadecyl alcohol, heptadecyl alcohol, octadecyl alcohol, nonadecyl alcohol, eicosyl alcohol, heneicosyl alcohol, docosyl alcohol, tricosyl alcohol and tetracosyl alcohol; (2) monohydric branched-chain saturated aliphatic alcohols such as 2-methyl-pentyl alcohol, 2-ethyl-hexyl alcohol, 2-propyl-heptyl alcohol, 2-butyl-octyl alcohol, 2-pentyl-nonyl alcohol, 2-hexyl-decyl alcohol, 2-heptyl-undecyl alcohol, 2-octyl-dodecyl alcohol, 2-nonyl-tridecyl alcohol, 2-decyl-tridecyl alcohol, 2-undecyl-pentadecyl alcohol and 2-dodecyl-hexadecyl alcohol; and (3) monohydric straight-chain unsaturated aliphatic alcohols such as 10-undecenyl alcohol, 9c-tetradecenyl alcohol, 9c-hexadecenyl alcohol, 9c-octadecenyl alcohol, 9t-octadecenyl alcohol, 9c,12c-octadecadienyl alcohol, 9c,12c,15c-octadecatrienyl alcohol, 9c-eicosenyl alcohol, 5,8,11,14-eicosatetraenyl alcohol, 13c-docosenyl alcohol and 13t-docosenyl alcohol.

[0016] Component A is one or more selected from alkyleneoxide addition compounds simultaneously satisfying aforementioned Conditions 1, 2 and containing Component E and Component F described below in a total amount of 60

weight % or more at a weight ratio of 40/60-80/20, where Component E is an alkyleneoxide addition compound with number average molecular weight of 1000-12000, obtainable by adding ethylene oxide and propylene oxide monohydric trihydric aliphatic alcohol (s) with 4-13 carbon atoms at a weight ratio of 35/65-80/20 and Component F is an alkyleneoxide addition compound with number average molecular weight of 1000-400, obtainable by adding ethylene oxide and propylene oxide to monohydric aliphatic alcohol(s), with 14-16 carbon atoms at a weight ratio of 35/65-80/20.

[0017] Examples of monohydric-trihydric aliphatic alcohols with 4-13 carbon atoms for Component E include butyl alcohol, pentyl alcohol, hexyl alcohol, heptyl alcohol, octyl alcohol, nonyl alcohol, decyl alcohol, undecyl alcohol, codecyl alcohol, tridecyl alcohol, 2-methyl-pentyl alcohol, 2-ethyl-hexyl alcohol, 2-propyl-heptyl alcohol, 2-butyl-octyl alcohol, 1,4 butane diol, 1,6-hexane diol, neopentyl glycol and trimethylol propane. Among these, however, monohydric aliphatic alcohols with 6-13 carbon atoms such as hexyl alcohol, heptyl alcohol, octyl alcohol, nonyl alcohol, decyl alcohol, undecyl alcohol, dodecyl alcohol and tridecyl alcohol are preferred.

[0018] Examples of monohydric aliphatic alcohols with 14-16 carbon atoms for Component F include tetradecyl alcohol, pentadecyl alcohol, hexadecyl alcohol, 2-pentyl-nonyl alcohol, 2-hexyl-decyl alcohol, 9c-tetradecenyl alcohol and 9c-hexadecenyl alcohol. Among these, however, those containing 70 mole % more of straight-chain aliphatic alcohols such as tetradecyl alcohol, pentadecyl alcohol and hexadecyl alcohol are preferred.

[0019] These alkyleneoxide addition compounds serving as Component A themselves can be synthesized by commonly known methods of causing alkylene oxides with 2-4 carbon atoms to sequentially undergo addition reactions to aliphatic alcohols in the presence of an alkaline catalyst.

[0020] Component B is a polyoxyalkylene-modified silicone having polyoxyalkylene groups comprising oxyalkylene units which are oxyethylene units and/or oxypropylene units and containing the polyoxyalkylene groups and silicone chains at a weight ratio of 25/75-90/10, wherein 25 weight % or more of the oxyalkylene units which Component B contains are oxyethylene units. Examples of such polyoxyalkylene-modified silicones include (1) polyoxyethylene-modified silicones having polyoxyethylene groups with a repetition of oxyethylene units, (2) polyoxypropylene-modified silicones having polyoxypropylene groups with a repetition of oxypropylene units, and (3) polyoxyethylenepolyoxypropyl-modified silicones having a polyoxyethylenepolyoxypropylene group with a repetition of oxyethylene units and oxypropylene units. The weight ratio between the polyoxyalkylene group and the silicone chain in the polyoxyalkylene-modified silicone of Component B is 25/75-90/10, and is more preferably 30/70-85/15. There is no particular limitation on the number average molecular weight of the polyoxyalkylene-modified silicone but it is preferred to be in the range of 2500-50000.

[0021] The polyoxyalkylene-modified silicone of Composition B as explained above, is a structure with a polyalkylene group connected through a carbon atom which is directly connected to a silicon atom in the silicone chain. The polyoxyalkylene group may be connected to the silicone chain as a straight chain or as a side chain. Methods of synthesizing such examples of polyoxyalkylene-modified silicone are themselves known.

[0022] Component C is a phenol antioxidant.

[0023] Examples of phenol antioxidants serving as Component C include triethyleneglycol-bis[3-(3-t-butyl-5-methyl-4-hydroxyphenyl)propionate], 1,3,5-trimethyl-2,4,6-tris(3,5-di-t-butyl-4-hydroxybenzyl) benzene, 1,6-hexanediol-bis[3-(3,5-di-t-butyl-4-hydroxyphenyl) propionate], pentaerythritol-tetrakis[3-(3,5-di-t-butyl-4-hydroxyphenyl) propionate], 2,2'-methylene-bis-(6-t-butyl-methylphenol), 2,2'-butylidene-bis-(6-t-butyl-4-methylphenol), 1,1,3-tris(2-methyl-4-hydroxy-5-t-butylphenol)butane, 1,3,5-tris(3',5'-di-t-butyl-4-hydrobenzyl) isocyanuric acid and 1,3,5-tris(4-butyl-3-hydroxy-2,6-dimethylbenzyl) isocyanuric acid.

[0024] Component D contains an emulsifier, an antistatic agent and a lubricant coadjuvant.

[0025] The emulsifiers serving as Component D are nonionic surfactants. Examples of such non-ionic surfactant include (1) ether-type nonionic surfactants having a polyoxylene group in the molecule such as polyoxyalkylene alkylether, polyoxyalkylene alkylphenylether, polyoxyalkylene alkylester, alkylene oxide adducts of castor oil, polyoxyalkylene alkylaminoether and polyoxyalkylene alkylamideether, (2) partial esters of polyhydric alcohol type nonionic surfactants such as sorbitan monolaurate, sorbitan trioleate, glycerol monolaurate and diglycerol dilaurate; (3) polyoxyalkylene esters of polyhydric alcohol and aliphatic acid type nonionic surfactants such as alkylene oxide adducts of partial ester of trihydric-hexahydric alcohol and aliphatic acid, alkylene oxide adducts of partial or complete ester of trihydric-hexahydric alcohol and aliphatic acid and alkylene oxide adducts of ester of trihydric-hexahydric alcohol and hydroxy aliphatic acid; and (4) alkylamide type nonionic surfactants such as diethanolamine monolauroidamide and diethylene triamine dioctylamide. Among these, however, ether type nonionic surfactants are preferred.

[0026] The antistatic agents serving as Compound D are anionic surfactants. Examples of such anionic surfactants include organic sulfonic acid salts such as sodium dodecyl benzene sulfonate, organic sulfuric acid salts such as sodium ester of polyoxyethylene lauryl sulfuric acid, organic phosphoric acid ester salts such as potassium polyoxyethylenelauryl phosphate and organic aliphatic acid salts such as sodium oleate and potassium alkenyl succinate.

[0027] The lubricant coadjuvants as Component D are aliphatic ester compounds shown by R^1-X-R^2 (referred to as Formula (1)) and/or aliphatic ester compounds shown by R^3-R^4 (referred to as Formula (2)), where R^1 and R^3 are each the residual group obtainable by removing the hydrogen atom from an aliphatic monohydric alcohol with 8-18 carbon atoms, R^2 is the residual group obtained by removing the hydrogen atom from an aliphatic monocarboxylic acid with

8-18 carbon atoms, R⁴ 8-18 carbon atoms, R⁴ is the residual group obtained by removing the hydroxyl group from an aliphatic monocarboxylic acid with 8-18 carbon atoms and X is the residual group obtainable by removing all hydroxyl groups from a (poly)alkyleneglycol having a (poly)oxyalkylene group formed with a total of 1-10 oxyethylene units and/or oxypropylene units.

[0028] In the above, R¹ and R³ are each the residual group obtainable by removing the hydrogen atom from an aliphatic monohydric alcohol with 8-18 carbon atoms such as octyl alcohol, lauryl alcohol, tridecyl alcohol, myristyl alcohol, cetyl alcohol, stearyl alcohol and oleyl alcohol R² is the residual group obtainable by removing the hydrogen atom from an aliphatic monocarboxylic acid with 8-18 carbon atoms such as caproic acid, caprylic acid, caprynic acid, undecanoic acid, lauric acid, tridecanoic acid, myristic acid, pentadecanoic acid, palmitic acid, stearic acid, palmitoleic acid, oleic acid, isooctanoic acid hexadecanoic acid and isooctadecanoic acid. X is the residual group obtainable by removing all hydroxyl groups from a (poly)alkyleneglycol having a (poly)oxyalkylenegroup formed with a total of 1-10 oxyethylene units and/or oxypropylene units. Example of such residual groups include (1) residual groups obtainable by removing all hydroxyl groups from a (poly)ethyleneglycol having a (poly)oxyethylene group formed with a total of 1-10 oxyethylene units; (2) residual groups obtainable by removing all hydroxyl groups from a (poly)propyleneglycol having a (poly)oxypropylene group formed with a total of 1-10 oxypropylene units; and (3) residual groups obtainable by removing all hydroxyl groups from a (poly)alkyleneglycol having a (poly)oxyethylene(poly)oxypropylene group formed with a total of 2-10 oxyethylene units and oxypropylene units. R⁴ is the residual group obtainable by removing the hydroxyl group from an aliphatic monocarboxylic acid with 8-18 carbon atoms such as caproic acid, caprylic acid caprylic acid, undecanoic acid, lauric acid, tridecanoic acid, myristic acid, pentadecanoic acid palmitic acid, stearic acid, palmitoleic acid, oleic acid, isooctanoic acid hexadecanoic acid and isooctadecanoic acid.

[0029] Component D contains a nonionic surfactant as an emulsifier in 20 weight % or more, an anionic surfactant as an antistatic agent in 1-20 weight % and aliphatic ester compounds shown by Formula (1) and/or aliphatic ester compounds shown by Formula (2) as a lubricant coadjuvant in a total of 25-60 weight %. In particular, those comprised of the three components of an emulsifier, an antistatic agent and a lubricant coadjuvant, containing a non-ionic surfactant as emulsifier by 50-70 weight % an anionic surfactant as antistatic agent by 1-10 weight % and aliphatic ester compounds shown by Formula (1) and/or aliphatic ester compounds shown by Formula (2) as lubricant coadjuvant by a total of 25-40 weight % are preferable as Component D.

[0030] As explained above, processing agents according to this invention are characterized not only as being comprised of four components, that is, Components A, B, C and D but also as containing these four components by a total of 70 weight % or more and containing 55-92 weight parts of Component A, 0.3-5 weight parts of Component B, 0.1-3 weight part of Component C and 0.6-44 weight parts of Component D for 100 weight parts of the total of these four components. More preferably, however, processing agents according to this invention are characterized as containing these four components by a total of 80 weight % or more and containing 55-90 weight parts of Component A, 0.5-2 weight parts of Component B, 0.5-2 weight parts of Component C and 9-41 weight parts of Component D for 100 weight parts of the total of these four components.

[0031] Processing agents according to this invention may contain other components within the limitation of not adversely affecting the desired effects obtained by the invention. Examples of such other components that may be contained include emulsion coadjuvants, antifoaming agents, stabilizers, antiseptics and antirust agents.

[0032] Next, the method according to this invention for processing synthetic fibers (hereinafter referred to simply as the method of this invention) is explained. The method of this invention is a method of applying a processing agent of this invention as described above at a rate of 0.1-3 weight % and more preferably 0.3-1.2 weight % of the synthetic fibers to be processed. The fabrication step during which a processing agent of this invention is to be applied to the synthetic fibers may be the spinning step or the step during which spinning and drawing are carried out simultaneously. Examples of the method of causing a processing agent of this invention to be attached to the synthetic fibers include the roller oiling method, the guide oiling method using a measuring pump, the emersion oiling method and the spray oiling method. The form in which a processing agent of this invention may be applied to synthetic fibers may be as a neat, as an organic solution or as an aqueous solution but the form as an aqueous solution is preferable, and it is particularly preferable as an aqueous solution of 5-30 weight %. When such a solution is applied, it is preferable to apply the solution at a rate of 0.1-3 weight % and more particularly 0.3-1.2 weight % as the processing agent with respect to the synthetic fiber.

[0033] Examples of synthetic fibers that may be processed by a method of this invention include (1) polyester fibers such as polyethylene terephthalate, polypropylene terephthalate and polylactic ester fibers; (2) polyamide fibers such as nylon 6 and nylon 66; (3) polyacryl fibers such as polyacrylic and modacrylic fibers; (4) polyolefin fibers such as polyethylene and polypropylene fibers and polyurethane fibers. The present invention is particularly effective, however, when applied to polyester fibers and polyamide fibers.

[0034] The invention is described next by way of embodiments. Processing agents according to this invention may be described by way of the following fourteen embodiments of the invention:

Embodiment 1 (not according to the present invention)

[0035] Processing agent for synthetic fibers containing Components A, B, C and D as described below respectively by 70 weight %, 1.5 weight %, 1 weight % and 27.5 weight % (for a total of 100 weight %) wherein:

Component A is a mixture of alkyleneoxide addition compound (A-1) and alkyleneoxide addition compound (A-6) at weight ratio of 50/20 where alkyleneoxide addition compound (A-1) has number average molecular weight of 3500, having random addition of EO (ethylene oxide) and PO (propylene oxide) to dodecyl alcohol at weight ratio of 70/30, and alkyleneoxide addition compound (A-6) has number average molecular weight of 1000, having random addition of EO and PO to hexadecyl alcohol at weight ratio of 50/50;

Component B is polyoxyalkylene-modified silicone (B-1) having polyoxyalkylene group with oxyalkylene units including both oxyethylene units and oxypropylene units and silicone chain at weight ratio of 70/30 (50% of the oxyalkylene units being oxyethylene units);

Component C is 2,2'-methylene-bis-(4-methyl-6-t-butylphenol) (hereinafter referred to as phenol antioxidant (C-1)); and

Component D is a mixture of Emulsifier (D-1), Emulsifier (D-2), Emulsifier (D-3), antistatic agent (D-7) and antistatic agent (D-9) at weight ratio of 10/10/6/0.5/1 where Emulsifier (D-1) is ω -hydroxy (polyoxyethylene) (repetition number n of oxyethylene units =7) octadecenate, Emulsifier (D-2) is α -dodecyl- ω -hydroxy (polyoxypropylene polyoxyethylene) (repetition number m of oxypropylene units =3, n=4), Emulsifier (D-3) is ethylene oxide adduct (n=20) of hydrogenated castor oil, antistatic agent (D-7) is potassium decanesulfonate, and antistatic agent (D-9) is potassium phosphoric acid ester of α -dodecyl- ω -hydroxy (polyoxyethylene) (n=3).

Embodiment 2 (not according to the present invention)

[0036] Processing agent for synthetic fibers containing Components A, B, C and D as described below respectively by 70 weight %, 1.5 weight %, 1 weight % and 27.5 weight % (for a total of 100 weight %) wherein:

Component A is a mixture of aforementioned alkyleneoxide addition compound (A-1) and alkyleneoxide addition compound (A-7) at weight ratio of 50/20 where alkyleneoxide addition compounds (A-7) has number average molecular weight of 2500, having random addition of EO and PO to tetradecyl alcohol at weight ratio of 55/45;

Component B is aforementioned polyoxyalkylene-modified silicone (B-1);

Component C is aforementioned phenol antioxidant (C-1); and

Component D is a mixture of aforementioned Emulsifier (D-1), aforementioned Emulsifier (D-2), aforementioned Emulsifier (D-3), aforementioned antistatic agent (D-7) and aforementioned antistatic agent (D-9) at weight ratio of 10/10/6/0.5/1.

Embodiment 3 (not according to the present invention)

[0037] Processing agent for synthetic fibers containing Components A, B, C and D as described below respectively by 70 weight %, 1.5 weight %, 1 weight % and 27.5 weight % (for a total of 100 weight %) wherein:

Component A is a mixture of alkyleneoxide addition compound (A-2) and aforementioned alkyleneoxide addition compound (A-6) at weight ratio of 50/20 where alkyleneoxide addition compound (A-2) has number average molecular weight of 1000, having random addition of EO and PO to octyl alcohol at weight ratio of 40/60;

Component B is aforementioned polyoxyalkylene-modified silicone (B-1);

Component C is aforementioned phenol antioxidant (C-1); and

Component D is a mixture of aforementioned Emulsifier (D-1), aforementioned Emulsifier (D-2), aforementioned Emulsifier (D-3); aforementioned; antistatic agent (D-7) and aforementioned antistatic agent (D-9) at weight ratio of 10/10/6/0.5/1.

Embodiment 4 (not according to the present invention)

[0038] Processing agent for synthetic fibers containing Components A, B, C and D as described below respectively by 70 weight %, 1.5 weight %, 1 weight % and 27.5 weight % (for a total of 100 weight %) wherein:

Component A is a mixture of aforementioned alkyleneoxide addition compound (A-1) and aforementioned alkyleneoxide addition compound (A-6) at weight ratio of 35/35;

Component B is aforementioned polyoxyalkylene-modified silicone (B-1);

Component C is aforementioned phenol antioxidant (C-1); and
Component D is a mixture of aforementioned Emulsifier (D-1), aforementioned Emulsifier (D-2), aforementioned Emulsifier (D-3), aforementioned antistatic agent (D-7) and aforementioned antistatic agent (D-9) at weight ratio of 10/10/6/0.5/1.

Embodiment 5 (not according to the present invention)

[0039] Processing agent for synthetic fibers containing Components A, B, C and D as described below respectively by 60 weight %, 1.5 weight %, 1 weight % and 37.5 weight % (for a total of 100 weight %) wherein:

Component A is a mixture of aforementioned alkyleneoxide addition compound (A-1) and aforementioned alkyleneoxide addition compound (A-7) at weight ratio of 45/15;
Component B is aforementioned polyoxyalkylene-modified silicone (B-1);
Component C is aforementioned phenol antioxidant (C-1); and
Component D is a mixture of aforementioned Emulsifier (D-1), aforementioned Emulsifier (D-2), aforementioned Emulsifier (D-3), aforementioned antistatic agent (D-7) and aforementioned antistatic agent (D-9) at weight ratio of 15/15/6/0.5/1.

Embodiment 6 (not according to the present invention)

[0040] Processing agent for synthetic fibers containing Components A, B, C and D as described below respectively by 85 weight %, 1.5 weight %, 1 weight % and 12.5 weight % (for a total of 100 weight %) wherein:

Component A is a mixture of aforementioned alkyleneoxide addition compound (A-1) and aforementioned alkyleneoxide addition compound (A-6) at weight ratio of 65/20;
Component B is aforementioned polyoxyalkylene-modified silicone (B-1) ;
Component C is aforementioned phenol antioxidant (C-1); and
Component D is a mixture of aforementioned Emulsifier (D-1), aforementioned Emulsifier (D-2), aforementioned Emulsifier (D-3), aforementioned antistatic agent (D-7) and aforementioned antistatic agent (D-9) at weight ratio of 5/5/1/0.5/1.

Embodiment 7 (not according to the present invention)

[0041] Processing agent for synthetic fibers containing Components A, B, C and D as described below respectively by 70 weight %, 0.4 weight %, 1 weight % and 28.6 weight % (for a total of 100 weight %) wherein:

Component A is a mixture of aforementioned alkyleneoxide addition compound (A-1) and aforementioned alkyleneoxide addition compound (A-6) at weight ratio of 50/20;
Component B is aforementioned polyoxyalkylene-modified silicone (E-1) ;
Component C is aforementioned phenol antioxidant (C-1); and
Component D is a mixture of aforementioned Emulsifier (D-1), aforementioned Emulsifier (D-2), aforementioned Emulsifier (D-3), Emulsifier (D-6), aforementioned antistatic agent (D-7) and aforementioned antistatic agent (D-9) at weight ratio of 10/10/6/1.1/0.5/1 where Emulsifier (D-6) is trimethyloctyl ammonium octyl phosphate.

Embodiment 8 (not according to the present invention)

[0042] Processing agent for synthetic fibers containing Components A, B, C and D as described below respectively by 70 weight %, 1.5 weight %, 0.7 weight % and 27.8 weight % (for a total of 100 weight %) wherein:

Component A is a mixture of aforementioned alkyleneoxide addition compound (A-1) and aforementioned alkyleneoxide addition compound (A-6) at weight ratio of 50/20;
Component B is aforementioned polyoxyalkylene-modified silicone (B-1) ;
Component C is aforementioned phenol antioxidant (C-1); and
Component D is a mixture of aforementioned Emulsifier (D-1), aforementioned Emulsifier (D-2), aforementioned Emulsifier (D-3), aforementioned antistatic agent (D-7) and aforementioned antistatic agent (D-9) at weight ratio of 10/10.3/6/0-5/1.

Embodiment 9 (according to the present invention)

[0043] Processing agent for synthetic fibers containing Components B, C and D as described below respectively by 65 weight %, 1.5 weight %, 1 weight % and 32.5 weight % (for a total of 100 weight %) wherein:

Component A is a mixture of aforementioned alkyleneoxide addition compound (A-1) and aforementioned alkyleneoxide addition compound (A-6) at weight ratio of 45/20;

Component B is aforementioned polyoxyalkylene-modified silicone (B-1) ;

Component C is aforementioned phenol antioxidant (C-1), and

Component D is a mixture of aforementioned Emulsifier (D-1), aforementioned

[0044] Emulsifier (D-2), aforementioned Emulsifier (D-3), aforementioned; antistatic agent (D-7), aforementioned antistatic agent (D-9) and Lubricant coadjuvant (D-11) at weight ratio of 10/10/1/0.5/1/10 where Lubricant coadjuvant (D-11) is dodecyl octanoate.

Embodiment 10 according to the present invention)

[0045] Processing agent for synthetic fibers containing Components A, B, C and D as described below respectively by 65 weight %, 1.5 weight %, 1 weight % and 32.5 weight % (for a total of 100 weight %) wherein:

Component A is a mixture of aforementioned alkyleneoxide addition compound (A-1) and aforementioned alkyleneoxide addition compound (A-6) at weight ratio of 45/20;

Component B is aforementioned polyoxyalkylene-modified silicone (B-1) ;

Component C is aforementioned phenol antioxidant (C-1); and

Component D is a mixture of aforementioned Emulsifier (D-1), aforementioned Emulsifier (D-2), aforementioned Emulsifier (D-3), aforementioned antistatic agent (D-7), aforementioned antistatic agent (D-9), and Lubricant coadjuvant (D-12) at weight ratio of 10/10/1/0.5/1/10 where Lubricant coadjuvant (D-12) is ester of α -dodecyl- ω -hydroxy (polyoxyethylene) (n=6) and decanoic acid.

Embodiment 11 (according to the present invention)

[0046] Processing agent for synthetic fibers containing Components A, B, C and D as described below respectively by 70 weight %, 1.5 weight %, 1, weight % and 27.5 weight % (for a total of 100 weight %) wherein;

Component A is a mixture of aforementioned alkyleneoxide addition compounds (A-L) and aforementioned alkyleneoxide addition compound (A-6) at weight ratio of 50/20;

Component B is aforementioned polyoxyalkylene-modified silicone (B-1)

Component C is aforementioned phenol antioxidant (C-1); and

Component D is a mixture of aforementioned Emulsifier (D-1), aforementioned Emulsifier (D-2), aforementioned Emulsifier (D-3), aforementioned antistatic agent (D-7), aforementioned antistatic agents (D-9) and aforementioned Lubricant coadjuvant (D-11) at weight ratio of 10/10/3/0.5/1/3.

Embodiment 12 (according to the present invention)

[0047] Processing agent for synthetic fibers containing Component A, B, C and D as described below respectively by 65 weight %, 1.5 weight %, 1 weight % and 32.5 weight % (for a total of 100 weight %) wherein:

Component A is a mixture of aforementioned alkyleneoxide addition compound (A-1) and aforementioned alkyleneoxide addition compound (A-6) at weight ratio of 45/20;

Component B is aforementioned polyoxyalkylene-modified silicone (B-1) ;

Component C is aforementioned phenol antioxidant (C-1); and

Component D is a mixture of aforementioned Emulsifier (D-1), aforementioned Emulsifier (D-2), aforementioned Emulsifier (D-3), aforementioned antistatic agent (D-7), aforementioned antistatic agent (D-9) and Lubricant coadjuvant (D-13) at weight ratio of 10/10/1/0.5/1/10 wherein Lubricant coadjuvant (D-13) is dodecyl dodecanate.

Embodiment 13 (according to the present invention)

[0048] Processing agent for synthetic fibers containing Components A, B, C and D as described below respectively

by 65 weight %, 1.5 weight %, 1 weight % and 32.5 weight % (for a total of 100 weight %) wherein:

Component A is a mixture of aforementioned alkyleneoxide addition compound (A-1) and aforementioned alkyleneoxide addition compound (A-6) at weight ratio of 45/20;

Component B is aforementioned polyoxyalkylene-modified silicone (B-1) ;

Component C is aforementioned phenol antioxidant (C-1); and

Component D is a mixture of aforementioned Emulsifier (D-1), aforementioned Emulsifier (D-2), aforementioned Emulsifier (D-3), aforementioned antistatic agent (D-7), aforementioned antistatic agent (D-9) and Lubricant coadjutant (D-14) at weight ratio of 10/10/110.5/11/10 wherein Lubricant coadjutant (D-14) is 2-ethylhexyl octadecenate.

Embodiment 14 (according to the present invention)

[0049] Processing agent for synthetic fibers containing Components A, B, C and D as described below respectively by 70 weight %, 1.5 weight %, 1 weight % and 27.5 weight % (for a total of 100 weight %) wherein:

Component A is a mixture of aforementioned alkyleneoxide addition compounds (A-1) and aforementioned alkyleneoxide addition compound (A-6) at weight ratio of 50/20;

Component B is aforementioned polyoxyalkylene-modified silicone (B-1)

Component C is aforementioned phenol antioxidant (C-1); and

Component D is a mixture of aforementioned Emulsifier (D-1), aforementioned Emulsifier (D-2), aforementioned Emulsifier (D-3), aforementioned antistatic agent (D-7), aforementioned antistatic agent (D-9) and aforementioned: Lubricant coadjutant (D-13) at weight ratio of 10/10/3/0.5/1/3.

[0050] A processing method according to this invention may be described by way of the following embodiment of the invention:

Embodiment 15

[0051] Method of processing synthetic fibers by preparing an aqueous solution containing a processing agent of any of Embodiments 9-14 described above by 10 weight % and applying this aqueous solution to polyethylene terephthalate fibers that have been spun at a rate of 0.5 weight % as processing agent.

[0052] The invention will be described next by way of examples in order to make its details and effects clearer but it goes without saying that these examples are not intended to limit the scope of the invention. In what follows, "parts" will mean "weight parts" and "%" will mean "weight %" unless otherwise specified.

Part 1 (Preparation of processing agents for synthetic fibers)

Reference Example 1 (Preparation of processing agent (P-1))

[0053] Processing agent (P-1) was prepared by uniformly mixing together 70 parts of Component A, 1-5 parts of Component B, 1 part of Component C and 27.5 parts of Component D where Component A is a mixture of alkyleneoxide addition compound with number average molecular weight of 3500 with random addition of EO and PO at weight ratio of 70/30 to Dodecyl alcohol and alkyleneoxide addition compounds with number average molecular weight of 1000 with random addition of EO and PO at weight ratio of 50/30 to hexadecyl alcohols at a weight ratio of 50/20; Component B is polyoxyalkylene-modified silicone (B-1) having polyoxyalkylene group with oxyalkylene units including both oxyethylene units and oxypropylene units and silicone chain at weight ratio of 70/30 (50% of the oxyalkylene units being oxyethylene units); Component C is 2,2'-methylene-bis-(4-methyl-6-t-butylphenol) ; and Component D is a mixture of ω -hydroxy (polyoxyethylene) (n=7) octadecenate, α -dodecyl- ω -hydroxy (polyoxypropylene polyoxyethylene) (m=3, methylene oxide adduct (n=20) of hydrogenated castor oil, potassium decanesulfonate, and potassium phosphoric acid ester of α -dodecyl- ω -hydroxy (polyoxyethylene) (n=3) at weight ratio of 10/10/6/0-5/1.

Reference Examples 2-31, 34 and 37. Test Examples 32, 33, 35 and 36 and Comparison

Examples 1-19 (preparation of processing agents (P-2)-(P-37) and (R-1)-(R-19))

[0054] Processing agents (P-2)-(P-31), (P-34) and (P-37) of Reference Examples 2-31, 34 and 37, processing agents (P-32), (P-33), (P-35) and (P-36) of Test Examples 32, 33, 35 and 36 and processing agents (R-19) of Comparison Examples 1-19 were prepared similarly as processing agent (P-1) of Reference Example 1. Details of the components

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used for the preparation of these processing agents are shown in Tables 1-4 and the details of these processing agents are shown in Tables 5-9.

Table 1

	Aliphatic alcohol used for synthesis				Alkyleneoxide addition compound				
	Kind	*1	*2	Form	*3	*4	*5	*6	NAMW
A-1	Dodecyl alcohol	1	12	Straight-chain	EO/PO	R	70	-OH	3500
A-2	Octyl alcohol	1	8	Straight-chain	EO/PO	R	40	-OH	1000
A-3	Butyl alcohol	1	4	Straight-chain	EO/PO	R	50	-OH	3000
A-4	Dodecyl alcohol	1	12	Straight-chain	EO/PO	R	25	-OH	1000
A-5	Dodecyl alcohol	1	12	Straight-chain	EO/PO	R	90	-OH	2500
A-6	Hexadecyl alcohol	1	16	Straight-chain	EO/PO	R	50	-OH	1000
A-7	Tetradecyl alcohol	1	14	Straight-chain	EO/PO	B	55	-OH	2500
A-8	Isohexadecyl alcohol	1	16	Branched-chain	EO/PO	R	50	-OH	1000
A-9	Hexadecyl alcohol	1	16	Straight-chain	EO/PO	R	25	-OH	2500
A-10	Hexadecyl alcohol	1	16	Straight-chain	EO/PO	R	90	-OH	2500
A-11	Octadecyl alcohol	1	18	Straight-chain	EO/PO	R	45	-OCH ₃	2000
A-12	Trimethylol propane	3	6	Branched-chain	EO/PO	R	10	-OH	6000
A-13	Trimethylol propane	3	6	Branched-chain	EO/PO	R	40	-OH	6000
A-14	Glycerol	3	3	Branched-chain	EO/PO	R	60	-OH	6000
A-15	Propylene glycol	2	3	Branched-chain	EO/PO	B	25	-OH	2000
In Table 1 (and thereafter): *1: Valence *2: Number of carbon atoms *3: Kind of alkyleneoxide *4: Form of addition *5: Ratio (%) of oxyethylene units in polyoxyalkylene group *6: End group of polyoxyalkylene group NAMW: Number average molecular weight									

Table 2

	*7	*8	NAMW
B-1	70/30	50	16000
B-2	35/65	20	11000
B-3	94/6	50	43000
In Table 2: *7: Weight ratio between polyoxyalkylene group with oxyalkylene units including oxyethylene units and oxypropylene units / silicon chains *8: Ratio (%) of oxyethylene units in oxyalkylene units			

Table 3

	Name of compound	Type
C-1	2,2'-methylene-bis-(4-methyl-6-t-butylphenol)	Phenol antioxidant
C-2	1,3,5-tris(4-butyl-3-hydroxy-2,6-dimethylbenzyl) Isocyanuric acid	Phenol antioxidant

(continued)

	Name of compound	Type
C-3	Octyldiphenyl phosphite	Phosphite antioxidant
C-4	Dilauryl-3,3'-thiodipropionate	Thioether antioxidant

Table 4

	Type	Kind	Name of compound
D-1	EM	NS	ω -hydroxy (polyoxyethylene) (n=7) octadecenate
D-2	EM	NS	α -dodecyl- ω -hydroxy (polyoxypropylene polyoxyethylene) (m=3, n=4)
D-3	EM	NS	Ethylene oxide adduct (n=20) of hydrogenated castor oil
D-4	EM	NS	Sorbitan monolaurate
D-5	EM	NS	Amide of diethanolamine and decanoic acid
D-6	EM	CS	Trimethyloctyl ammonium octyl phosphate
D-7	AO	AS	Potassium decane sulfonate
D-8	AO	AS	Potassium cis-9-octadecenate
D-9	AO	AS	Potassium dodecylpoly (oxyethylene)(n=3) phosphate
D-10	AO	AS	Potassium tetracosyl phosphate
D-11	LC	AEC	Dodecyl octanoate (Formula (2) where R ³ is residual group obtainable by removing hydrogen atom from dodecyl alcohol and R ⁴ is residual group obtainable by removing hydroxyl group from octanoic acid)
D-12	LC	AEC	Ester of α -dodecyl- ω -hydroxy (polyoxyethylene)(n=6) and decanoic acid (Formula (1) where R ¹ is residual group obtainable by removing hydrogen atom from dodecyl alcohol, R ² is residual group obtainable by removing hydroxyl group from decanoic acid and X is residual group obtainable by removing all hydroxyl groups from polyethylene glycol having polyoxyethylene group with 6 oxyethylene units)
D-13	LC	AEC	Dodecyl dodecanate
D-14	LC	ARC	2-ethylhexyl octadecenate
D-15	LC	MO	Mineral oil with viscosity $3 \times 10^{-2} \text{ m}^2/\text{s}$ at 30°C
<p>In Table 4:</p> <p>EM: Emulsifier;</p> <p>AO: antistatic agent;</p> <p>LC: Lubricant coadjuvant;</p> <p>NS: Nonionic surfactant;</p> <p>CS: Cationic surfactant;</p> <p>AS: Anionic surfactant;</p> <p>AEC: Aliphatic ester compound;</p> <p>MO: Mineral oil.</p>			

Table 5

	Reference Example																									
	1	2	3	4	5	6	7	8	9	10	11	12	13													
	P-1	P-2	P-3	P-4	P-5	P-6	P-7	P-8	P-9	P-10	P-11	P-12	P-13													
A-150 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	20	50	50	50	50	50	50	35	35	50	50	50	45													
A-6		20	15	10	20	20								20	35	35	50	20	20	15						
A-7																										
A-8																										
A-9																										
A-10																										
A-11																										
A-12																										
A-13																										
A-14																										
A-15																										
B-1 B-2 B-3							1.5	1.5	1.5	1.5	1.5	1.5	1.5								1.5	1.5	1.5	1.5	1.5	1.5
C-1 C-2 C-3 C-4							1	1	1	1	1	1	1								1	1	1	1	1	1
D-1 D-2 D-3 D-4 D-5 D-6 D-7							10 10 6 0.5	10 10 6 0.5	10 10 6 0.5	10 10 6 0.5	10 10 6 0.5	10 10 6 0.5	10 10 6 0.5								10 10 6 0.5	10 10 6 0.5	10 10 6 10 0.5	10 10 6 0.5	10 10 6 0.5	15 15 6 0.5

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[illegible]

Table 6

	Reference Example											
	14	15	16	17	18	19	20	21	22	23	24	25
	P-14	P-15	P-16	P-17	P-18	P-19	P-20	P-21	P-22	P-23	P-24	P-25
A-1	65	35	50	50	50	50	50	50	50	50	50	50
A-2												
A-3												
A-4												
A-5	20	35	20				20	20	20	20	20	20
A-6												
A-7												
A-8												
A-9												
A-10												
A-11												
A-12												
A-13												
A-14												
A-15												
B-1	1.5	1.5	1-5	1.5	1.5	1.5	0.4	1.5	3	1.5	1.5	1.5
B-2												
B-3												
C-1		1	1	1	1	1	1	1	1	0.7	0.3	2.5
C-2												
C-3												
C-4												
D-1	5	10	10.8 6	10	10	10	10	10	9.5	10	10	8.5
D-2	5	10		10	10	10	10	10	10	10.3	10	10
D-3	1	6					6	6	5	6	6	6
D-4												
D-5				6	6	6						
D-6							11				0.7	
D-7	0.5	0.5		0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5

5	
10	
15	
20	
25	
30	
35	
40	
45	
50	
55	

[illegible]

Table 7

	Reference Example						Test E.g.		Ref E.g.	Test E.g.		Ref E.g.
	26	27	28	29	30	31	32	33	34	35	36	37
	P-26	P-27	P-28	P-29	P-30	P-31	P-32	P-33	P-34	P-35	P-36	P-37
A-1	50	50	45	60	50	50	45	45		50 45	45	50
A-2												
A-3												
A-4												
A-5												
A-6	20	20	20	30	20	20	20	20	20	20	20	20
A-7												
A-8												
A-9												
A-10												
A-11												
A-12												
A-13												
A-14												
A-15												
B-1	1.5	1.5	1.5		1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
B-2												
B-3												
C-1			1	1	1	1	1	1	1	1	1	1
C-2												
C-3	1											
C-4		1										
D-1	10	10	3		10	10	10	10	10	10	10	10
D-2	10	10	3		11.5	10.5	10	10	10	10	10	10
D-3	6.	6			6		1	1	3	1	1	3
D-4												
D-5												
D-6												
D-7	0.5	0.5	0.5	3.5		3	0.5	0.5	0.5	0.5	0.5	0.5

(continued)

	P-26	P-27	P-28	P-29	P-30	P-31	P-32	P-33	P-34	P-35	P-36	P-37
D-8						2						
D-9	1	1		4		2	1	1	1	1	1	1
D-10												
D-11			20				10		3			
D-12								10				
D-13										10		3
D-14											10	
D-15			5									
G-1	1		5									
Total	101	100	105	100	100	100	100	100	100	100	100	100
A/(A-D)	70	70	65	90	70	70	65	65	70	65	65	70
B/(A-D)	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
C/(A-D)	1	1	1	1	1	1	1	1	1	1	1	1
D/(A-D)	27.5	27.5	32.5	7.5	27.5	27.5	32.5	32.5	27.5	32.5	32.5	27.5
A3/A	100	100	100	100	100	100	100	100	100	100	100	100
(E+F)/A	100	100	100	100	100	100	100	100	100	100	100	100
E/F	71.4/28.6	71.4/28.6	69.2/30.8	66.7/33.3	71.4/28.6	71.4/28.6	69.2/30.8	59.2/30.8	71.4/28.6	69.2/30.8	69.2/30.8	71.4/28.6
D ¹ /D.	94.5	94.5	18.5	0	100	74.5	64.6	64.6	83.6	64.6	64.6	83.6
D ² /D	5.5	5.5	4.6	100	0	25.5	4.6	4.6	5.5	4.6	4.6	5.5
D ³ /D	0	0	76.9	0	0	0	30.8	30.8	10.9	30.8	30.8	10.9

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Table 8

		Comparison Example									
		1	2	3	4	5	6	7	8	9	10
		R-1	R-2	R-3	R-4	R-5	R-6	R-7	R-8	R-9	R-10
5	A-1	30	60		20				50	40	20
	A-2									55	
10	A-3			50		50					
	A-4										
	A-5						50				
	A-6	15	35	20		20	20		20		
15	A-7										
	A-8										
	A-9										
	A-10										
20	A-11										
	A-12										
	A-13										
	A-14				50			75			56
	A-15										
25	B-1	1.5	1	1.5	1.5	1.5	1.5	1			
	B-2										
	B-3										
30	C-1	1	1	1	1	1	1		1	1	
	C-2							0.5			
	C-3										
	C-4										
35	D-1	20	2	10	10	10	10	2	10		
	D-2	21		10	10	10	10	10	11.5		
	D-3	10		6	6	6	6		6		
	D-4										
	D-5										
40	D-6										
	D-7	0.5		0.5	0.5	0.5	0.5	1	0.5		
	D-8										1
	D-9	1	1	1	1	1	1	0.5	1	4	
	D-10										3
45	D-11										20
	D-12							10			
	D-13										
	D-14										
	D-15										
50	G-1										
	Total	100	100	100	100	100	100	100	100	100	100
55	A/(A-D)	45	95	70	70	70	70	75	.70	95	76
	B/(A-D)	1.5	1	1.5	1.5	1.5	1.5	1	0	0	0
	C/(A-D)	1	1	1	1	1	1	0.5	1	1	0
	D/(A-D)	52.5	3	27.5	27.5	27.5	27.5	23.5	29	4	24
	A3/A	100	100	28.6	28.6	28.6	28.6	0	100	100	26.3

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(continued)

	R-1	R-2	R-3	R-4	R-5	R-6	R-7	R-8	R-9	R-10
(E+F)/A	100	100	100	28.6.	28.6	28.6	0	100	100	26.3
E/F	66.7/33.3	63.2/36.8	71.4/28.6	100/0	0/100	0/100	0/0	71.4/28.6	100/0	100/0
D ¹ /D	97.1	66.7	94.5	94.5	94.5	94.5	51.1	94.8	0	0
D ² /D	2.9	33.3	5.5	5.5	5.5	5.5	6.4	5.2	100	16.7
D ³ /D	0	0	0	0	0	0	42.6	0	0	83.3

Table 9

	ComparaisonExample								
	11	12	13	14	15	16	17	18	19
	R-11	R-12	R-13	R-14	R-15	R-16	R-17	R-18	R-19
A-1	29	50	50	50	47	50	50	68	30
A-2									
A-3									
A-4									
A-5	20	20	20	20	16	37	20	29	15
A-6									
A-7									
A-8									
A-9									
A-10									
A-11									
A-12									
A-13									
A-14									
A-15									
B-1	1	1.5	6	1.5	1	1.5	1.5	1.5	1.5
B-2									
B-3									
C-1		1	1				4	1.5	1
C-2									
C-3									
C-4									
D-1	5	10	10	10		10	10		20
D-2		10	10	11			10		20
D-3		6	6	6			3		6
D-4									
D-5		0.5	0.5	0.5		0.5	0.5		0.5
D-6									
D-7									

(continued)

	R-11	R-12	R-13	R-14	R-15	R-16	R-17	R-18	R-19
D-8					2	0.5			
D-9	5	1	1	1		0.5	1		1
D-10									
D-11									5
D-12	40								
D-13									
D-14									
D-15									
G-1									
Total	100	100	104.5	100	100	100	100	100	100
A/(A-D)	49	70	70	70	95	87	70	97	45
B/(A-D)	1	0	6	1.5	1	1.5	1.5	1.5	1.5
C/(A-D)	0	1	1	0	0	0	4	1.5	1
D/(A-D)	50	27.5	27.5	28.5	2	11.5	24.5	0	52.5
A3/A	100	100	100	100	16.8	100	100	100	100
(E+F)/A	100	100	100	100	66.3	100	100	100	100
E/F	59.2/40.8	71.4/28.6	71.4/28.6	71.4/28.6	25.3/74.7	57.5/42.5	71.4 28.6	70.1/29.9	66.7/33.3
D ¹ /D	10	94.5	94.5	94.7	0	87	93.9	0	87.6
D ² /D	10	5.5	5.5	5.3	100	13	6.1	0	2.9

(continued)

	R-11	R-12	R-13	R-14	R-15	R-16	R-17	R-18	R-19
D ³ /D	80	0	0	0	0	0	0	0	9.5
<p>In Tables 5-9:</p> <p>A/(A-D): Ratio (part) of Component A to the total of 100 weight parts of components A, B, C and D;</p> <p>B/(A-D): Ratio (part) of Component B to the total of 100 weight parts of Components A, B, C and D;</p> <p>C/(A-D): Ratio (part) of Component C to the total of 100 weight parts of Components A, B, C and D;</p> <p>D/(A-D): Ratio (part) of Component D to the total of 100 weight parts of Components A, B, C and D;</p> <p>A3/A: Ratio (%) of alkyleneoxide addition compound with Condition 3 in Component A;</p> <p>(E+F)/A: Ratio (%) of Components E and F in Component A; E/F: Weight ratio between Components E and F;</p> <p>D¹/D: Ratio (%) of emulsifier in Component D;</p> <p>D²/D: Ratio (%) of antistatic agent in Component D;</p> <p>D³/D: Ratio (%) of lubricant coadjuvant in Component D;</p> <p>A-1-A-15: Alkyleneoxide addition compounds shown in Table 1;</p> <p>B-1-B-3: Polyoxyalkylene-modified silicone shown in Table 2;</p> <p>C-1-C-4: Antioxidants shown in Table 3;</p> <p>D1-D6: Emulsifiers shown in Table 4;</p> <p>D7-D-10: Antistatic agents shown in Table 4;</p> <p>D-11-D-15: Lubricant coadjuvants shown in Table 4;</p> <p>G-1: Ethylene glycol</p>									

Part 2Attachment of processing agent onto synthetic fibers

- 5 **[0055]** Each of the processing agents prepared in Part 1 was diluted with water to prepare a 10% aqueous solution. After polyethylene terephthalate chips with intrinsic viscosity of 0.64 and containing titanium oxide by 0.2% were dried by a known method, they were spun at 295°C by using an extruder. The 10% aqueous solution thus prepared was applied onto the yarns extruded out of the nozzle to be cooled and solidified by a guide oiling method using a measuring pump such that the attached amount of the processing agent became as shown in Tables 8 and 9. Thereafter, the yarns
- 10 were collected by means of a guide and wound up at the rate of 3000m/minute without any drawing by a mechanical means to obtain partially drawn 128 decitex-36 filament yarns as wound cakes of 10kg.

False twisting

- 15 **[0056]** The cakes thus obtained as described above were subjected to a false twisting process under the conditions described below by using a false twister of the contact heater type (product name of SDS1200 produced by Teijinseiki Co., Ltd.):

	Fabrication speeds:	800m/minute and 1200m/minute;
20	Draw ratio:	1.652;
	Twisting system:	Three-axis disk friction method (with one guide disk on the inlet side, one guide disk on the outlet side and four hard polyurethane disks);
	Heater on twisting	side: Length of 2.5m with surface temperature of 210°C;
	Heater on untwisting	side; None;
25	Target number of	twisting; 3300T/m.

The false twisting process was carried out under the conditions given above by a continuous operation of 25 days.

Evaluation of fluffs

- 30 **[0057]** In the aforementioned false twisting process, the number of fluffs per hour was measured by means of a fly counter (product name of DT-105 produced by Toray Engineering Co., Ltd.) before the false twisted yarns were wound up and evaluated according to the standards as described below:

- 35 AAA: The measured number of fluffs was zero;
 AA: The measured number of fluffs was less than 1 (exclusive of zero);
 A: The measured number of fluffs was 1-2;
 B: The measured number of fluffs was 3-9;
 C: The measured number of fluffs was 10 or greater.

- 40 The results of the measurement are shown in Tables 10 and 11.

Evaluation of yarn breaking

- 45 **[0058]** The number of occurrences of yarn breaking during the 25 days of operation in the false twisting process described above was converted into the number per day and such converted numbers were evaluated according to the standards as described below:

- 50 AAA: The number of occurrence was zero;
 AA: The number of occurrence was less than 0.5 (exclusive of zero);
 A: The number of occurrence was 0.5 or greater and less than 1;
 B: The number of occurrence was 1 or greater and less than 5;
 C: The number of occurrence was 5 or greater.

- 55 The results are shown in -Tables 10 and 11.

Dyeing property

[0059] A fabric with diameter of 70mm and length of 1.2mm was produced from the false-twisted yarns on which fluffs were measured as above by using a knitting machine for tubular fabric. The fabric thus produced was dyed by a high temperature and high pressure dyeing method by using disperse dyes (product name of Kayalon Polyester Blue-EBL-E produced by Nippon Kayaku Co. Ltd.). The dyed fabrics were washed with water, subjected to a reduction clearing process and dried according to a known routine and were thereafter set on an iron cylinder with diameter 70mm and length 1m. An inspection process for visually counting the number of points of densely dyed portion on the fabric surface was repeated five times and the evaluation results thus obtained were converted into the number of points per sheet of fabric. The evaluation was carried out according to the following standards:

- AAA: There was no densely dyed portion;
 AA: There was 1 point of densely dyed portion;
 A: There were 2 points of densely dyed portion;
 B: There were 3-6 points of densely dyed portion;
 C: There were 7 or more points of densely dyed portion.

The results are shown in Tables 10 and 11.

[0060] From the results shown in Tables 10 and 11, it should be clear that the present invention has the favorable effects of sufficiently preventing the occurrence of fluffs, yarn breaking and uneven dyeing although the speed of the spinning and fabrication processes of synthetic fibers is increased in recent years.

Table 10

Reference Example	Kind	Attached amount	Speed of false twisting process					
			800m/minute			1200m/minute		
			Fluffs	Yarn breaking	Dyeing property	Fluffs	Yarn breaking	Dyeing property
38	P-1	0.4	AAA	AAA	AAA	AA	AAA	AAA
39	P-2	0.4	AAA	AAA	AAA	AA	AAA	AAA
40	P-3	0.4	AAA	AAA	AAA	AA	AAA	AA
41	P-4	0.4	AA	AAA	AAA	AA	AAA	AA
42	P-5	0.4	AA	AAA	A.AA	AA	AAA	AA
43	P-6	0.4	AA	AAA	AAA	AA	AAA	AA
44	P-7	0.4	AAA	AAA	AAA	AA	AAA	AAA
45	P-8	0.4	AA	AA	AA	A	AA	A
46	P-9	0.6	AAA,	AAA	AAA	AA	AAA	AAA
47	P-10	0.4	AA	AAA	AAA	AA	AAA	AA
48	P-11	0.6	AA	AAA	AAA	AA	AAA	AA
49	P-12	0.4	AA	AAA	AAA	A	AAA	AA
50	P-13	0.4	AAA	AAA	AAA	AA	AAA	AAA
51	P-14	0.4	AAA	AAA	AAA	AA	AAA	AAA
52	P-15	0.4	AA	AAA	AAA	A	AAA	AA
53	P-16	0.4	AAA	AAA	AAA	AA	AAA	AAA
54	P-17	0.4	AA	AAA	AAA	A	AAA	AA
55	P-18	0.4	AA	AAA	AAA	A	AAA	AA
56	P-19	0.4	AA	AAA	AAA	A	AAA	AA
57	P-20	0.4	AA	AAA	AA	A	AAA	AA
58	P-21	0.5	AA	AAA	AAA	AA	AAA	AAA
59	P-22	0.6	AAA	AA	AAA	AA	AA	AAA
60	P-23	0.4	AAA	AAA	AAA	AA	AAA	AAA
61	P-24	0.4	AA	AAA	AA	AA	AA	AA
62	P-25	0.4	AA	AA	AA	A	A	AA
63	P-26	0.4	AA	AAA	AAA	AA	AAA	AA

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(continued)

Reference Example	Kind	Attached amount	Speed of false twisting process					
			800m/minute			1200m/minute		
			Fluffs	Yarn breaking	Dyeing property	Fluffs	Yarn breaking	Dyeing property
64	P-27	0.4	AA	AAA	AHA	AA	AA	AA
65	P-28	0.4	AA	AAA	AA	AA	AA	AA
66	P-29	0.4	A	A	A	A	A	A
67	P-30	0.4	AA	AAA	AA	A	AAA	A
68	P-31	0.5	AA	A	AA	A	A	A
Test Example								
69	P-32	0.6	AAA	AAA	AAA	AAA	AAA	AAA
70	P-33	0.4	AAA	AAA	AAA	AAA	AAA	AAA
Reference Example								
71	P-34	0.4	AAA	AAA	AAA	AAA	AAA	AAA
Test Example								
72	P-35	0.6	AAA	AAA	AAA	AAA	AAA	AAA
73	P-36	0.4	AAA	AAA	AAA	AAA	AAA	AAA
Reference Example								
74	P-37	0.4	AAA	AAA	AAA	AAA	AAA	AAA

Table 11

Comparison Example	Kind	Attached amount	Speed of false twisting process					
			800m/minute			1200m/minute		
			Fluffs	Yarn breaking	Dyeing property	Fluffs	Yarn breaking	Dyeing property
20	R-1	0.4	B	C	C	C	C	C
21	R-2	0.4	B	A	C	C	B	C
22	R-3	0.4	B	B	B	C	B	C
23	R-4	0.4	B	B	B	C	B	C
24	R-5	0.4	C	A	C	C	B	B
25	R-6	0.4	B	B	B	C	C	B
26	R-7	0.4	B	A	B	C	B	B
27	R-8	0.4	B	B	C	C	C	C
28	R-9	0.4	C	B	C	C	C	C
29	R-10	0.4	C	C	C	C	C	C
30	R-11	0.6	C	C	C	C	C	C
31	R-12	0.4	B	B	B	C	C	C
32	R-13	0.5	B	B	C	C	C	C
33	R-14	0.4	B	B	B	C	B	C
34	R-15	0.4	C	B	C	C	C	C
35	R-16	0.4	C	B	C	C	C	C
36	R-17	0.4	B	B	B	C	C	C

(continued)

Comparison Example	Kind	Attached amount	Speed of false twisting process					
			800m/minute			1200m/minute		
			Fluffs	Yarn breaking	Dyeing property	Fluffs	Yarn breaking	Dyeing property
37	R-18	0.5	B	A	C	C	B	C
38	R-19	0.6	B	C	C	C	C	C
In Tables 10 and 11: Attached amount: Amount (%) that attached to synthetic fibers as processing agent.								

Claims

- A processing agent for synthetic fibers, said processing agent containing Component A, Component B, Component C and Component D in a total of 70 weight % or more, said processing agent containing 55-92 weight parts of said Component A, 0.3-5 weight parts of said Component B, 0.1-3 weight parts of said Component C and 0.6-44 weight parts of said Component D for 100 weight parts of the total of Components A, B, C and D;

wherein said Component A is one or more alkyleneoxide addition compounds simultaneously satisfying Conditions 1, 2 and 3, said Condition 1 being the condition of having a number average molecular weight of 1000-12000 and being obtainable by adding alkylene oxide(s) with 2-4 carbon atoms to monohydric-trihydric aliphatic alcohol(s) with 1-24 carbon atoms, said Condition 2 being the condition of having polyoxyalkylene groups comprising oxyalkylene units of which 10-80 weight % are oxyethylene units, and said Condition 3 being the condition of containing 30 weight % or more of alkyleneoxide addition compounds obtainable by adding ethylene oxide and propylene oxide to monohydric aliphatic alcohol(s) with 6-24 carbon atoms at a weight ratio of 35/65-80/20, and wherein said Component A contains Component E and Component F in a total of 60 weight % or more and at a weight ratio of 40/60-80/20;

wherein said Component E is an alkyleneoxide addition compound with number average molecular weight of 1000-x 2000 which is obtainable by adding ethylene oxide and propylene oxide to monohydric-trihydric aliphatic alcohol (s) with 6-13 carbon atoms carbon atoms at a weight ratio of 35/65-80/20; and

wherein said Component F is an alkyleneoxide addition compound with number average molecular weight of 1000-4000 which is obtainable by adding ethylene oxide and propylene oxide to monohydric aliphatic alcohol(s) with 14-16 carbon atoms and containing 70 mole % or more of straight-chain aliphatic alcohol(s) at a weight ratio of 35/65-80/20

wherein said Component B is a polyoxyalkylene-modified silicone having polyoxyalkylene groups comprising oxyalkylene units which are oxyethylene units and/or oxypropylene units and containing polyoxyalkylene groups and silicone chains at a weight ratio of 25/75-90/10, wherein 25 weight % or more of the oxyalkylene units which Component B contains are oxyethylene units;

wherein said Component C is a phenol antioxidants; and wherein said Component D contains a nonionic surfactant as an emulsifier in an amount of 20 weight % or more, an anionic surfactant as an antistatic agent in an amount of 1-20 weight %, and an aliphatic ester compound(s) shown by formula R^1-X-R^2 and/or aliphatic ester compound(s) shown by formula R^3-R^4 as a lubricant coadjuvant in a total amount of 25-60 weight %, where R^1 and R^3 are each the residual group obtainable by removing the hydrogen atom from an aliphatic monohydric alcohol with 8-18 carbon atoms, R^2 is the residual group obtainable by removing the hydrogen atom from an aliphatic monocarboxylic acid with 8-18 carbon atoms, R^4 is the residual group obtainable by removing the hydroxyl group from an aliphatic monocarboxylic acid with 8-18 carbon atoms and X is the residual group obtainable by removing all hydroxyl groups from a (poly)alkyleneglycol having a (poly)oxyalkylenegroup formed with a total of 1-10 oxyethylene units and/or oxypropylene units.
- The processing agent of claim 1 containing said Component A, said Component B, said Component C and said Component D in a total of 80 weight % or more, said processing agent containing 55-90 weight parts of said Component A, 0.5-2 weight parts of said Component B, 0.5-2 weight parts of said Component C and 9-41 weight parts of said Component D for 100 weight parts of the total of components A, B, C and D.
- The processing agent of claim 1 or 2, wherein said Component D contains a nonionic surfactant as an emulsifier in 50-70 weight %, an anionic surfactant as an antistatic agent in 1-10 weight %, and aliphatic ester compound(s)

shown by formula R^1-X-R^2 and/or aliphatic ester compound(s) shown by formula R^3-R^4 a lubricant coadjuvant in a total amount of 25-40 weight %.

4. A method of processing synthetic fibers, said method comprising the step of applying the processing agent of any of claims 1 to 3 at a rate of 0.1-3 weight % of said synthetic fibers.
5. The method of claim 4, further comprising the step of preparing an aqueous solution containing said processing agent in 5-30 weight %, wherein said processing agent is applied as said aqueous solution to said synthetic fibers.

Patentansprüche

1. Verarbeitungshilfsmittel für Synthesefasern, wobei das Verarbeitungshilfsmittel eine Komponente A, eine Komponente B, eine Komponente C und eine Komponente D in einem Gewichtsanteil von insgesamt 70 Gew.-% oder mehr enthält, wobei das Verarbeitungshilfsmittel 55-92 Gewichtsteile der Komponente A, 0,3-5 Gewichtsteile der Komponente B, 0,1-3 Gewichtsteile der Komponente C und 0,6-44 Gewichtsteile der Komponente D pro 100 Gewichtsteile der gesamten Komponenten A, B, C und D enthält;
wobei die Komponente A aus einer oder mehreren Alkylenoxid-Additionskomponenten besteht, die gleichzeitig die Bedingungen 1, 2 und 3 erfüllen, wobei die Bedingung 1 ein zahlengemitteltes Molekulargewicht von 1000-12000 ist, das durch Addition von Alkylenoxid(en) mit 2-4 Kohlenstoffatomen an einen oder mehrere einwertige - dreiwertige Alkohole mit 1-24 Kohlenstoffatomen erhältlich ist, wobei die Bedingung 2 die Anwesenheit von Polyoxyalkylen-
gruppen mit Oxyalkylen-Einheiten ist, von denen 10-80 Gew.-% Oxyethylen-Einheiten sind, und wobei die Bedingung 3 ein Gehalt von 30 Gew.-% oder mehr an Alkylenoxid-Additionsverbindungen ist, der durch Addition von Ethylenoxid und Propylenoxid an einen oder mehrere einwertige aliphatische Alkohole mit 6-24 Kohlenstoffatomen in einem Gewichtsverhältnis von 35/65-80/20 erhältlich ist, und wobei die Komponente A eine Komponente E und eine Komponente F in einem Gewichtsanteil von insgesamt 60 Gew.-% oder mehr und in einem Gewichtsverhältnis von 40/60-80/20 enthält;
wobei die Komponente E eine Alkylenoxid-Additionsverbindung mit einem zahlengemittelten Molekulargewicht von 1000-12000 ist, die durch Addition von Ethylenoxid und Propylenoxid an einen oder mehrere einwertige-mehrwertige aliphatische Alkohole mit 6-13 Kohlenstoffatomen in einem Gewichtsverhältnis von 35/65-80/20 erhältlich ist; und
wobei die Komponente F eine Alkylenoxid-Additionsverbindung mit einem zahlengemittelten Molekulargewicht von 1000-4000 ist, die durch Addition von Ethylenoxid und Propylenoxid an einen oder mehrere einwertige aliphatische Alkohole mit 14-16 Kohlenstoffatomen erhältlich ist, und mindestens 70 Mol.-% eines oder mehrerer geradkettiger aliphatischer Alkohole in einem Gewichtsverhältnis von 35/65-80/20 enthält,
wobei die Komponente B ein polyoxyalkylen-modifiziertes Silicon mit Polyoxyalkylengruppen ist, die Oxyalkylen-Einheiten aufweisen, die Oxyethylen-Einheiten und/oder Oxypropylen-Einheiten sind, und Polyoxyalkylengruppen und Silicon-Ketten in einem Gewichtsverhältnis von 25/75-90/10 oder mehr enthält, wobei 25 Gew.-% oder mehr der in der Komponente B enthaltenen Oxyalkylen-Einheiten Oxyethylen-Einheiten sind;
wobei die Komponente C ein Phenol-Antioxidationsmittel ist; und
wobei die Komponente D ein nichtionisches Tensid als Emulgator in einem Anteil von 20 Gew.-% oder mehr, ein anionisches Tensid als Antistatikum in einem Anteil von 1-20 Gew.-% und eine oder mehrere, durch die Formel R^1-X-R^2 dargestellte aliphatische Esterverbindungen und/oder eine oder mehrere durch die Formel R^3-R^4 dargestellte aliphatische Esterverbindungen als Gleitmittelzusatz in einem Gesamtanteil von 25-60 Gew.-% enthält,
wobei R^1 und R^3 jeweils die durch Entfernen des Wasserstoffatoms von einem aliphatischen einwertigen Alkohol mit 8-18 Kohlenstoffatomen erhältliche Restgruppe ist, R^2 die durch Entfernen des Wasserstoffatoms von einer aliphatischen Monocarbonsäure mit 8-18 Kohlenstoffatomen erhältliche Restgruppe ist, R^4 die durch Entfernen der Hydroxylgruppe von einer aliphatischen Monocarbonsäure mit 8-18 Kohlenstoffatomen erhältliche Restgruppe ist und X die Restgruppe ist, die durch Entfernen aller Hydroxygruppen von einem (Poly)oxyalkylenglycol erhältlich ist, das eine (Poly)oxyalkylengruppe aufweist, die mit insgesamt 1-10 Oxyethylen-Einheiten und/oder Oxypropylen-Einheiten gebildet wird.
2. Verarbeitungshilfsmittel nach Anspruch 1, das die Komponente A, die Komponente B, die Komponente C und die Komponente D in einem Anteil von insgesamt 80 Gew.-% oder mehr enthält, wobei das Verarbeitungshilfsmittel 55-90 Gewichtsteile der Komponente A, 0,5-2 Gewichtsteile der Komponente B, 0,5-2 Gewichtsteile der Komponente C und 9-41 Gewichtsteile der Komponente D pro 100 Gewichtsteile der gesamten Komponenten A, B, C und D enthält.
3. Verarbeitungshilfsmittel nach Anspruch 1 oder 2, wobei die Komponente D ein nichtionisches Tensid als Emulgator in einem Anteil von 50-70 Gew.-%, ein anionisches Tensid als Antistatikum in einem Anteil von 1-10 Gew.-% und

eine oder mehrere, durch die Formel R^1-X-R^2 dargestellte aliphatische Esterverbindungen und/oder eine oder mehrere, durch die Formel R^3-R^4 dargestellte aliphatische Esterverbindungen als Gleitmittelzusatz in einem Gesamtanteil von 25-40 Gew.-% enthält.

- 5 4. Verfahren zur Verarbeitung von Synthesefasern, wobei das Verfahren den Schritt zum Aufbringen des Verarbeitungshilfsmittels nach einem der Ansprüche 1 bis 3 in einem Anteil von 0,1-3 Gew.-% der Synthesefasern aufweist.
5. Verfahren nach Anspruch 4, das ferner den Schritt zur Herstellung einer wässrigen Lösung aufweist, die das Verarbeitungshilfsmittel in einem Anteil von 5-30 Gew.-% enthält, wobei das Verarbeitungshilfsmittel als die wässrige
10 Lösung auf die Synthesefasern aufgebracht wird.

Revendications

- 15 1. Agent de traitement pour fibres synthétiques, ledit agent de traitement contenant un Composant A, un Composant B, un Composant C et un Composant D dans une proportion totale de 70% en poids ou plus, ledit agent de traitement contenant 55-92 parties en poids dudit Composant A, 0,3-5 parties en poids dudit Composant B, 0,1-3 parties en poids dudit Composant C et 0,6-44 parties en poids dudit Composant D pour 100 parties en poids du total des Composants A, B, C et D;
20 dans lequel ledit Composant A consiste en un ou plusieurs composés d'addition d'oxyde d'alkylène satisfaisant simultanément aux Conditions 1, 2 et 3, ladite Condition 1 étant la condition d'avoir un poids moléculaire moyen en nombre de 1000-12000 et de pouvoir être obtenu par addition d'un ou de plusieurs oxydes d'alkylène ayant 2-4 atomes de carbone sur un ou plusieurs alcools aliphatiques monovalents-trivalents ayant 1-24 atomes de carbone, ladite Condition 2 étant la condition d'avoir des groupes polyoxyalkylène comprenant des unités oxyalkylène dont
25 10-80% en poids sont des unités oxyéthylène, et ladite Condition 3 étant la condition de contenir 30% en poids ou plus de composés d'addition d'oxyde d'alkylène pouvant être obtenus par addition d'oxyde d'éthylène et d'oxyde de propylène sur un ou plusieurs alcools aliphatiques monovalents ayant 6-24 atomes de carbone dans un rapport pondéral de 35/65-80/20, et dans lequel ledit Composant A contient un Composant E et un Composant F dans une proportion totale de 60% en poids ou plus et dans un rapport pondéral de 40/60-80/20;
30 dans lequel ledit Composant E est un composé d'addition d'oxyde d'alkylène avec un poids moléculaire moyen en nombre de 1000-12000 pouvant être obtenu par addition d'oxyde d'éthylène et d'oxyde de propylène sur un ou plusieurs alcools aliphatiques monovalents-trivalents ayant 6-13 atomes de carbone dans un rapport pondéral de 35/65-80/20; et
dans lequel ledit Composant F est un composé d'addition d'oxyde d'alkylène avec un poids moléculaire moyen en
35 nombre de 1000-4000 pouvant être obtenu par addition d'oxyde d'éthylène et d'oxyde de propylène sur un ou plusieurs alcools aliphatiques monovalents ayant 14-16 atomes de carbone et contenant 70% en moles ou plus d'un ou plusieurs alcools aliphatiques à chaîne linéaire dans un rapport pondéral de 35/65-80/20;
dans lequel ledit Composant B est un silicone modifié par un polyoxyalkylène et ayant des groupes polyoxyalkylène comprenant des unités oxyalkylène qui sont des unités oxyéthylène et/ou des unités oxypropylène et contenant des
40 groupes polyoxyalkylène et des chaînes silicone dans un rapport pondéral de 25/75-90/10, où 25% en poids ou plus des unités oxyalkylène contenues par le Composant B sont des unités oxyéthylène;
dans lequel ledit Composant C est un antioxydant phénolique; et
dans lequel ledit Composant D contient un tensioactif non ionique en tant qu'émulsifiant en une quantité de 20% en poids ou plus, un tensioactif anionique en tant qu'agent antistatique en une quantité de 1-20% en poids, et un
45 ou plusieurs composés esters aliphatiques représentés par la formule R^1-X-R^2 et/ou composés esters aliphatiques représentés par la formule R^3-R^4 en tant que coadjuvant de lubrification en une quantité totale de 25-60% en poids, où R^1 et R^3 représentent chacun le groupe résiduel susceptible d'être obtenu par élimination de l'atome d'hydrogène d'un alcool monovalent aliphatique ayant 8-18 atomes de carbone, R^2 représente le groupe résiduel susceptible d'être obtenu par élimination de l'atome d'hydrogène d'un acide monocarboxylique aliphatique ayant 8-18 atomes
50 de carbone, R^4 représente le groupe résiduel susceptible d'être obtenu par élimination du groupe hydroxyle d'un acide monocarboxylique aliphatique ayant 8-18 atomes de carbone et X représente le groupe résiduel susceptible d'être obtenu par élimination de tous les groupes hydroxyle d'un (poly)alkylèneglycol ayant un groupe (poly)oxyalkylène formé avec un total de 1-10 unités oxyéthylène et/ou unités oxypropylène.
- 55 2. Agent de traitement selon la revendication 1 contenant ledit Composant A, ledit Composant B, ledit Composant C et ledit Composant D dans une proportion totale de 80% en poids ou plus, ledit agent de traitement contenant 55-90 parties en poids dudit Composant A, 0,5-2 parties en poids dudit Composant B, 0,5-2 parties en poids dudit Composant C et 9-41 parties en poids dudit Composant D pour 100 parties en poids du total des Composants A, B, C et D.

3. Agent de traitement selon la revendication 1 ou 2, dans lequel ledit Composant D contient un tensioactif non ionique en tant qu'émulsifiant à raison de 50-70% en poids, un tensioactif anionique en tant qu'agent antistatique à raison de 1-10% en poids, et un ou plusieurs composés esters aliphatiques représentés par la formule R^1-X-R^2 et/ou composés esters aliphatiques représentés par la formule R^3-R^4 en tant que coadjuvant de lubrification en une quantité totale de 25-40% en poids.
4. Procédé de traitement de fibres synthétiques, ledit procédé comprenant l'étape consistant à appliquer l'agent de traitement selon l'une quelconque des revendications 1 à 3 à raison de 0,1-3% en poids desdites fibres synthétiques.
5. Procédé selon la revendication 4, comprenant en outre l'étape consistant à préparer une solution aqueuse contenant ledit agent de traitement à raison de 5-30% en poids, ledit agent de traitement étant appliqué sous la forme de ladite solution aqueuse sur lesdites fibres synthétiques.

REFERENCES CITED IN THE DESCRIPTION

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