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(54) VISCOSE-RAYON TREATMENT AGENT, VISCOSE RAYON, SHORT VISCOSE-RAYON FIBER, AND METHOD FOR MANUFACTURING SPUNLACE NON-WOVEN FABRIC

(57) The present invention addresses the problem of providing a viscose-rayon treatment agent, etc. capable of enhancing the effect of reducing falling foam formation, and reducing generation of an odor. The viscose-rayon treatment agent contains an antioxidant and at least one substance selected from the following fatty acid derivatives, fatty acids, and oils and fats. The content of the antioxidant in the viscose-rayon treatment agent is 0.1-10 mass%. The fatty acid derivative is at least one compound selected from: compounds obtained by adding an ethylene oxide at a proportion of 1-30 moles relative to 1 mole of a fatty acid having 12-24 carbon atoms; and ester compounds composed of 1 mole of a compound polymerized with 4-50 moles of an ethylene glycol, and 1-2 moles of a fatty acid having 12-24 carbon atoms. The fatty acid has 12-24 carbon atoms. The oils and fats are at least one oil selected from plant oils, animal oils, and hardened oils thereof.

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Description

TECHNICAL FIELD

[0001] The present invention relates to a treatment agent for viscose rayon, viscose rayon to which the treatment agent for viscose rayon has been attached, a short fiber of viscose rayon, and a method for producing spunlace nonwoven fabric.

BACKGROUND ART

[0002] As raw material fibers for nonwoven fabrics, natural fibers such as cotton fibers, regenerated fibers such as rayon, and synthetic resins such as polyolefins are known. Among them, viscose rayon, a regenerated fiber made from pulp, cotton linters, or similar materials, has attracted attention due to its excellent biodegradability, hygroscopicity, and water absorption.

[0003] When producing nonwoven fabric, a treatment agent for nonwoven fabrics containing a surfactant and the like may be applied to the surface of the raw material fibers to impart various properties such as lubricity and bundling properties. Patent Document 1 discloses that when a spunlace nonwoven fabric is produced, a spunlace fiber treatment agent is applied to raw material fibers such as viscose rayon. This spunlace fiber treatment agent contains a polyoxyalkylene derivative and a function-imparting agent.

CITATION LIST

PATENT LITERATURE

[0004] Patent Literature 1: Japanese Patent No. 6132966

SUMMARY OF INVENTION

TECHNICAL PROBLEM

[0005] However, this conventional spunlace fiber treatment agent has the problem that it does not sufficiently achieve both the reduction of foaming due to detachment (that is, preventing the water used for hydroentanglement in the nonwoven fabric production process from foaming easily as a result of mixing with the treatment agent that has detached from the raw material fibers) and the reduction of odor in the raw material fibers to which the spunlace fiber treatment agent is attached.

SOLUTION TO PROBLEM

[0006] As a result of research to solve the above problem, the inventors of the present application have found that a treatment agent for viscose rayon containing three specific components is particularly suitable.

[0007] Aspects of the treatment agent for viscose rayon aimed at solving the above problem will be described.

[0008] According to the first aspect, a treatment agent for viscose rayon is characterized in that it contains a fatty acid derivative, at least one selected from a fatty acid and a fat or oil, and an antioxidant. The fatty acid derivative is at least one selected from a compound obtained by adding 1 mol or more and 30 mol or less of ethylene oxide to 1 mol of a fatty acid having 12 or more and 24 or less carbon atoms, and an ester compound of 1 mol or more and 2 mol or less of a fatty acid having 12 or more and 24 or less carbon atoms and 1 mol of a compound obtained by polymerizing 4 mol or more and 50 mol or less of ethylene glycol. The fatty acid has 12 or more and 24 or less carbon atoms. The fat or oil is at least one selected from a vegetable oil, an animal oil, and a hydrogenated oil thereof.

[0009] According to the second aspect, the treatment agent for viscose rayon described in the first aspect preferably contains the fatty acid derivative in an amount of 80 parts by mass or more and 99.89 parts by mass or less, at least one of the fatty acid and the fat or oil in an amount of 0.01 parts by mass or more and 10 parts by mass or less, and the antioxidant in an amount of 0.1 parts by mass or more and 10 parts by mass or less, where the sum of the contents of the fatty acid derivative, at least one of the fatty acid and the fat or oil, and the antioxidant in the treatment agent for viscose rayon is taken as 100 parts by mass.

[0010] According to the third aspect, the treatment agent for viscose rayon of the first aspect preferably further contains at least one selected from a lubricant and an anionic surfactant. The lubricant is at least one selected from a hydrocarbon compound, an ester compound, excluding the fat or oil and the fatty acid derivative, and a silicone.

[0011] According to the fourth aspect, the treatment agent for viscose rayon described in the third aspect preferably contains the fatty acid derivative in an amount of 60 parts by mass or more and 98.89 parts by mass or less, at least one of

the fatty acid and the fat or oil in an amount of 0.01 parts by mass or more and 10 parts by mass or less, the antioxidant in an amount of 0.1 parts by mass or more and 10 parts by mass or less, and the lubricant in an amount of 1 part by mass or more and 20 parts by mass or less, where the sum of the contents of the fatty acid derivative, at least one of the fatty acid and the fat or oil, the antioxidant, and the lubricant in the treatment agent for viscose rayon is taken as 100 parts by mass.

[0012] According to the fifth aspect, the treatment agent for viscose rayon described in the third aspect preferably contains the fatty acid derivative in an amount of 60 parts by mass or more and 98.89 parts by mass or less, at least one of the fatty acid and the fat or oil in an amount of 0.01 parts by mass or more and 10 parts by mass or less, the antioxidant in an amount of 0.1 parts by mass or more and 10 parts by mass or less, and the anionic surfactant in an amount of 1 part by mass or more and 20 parts by mass or less, where the sum of the contents of the fatty acid derivative, at least one of the fatty acid and the fat or oil, the antioxidant, and the anionic surfactant in the treatment agent for viscose rayon is taken as 100 parts by mass.

[0013] According to the sixth aspect, the treatment agent for viscose rayon described in the third aspect preferably contains the fatty acid derivative in an amount of 40 parts by mass or more and 97.89 parts by mass or less, at least one of the fatty acid and the fat or oil in an amount of 0.01 parts by mass or more and 10 parts by mass, the antioxidant in an amount of 0.1 parts by mass or more and 10 parts by mass or less, the lubricant in an amount of 1 part by mass or more and 20 parts by mass or less, and the anionic surfactant in an amount of 1 part by mass or more and 20 parts by mass or less, where the sum of the contents of the fatty acid derivative, at least one of the fatty acid and the fat or oil, the antioxidant, the lubricant, and the anionic surfactant in the treatment agent for viscose rayon is taken as 100 parts by mass.

[0014] According to the seventh aspect, in the treatment agent for viscose rayon described in any one of the first to sixth aspects, the viscose rayon is preferably a short fiber of viscose rayon.

[0015] Aspects of the viscose rayon aimed at solving the above problem will be described.

[0016] According to the eighth aspect, viscose rayon is characterized by having attached thereto the treatment agent for viscose rayon described in any one of the first to seventh aspects.

[0017] According to the ninth aspect, a short fiber of viscose rayon is characterized by having attached thereto the treatment agent for viscose rayon described in any one of the first to seventh aspects.

[0018] An aspect of the method for producing a spunlace nonwoven fabric aimed at solving the above problem will be described.

[0019] According to the tenth aspect, a method for producing a spunlace nonwoven fabric is characterized by including the following first and second steps. The first step involves carding the short fiber of viscose rayon described in the ninth aspect to produce a web. The second step involves entangling the web obtained in the first step using water flow.

ADVANTAGEOUS EFFECTS OF INVENTION

[0020] The present invention succeeds in enhancing the effect of reducing foaming due to detachment and reducing odor generation from viscose rayon.

DESCRIPTION OF EMBODIMENTS

(First embodiment)

[0021] Hereinafter, the first embodiment of a treatment agent for viscose rayon according to the present invention (hereinafter referred to as the "treatment agent") will be described. The treatment agent contains a fatty acid derivative, at least one selected from a fatty acid and a fat or oil, and an antioxidant. The fatty acid derivative is at least one selected from a compound obtained by adding 1 mol or more and 30 mol or less of ethylene oxide to 1 mol of a fatty acid having 12 or more and 24 or less carbon atoms, and an ester compound of 1 mol or more and 2 mol or less of a fatty acid having 12 or more and 24 or less carbon atoms and 1 mol of a compound obtained by polymerizing 4 mol or more and 50 mol or less of ethylene glycol. The fatty acid has 12 or more and 24 or less carbon atoms. The fat or oil is at least one selected from a vegetable oil, an animal oil, and a hydrogenated oil thereof. The treatment agent may further contain a lubricant and/or an anionic surfactant as necessary.

<Fatty acid derivative (A)>

[0022] The fatty acid derivative (A) used in the treatment agent of the present embodiment is at least one selected from a compound obtained by adding 1 mol or more and 30 mol or less of ethylene oxide to 1 mol of a fatty acid having 12 or more and 24 or less carbon atoms, and an ester compound of 1 mol or more and 2 mol or less of a fatty acid having 12 or more and 24 or less carbon atoms and 1 mol of a compound obtained by polymerizing 4 mol or more and 50 mol or less of ethylene glycol.

[0023] Any known fatty acid may be appropriately used as a raw material for the fatty acid derivative (A), and it may be

either saturated or unsaturated. It may also be linear or have a branched chain structure. The fatty acid has a carbon number of 12 or more and 24 or less, preferably 12 or more and 22 or less. The range may be defined by arbitrarily combining any of the above upper and lower limits.

[0024] The number of moles of ethylene oxide added is 1 mol or more and 30 mol or less, preferably 2 mol or more and 25 mol or less. The range may be defined by arbitrarily combining any of the above upper and lower limits. The number of moles of ethylene oxide added refers to the number of moles of ethylene oxide per mol of the fatty acid used as a raw material.

[0025] Specific examples of the fatty acid derivative (A) include (1) a polyoxyethylene alkyl (or alkylene) ester obtained by a reaction in which ethylene oxide is added to a saturated or unsaturated fatty acid, such as a compound obtained by adding 20 mol of ethylene oxide to 1 mol of oleic acid, a compound obtained by adding 10 mol of ethylene oxide to 1 mol of oleic acid, a compound obtained by adding 30 mol of ethylene oxide to 1 mol of oleic acid, a compound obtained by adding 5 mol of ethylene oxide to 1 mol of stearic acid, a compound obtained by adding 10 mol of ethylene oxide to 1 mol of stearic acid, and a compound obtained by adding 10 mol of ethylene oxide to 1 mol of lauric acid; (2) a polyethylene glycol alkyl (or alkylene) ester obtained by a reaction in which polyethylene glycol is added to a saturated or unsaturated fatty acid, such as an ester compound of 1 mol of oleic acid and 1 mol of a compound obtained by polymerizing 9 mol of ethylene glycol, an ester compound of 2 mol of oleic acid and 1 mol of a compound obtained by polymerizing 14 mol of ethylene glycol, an ester compound of 1 mol of stearic acid and 1 mol of a compound obtained by polymerizing 23 mol of ethylene glycol, an ester compound of 2 mol of lauric acid and 1 mol of a compound obtained by polymerizing 9 mol of ethylene glycol, and an ester compound of 2 mol of stearic acid and 1 mol of a compound obtained by polymerizing 23 mol of ethylene glycol; and (3) an ester of polyoxyethylene and a fatty acid derived from a fat or oil obtained by a reaction in which ethylene oxide is added to a naturally occurring fatty acid, such as a compound obtained by adding 30 mol of ethylene oxide to 1 mol of castor oil, a compound obtained by adding 10 mol of ethylene oxide to 1 mol of hydrogenated castor oil, and a compound obtained by adding 10 mol of ethylene oxide to 1 mol of coconut fatty acid.

[0026] The fatty acid derivative (A) may be used as a single type or in a combination of two or more types.

[0027] In the treatment agent, the lower limit of the fatty acid derivative (A) content is preferably 30% by mass or more, and more preferably 40% by mass or more. The upper limit of the fatty acid derivative (A) content is preferably 95% by mass or less, and more preferably 92% by mass or less. Regulating the content within this specified range can further enhance the effects of the present invention. In one aspect of the present embodiment, the fatty acid derivative (A) content in the treatment agent is, for example, 40% by mass or more, 60% by mass or more, 69% by mass or more, 70% by mass or more, 72% by mass or more, 75% by mass or more, 80% by mass or more, 82% by mass or more, 84% by mass or more, 86% by mass or more, 87% by mass or more, or 90.8% by mass or more. Similarly, the fatty acid derivative (A) content in the treatment agent is, for example, 92% by mass or less, 90.8% by mass or less, 87% by mass or less, 86% by mass or less, 84% by mass or less, 82% by mass or less, 80% by mass or less, 75% by mass or less, 72% by mass or less, 70% by mass or less, 69% by mass or less, or 60% by mass or less. The range may be defined by arbitrarily combining any of the above upper and lower limits.

<Fatty acid (B1) and fat or oil (B2)>

[0028] The fatty acid (B1) used in the treatment agent of the present embodiment has 12 or more and 24 or less carbon atoms. Any known fatty acid having 12 or more and 24 or less carbon atoms may be appropriately used. The fatty acid may be either saturated or unsaturated. It may also be linear or have a branched chain structure. The fatty acid (B1) has a carbon number of 12 or more and 24 or less, preferably 12 or more and 22 or less. The range may be defined by arbitrarily combining any of the above upper and lower limits. Specific examples of the fatty acid (B1) include lauric acid, myristic acid, palmitic acid, stearic acid, oleic acid, linoleic acid, linolenic acid, arachidic acid, behenic acid, lignoceric acid, and coconut fatty acid.

[0029] The fat or oil (B2) used in the treatment agent of the present embodiment is at least one selected from vegetable oils, animal oils, and hydrogenated oils thereof. Specific examples of the fat or oil (B2) include castor oil, sesame oil, tall oil, palm oil, palm kernel oil, coconut oil, rapeseed oil, lard, beef tallow, and whale oil, and hydrogenated oils thereof, such as hydrogenated castor oil and hydrogenated palm oil.

[0030] The fatty acid (B1) and the fat or oil (B2) may each be used as a single type or in a combination of two or more types.

[0031] In the treatment agent, the lower limit of the content of at least one component selected from the fatty acid (B1) and the fat or oil (B2) is preferably 0.01% by mass or more, and more preferably 0.05% by mass or more. Regulating the content within this specified range can further enhance the effect of reducing foaming due to detachment. The upper limit of the content of this component is preferably 15% by mass or less, and more preferably 10% by mass or less. Regulating the content within this specified range can further improve the emulsion stability of the treatment agent. In one aspect of the present embodiment, the sum of the fatty acid (B1) content and the fat or oil (B2) content in the treatment agent is, for example, 0.05% by mass or more, 0.5% by mass or more, 1% by mass or more, 3% by mass or more, 4% by mass or more,

5% by mass or more, 6% by mass or more, 7% by mass or more, or 9% by mass or more. Similarly, the sum of the fatty acid (B1) content and the fat or oil (B2) content in the treatment agent is, for example, 10% by mass or less, 9% by mass or less, 7% by mass or less, 6% by mass or less, 5% by mass or less, 4% by mass or less, 3% by mass or less, 1% by mass or less, or 0.5% by mass or less. The range may be defined by arbitrarily combining any of the above upper and lower limits.

<Antioxidant (C)>

[0032] Any known antioxidant may be appropriately used as the antioxidant (C) in the treatment agent of the present embodiment. Specific examples of the antioxidant (C) include (1) phenol-based antioxidants, such as 1,3,5-tris(4-t-butyl-3-hydroxy-2,6-dimethylbenzyl)-1,3,5-triazine-2,4,6-(1H,3H,5H)-trione, 1,3,5-tris(3',5'-di-t-butyl-4-hydroxybenzyl) isocyanurate, 1,3,5-tris(4-t-butyl-3-hydroxy-2,6-dimethylbenzyl) isocyanurate, 1,3,5-trimethyl-2,4,6-tris(3,5-di-t-butyl-4-hydroxybenzyl)benzene, 2,2'-methylene-bis(4-methyl-6-t-butylphenol), 1,1,3-tris(2-methyl-4-hydroxy-5-t-butylpheny)butane, and pentaerythritol=tetrakis[3-(3',5'-di-t-butyl-4'-hydroxyphenyl)propionate]; (2) thioether-based antioxidants, such as 4,4'-thiobis-(6-t-butyl-3-methylphenol), dilauryl-3,3'-thiodipropionate, 2,2-bis({[3-(dodecylthio)propionyl]oxy}methyl)-1,3-propanediyl=bis[3-(dodecylthio)propionate], and ditridecan-1-yl=3,3'-sulfanediyl dipropanoate; and (3) phosphorus-based antioxidants, such as 3,9-bis(2,6-di-t-butyl-4-methylphenoxy)-2,4,8,10-tetraoxa-3,9-diphosphaspiro[5.5]undecane, tris(mixed, mono and dinonylphenyl) phosphite, tris(2,3-di-t-butylphenyl) phosphite, 4,4'-butylidene-bis(3-methyl-6-t-butylphenyl-ditridecyl) phosphite, 1,1,3-tris(2-methyl-4-di-tridecyl phosphite-5-t-butylphenyl)butane, tris(2,4-dit-butylphenyl) phosphite, bis(2,4-di-t-butylphenyl)pentaerythritol-di-phosphite, tetrakis(2,4-di-t-butylphenyl)-4,4'-biphenylene phosphanite, bis(2,6-di-t-butyl-4-methylphenyl)pentaerythritol-diphosphite, tetrakis(2,4-di-t-butylphenyl)-4,4'-biphenylene diphosphonite, tetratridecyl-4,4'-butylidene-bis-(2-t-butyl-5-methylphenol) diphosphite, triphenyl phosphite, diphenyldecyl phosphite, tridecyl phosphite, trioctyl phosphite, tridodecyl phosphite, trioctadecyl phosphite, trinonylphenyl phosphite, tridodecyl trithiophosphite, and octyldiphenyl phosphite.

[0033] The antioxidant (C) may be used as a single type or in a combination of two or more types. When a single type of antioxidant is used alone, it is preferable to use either a phenol-based antioxidant or a thioether-based antioxidant. This approach can further enhance the effects of the present invention, particularly in reducing odor in fibers to which the treatment agent has been attached. When two or more types of antioxidants are used in combination, it is preferable to use both a phenol-based antioxidant and a thioether-based antioxidant. This approach can further enhance the reduction of odor.

[0034] In the treatment agent of the present embodiment, the contents of the fatty acid derivative (A), at least one of the fatty acid (B1) and the fat or oil (B2), and the antioxidant (C) are not particularly limited. The treatment agent preferably contains the fatty acid derivative (A) in an amount of 80 parts by mass or more and 99.89 parts by mass or less, at least one of the fatty acid (B1) and the fat or oil (B2) in an amount of 0.01 parts by mass or more and 10 parts by mass or less, and the antioxidant (C) in an amount of 0.1 parts by mass or more and 10 parts by mass or less, where the sum of the contents of the fatty acid derivative (A), at least one of the fatty acid (B1) and the fat or oil (B2), and the antioxidant (C) is taken as 100 parts by mass. This composition can further enhance the effects of the present invention.

[0035] In the treatment agent, the lower limit of the antioxidant (C) content is preferably 0.1% by mass or more, and more preferably 0.15% by mass or more. Regulating the content within this specified range can particularly enhance the reduction of odor in fibers to which the treatment agent has been attached. The upper limit of the antioxidant (C) content is preferably 15% by mass or less, and more preferably 10% by mass or less. Regulating the content within this specified range can further improve the emulsion stability of the treatment agent. In one aspect of the present embodiment, the antioxidant (C) content in the treatment agent is, for example, 0.15% by mass or more, 1% by mass or more, 2% by mass or more, 3% by mass or more, 4% by mass or more, 5% by mass or more, 7% by mass or more, 9% by mass or more, or 9.5% by mass or more. Similarly, the antioxidant (C) content in the treatment agent is, for example, 10% by mass or less, 9.5% by mass or less, 9% by mass or less, 7% by mass or less, 5% by mass or less, 4% by mass or less, 3% by mass or less, 2% by mass or less, or 1% by mass or less. The range may be defined by arbitrarily combining any of the upper and lower limits.

<Lubricant (D)>

[0036] The treatment agent (D) of the present embodiment may further contain at least one lubricant selected from a hydrocarbon compound, an ester compound, excluding the fatty acid derivative (A) and the fat or oil (B2), and a silicone. Blending the lubricant (D) can further enhance the effects of the present invention, with a particular improvement in carding performance.

[0037] Specific examples of the hydrocarbon compound include mineral oil and paraffin wax.

[0038] Specific examples of the ester compound include those formed from an aliphatic monoalcohol and an aliphatic monocarboxylic acid, such as butyl stearate and stearyl stearate; and those formed from an aliphatic polyhydric alcohol and an aliphatic monocarboxylic acid, such as glycerin monooleate, glycerin trioleate, sorbitan monolaurate, sorbitan trilaurate, sorbitan monooleate, sorbitan trioleate, sorbitan monostearate, and sorbitan tristearate. The ester compound

used as the lubricant is a compound obtained by reacting a fatty acid with an alcohol, excluding the fatty acid derivative (A) and the fat or oil (B2).

[0039] Specific examples of the silicone include dimethyl silicone, amino silicone, amino-modified silicone, and polyoxyalkylene-modified silicone.

[0040] The lubricant (D) may be used as a single type, or in a combination of two or more types.

[0041] When the treatment agent of the present embodiment contains the fatty acid derivative (A), at least one of the fatty acid (B1) and the fat or oil (B2), the antioxidant (C), and the lubricant (D), their respective contents in the treatment agent are not particularly limited. The treatment agent preferably contains the fatty acid derivative (A) in an amount of 60 parts by mass or more and 98.89 parts by mass or less, at least one of the fatty acid (B1) and the fat or oil (B2) in an amount of 0.01 parts by mass or more and 10 parts by mass or less, the antioxidant (C) in an amount of 0.1 parts by mass or more and 10 parts by mass or less, and the lubricant (D) in an amount of 1 part by mass or more and 20 parts by mass or less, where the sum of the contents of the fatty acid derivative (A), at least one of the fatty acid (B1) and the fat or oil (B2), the antioxidant (C), and the lubricant (D) is taken as 100 parts by mass. This composition can further enhance the effects of the present invention.

[0042] In the treatment agent, the lower limit of the lubricant (D) content is preferably 0.1% by mass or more, and more preferably 1% by mass or more. Regulating the content within this specified range can particularly enhance the carding performance. The upper limit of the lubricant (D) content is preferably 25% by mass or less, and more preferably 20% by mass or less. Regulating the content within this specified range can further improve the emulsion stability of the treatment agent. In one aspect of the present embodiment, the lubricant (D) content in the treatment agent is, for example, 1% by mass or more, 5% by mass or more, 9% by mass or more, 10% by mass or more, or 15% by mass or more. Similarly, the lubricant (D) content in the treatment agent is, for example, 20% by mass or less, 15% by mass or less, 10% by mass or less, 9% by mass or less, or 5% by mass or less. The range may be defined by arbitrarily combining any of the upper and lower limits.

<Anionic surfactant (E)>

[0043] The treatment agent of the present embodiment may further contain an anionic surfactant (E). Blending the anionic surfactant (E) can further enhance the effects of the present invention, with a particular improvement in emulsion stability when the treatment agent is prepared into an aqueous liquid.

[0044] Any known anionic surfactant may be appropriately used as the anionic surfactant (E). Specific examples of the anionic surfactant (E) include (1) phosphate ester salts of aliphatic alcohols, such as lauryl phosphate ester salts, cetyl phosphate ester salts, octyl phosphate ester salts, oleyl phosphate ester salts, and stearyl phosphate ester salts; (2) phosphate ester salts of a product obtained by adding at least one alkylene oxide selected from ethylene oxide and propylene oxide to an aliphatic alcohol, such as polyoxyethylene lauryl ether phosphate ester salts, polyoxyethylene oleyl ether phosphate ester salts, and polyoxyethylene stearyl ether phosphate ester salts; (3) aliphatic sulfonate salts or aromatic sulfonate salts, such as laurylsulfonic acid salts, myristylsulfonic acid salts, cetylsulfonic acid salts, oleylsulfonic acid salts, stearylsulfonic acid salts, tetradecanesulfonic acid salts, dodecylbenzenesulfonic acid salts, and secondary alkylsulfonic acid (C13 to C15) salts; (4) sulfate ester salts of aliphatic alcohols, such as lauryl sulfate ester salts, oleyl sulfate ester salts, and stearyl sulfate ester salts; (5) sulfate ester salts of a product obtained by adding at least one alkylene oxide selected from ethylene oxide and propylene oxide to an aliphatic alcohol, such as polyoxyethylene lauryl ether sulfate ester salts, polyoxyalkylene (polyoxyethylene or polyoxypropylene) lauryl ether sulfate ester salts, and polyoxyethylene oleyl ether sulfate ester salts; (6) sulfate ester salts of fatty acids, such as castor oil fatty acid sulfate ester salts, sesame oil fatty acid sulfate ester salts, tall oil fatty acid sulfate ester salts, soybean oil fatty acid sulfate ester salts, rapeseed oil fatty acid sulfate ester salts, palm oil fatty acid sulfate ester salts, lard fatty acid sulfate ester salts, beef tallow fatty acid sulfate ester salts, and whale oil fatty acid sulfate ester salts; (7) sulfate ester salts of fats/oils, such as sulfate ester salts of castor oil, sulfate ester salts of sesame oil, sulfate ester salts of tall oil, sulfate ester salts of soybean oil, sulfate ester salts of rapeseed oil, sulfate ester salts of palm oil, sulfate ester salts of lard, sulfate ester salts of beef tallow, and sulfate ester salts of whale oil; (8) fatty acid salts, such as laurate salts, oleate salts, and stearate salts; and (9) sulfosuccinate ester salts of aliphatic alcohols, such as dioctyl sulfosuccinate salts. Examples of the counter ion of the anionic surfactant include alkali metal salts, such as potassium salts and sodium salts; ammonium salts; and alkanolamine salts, such as triethanolamine.

[0045] The anionic surfactant (E) may be used as a single type or in a combination of two or more types.

[0046] When the treatment agent of the present embodiment contains the fatty acid derivative (A), at least one of the fatty acid (B1) and the fat or oil (B2), the antioxidant (C), and the anionic surfactant (E), their respective contents in the treatment agent are not particularly limited. The treatment agent preferably contains the fatty acid derivative (A) in an amount of 60 parts by mass or more and 98.89 parts by mass or less, at least one of the fatty acid (B1) and the fat or oil (B2) in an amount of 0.01 parts by mass or more and 10 parts by mass or less, the antioxidant (C) in an amount of 0.1 parts by mass or more and 10 parts by mass or less, and the anionic surfactant (E) in an amount of 1 part by mass or more and 20 parts by mass or

less, where the sum of the contents of the fatty acid derivative (A), at least one of the fatty acid (B1) and the fat or oil (B2), the antioxidant (C), and the anionic surfactant (E) is taken as 100 parts by mass. This composition can further enhance the effects of the present invention.

[0047] When the treatment agent of the present embodiment contains the fatty acid derivative (A), at least one of the fatty acid (B1) and the fat or oil (B2), the antioxidant (C), the lubricant (D), and the anionic surfactant (E), their respective contents in the treatment agent are not particularly limited. The treatment agent preferably contains the fatty acid derivative (A) in an amount of 40 parts by mass or more and 97.89 parts by mass or less, at least one of the fatty acid (B1) and the fat or oil (B2) in an amount of 0.01 parts by mass or more and 10 parts by mass or less, the antioxidant (C) in an amount of 0.1 parts by mass or more and 10 parts by mass or less, the lubricant (D) in an amount of 1 part by mass or more and 20 parts by mass or less, and the anionic surfactant (E) in an amount of 1 part by mass or more and 20 parts by mass or less, where the sum of the contents of the fatty acid derivative (A), at least one of the fatty acid (B1) and the fat or oil (B2), the antioxidant (C), the lubricant (D), and the anionic surfactant (E) is taken as 100 parts by mass. This composition can further enhance the effects of the present invention.

[0048] In the treatment agent, the lower limit of the anionic surfactant (E) content is preferably 0.1% by mass or more, and more preferably 1% by mass or more. Regulating the content within this specified range can particularly improve the emulsion stability of the treatment agent. The upper limit of the anionic surfactant (E) content is preferably 25% by mass or less, and more preferably 20% by mass or less. Regulating the content within this specified range can further enhance the effect of reducing foaming due to detachment. In one aspect of the present embodiment, the anionic surfactant (E) content in the treatment agent is, for example, 1% by mass or more, 2% by mass or more, 4% by mass or more, 5% by mass or more, 9% by mass or more, 10% by mass or more, 13% by mass or more, or 15% by mass or more. Similarly, the anionic surfactant (E) content in the treatment agent is, for example, 20% by mass or less, 15% by mass or less, 13% by mass or less, 10% by mass or less, 9% by mass or less, 5% by mass or less, 4% by mass or less, or 2% by mass or less. The range may be defined by arbitrarily combining any of the above upper and lower limits.

<Other components>

[0049] The treatment agent of the present embodiment may also contain a nonionic surfactant, a polyhydric alcohol, or other similar components in addition to those described above, provided that they do not impair the effects of the present invention.

[0050] Specific examples of the nonionic surfactant include (1) a polyoxyalkylene alkyl (or alkenyl) ether obtained by a reaction in which an alkylene oxide is added to a saturated or unsaturated aliphatic monohydric alcohol, such as a compound obtained by adding 10 mol of ethylene oxide to 1 mol of lauryl alcohol, a compound obtained by adding 5 mol of ethylene oxide to 1 mol of stearyl alcohol, a compound obtained by adding 30 mol of ethylene oxide to 1 mol of oleyl alcohol, a compound obtained by adding 10 mol of ethylene oxide to 1 mol of a C12-13 alcohol, a compound obtained by randomly adding 10 mol of ethylene oxide and 10 mol of propylene oxide to 1 mol of lauryl alcohol, a compound obtained by randomly adding 6 mol of ethylene oxide and 2 mol of propylene oxide to 1 mol of a C12-13 alcohol, a compound obtained by adding 5 mol of ethylene oxide to 1 mol of isodecyl alcohol and then adding 5 mol of propylene oxide, and a compound obtained by adding 2 mol of propylene oxide to 1 mol of isodecyl alcohol and then adding 5 mol of ethylene oxide; (2) a polyoxyalkylene polyhydric alcohol ether obtained by a reaction in which an alkylene oxide is added to an aliphatic polyhydric alcohol, such as a compound obtained by adding 10 mol of ethylene oxide to 1 mol of sorbitol and then adding 1 mol of lauric acid, a compound obtained by adding 20 mol of ethylene oxide to 1 mol of sorbitol and then adding 1 mol of oleic acid, a compound obtained by adding 20 mol of ethylene oxide to 1 mol of sorbitol and then adding 1 mol of stearic acid, and a compound obtained by adding 20 mol of ethylene oxide to 1 mol of sorbitol and then adding 3 mol of stearic acid; (3) a polyoxyalkylene alkylphenol ether obtained by a reaction in which an alkylene oxide is added to an alkylphenol, such as a compound obtained by adding 10 mol of ethylene oxide to octylphenol and a compound obtained by adding 10 mol of ethylene oxide to nonylphenol; and (4) a polyoxyalkylene amino ether obtained by a reaction in which an alkylene oxide is added to a saturated or unsaturated aliphatic amine, such as a compound obtained by adding 5 mol of ethylene oxide to octylamine, a compound obtained by adding 8 mol of ethylene oxide to laurylamine, and a compound obtained by adding 20 mol of ethylene oxide to stearylamine. When two or more alkylene oxides are used, their addition may be block addition, random addition, or a combination of block and random additions, and is not particularly limited.

[0051] Specific examples of the polyhydric alcohol include ethylene glycol, propylene glycol, pentanediol, hexanediol, glycerin, pentaerythritol, sorbitol, sorbitan, polyethylene glycol, polypropylene glycol, and a reaction product of propylene glycol and an alkylene oxide.

[0052] The other components may be used as a single type or in a combination of two or more types.

[0053] The content of the other components in the treatment agent is preferably 50% by mass or less, more preferably 10% by mass or less, and still more preferably 1% by mass or less, so as not to hinder the effects of the present invention.

[0054] The viscose rayon to which the treatment agent of the present embodiment is applied may be either long fibers, generally referred to as filaments, or short fibers, generally referred to as staples. Short fibers are preferable. The length of

the short fibers in the present embodiment is not particularly limited as long as they fall within the definition of short fibers in the technical field of the present invention. However, it is preferably 100 mm or less, and more preferably 51 mm or less.

[0055] With the first embodiment, the following effect can be obtained.

(1) The treatment agent of the present embodiment contains the fatty acid derivative (A), at least one of the fatty acid (B1) and the fat or oil (B2), and the antioxidant (C). This formulation enhances the effect of reducing foaming due to detachment, meaning that it prevents the water used for hydroentangling from foaming easily as a result of mixing with the treatment agent that has detached from viscose rayon when the viscose rayon to which the treatment agent is attached is hydroentangled. Consequently, the operational efficiency in the production process of spunlace nonwoven fabric can be improved. Additionally, the treatment agent reduces odor generation from the viscose rayon to which the treatment agent is attached. Furthermore, it reduces discoloration of the viscose rayon to which the treatment agent is attached. Moreover, it improves carding performance when the viscose rayon to which the treatment agent is attached passes through a carding machine. Finally, it enhances emulsion stability when the treatment agent is prepared as an aqueous liquid.

(Second embodiment)

[0056] Next, the second embodiment of viscose rayon according to the present invention will be described. The viscose rayon of the present embodiment has the treatment agent of the first embodiment attached to it.

[0057] The treatment agent can be applied using a known method, such as immersion, spraying, showering, rolling, or dropping/flow-down. It may also be applied, for example, after the refining process or during the spinning process, without particular limitation.

[0058] The viscose rayon to be treated with the treatment agent of the present embodiment may be the aforementioned viscose rayon.

[0059] When applied to viscose rayon, the treatment agent may be in the form of an aqueous liquid or an organic solvent-based solution. In the method for treating viscose rayon, it is preferable to dilute the treatment agent of the first embodiment with water to form an aqueous solution with a concentration of 0.5% to 20% by mass and to apply this aqueous liquid to the viscose rayon. As for the attachment amount of the treatment agent, it is preferable to apply the treatment agent such that the solid content, excluding the solvent, is 0.1% to 1% by mass relative to the viscose rayon.

(Third embodiment)

[0060] The third embodiment of a method for producing a spunlace nonwoven fabric according to the present invention will be described.

[0061] The spunlace nonwoven fabric is produced through a sequential process including a web-forming step (first step), in which a web is produced by carding viscose rayon, and a hydroentangling step (second step), in which the web is entangled using water flow.

(Web-forming step)

[0062] The web-forming step involves carding the viscose rayon, to which the treatment agent is attached, to produce a web. The carding can be performed using a known carding machine. Examples include flat cards, combination cards, and roller cards.

(Hydroentangling step)

[0063] The hydroentangling step involves entangling the web obtained in the web-forming step using water flow. A high-pressure water flow can be applied to the web to entangle the fibers with each other under the force of the water pressure, forming a sheet. After the hydroentangling step, a drying step or a winding step may be performed as needed.

[0064] With the second and third embodiments, in addition to the effect (1) mentioned above, the following effect can be obtained.

[0065] (2) Since the effect of reducing foaming due to detachment is enhanced, the water used for hydroentangling can be circulated for reuse in the hydroentangling process. Therefore, hydroentangling can be performed in a suitable manner, and the texture of the spunlace nonwoven fabric can be improved.

[0066] The first to third embodiments can be modified as follows. The first to third embodiments and the following modifications can be implemented in combination with each other, provided that no technical contradictions arise.

- In the treatment agent of the above embodiments, components commonly used in treatment agents, such as

surfactants, antistatic agents, binding agents, ultraviolet absorbers, and pH regulators, other than those described above, may be further blended to maintain the quality of the treatment agent, as long as the effects of the present invention are not impaired.

EXAMPLES

[0067] The following examples are provided to illustrate the features and effects of the present invention more specifically; however, the invention is not limited to these examples.

Experimental Part 1 <Preparation of treatment agent>

(Example 1)

[0068] The following materials were used as raw materials for the treatment agent. The numerical values for the components shown in Table 1 indicate their respective contents in the treatment agent.

[0069] Fatty acid derivative (A): Compound obtained by adding 20 mol of ethylene oxide to 1 mol of oleic acid

Fatty acid (B): Stearic acid

Antioxidant (C): 1,3,5-Tris(4-t-butyl-3-hydroxy-2,6-dimethylbenzyl)-1,3,5-triazine-2,4,6-(1H,3H,5H)-trione, which is phenol-based antioxidant, and ditridecan-1-yl=3,3'-sulfanediyl dipropanoate, which is thioether-based antioxidant

Lubricant (D): Stearyl stearate

Anionic surfactant (E): Potassium lauryl phosphate

A treatment agent was prepared with the content ratios shown in Table 1. To 100 parts of this treatment agent, 900 parts of water was added, and the mixture was stirred at 50°C to prepare a 10% aqueous liquid containing 10% by mass of the treatment agent.

(Examples 2 to 24 and Comparative Examples 1 to 8)

[0070] The treatment agents and their 10% aqueous liquids of Examples 2 to 24 and Comparative Examples 1 to 8 were prepared in the same manner as the treatment agent and their aqueous liquid of Example 1.

[0071] The details of the treatment agents of the examples prepared above are summarized in Table 1. The treatment agents of Examples 3, 4, 6, 8, and 24 and Comparative Examples 1, 2, and 6 contain a nonionic surfactant and/or a polyhydric alcohol as other components. In Example 24 in Table 1, the content of the other components (expressed in parts by mass (*)) is shown relative to 100 parts by mass of the total of components (A) to (E).

[0072] The type and content of the fatty acid derivative (A), the type and content of the fatty acid (B1) and the fat or oil (B2), the type and content of the antioxidant (C), the type and content of the lubricant (D), the type and content of the anionic surfactant (E), and the type and content of other components are shown in the "Fatty acid derivative agent (A)" section, the "Fatty acid, fat/oil (B)" section, the "Antioxidant (C)" section, the "Lubricant (D)" section, the "Anionic surfactant (E)" section, and the "Other components" section of Table 1, respectively.

[Table 1]

Classification	Fatty acid derivative (A)		Fatty acid, fat/oil (B)		Antioxidant (C)		Lubricant (D)		Anionic surfactant (E)		Other components	
	Type	Parts by mass	Type	Parts by mass	Type	Parts by mass	Type	Parts by mass	Type	Parts by mass	Type	Parts by mass (*)
Example 1	A-1	80	B-2	3	C-1 C-4	5 2	D-1	5	E-1	5	-	-
Example 2	A-2	10	B-2	5	C-1	1.5	D-2	9	E-2	1	-	-
	A-3	72			C-5	1.5						
Example 3	A-3	69	B-3	1	C-1 C-5	1 1	D-2	10	E-2	10	F-2	8
Example 4	A-1	75	B-2	3	C-1 C-4	5 2	D-1	5	E-1	5	F-4	5

(continued)

Classification	Fatty acid derivative (A)		Fatty acid, fat/oil (B)		Antioxidant (C)		Lubricant (D)		Anionic surfactant (E)		Other components	
	Type	Parts by mass	Type	Parts by mass	Type	Parts by mass	Type	Parts by mass	Type	Parts by mass	Type	Parts by mass (*)
Example 5	A-5	60	B-4	0.5	C-2 C-5	5 4.5	D-4	15	E-5	15	-	-
Example 6	A-1	72	B-2	3	C-1 C-4	5 2	D-1	5	E-1	5	F-3	8
Example 7	A-6 A-7	40 40	B-8	1	C-1 C-5	2 2	D-6	10	E-1	5	-	-
Example 8	A-1	72	B-2	3	C-1 C-4	5 2	D-1	5	E-1	5	F-4 F-8	5 3
Example 9	A-8 A-10	20 50	B-7	5	C-2 C-4	2.5 2.5	D-9	5	E-4	15	-	-
Example 10	A-1	80	B-1	5	C-1	3	D-8	10	E-1	2	-	-
Example 11	A-3	40	B-3	10	C-2	10	D-4	20	E-5	20	-	-
Example 12	A-2 A-3	10 72	B-2	5	C-2	3	D-2	9	E-2	1	-	-
Example 13	A-3	84	B-7	3	C-2	3	D-5	1	E-2	9	-	-
Example 14	A-2 A-8	9 60	B-5	1	C-1	2	D-7 D-11	10 5	E-1 E-5	4 9	-	-
Example 15	A-4	80	B-3	9	C-3	5	D-3	1	E-3	5	-	-
Example 16	A-2	75	B-2	5	C-1 C-5	5 5	D-2 D-10	9 1	-	-	-	-
Example 17	A-7	75	B-4	10	C-4	5	D-6	10	-	-	-	-
Example 18	A-6	80	B-6	5	C-5	5	-	-	E-3	10	-	-
Example 19	A-3	86	B-7	4	C-2	9	-	-	E-2	1	-	-
Example 20	A-7	87	B-8 B-12	3 2	C-2	3	-	-	E-2	5	-	-
Example 21	A-9	87	B-9	6	C-4	3	-	-	E-6	4	-	-
Example 22	A-6	90.8	B-13	0.05	C-5	0.15	-	-	E-5	9	-	-
Example 23	A-7	87	B-10	3	C-2	10	-	-	-	-	-	-
Example 24	A-8	92	B-11	7	C-3	1	-	-	-	-	F-1	41
Comparative Example 1	A-10	30	-	-	-	-	D-7 D-8	15 10	E-5	15	F-5	30
Comparative Example 2	-	-	-	-	-	-	D-9 D-10 D-11	15 5 5	-	-	F-5 F-6	15 60
Comparative Example 3	A-3	95	B-3	5	-	-	-	-	-	-	-	-
Comparative Example 4	A-2 A-3	25 51	B-12	4	-	-	-	-	E-2	20	-	-

(continued)

Classification	Fatty acid derivative (A)		Fatty acid, fat/oil (B)		Antioxidant (C)		Lubricant (D)		Anionic surfactant (E)		Other components	
	Type	Parts by mass	Type	Parts by mass	Type	Parts by mass	Type	Parts by mass	Type	Parts by mass	Type	Parts by mass (*)
Comparative Example 5	A-10	79	-	-	C-1	10	D-4	1	E-3	10	-	-
Comparative Example 6	A-6	20	B-5	5	-	-	D-5	5	-	-	F-8	70
Comparative Example 7	A-5	56.35	B-4	0.47	C-2 C-5	5 10	D-4	14.09	E-5	14.09	-	-
Comparative Example 8	A-4	84.17	B-3	9.47	C-3	0.05	D-3	1.05	E-3	5.26	-	-

[0073] The details of the fatty acid derivative (A), the fatty acid (B1), the fat or oil (B2), the antioxidant (C), the lubricant (D), the anionic surfactant (E), and the other components listed in Table 1 are as follows.

(Fatty acid derivative (A))

[0074]

A-1: Compound obtained by adding 20 mol of ethylene oxide to 1 mol of oleic acid
A-2: Compound obtained by adding 5 mol of ethylene oxide to 1 mol of stearic acid
A-3: Compound obtained by adding 10 mol of ethylene oxide to 1 mol of stearic acid
A-4: Ester compound of 2 mol of lauric acid and 1 mol of compound obtained by polymerizing 9 mol of ethylene glycol
A-5: Ester compound of 2 mol of stearic acid and 1 mol of compound obtained by polymerizing 23 mol of ethylene glycol
A-6: Compound obtained by adding 10 mol of ethylene oxide to 1 mol of coconut fatty acid
A-7: Ester compound of 2 mol of oleic acid and 1 mol of compound obtained by polymerizing 14 mol of ethylene glycol
A-8: Compound obtained by adding 10 mol of ethylene oxide to 1 mol of oleic acid
A-9: Compound obtained by adding 30 mol of ethylene oxide to 1 mol of oleic acid
A-10: Ester compound of 1 mol of oleic acid and 1 mol of compound obtained by polymerizing 9 mol of ethylene glycol

(Fatty acid (B1) and fat or oil (B2))

[0075]

B-1: Beef tallow
B-2: Stearic acid
B-3: Palmitic acid
B-4: Coconut oil
B-5: Palm oil
B-6: Behenic acid
B-7: Hydrogenated palm oil
B-8: Hydrogenated castor oil
B-9: Castor oil
B-10: Oleic acid
B-11: Lard
B-12: Lauric acid
B-13: Coconut fatty acid

(Antioxidant (C))

[0076]

C-1: 1,3,5-Tris(4-t-butyl-3-hydroxy-2,6-dimethylbenzyl)-1,3,5-triazine-2,4,6-(1H,3H,5H)-trione, which is phenol-based antioxidant
C-2: Pentaerythritol=tetrakis[3-(3',5'-di-t-butyl-4'-hydroxyphenyl)propionate], which is phenol-based antioxidant
C-3: 3,9-Bis(2,6-di-t-butyl-4-methylphenoxy)-2,4,8,10-tetraoxa-3,9-diphosphaspiro[5.5]undecane, which is phosphorus-based antioxidant
C-4: Ditridecan-1-yl=3,3'-sulfanediyl dipropanoate, which is thioether-based antioxidant.
C-5: 2,2-Bis({[3-(dodecylthio)propionyl]oxy}methyl)-1,3-propanediyl=bis[3-(dodecylthio)propionate], which is thioether-based antioxidant

(Lubricant (D))

[0077]

D-1: Stearyl stearate
D-2: Mineral oil (viscosity: 500 seconds)
D-3: Dimethyl silicone
D-4: Mineral oil (viscosity: 180 seconds)
D-5: Amino silicone
D-6: Paraffin wax
D-7: Mineral oil (viscosity: 60 seconds)
D-8: Glycerin monooleate
D-9: Mineral oil (viscosity: 80 seconds)
D-10: Sorbitan tristearate
D-11: Sorbitan monostearate

(Anionic surfactant (E))

[0078]

E-1: Potassium lauryl phosphate
E-2: Sodium dioctyl sulfosuccinate
E-3: Sodium tetradecanesulfonate
E-4: Sodium oleate
E-5: Sodium salt of beef tallow sulfate
E-6: Potassium stearate

(Other components)

[0079]

F-1: Compound obtained by adding 5 mol of ethylene oxide to 1 mol of stearyl alcohol
F-2: Compound obtained by randomly adding 6 mol of ethylene oxide and 2 mol of propylene oxide to 1 mol of C12-13 alcohol
F-3: Compound obtained by adding 5 mol of ethylene oxide to 1 mol of isodecyl alcohol and then adding 5 mol of propylene oxide
F-4: Compound obtained by adding 2 mol of propylene oxide to 1 mol of isodecyl alcohol and then adding 5 mol of ethylene oxide
F-5: Compound obtained by adding 20 mol of ethylene oxide to 1 mol of sorbitol and then adding 1 mol of stearic acid
F-6: Compound obtained by adding 20 mol of ethylene oxide to 1 mol of sorbitol and then adding 3 mol of stearic acid
F-7: Compound obtained by polymerizing 8 mol of propylene glycol
F-8: Compound obtained by polymerizing 45 mol of ethylene glycol

Experimental Part 2 <Attachment of treatment agent to viscose rayon fibers>

[0080] The 10% aqueous liquid of each treatment agent prepared in Experimental Part 1 was further diluted with water to prepare a 0.2% aqueous emulsion (% by mass). The aqueous emulsion of each example was applied to viscose rayon fibers with a fineness of 1.3×10^{-4} g/m (1.2 denier) and a fiber length of 38 mm using a spraying method so that the attachment amount (excluding the solvent) was 0.2% by mass. The viscose rayon fibers were then dried in a hot air dryer at 80°C for 2 hours. After drying, the fibers were conditioned overnight in an atmosphere of 25°C and 40% RH to obtain viscose rayon fibers to which the treatment agent had been attached.

Experimental Part 3 <Evaluation of treatment agent>

(Evaluation tests)

[0081] Using the viscose rayon fibers to which the treatment agent had been attached, tests were conducted for foaming due to detachment, fiber odor, fiber discoloration, carding performance, and emulsion stability. The procedures for each test are described below, and the results are shown in Table 2.

(Foaming due to detachment test)

[0082] First, 20 g of viscose rayon fibers to which the treatment agent had been attached was placed in 150 g of water. After 15 minutes, the viscose rayon fibers were taken out and squeezed using a hand juicer. Next, 10 g of the squeezed liquid was transferred to a 25-ml graduated cylinder with a ground-in stopper and shaken vigorously for 30 seconds. After standing for 30 seconds, the liquid was shaken again for another 30 seconds. Following a 5-minute standing period, the height from the liquid surface to the upper surface of the foam was measured. The results are shown in the "Foaming due to detachment test" section of Table 2.

Evaluation criteria for foaming due to detachment test

[0083]

◎ (Good): The height from the liquid surface to the upper surface of the foam was less than 1 mm
○ (Acceptable): The height from the liquid surface to the upper surface of the foam was 1 mm or more but less than 2 mm
× (Not acceptable): The height from the liquid surface to the upper surface of the foam was 2 mm or more

(Fiber odor test)

[0084] 20 g of viscose rayon fibers to which the treatment agent had been attached was placed in 150 g of water, sealed for 30 minutes, and then evaluated for odor by 10 testers. The results are shown in the "Odor test" section of Table 2.

Evaluation criteria for fiber odor test

[0085]

◎◎ (Excellent): No tester judged that there was an odor
◎ (Good): One or two testers judged that there was an odor
○ (Acceptable): Three to five testers judged that there was an odor
× (Not acceptable): Six or more testers judged that there was an odor

(Fiber discoloration test)

[0086] Each of the 10 testers evaluated whether discoloration, such as yellowing, had occurred in the viscose rayon fibers to which the treatment agent had been attached, compared to the fibers before the treatment agent was attached. The results are shown in the "Fiber discoloration test" section of Table 2.

Evaluation criteria for fiber discoloration test

[0087]

◎◎ (Excellent): No tester judged that discoloration was present
◎ (Good): One or two testers judged that discoloration was present
○ (Acceptable): Three to five testers judged that discoloration was present
× (Not acceptable): Six or more testers judged that discoloration was present

(Evaluation of carding performance)

[0088] In a thermostatic chamber at 20°C and 65% RH, 20 g of viscose rayon fibers to which the treatment agent had been attached was conditioned for 24 hours and then supplied to a miniature carding machine. The ratio of the discharge amount to the input amount was calculated and evaluated according to the following criteria. The results are shown in the "Carding performance test" section of Table 2.

Evaluation criteria for carding performance

[0089]

◎ (Good): The discharge amount was 90% or more
○ (Acceptable): The discharge amount was 80% or more but less than 90%
× (Not acceptable): The discharge amount was less than 80%

(Evaluation of emulsion stability)

[0090] In a 100-ml conical-bottom precipitation tube, 100 g of the 10% aqueous liquid of each treatment agent prepared in Experimental Part 1 was placed and allowed to stand at 25°C. After 24 hours, the amount of precipitate was measured and evaluated according to the following criteria. The results are shown in the "Emulsion stability test" section of Table 2.

Evaluation criteria for emulsion stability

[0091]

◎ (Good): The amount of precipitate was 0.1 ml or less
○ (Acceptable): The amount of precipitate was more than 0.1 ml but 0.5 ml or less
× (Not acceptable): The amount of precipitate was more than 0.5 ml

[Table 2]

Classification	Foaming due to detachment test	Fiber odor test	Fiber discoloration test	Carding performance test	Emulsion stability test
Example 1	◎	◎◎	◎◎	◎	◎
Example 2	◎	◎◎	◎◎	◎	◎
Example 3	◎	◎◎	◎◎	◎	◎
Example 4	◎	◎◎	◎◎	◎	◎
Example 5	◎	◎◎	◎◎	◎	◎
Example 6	◎	◎◎	◎◎	◎	◎
Example 7	◎	◎◎	◎◎	◎	◎
Example 8	◎	◎◎	◎◎	◎	◎
Example 9	◎	◎◎	◎◎	◎	◎
Example 10	◎	◎	◎	◎	◎
Example 11	◎	◎	◎	◎	◎
Example 12	◎	◎	◎	◎	◎
Example 13	◎	◎	◎	◎	◎

(continued)

Classification	Foaming due to detachment test	Fiber odor test	Fiber discoloration test	Carding performance test	Emulsion stability test
Example 14	◎	◎	◎	◎	◎
Example 15	◎	○	○	◎	◎
Example 16	◎	◎◎	◎◎	◎	○
Example 17	◎	◎	◎	◎	○
Example 18	◎	◎	◎	○	◎
Example 19	◎	◎	◎	○	◎
Example 20	◎	◎	◎	○	◎
Example 21	◎	◎	◎	○	◎
Example 22	◎	◎	◎	○	◎
Example 23	○	◎	◎	○	○
Example 24	○	○	○	○	○
Comparative Example 1	×	×	×	◎	◎
Comparative Example 2	×	×	×	◎	○
Comparative Example 3	◎	×	○	○	×
Comparative Example 4	○	×	○	○	◎
Comparative Example 5	×	◎	◎	◎	◎
Comparative Example 6	◎	×	○	○	○
Comparative Example 7	◎	◎◎	◎◎	◎	×
Comparative Example 8	◎	×	×	◎	◎

[0092] As evident from the results shown in Table 2, the treatment agent of the present invention enhances the effect of reducing foaming due to detachment. In addition, it has the effect of reducing the odor in fibers to which the treatment agent has been attached.

[0093] The present disclosure also includes the following aspects.

(Clause 1)

[0094] A treatment agent for viscose rayon comprising a fatty acid derivative, at least one selected from the group consisting of a fatty acid and a fat or oil, and an antioxidant.

[0095] The fatty acid derivative is at least one selected from the group consisting of a compound obtained by adding 1 mol or more and 30 mol or less of ethylene oxide to 1 mol of a fatty acid having 12 or more and 24 or less carbon atoms, and an ester compound of 1 mol or more and 2 mol or less of a fatty acid having 12 or more and 24 or less carbon atoms and 1 mol of a compound obtained by polymerizing 4 mol or more and 50 mol or less of ethylene glycol.

[0096] The fatty acid has 12 or more and 24 or less carbon atoms.

[0097] The fat or oil is at least one selected from the group consisting of a vegetable oil, an animal oil, and a hydrogenated oil thereof.

(Clause 2)

[0098] The treatment agent for viscose rayon according to clause 1, wherein the treatment agent contains the fatty acid derivative in an amount of 80 parts by mass or more and 99.89 parts by mass or less, at least one of the fatty acid and the fat or oil in an amount of 0.01 parts by mass or more and 10 parts by mass or less, and the antioxidant in an amount of 0.1 parts by mass or more and 10 parts by mass or less, where the sum of the contents of the fatty acid derivative, at least one of the fatty acid and the fat or oil, and the antioxidant is taken as 100 parts by mass.

(Clause 3)

[0099] The treatment agent for viscose rayon according to clause 1, further comprising at least one selected from the group consisting of a lubricant and an anionic surfactant.

[0100] The lubricant is at least one selected from the group consisting of a hydrocarbon compound, an ester compound, excluding the fat or oil and the fatty acid derivative, and a silicone.

(Clause 4)

[0101] The treatment agent for viscose rayon according to clause 3, wherein the treatment agent contains the fatty acid derivative in an amount of 60 parts by mass or more and 98.89 parts by mass or less, at least one of the fatty acid and the fat or oil in an amount of 0.01 parts by mass or more and 10 parts by mass or less, the antioxidant in an amount of 0.1 parts by mass or more and 10 parts by mass or less, and the lubricant in an amount of 1 part by mass or more and 20 parts by mass or less, where the sum of the contents of the fatty acid derivative, at least one of the fatty acid and the fat or oil, the antioxidant, and the lubricant is taken as 100 parts by mass.

(Clause 5)

[0102] The treatment agent for viscose rayon according to clause 3, wherein the treatment agent contains the fatty acid derivative in an amount of 60 parts by mass or more and 98.89 parts by mass or less, at least one of the fatty acid and the fat or oil in an amount of 0.01 parts by mass or more and 10 parts by mass or less, the antioxidant in an amount of 0.1 parts by mass or more and 10 parts by mass or less, and the anionic surfactant in an amount of 1 part by mass or more and 20 parts by mass or less, where the sum of the contents of the fatty acid derivative, at least one of the fatty acid and the fat or oil, the antioxidant, and the anionic surfactant is taken as 100 parts by mass.

(Clause 6)

[0103] The treatment agent for viscose rayon according to clause 3, wherein the treatment agent contains the fatty acid derivative in an amount of 40 parts by mass or more and 97.89 parts by mass or less, at least one of the fatty acid and the fat or oil in an amount of 0.01 parts by mass or more and 10 parts by mass or less, the antioxidant in an amount of 0.1 parts by mass or more and 10 parts by mass or less, the lubricant in an amount of 1 part by mass or more and 20 parts by mass or less, and the anionic surfactant in an amount of 1 part by mass or more and 20 parts by mass or less, where the sum of the contents of the fatty acid derivative, at least one of the fatty acid and the fat or oil, the antioxidant, the lubricant, and the anionic surfactant is taken as 100 parts by mass.

(Clause 7)

[0104] The treatment agent for viscose rayon according to any one of clauses 1 to 6, wherein the viscose rayon is a short fiber of viscose rayon.

(Clause 8)

[0105] A viscose rayon to which the treatment agent for viscose rayon according to any one of clauses 1 to 6 is attached.

(Clause 9)

[0106] A short fiber of viscose rayon to which the treatment agent for viscose rayon according to any one of clauses 1 to 6 is attached.

(Clause 10)

[0107] A method for producing a spunlace nonwoven fabric, comprising the following first and second steps.

[0108] The first step involves carding the short fiber of viscose rayon according to clause 9 to produce a web.

[0109] The second step involves entangling the web obtained in the first step using water flow.

Claims

1. A treatment agent for viscose rayon comprising a fatty acid derivative, at least one selected from the group consisting of a fatty acid and a fat or oil, and an antioxidant, wherein

   the content of the antioxidant in the treatment agent for viscose rayon is 0.1% by mass or more and 10% by mass or less,
   the fatty acid derivative is at least one selected from the group consisting of a compound obtained by adding 1 mol or more and 30 mol or less of ethylene oxide to 1 mol of a fatty acid having 12 or more and 24 or less carbon atoms, and an ester compound of 1 mol or more and 2 mol or less of a fatty acid having 12 or more and 24 or less carbon atoms and 1 mol of a compound obtained by polymerizing 4 mol or more and 50 mol or less of ethylene glycol, the fatty acid has 12 or more and 24 or less carbon atoms, and
   the fat or oil is at least one selected from the group consisting of a vegetable oil, an animal oil, and a hydrogenated oil thereof.

2. The treatment agent for viscose rayon according to claim 1, wherein the treatment agent contains the fatty acid derivative in an amount of 80 parts by mass or more and 99.89 parts by mass or less, at least one of the fatty acid and the fat or oil in an amount of 0.01 parts by mass or more and 10 parts by mass or less, and the antioxidant in an amount of 0.1 parts by mass or more and 10 parts by mass or less, where the sum of the contents of the fatty acid derivative, at least one of the fatty acid and the fat or oil, and the antioxidant is taken as 100 parts by mass.

3. The treatment agent for viscose rayon according to claim 1, further comprising at least one selected from the group consisting of a lubricant and an anionic surfactant,
   wherein the lubricant is at least one selected from the group consisting of a hydrocarbon compound, an ester compound, excluding the fat or oil and the fatty acid derivative, and a silicone.

4. The treatment agent for viscose rayon according to claim 3, wherein the treatment agent contains the fatty acid derivative in an amount of 60 parts by mass or more and 98.89 parts by mass or less, at least one of the fatty acid and the fat or oil in an amount of 0.01 parts by mass or more and 10 parts by mass or less, the antioxidant in an amount of 0.1 parts by mass or more and 10 parts by mass or less, and the lubricant in an amount of 1 part by mass or more and 20 parts by mass or less, where the sum of the contents of the fatty acid derivative, at least one of the fatty acid and the fat or oil, the antioxidant, and the lubricant is taken as 100 parts by mass.

5. The treatment agent for viscose rayon according to claim 3, wherein the treatment agent contains the fatty acid derivative in an amount of 60 parts by mass or more and 98.89 parts by mass or less, at least one of the fatty acid and the fat or oil in an amount of 0.01 parts by mass or more and 10 parts by mass or less, the antioxidant in an amount of 0.1 parts by mass or more and 10 parts by mass or less, and the anionic surfactant in an amount of 1 part by mass or more and 20 parts by mass or less, where the sum of the contents of the fatty acid derivative, at least one of the fatty acid and the fat or oil, the antioxidant, and the anionic surfactant is taken as 100 parts by mass.

6. The treatment agent for viscose rayon according to claim 3, wherein the treatment agent contains the fatty acid derivative in an amount of 40 parts by mass or more and 97.89 parts by mass or less, at least one of the fatty acid and the fat or oil in an amount of 0.01 parts by mass or more and 10 parts by mass or less, the antioxidant in an amount of 0.1 parts by mass or more and 10 parts by mass or less, the lubricant in an amount of 1 part by mass or more and 20 parts by mass or less, and the anionic surfactant in an amount of 1 part by mass or more and 20 parts by mass or less, where the sum of the contents of the fatty acid derivative, at least one of the fatty acid and the fat or oil, the antioxidant, the lubricant, and the anionic surfactant is taken as 100 parts by mass.

7. The treatment agent for viscose rayon according to any one of claims 1 to 6, wherein the viscose rayon is a short fiber of viscose rayon.

8. A viscose rayon to which the treatment agent for viscose rayon according to any one of claims 1 to 6 is attached.

9. A short fiber of viscose rayon to which the treatment agent for viscose rayon according to any one of claims 1 to 6 is attached.

10. A method for producing a spunlace nonwoven fabric, comprising first and second steps:

the first step involves carding the short fiber of viscose rayon according to claim 9 to produce a web; and the second step involves entangling the web obtained in the first step using water flow.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2023/032301

A. CLASSIFICATION OF SUBJECT MATTER

D06M 13/224(2006.01)i; ***D04H 1/4258***(2012.01)i; ***D04H 1/492***(2012.01)i; ***D06M 13/184***(2006.01)i; *D06M 101/06*(2006.01)n
FI: D06M13/224; D04H1/4258; D04H1/492; D06M13/184; D06M101:06

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)

D06M13/00-15/715; D04H1/00-18/04

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 2020-109221 A (TAKEMOTO YUSHI KABUSHIKI KAISHA) 16 July 2020 (2020-07-16) paragraphs [0037]-[0050], examples, table 1	1-10
A	JP 2012-229506 A (MATSUMOTO YUSHI-SEIYAKU CO., LTD.) 22 November 2012 (2012-11-22) paragraphs [0050], [0060]-[0066]	1-10
A	WO 2007/108206 A1 (MATSUMOTO YUSHI-SEIYAKU CO., LTD.) 27 September 2007 (2007-09-27) paragraphs [0057], [0076]-[0079]	1-10
A	CN 113005634 A (LI, Sipeng) 22 June 2021 (2021-06-22) claim 2	1-10

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

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Date of the actual completion of the international search	Date of mailing of the international search report
02 November 2023	**14 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.

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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/JP2023/032301

Patent document cited in search report	Publication date (day/month/year)	Patent family member(s)	Publication date (day/month/year)
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JP 2012-229506 A	22 November 2012	(Family: none)	
WO 2007/108206 A1	27 September 2007	KR 10-2008-0104120 A CN 101374992 A	
CN 113005634 A	22 June 2021	(Family: none)	

Form PCT/ISA/210 (patent family annex) (January 2015)

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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