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(54) **FIBER-TREATING AGENT**

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(57) **ABSTRACT**
A fiber-treating agent including the following components (A) to (C) and having a turbidity of 1,000 NTU or less, where a part or all of the components (A) and (B) are optionally a condensate formed from the components: (A): formaldehyde or a hydrate thereof, (B): a phenolic compound having an electron donating group on at least one of meta-positions and a hydrogen atom on at least one of ortho-positions and a para-position, where the electron donating group on the meta-position optionally forms, together with adjacent carbon atoms, a benzene ring optionally substituted with a hydroxy group, and (C): water.

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FIBER-TREATING AGENT

FIELD OF THE INVENTION

[0001] The present invention relates to a fiber-treating agent for imparting water resistance, heat resistance and heat shape memory ability to naturally derived fibers which are used for hair ornament products such as wigs and extensions.

BACKGROUND OF THE INVENTION

[0002] Examples of applications of naturally derived fibers include hair ornament products such as wigs and extensions. Unlike synthetic fibers, naturally derived fibers have natural texture and appearance originating from a natural material. Among naturally derived fibers, regenerated protein fibers, for example, regenerated collagen fibers are obtained by solubilizing acid-soluble collagen or insoluble collagen with an alkali or an enzyme to obtain a spinning stock solution, and discharging the spinning stock solution into a coagulation bath through a spinning nozzle to form fibers.

[0003] However, regenerated collagen fibers generally have higher hydrophilicity and hence higher water absorption as compared to synthetic fibers, and the fibers have extremely low mechanical strength when they contain a large amount of water. This leads to deterioration of suitability as a hair ornament product such that during shampooing, mechanical strength significantly decreases because of the high water absorption, and during subsequent blowing with a hair drier, rupture occurs.

[0004] Regenerated collagen fibers also have the problem of low heat resistance, so that if a set using a hair iron is performed at a temperature as high as that for human hair, shrinkage or crimping occurs, resulting in impairment of visual quality.

[0005] Further, in plastic synthetic fibers, the shape in a heat set with a hair iron or the like is continuously memorized even after subsequent hair washing (there is heat shape memory ability), whereas in regenerated collagen fibers, the shape in a heat set with a hair iron or the like is lost through subsequent hair washing (there is no heat shape memory ability). Therefore, regenerated collagen fibers are inferior to conventional plastic synthetic fibers in terms of degree of freedom of styling.

[0006] The three points described above are a factor in limiting popularization of regenerated collagen fibers which are used for hair ornament products. In particular, water resistance, that is, a decrease in mechanical strength has a significant impact when it is wet. On the other hand, in the field of human hair fibers also used for hair ornament products, a method is known in which to human hair fibers having essentially no heat shape memory ability, a specific aldehyde derivative and phenolic compound are applied for newly imparting heat shape memory ability (Patent Literature 1).

CITATION LIST

Patent Literature

[0007] Patent Literature 1: JP-A-2019-143281

SUMMARY OF THE INVENTION

[0008] The present invention provides a fiber-treating agent comprising the following components (A) to (C) and having a turbidity of 1,000 NTU or less, wherein a part or all of the components (A) and (B) are optionally a condensate formed from the components:

[0009] (A): formaldehyde or a hydrate thereof;

[0010] (B): a phenolic compound having an electron donating group on at least one of meta-positions and a hydrogen atom on at least one of ortho-positions and a para-position, wherein the electron donating group on the meta-position optionally forms, together with adjacent carbon atoms, a benzene ring optionally substituted with a hydroxy group; and

[0011] (C): water.

[0012] Further, the present invention provides a method for treating fibers, comprising the following step (i):

[0013] (i) immersing fibers in the fiber-treating agent to treat the fibers while maintaining a state in which the turbidity of the treating agent is 1,000 NTU or less.

[0014] Further, the present invention provides a method for producing fibers for hair ornament products, comprising a step of treating fibers by the method for treating fibers.

[0015] Further, the present invention provides a method for producing a hair ornament product, comprising a step of treating fibers by the method for treating fibers.

[0016] Further, the present invention provides a fiber for hair ornament products, comprising a condensate formed from the components (A) and (B).

[0017] Further, the present invention provides a hair ornament product having, as a constituent element, fibers comprising a condensate formed from the components (A) and (B).

DETAILED DESCRIPTION OF THE INVENTION

[0018] In some situations of production of hair ornament products, fibers are intensively extended, and in the technique disclosed in Patent Literature 1, there are cases where the stretchability (tenacity) of treated fibers is not sufficient. For this reason, it is required to enhance the stretchability of treated fibers for preventing rupture during extension.

[0019] Accordingly, the present invention relates to a fiber-treating agent for producing fibers for hair ornament products in which the water resistance and the heat resistance of naturally derived fibers typified by regenerated collagen fibers are improved, heat shape memory ability is imparted, and the fibers are excellent in stretchability (tenacity).

[0020] The present inventor found that when the fiber-treating agent disclosed in Patent Literature 1 is handled on the basis of the method for treating fibers in this document, a composition in which the fibers are immersed is changed through two-step phases. That is, in the phase 1, formaldehyde and a phenolic compound are present while reacting independently of each other, and in the phase 2, the formaldehyde and the phenolic compound grow while reacting with each other to form a condensation product, so that the turbidity of the composition increases.

[0021] The present inventor found that when naturally derived fibers are brought into contact with the composition in the phase 2, a hard resin layer is formed on the surfaces of the fibers, and thus motions, such as bending and stretch-

ing, of the fibers are restricted, so that it is difficult to maintain the stretchability (tenacity) of the naturally derived fibers, and the feel of the fiber surfaces is deteriorated.

[0022] The present inventor has further conducted studies on the basis of the above-described findings, and resultantly found that by treating naturally derived fibers with a composition containing formaldehyde and a specific phenolic compound and having a turbidity of 1,000 NTU or less while maintaining a state in which the turbidity of the treating agent is 1,000 NTU or less, not only the water resistance and the heat resistance of the naturally derived fibers are improved, so that heat shape memory ability can be imparted, but also surprisingly, the stretchability (tenacity) of the naturally derived fibers is improved as compared to that before the treatment, and can be enhanced to a level close to that of human hair, and the feel of the fiber surfaces can also be improved, leading to completion of the present invention. While it is common knowledge that when fibers are treated with a treating agent like that used in Cited Literature 1, formaldehyde cross-links tissues, and therefore the tissues become fragile after the treatment, it is surprising that results have been obtained which show that stretchability (tenacity) is improved as compared to that before the treatment when naturally derived fibers are used as an object to be treated.

[0023] According to the present invention, it is possible to provide a fiber-treating agent for producing fibers for hair ornament products in which the water resistance and the heat resistance of naturally derived fibers are improved, heat shape memory ability is imparted, and stretchability (tenacity) is improved.

[Fibers to be Treated in the Present Invention]

[0024] Fibers to be treated with the fiber-treating agent of the present invention may be either synthetic fibers or naturally derived fibers, and are preferably naturally derived fibers. The naturally derived fiber refers to fibers which are taken from a natural animal or plant, or artificially produced using keratin, collagen, casein, soybeans, peanuts, corn, silk flocks, silk fibroin or the like as a raw material and which are used for production of a hair ornament product. Among them, fibers produced using keratin, collagen, casein, soybeans, peanuts, corn, silk flocks, silk fibroin or the like as a raw material are preferable, regenerated protein fibers such as regenerated collagen fibers made from collagen as a raw material or regenerated silk fibers made from silk fibroin as a raw material are more preferable, and regenerated collagen fibers are further more preferable.

[0025] Regenerated collagen fibers can be produced by a known technique, are not required to have a composition of collagen 100%, and may contain a natural or synthetic polymer and additives for improvement of quality. The regenerated collagen fibers may be post-processed. Regenerated collagen fibers are preferably in the form of filaments. Filaments are generally taken from fibers wound around a bobbin or packed in a box. It is also possible to directly use filaments coming out from a drying step in a production process of regenerated collagen fibers.

[Condensate Formed from Components (A) and (B)]

[0026] In the fiber-treating agent of the present invention, formaldehyde as a component (A) and a phenolic compound as a component (B) may be contained as the compounds themselves, or may be contained with a part or all of the components (A) and (B) being a condensate formed from the

components. The condensate may include water-soluble condensates having a small molecular weight, and water-insoluble condensates formed by linkage of the water-soluble condensates as long as the turbidity is 1,000 NTU or less. Herein, the condensate includes both water-soluble and water-insoluble condensates when referred to simply as a "condensate".

[0027] Here, NTU (nephelometric turbidity unit) is a unit of turbidity in a turbidimetric method using formazin as a turbidity standard solution. The turbidity of the fiber-treating agent can be measured at room temperature (25° C.) with the fiber-treating agent directly placed in a measurement cell of a digital turbidimeter (manufactured by AS ONE Corporation/model: TB700).

[Component (A): Formaldehyde or Hydrate Thereof]

[0028] Examples of the hydrate of formaldehyde include formaldehyde monohydrate (methanediol). Among them, formaldehyde is preferable from the viewpoint of imparting higher shape sustainability and durability to naturally derived fibers after treatment.

[0029] The content of a constituent element derived from the component (A) in the fiber-treating agent of the present invention is preferably 0.1 mass % or more, more preferably 0.2 mass % or more, further more preferably 0.3 mass % or more, even more preferably 0.5 mass % or more, from the viewpoint of imparting higher shape sustainability and strength to naturally derived fibers after treatment, and preferably 80 mass % or less, more preferably 60 mass % or less, further more preferably 50 mass % or less, even more preferably 40 mass % or less, even more preferably 30 mass % or less, from the viewpoint of formulation compatibility in addition to the above-described viewpoint.

[0030] That is, the content of a constituent element derived from the component (A) in the fiber-treating agent in the present invention is preferably from 0.1 to 80 mass %, more preferably from 0.2 to 60 mass %, further more preferably from 0.3 to 50 mass %, even more preferably from 0.5 to 40 mass %, even more preferably from 0.5 to 30 mass %, from the viewpoint of imparting higher shape sustainability and strength to naturally derived fibers after treatment and the viewpoint of formulation compatibility.

[0031] Herein, the term "constituent element derived from the component (A)" refers to a constituent part derived from the component (A) in the condensate and the remaining component (A).

[0032] When the component (B) is a component (B1) or a component (B2), the content of a constituent element derived from the component (A) in the fiber-treating agent of the present invention is preferably 0.1 mass % or more, more preferably 1 mass % or more, further more preferably 3 mass % or more, even more preferably 5 mass % or more and preferably 80 mass % or less, more preferably 60 mass % or less, further more preferably 50 mass % or less, even more preferably 40 mass % or less, even more preferably 30 mass % or less, from the viewpoint of imparting higher shape sustainability and strength to fibers after treatment and the viewpoint of formulation compatibility. That is, when the component (B) is the component (B1) or the component (B2), the content of a constituent element derived from the component (A) in the fiber-treating agent of the present invention is preferably from 0.1 to 80 mass %, more preferably from 1 to 60 mass %, further more preferably

from 3 to 50 mass %, even more preferably from 5 to 40 mass %, even more preferably from 5 to 30 mass %.

[0033] When the component (B) is a component (B3), the content of a constituent element derived from the component (A) in the fiber-treating agent of the present invention is preferably 0.1 mass % or more, more preferably 0.2 mass % or more, further more preferably 0.3 mass % or more, even more preferably 0.5 mass % or more, and preferably 50 mass % or less, more preferably 40 mass % or less, further more preferably 30 mass % or less, even more preferably 20 mass % or less, even more preferably 10 mass % or less, from the viewpoint of imparting higher shape sustainability and strength to fibers after treatment and the viewpoint of formulation compatibility. That is, when the component (B) is the component (B3), the content of a constituent element derived from the component (A) in the fiber-treating agent of the present invention is preferably from 0.1 to 50 mass %, more preferably from 0.2 to 40 mass %, further more preferably from 0.3 to 30 mass %, even more preferably from 0.5 to 20 mass %, even more preferably from 0.5 to 10 mass %.

[Component (B): Specific Phenolic Compound]

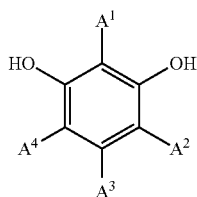
[0034] The component (B) is a phenolic compound having an electron donating group on at least one, preferably two of meta-positions and a hydrogen atom on at least one of ortho-positions and a para-position. The electron donating group on the meta-position of the phenolic compound may form a benzene ring together with an adjacent carbon atom, and the benzene ring may be further substituted with a hydroxy group. The molecular weight of the component (B) is preferably 110 or more, and preferably 1,000 or less, more preferably 700 or less, further more preferably 500 or less, from the viewpoint of good infiltration into naturally derived fibers. Examples of the phenolic compound of the component (B) include the following components (B1), (B2) and (B3).

[0035] (B1) resorcin derivative of formula (1)

[0036] (B2) Naphthol derivative of formula (2) or (3)

[0037] (B3) Flavan-3-ol derivative of formula (4)

[0038] The component (B1) is a compound of the following formula (1):

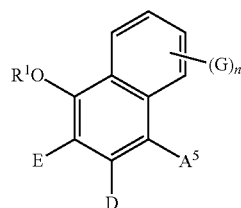


[0039] wherein

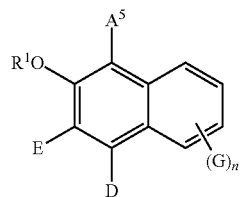
[0040] A^1 to A^4 are the same or different, and each represents a hydrogen atom, a hydroxy group, a halogen atom, a carboxyl group or a salt thereof, a sulfonic acid group or a salt thereof, a linear or branched alkyl group or alkenyl group having 1 to 6 carbon atoms, or a linear or branched alkoxy group or alkenyloxy group having 1 to 6 carbon atoms.

[0041] Examples of the component (B1) include resorcin, 2-methylresorcin, 4-chlororesorcin, and pyrogallol.

[0042] The component (B2) is a compound of the following formula (2) or (3):



(2)



(3)

[0043] where in

[0044] R^1 represents a hydrogen atom or a methyl group,

[0045] A^5 represents a hydrogen atom, a linear or branched alkyl group or alkenyl group having 1 to 12 carbon atoms, an optionally substituted aralkyl group or arylalkenyl group having 7 to 12 carbon atoms, a linear or branched alkoxy group or alkenyloxy group having 1 to 6 carbon atoms, a halogen atom or $-\text{CO}-R^2$ (R^2 is a linear or branched alkyl group or alkenyl group having 1 to 12 carbon atoms, an optionally substituted aralkyl group or arylalkenyl group having 7 to 12 carbon atoms, or an optionally substituted aromatic hydrocarbon group having 6 to 12 carbon atoms),

[0046] D represents a hydrogen atom, a hydroxy group, a methyl group, or a linear or branched alkoxy group or alkenyloxy group having 1 to 12 carbon atoms,

[0047] E represents a hydrogen atom, a hydroxy group, a linear or branched alkyl group or alkenyl group having 1 to 6 carbon atoms, or an alkoxy group or alkenyloxy group having 1 to 6 carbon atoms, and

[0048] G represents a hydroxy group, a linear or branched alkyl group or alkenyl group having 1 to 6 carbon atoms, or an alkoxy group having 1 to 6 carbon atoms, and n represents an integer of 0 to 2.

[0049] In the naphthol derivative of formula (2) or (3), R^1 in formula (2) or (3) is preferably a hydrogen atom, or an alkyl group or alkenyl group having 1 to 4 carbon atoms, more preferably a hydrogen atom.

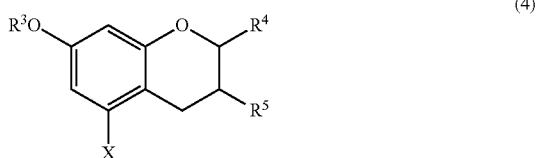
[0050] A^5 is preferably a hydrogen atom, a hydroxy group, a linear or branched alkyl group having 1 to 4 carbon atoms, or an alkoxy group having 1 to 4 carbon atoms, more preferably a hydrogen atom or a hydroxy group.

[0051] D is preferably a hydrogen atom, a hydroxy group, a linear or branched alkyl group having 1 to 4 carbon atoms, or an alkoxy group having 1 to 4 carbon atoms.

[0052] E is preferably a hydrogen atom, a hydroxy group, an alkyl group having 1 to 4 carbon atoms, or an alkoxy group having 1 to 4 carbon atoms.

[0053] Examples of the compound include 1-naphthol, 2-naphthol, 3-methylnaphthalen-1-ol, naphthalene-1,5-diol, and naphthalene-1,8-diol.

[0054] The compound (B3) is a flavan-3-ol derivative of the following formula (4):



[0055] wherein

[0056] R^3 represents a hydrogen atom or a methyl group,

[0057] X represents a hydrogen atom, a hydroxy group or a methoxy group,

[0058] R^4 represents an aromatic hydrocarbon group optionally substituted with up to 3 hydroxy groups or methoxy groups and optionally forming a fused ring with 1,3-dioxolane, and

[0059] R^5 represents a hydroxy group, a methoxy group, an aromatic hydrocarbon group optionally substituted with up to 3 hydroxy groups or methoxy groups and optionally forming a fused ring with 1,3-dioxolane, or an arylcarbonyloxy group or aralkylcarbonyloxy group optionally substituted with up to 3 hydroxy groups or methoxy groups.

[0060] The molecular weight of the compound of formula (4) is preferably 150 or more. From the viewpoint of good infiltration into fibers, the molecular weight is preferably 1,000 or less, more preferably 700 or less, further more preferably 500 or less.

[0061] Examples of the component (B3) include non-gallates such as catechin, epicatechin and epigallocatechin, and gallates such as catechin gallate, epicatechin gallate and epigallocatechin gallate, and herein, the term “catechins” is a generic term of these compounds. Among them, one or more selected from the group consisting of catechin, epigallocatechin and epigallocatechin gallate are preferable. It is also possible to use a mixture containing any of the above-described compounds, such as a tea extract.

[0062] Analysis of catechins in a mixture can be performed by an analysis method appropriate to a measurement sample among known methods for analyzing non-polymeric catechins. It is possible to perform the analysis by, for example, a liquid chromatography (HPLC) method. In the measurement, treatment may be appropriately performed if necessary, such as freeze-drying of the sample for adaptation to the detection range of an apparatus, or removal of contaminants in the sample for adaptation to the resolution of an apparatus.

[0063] From the viewpoint of more significantly changing the shape of naturally derived fibers after treatment with a fiber-treating agent of the present invention by a condensate of the component (A) and the component (B) which is formed in the naturally derived fibers, further improving the shape sustainability and durability of the naturally derived fibers, and further improving natural appearance and feel quality, the component (B) is preferably one or more selected from the group consisting of resorcin, 1-naphthol,

2-naphthol, 3-methylnaphthalen-1-ol, naphthalene-1,5-diol, naphthalene-1,8-diol, catechin, epicatechin, epigallocatechin, catechin gallate, epicatechin gallate, epigallocatechin gallate and a tea extract, more preferably one or more selected from the group consisting of resorcin, catechin, epicatechin, epigallocatechin, catechin gallate, epicatechin gallate, epigallocatechin gallate and a tea extract.

[0064] One component (B) may be used alone, or two or more types may be used in combination, and two or more of (B1) to (B3) may be used in combination. One or more selected from the group consisting of (B1) and (B3) are preferable from the viewpoint of being able to impart higher shape sustainability and durability to naturally derived fibers and the viewpoint of enhancing feel quality, and (B3) is more preferable from the viewpoint of being able to improve productivity in a factory by suppressing elution of the component (A) from treated fibers to omit a fiber washing step and the viewpoint of making coloring of fibers minimal to enhance suitability for use for hair ornament products.

[0065] The content of a constituent element derived from the component (B) in the fiber-treating agent of the present invention is preferably 0.1 mass % or more, more preferably 1 mass % or more, further more preferably 2.5 mass % or more, even more preferably 5 mass % or more, from the viewpoint of imparting higher shape sustainability and strength to naturally derived fibers after treatment, and preferably 80 mass % or less, more preferably 60 mass % or less, further more preferably 50 mass % or less, even more preferably 40 mass % or less, even more preferably 35 mass % or less, even more preferably 30 mass % or less, from the viewpoint of improving the feel of the fiber surfaces in addition to the above-described viewpoint.

[0066] The content of a constituent element derived from the component (B) in the fiber-treating agent of the present invention is preferably from 0.1 to 80 mass %, more preferably from 1 to 60 mass %, further more preferably from 2.5 to 50 mass %, even more preferably from 5 to 40 mass %, even more preferably from 5 to 35 mass %, even more preferably from 5 to 30 mass %, from the viewpoint of imparting higher shape sustainability and strength to treated fibers and the viewpoint of improving the feel of the fiber surfaces.

[0067] Herein, the term “constituent element derived from the component (B)” refers to a constituent part derived from the component (B) in the condensate and the remaining component (B). When a mixture containing the component (B) is used, such as a mixture containing catechins, such as a tea extract, the above-mentioned term refers to the component (B) contained in the mixture.

[0068] When the component (B) is the component (B1) or the component (B2), the content of a constituent element derived from the component (B) in the fiber-treating agent of the present invention is preferably 0.1 mass % or more, more preferably 1 mass % or more, further more preferably 2.5 mass % or more, even more preferably 5 mass % or more, and preferably 60 mass % or less, more preferably 50 mass % or less, further more preferably 40 mass % or less, even more preferably 35 mass % or less, even more preferably 30 mass % or less, from the viewpoint of imparting higher shape sustainability and strength to treated fibers and the viewpoint of improving the feel of the fiber surfaces. That is, when the component (B) is the component (B1) or the component (B2), the content of a constituent element derived from the component (B) in the fiber-treating agent of

the present invention is preferably from 0.1 to 60 mass %, more preferably from 1 to 50 mass %, further more preferably from 2.5 to 40 mass %, even more preferably from 5 to 35 mass %, even more preferably from 5 to 30 mass %.

[0069] When the component (B) is the component (B3), the content of a constituent element derived from the component (B) in the fiber-treating agent of the present invention is preferably 0.1 mass % or more, more preferably 0.2 mass % or more, further more preferably 0.5 mass % or more, even more preferably 1 mass % or more, even more preferably 2 mass % or more, and preferably 50 mass % or less, more preferably 40 mass % or less, further more preferably 30 mass % or less, even more preferably 20 mass % or less, even more preferably 15 mass % or less, from the viewpoint of imparting higher shape sustainability and strength to treated fibers and the viewpoint of improving the feel of the fiber surfaces. That is, when the component (B) is the component (B3), the content of a constituent element derived from the component (B) in the fiber-treating agent of the present invention is preferably from 0.1 to 50 mass %, more preferably from 0.2 to 40 mass %, further more preferably from 0.5 to 30 mass %, even more preferably from 1 to 20 mass %, even more preferably from 2 to 15 mass %.

[0070] When the component (B) is the component (B1) or the component (B2), the total content of a constituent element derived from the component (A) and a constituent element derived from the component (B) in the fiber-treating agent of the present invention is preferably 1 mass % or more, more preferably 5 mass % or more, further more preferably 10 mass % or more, even more preferably 20 mass % or more, from the viewpoint of imparting higher shape sustainability and strength to treated fibers, and preferably 80 mass % or less, more preferably 60 mass % or less, further more preferably 50 mass % or less, even more preferably 40 mass % or less, even more preferably 30 mass % or less, from the viewpoint of improving the feel of the fiber surfaces.

[0071] When the component (B) is the component (B3), the total content of a constituent element derived from the component (A) and a constituent element derived from the component (B) in the fiber-treating agent of the present invention is preferably 0.1 mass % or more, more preferably 1 mass % or more, further more preferably 2.5 mass % or more, even more preferably 4 mass % or more, even more preferably 5 mass % or more, from the viewpoint of imparting higher shape sustainability and strength to treated fibers, and preferably 50 mass % or less, more preferably 30 mass % or less, further more preferably 20 mass % or less, even more preferably 15 mass % or less, from the viewpoint of improving the feel of the fiber surfaces.

[0072] The molar ratio of a constituent element derived from the component (A) to a constituent element derived from the component (B), (A)/(B), in the fiber-treating agent of the present invention is preferably 0.005 or more, more preferably 0.01 or more, further more preferably 0.05 or more, even more preferably 0.1 or more, even more preferably 0.5 or more, from the viewpoint of further improving the shape sustainability and strength of naturally derived fibers after treatment by a condensate of the components which is formed in the naturally derived fibers, and preferably less than 5, more preferably 4 or less, further more preferably 3 or less, even more preferably 2 or less, from the viewpoint of a good feel.

[0073] That is, the molar ratio of a constituent element derived from the component (A) to a constituent element derived from the component (B), (A)/(B), is preferably 0.005 or more and less than 5, more preferably from 0.01 to 4, further more preferably from 0.05 to 3, even more preferably from 0.1 to 2, even more preferably from 0.5 to 2, from the viewpoint of further improving the shape sustainability and strength of naturally derived fibers after treatment by a condensate of the components which is formed in the naturally derived fibers, and the viewpoint of a good feel.

[Component (C): Water]

[0074] The fiber-treating agent of the present invention has water as a medium. The content of the component (C) in the fiber-treating agent of the present invention is preferably 10 mass % or more, more preferably 20 mass % or more, further more preferably 30 mass % or more, even more preferably 40 mass % or more, and preferably 99 mass % or less, more preferably 98 mass % or less, further more preferably 97 mass % or less, even more preferably 95 mass % or less.

[0075] That is, the content of the component (C) in the fiber-treating agent of the present invention is preferably from 10 to 99 mass %, more preferably from 20 to 98 mass %, further more preferably from 30 to 97 mass %, even more preferably from 40 to 95 mass %.

[Component (D): Organic Compound Having a Hansen Solubility Parameter SP Value of from 16 to 40 Mpa^{1/2}]

[0076] If an insoluble condensate having a large molecular weight is formed in the fiber-treating agent of the present invention by a reaction with the components (A) and (B), motions, such as bending and stretching, of naturally derived fibers may be restricted by a hard resin layer formed on the surfaces of the naturally derived fibers, resulting in not only impairment of the stretchability (tenacity) of the fibers but also deterioration of the feel of the fiber surfaces. Thus, it is preferable that the fiber-treating agent of the present invention contains an organic compound having a Hansen solubility parameter SP value of 16 Mpa^{1/2} or more and 40 Mpa^{1/2} or less, provided that organic salts and compounds having an aldehyde group and having a molecular weight of 150 or less are excluded, from the viewpoint of easily dissolving oligomeric condensation products of the components (A) and (B), which are formed in the process of reaction and cause an increase in turbidity, by preventing aggregation of the oligomeric condensation products. Since organic salts, which have charge, rapidly increase the turbidity when present in the system, and compounds having an aldehyde group, such as glutaraldehyde, rapidly increase the turbidity by cross-linking phenol compounds of the component (B) at multiple points, the organic salts and the compounds having an aldehyde group are excluded from the component (D).

[0077] In the present invention, the Hansen solubility parameter SP value refers to δ_{Tot} (Mpa^{1/2}) calculated at 25° C. in the DIY program using Software Package HSPiP 4th Edition 4.1.07 based on Hansen Solubility Parameters: A User's handbook, CRC Press, Boca Raton FL, 2007.

[0078] Examples of the organic compound having a Hansen solubility parameter SP value of 16.0 Mpa^{1/2} or more and 40.0 Mpa^{1/2} or less in the compound (D) include monohydric alcohols, dihydric alcohols, dihydric alcohol derivatives, polyhydric alcohols with a valence number of 3

or more, lactam, imidazolidinone, pyrimidinone, lactone, alkylene carbonate, and other general-purpose organic solvents whose SP value is within the above-described range.

[0079] Specific examples of the compound having a Hansen solubility parameter SP value of $16 \text{ Mpa}^{1/2}$ or more and $40 \text{ Mpa}^{1/2}$ or less are listed below. The parenthesized numerical value in each example is a SP value calculated by the above-described method.

[0080] Examples of monohydric alcohol: ethanol (25.4), 1-propanol (22.9), isopropyl alcohol (22.3) and 1-butanol (22.9)

[0081] Examples of dihydric alcohol: ethylene glycol (31.6), diethylene glycol (29.2), triethylene glycol (26.1), tetraethylene glycol (24.3), pentaethylene glycol (23.1), hexaethylene glycol (22.2), propylene glycol (31.7), 1-dipropylene glycol (26.0) and tripropylene glycol (23.4)

[0082] Examples of dihydric alcohol derivative: dipropylene glycol monomethyl ether (21.1), dipropylene glycol dimethyl ether (17.8), dipropylene glycol diacetate (19.0) and dipropylene glycol monomethyl ether acetate (18.5)

[0083] Examples of polyhydric alcohol with a valence number of 3 or more: glycerin (35.7) and sorbitol (35.8)

[0084] Examples of lactam: 2-pyrrolidone (24.8) and N-methylpyrrolidone (22.0)

[0085] Examples of imidazolidinone: urea of ethylene (28.5), 1,3-dimethyl-2-imidazolidinone (22.3), dihydroxymethylethyleneurea (31.3), N,N'-dihydroxymethyl-4,5-dihydroxyethyleneurea (34.7) and DMDM hydantoin (28.1)

[0086] Examples of pyrimidinone: N,N'-dimethylpropyleneurea (21.3)

[0087] Examples of lactone: γ -butyrolactone (24.6)

[0088] Examples of alkylene carbonate: ethylene carbonate (29.2) and propylene carbonate (27.1)

[0089] Examples of general-purpose organic solvent: DMF (N,N-dimethylformamide) (24.2), DMAc (N,N-dimethylacetamide) (23.0), DMSO (dimethylsulfoxide) (23.6), THF (tetrahydrofuran) (18.2), 1,4-dioxane (20.5) and acetonitrile (23.9)

[0090] Among them, compounds having a Hansen solubility parameter SP value of $35.8 \text{ Mpa}^{1/2}$ or less are preferable, compounds having a Hansen solubility parameter SP value of $34.7 \text{ Mpa}^{1/2}$ or less are more preferable, and compounds having a Hansen solubility parameter SP value of $29.2 \text{ Mpa}^{1/2}$ or less are further more preferable, from the viewpoint of being able to maintain low turbidity over a longer time by adequately dissolving a condensate of the components (A) and (B) which is formed in the process of reaction and causes an increase in turbidity. From the same viewpoint, compounds having a Hansen solubility parameter SP value of $17.8 \text{ Mpa}^{1/2}$ or more are preferable, compounds having a Hansen solubility parameter SP value of $21.1 \text{ Mpa}^{1/2}$ or more are more preferable, and compounds having a Hansen solubility parameter SP value of $22.0 \text{ Mpa}^{1/2}$ or more are more preferable.

[0091] Among them, dihydric alcohols, lactam and imidazolidinone are preferable, and at least one selected from the group consisting of diethylene glycol (29.2), triethylene glycol (26.1), N-methylpyrrolidone (22.0), 1,3-dimethyl-2-imidazolidinone (22.3) and DMDM hydantoin (28.1) is more preferable.

[0092] Any one component (D) may be used alone, or two or more types may be used in combination. The content of the component (D) in the fiber-treating agent of the present invention is preferably 10 mass % or more, more preferably 15 mass % or more, further more preferably 25 mass % or more, from the viewpoint of long maintaining a state in which the turbidity of the fiber-treating agent is 1,000 NTU or less, and preferably 80 mass % or less, more preferably 60 mass % or less, further more preferably 45 mass % or less, from the viewpoint of efficiently carrying out a condensation reaction and further improving the shape sustainability and strength of naturally derived fibers after treatment by a condensate of the component (A) and the component (B) which is formed in the naturally derived fibers.

[Component (E): Sulfur-Containing Reducing Agent]

[0093] It is preferable that the fiber-treating agent of the present invention contains a sulfur-containing reducing agent from the viewpoint of improving the heat resisting temperature and suppressing coloring of naturally derived fibers after treatment, and suppressing an increase in turbidity of the fiber-treating agent during heating treatment.

[0094] Examples of the component (E) include sulfurous acid salts and thiol compounds. The sulfurous acid salt is preferably sodium sulfite or sodium pyrosulfite, and the thiol compound is preferably thioglycerol or Mesna (sodium 2-mercaptoethanesulfonate) because compounds having a carboxy group (for example thioglycolic acid) or an amino group (for example cysteamine) cause yellowish coloring, resulting in deterioration of suitability as a hair ornament product. Above all, sodium sulfite is preferable.

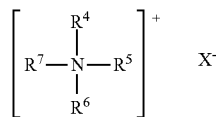
[0095] Any one component (E) may be used alone, or two or more types may be used in combination. The content of the component (E) in the fiber-treating agent of the present invention is preferably 0.1 mass % or more, more preferably 0.5 mass % or more, further more preferably 2.0 mass % or more, from the viewpoint of improving the heat resisting temperature, suppressing coloring, and suppressing an increase in turbidity during heating treatment, and preferably 20 mass % or less, more preferably 10 mass % or less, further more preferably 5.0 mass % or less from the viewpoint of suppressing a decrease in fiber strength by a reducing action.

[0096] The molar ratio of the component (E) to the component (A), (E)/(A), is preferably 0.1 or more, more preferably 0.3 or more, further more preferably 0.5 or more, from the viewpoint of sufficiently exhibiting the effect of improving the heat resistance and the effect of suppressing coloring of fibers treated with the component (E) and the effect of suppressing an increase in turbidity of the fiber-treating agent, and preferably 3.0 or less, more preferably 1.5 or less, further more preferably 1.0 or less from the viewpoint of suppressing a decrease in fiber strength by a reducing action.

[Cationic Surfactant]

[0097] The fiber-treating agent of the present invention may contain a cationic surfactant as long as the effects of the present invention are not impaired. The cationic surfactant is preferably a long chain monoalkyl quaternary ammonium salt having one alkyl group having 8 to 24 carbon atoms and three alkyl groups having 1 to 4 carbon atoms.

[0098] Preferably, at least one long chain monoalkyl quaternary ammonium surfactant is selected from the group consisting of compounds of the following formula:



[0099] wherein R⁴ is a saturated or unsaturated linear or branched alkyl group having 8 to 22 carbon atoms, R⁸—CO—NH—(CH₂)_m— or R⁸—CO—O—(CH₂)_m— (R⁸ represents a saturated or unsaturated linear or branched alkyl chain having 7 to 21 carbon atoms, and m represents an integer of 1 to 4), R⁵, R⁶ and R⁷ independently represent an alkyl group having 1 to 4 carbon atoms, or a hydroxyalkyl group having 1 to 4 carbon atoms, and X⁻ represents a hydrochloride ion, a bromide ion, a methosulfate ion or an ethosulfate ion.

[0100] Examples of the suitable cationic surfactant include long chain quaternary ammonium compounds such as cetyltrimethylammonium chloride, myristyltrimethylammonium chloride, behenyltrimethylammonium chloride, cetyltrimethylammonium bromide and stearamidopropyltrimonium chloride. One of them may be used alone, or a mixture thereof may be used.

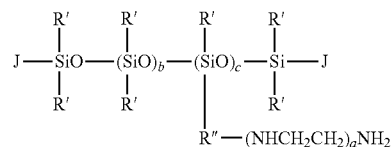
[0101] The content of the cationic surfactant in the fiber-treating agent of the present invention is preferably 0.05 mass % or more, more preferably 0.1 mass % or more, and preferably 10 mass % or less, more preferably 5 mass % or less, from the viewpoint of improving the feel of naturally derived fibers after treatment, and further improving the effects of the present invention.

[Silicone]

[0102] The fiber-treating agent of the present invention may contain silicone from the viewpoint of improving the feel of naturally derived fibers after treatment, and improving styling ease. The silicone is preferably one or more selected from the group consisting of dimethylpolysiloxane and amino-modified silicone.

[0103] As the dimethylpolysiloxane, any of cyclic or acyclic dimethylsiloxane polymers can be used, and examples thereof include SH200 Series, BY22-019, BY22-020, BY11-026, B22-029, BY22-034, BY22-050A, BY22-055, BY22-060, BY22-083 and FZ-4188 (each manufactured by Dow Corning Toray), and KF-9088, KM-900 Series, MK-15H and MK-88 (each manufactured by Shin-Etsu Chemical Co., Ltd.).

[0104] As the amino-modified silicone, any silicone having an amino group or an ammonium group can be used, and examples thereof include amino-modified silicone oil which is terminal-blocked at all or a part of terminal hydroxyl groups with a methyl group or the like, and amodimethicone which is not terminal-blocked. Examples of the amino-modified silicone preferable from the viewpoint of improving the feel of naturally derived fibers after treatment and improving styling ease include compounds of the following formula:



[0105] wherein R' represents a hydrogen atom, a hydroxy group or Ru, where R^X represents a substituted or unsubstituted monovalent hydrocarbon group having 1 to 20 carbon atoms, J represents R^X, R''—(NHCH₂CH₂)_aNH₂, OR^X or a hydroxy group, R'' represents a divalent hydrocarbon group having 1 to 8 carbon atoms, a represents a number of 0 to 3, and b and c represent numbers whose sum is 10 or more and less than 20,000, preferably 20 or more and less than 3,000, more preferably 30 or more and less than 1,000, further more preferably 40 or more and less than 800, in terms of number average.

[0106] Specific examples of the suitable commercially available product of amino-modified silicone include amino-modified silicone oils such as SF8452C and SS3551 (each manufactured by Dow Corning Toray) and KF-8004, KF-867S and KF-8015 (each manufactured by Shin-Etsu Chemical Co., Ltd.), and amodimethicone emulsions such as SM8704C, SM8904, BY22-079, FZ-4671 and FZ4672 (each manufactured by Dow Corning Toray).

[0107] The content of silicone in the fiber-treating agent of the present invention is preferably 0.1 mass % or more, more preferably 0.2 mass % or more, further more preferably 0.5 mass % or more, and preferably 20 mass % or less, more preferably 10 mass % or less, further more preferably 5 mass % or less, from the viewpoint of improving the feel of naturally derived fibers after treatment, and further improving the effects of the present invention.

[Cationic Polymer]

[0108] The fiber-treating agent of the present invention may contain a cationic polymer from the viewpoint of improving the feel of naturally derived fibers after treatment.

[0109] The cationic polymer refers to a polymer having a cationic group, or a group capable of being ionized into a cationic group, and also includes a generally cationic ampholytic polymer. That is, examples of the cationic polymer include those in the form of an aqueous solution, which contain an amino group or an ammonium group on the side chain of the polymer chain or contain a diallyl quaternary ammonium salt as a constituent unit, for example, cationized cellulose derivatives, cationic starch, cationized guar gum derivatives, polymers or copolymers of a diallyl quaternary ammonium salt, and quaternized polyvinylpyrrolidone derivatives. Among them, one or more selected from the group consisting of a polymer containing a diallyl quaternary ammonium salt as a constituent unit, a quaternized polyvinylpyrrolidone derivative and a cationized cellulose derivative are preferable, and one or more selected from the group consisting of a polymer or copolymer of a diallyl quaternary ammonium salt and a cationized cellulose derivative are more preferable, from the viewpoint of improving the effects of softness, smoothness and finger-combability in the feel during rinsing and shampooing and ease of styling and moisture retainability during blowing, and the stability of the agent.

[0110] Specific examples of the suitable polymer or copolymer of a diallyl quaternary ammonium salt include dimethyldiallylammonium chloride polymers (polyquaternium-6, for example, MERQUAT 100; Lubrizol Advanced Materials, Inc.), dimethyldiallylammonium chloride/acrylic acid copolymers (polyquaternium-22, for example, MERQUATs 280 and 295; Lubrizol Advanced Materials, Inc.), and dimethyldiallylammonium chloride/acrylamide copolymers (polyquaternium-7, for example, MERQUAT 550; Lubrizol Advanced Materials, Inc.).

[0111] Specific examples of the suitable quaternized polyvinylpyrrolidone derivative include polymers obtained by polymerizing a vinylpyrrolidone copolymer and dimethylaminoethyl methacrylate (polyquaternium 11, for example, GAFQUAT 734, GAFQUAT 755 and GAFQUAT 755N (Ashland Inc.)).

[0112] Specific examples of the suitable cationized cellulose include polymers obtained by adding glycidyltrimethylammonium chloride to hydroxycellulose (polyquaternium 10, for example, LEOGARDs G and GP (Lion Corporation) and POLYMERs JR-125, JR-400, JR-30M, LR-400 and LR-30M (Amerchol Corporation)), and hydroxyethylcellulose dimethyldiallylammonium chloride (polyquaternium-4, for example, CELQUATs H-100 and L-200 (Akzo Nobel N.V.)).

[0113] The content of the cationic polymer in the fiber-treating agent of the present invention is preferably 0.001 mass % or more, more preferably 0.01 mass % or more, further more preferably 0.05 mass % or more, and preferably 20 mass % or less, more preferably 10 mass % or less, from the viewpoint of improving the feel of naturally derived fibers after treatment.

[0114] Further, the fiber-treating agent of the present invention may contain an antioxidant such as ascorbic acid, and a pH adjuster such as sodium hydroxide, potassium hydroxide, phosphoric acid or hydrochloric acid.

[Turbidity]

[0115] It is desirable that the turbidity of the fiber-treating agent of the present invention be as low as possible from the viewpoint of improving the stretchability (tenacity) of naturally derived fibers and the viewpoint of improving the feel of the fiber surfaces. The turbidity of the fiber-treating agent is 1,000 NTU or less, preferably 500 NTU or less, more preferably 100 NTU or less, further more preferably 20 NTU or less. The turbidity of the fiber-treating agent refers to one from turbidness originating from a condensate of the components (A) and (B), and when other components causing turbidness are present, only turbidness caused by the condensate of the components (A) and (B) is taken into account. Here, the amount of the condensate can be determined by, for example, a derivatization-pyrolysis GC/MS method after filtration with a membrane filter having a pore diameter of 0.1 μm .

[pH]

[0116] The pH of the fiber-treating agent of the present invention is preferably 3.0 or more, more preferably 3.5 or more, further more preferably 4.0 or more, and preferably 11.0 or less, more preferably 9.0 or less, further more preferably 7.0 or less, from the viewpoint of suppressing damage to naturally derived fibers. The pH in the present invention is a value at 25° C.

[0117] That is, the pH of the fiber-treating agent of the present invention is preferably from 3.0 to 11.0, more

preferably from 3.5 to 9.0, further more preferably from 4.0 to 7.0 from the viewpoint of suppressing damage to naturally derived fibers.

[Method for Storing Fiber-Treating Agent]

[0118] When the fiber-treating agent produced as described above is transported and stored before being applied to fibers, or a raw material before preparation of the fiber-treating agent is transported and stored, the storage temperature can be set to a cool temperature or gap portions in a storage container can be filled with nitrogen for the purpose of preventing coloring of the component (B) by oxidation, and progress of an unintentional reaction during transportation. The storage temperature is preferably 1° C. or higher, more preferably 2° C. or higher, further more preferably 5° C. or higher, from the viewpoint of preventing occurrence of freezing and recrystallization, and preferably 25° C. or lower, more preferably 20° C. or lower, further more preferably 15° C. or lower, from the viewpoint of preventing coloring by oxidation and progress of an unintentional reaction.

[Method for Treating Fibers]

(Basic Treatment)

[0119] When using the fiber-treating agent of the present invention, naturally derived fibers are treated by a method comprising the following step (i), it is possible to impart shape sustainability and high durability to the naturally derived fibers while maintaining high stretchability (tenacity) of the naturally derived fibers.

[0120] (i) Immersing naturally derived fibers in the fiber-treating agent of the present invention to treat the fibers while maintaining a state in which the turbidity of the treating agent is 1,000 NTU or less.

[0121] The fiber-treating agent of the present invention may be directly applied to fibers, but when the fiber-treating agent is applied to the fibers after being heated for a certain time without causing an increase in turbidity of the treating agent, the stretchability of the fibers can be further enhanced. For this reason, the following step (0) may be provided before the step (i).

(0) Step of heating fiber-treating agent

[0122] The heating treatment in the step (0) is preferably 40° C. or higher, more preferably 45° C. or higher, further more preferably 50° C. or higher, from the viewpoint of improvement of productivity, and preferably 100° C. or lower, more preferably 80° C. or lower, further more preferably 70° C. or lower, from the viewpoint of being able to stop heating at an appropriate point.

[0123] When T is a heating time until the treating agent has a turbidity of more than 1,000 NTU after the treating agent is heated immediately after being prepared by mixing the components, the heating time in the step (0) is preferably 0.2 T or more, more preferably 0.3 T or more, further more preferably 0.4 T or more, from the viewpoint of exhibiting a stretchability improving effect on naturally derived fibers, and preferably 0.8 T or less, more preferably 0.7 T or less, further more preferably 0.6 T or less, from the viewpoint of exhibiting ability to treat naturally derived fibers for a long time.

[0124] In the step (i), the naturally derived fibers immersed in the fiber-treating agent may be dry or wet. The

amount of the fiber-treating agent in which the naturally derived fibers are immersed is preferably 2 or more, more preferably 3 or more, further more preferably 5 or more, even more preferably 10 or more, even more preferably 20 or more, and preferably 500 or less, more preferably 250 or less, further more preferably 100 or less, in terms of bath ratio to the mass of the naturally derived fibers (mass of fiber-treating agent/mass of naturally derived fibers).

[0125] That is, the bath ratio is preferably from 2 to 500, more preferably from 3 to 250, further more preferably from 5 to 100, even more preferably from 10 to 100, even more preferably from 20 to 100.

[0126] In the step (i), the naturally derived fibers may be fixed with a curler or the like, followed by immersion in the fiber-treating agent of the present invention under heating. This enables a desired shape to be imparted to the naturally derived fibers together with shape sustainability and high durability.

[0127] It is preferable that the immersion of the naturally derived fibers in the fiber-treating agent in the step (i) is performed under heating, and this heating is performed by heating the fiber-treating agent. This heating may be performed by immersing the naturally derived fibers in the fiber-treating agent being heated, or by immersing the naturally derived fibers in the fiber-treating agent at a low temperature, followed by heating. The temperature of the fiber-treating agent is preferably 200 or higher, more preferably 35° C. or higher, further more preferably 45° C. or higher for increasing interaction of the component (A) and the component (B) with fiber constituent molecules, for example protein molecules, in the naturally derived fibers, and accelerating a condensation reaction between the component (A) and the component (B) in the naturally derived fibers to obtain the effects of the present invention, and preferably lower than 100° C., more preferably 80° C. or lower, further more preferably 70° C. or lower, further more preferably 60° C. or lower for preventing the naturally derived fibers from being degenerated by heat and thus degraded.

[0128] The fiber-treating agent of the present invention is transparent right after preparation, but the turbidity increases as the condensate formed by reaction between the component (A) and the component (B) in the fiber-treating agent grows. From the viewpoint of further enhancing the stretchability (tenacity) of naturally derived fibers, it is desirable to carry out the step (i) with the turbidity being as low as possible and the turbidity of the fiber-treating agent during treatment is preferably 1,000 NTU or less, more preferably 500 NTU or less, further more preferably 100 NTU or less, even more preferably 20 NTU or less.

[0129] When T is a heating time until the treating agent has a turbidity of more than 1,000 NTU after the treating agent is heated immediately after being prepared by mixing the components, the immersion time in the step (i) is preferably 0.3 T or more, more preferably 0.4 T or more, further more preferably 0.5 T or more, from the viewpoint of exhibiting a stretchability improving effect on naturally derived fibers, and preferably 0.95 T or less, more preferably 0.90 T or less, further more preferably 0.85 T or less for suppressing damage to naturally derived fibers.

[0130] The specific immersion time is appropriately adjusted depending on a heating temperature used, and is preferably 15 minutes or more, more preferably 30 minutes or more, further more preferably 1 hour or more, from the

viewpoint of exhibiting a stretchability improving effect on naturally derived fibers, and preferably 48 hours or less, more preferably 24 hours or less, further more preferably 12 hours or less for suppressing damage to naturally derived fibers, for example.

[0131] It is preferable to carry out the step (i) in an environment where evaporation of moisture is suppressed. Examples of the specific means for suppressing evaporation of moisture include a method in which a container of the fiber-treating agent in which naturally derived fibers are immersed is covered with a film-shaped material, a cap, a lid or the like made of a material impermeable to water vapor.

[0132] After the step (i), the naturally derived fibers may be rinsed, or is not required to be rinsed, and it is preferable to rinse the naturally derived fibers from the viewpoint of preventing deterioration of the feel of the naturally derived fibers by an excess polymerized product.

[0133] These treatments may allow the components (A) and (B) to infiltrate the naturally derived fibers and interact with fiber constituent molecules, for example protein molecules, in the naturally derived fibers. In the naturally derived fibers, a condensate of the component (A) and the component (B) is formed. Therefore, the naturally derived fibers treated by the method of the present invention does not lose shape even when washed.

[0134] If the turbidity of the treating agent increases during treatment in the step (i), a hard resin layer is formed on the surfaces of naturally derived fibers, which makes it difficult to maintain high stretchability (tenacity) of the naturally derived fibers, and it is difficult to secure a good feel of the fiber surfaces. Thus, it is preferable to take out the naturally derived fibers from the treating agent before the turbidity of the treating agent exceeds 1,000 NTU. The turbidity of the treating agent can be confirmed by the above-described turbidity measurement method with a sample appropriately taken from the treating agent. If the naturally derived fibers taken out during treatment have not been sufficiently treated, the step (i) may be performed again. That is, it is preferable to provide step (ii) after the step (i), and to repeat the step (i) and the step (ii) two or more times.

[0135] (ii) Taking out naturally derived fibers from the treating agent before the turbidity of the treating agent exceeds 1,000 NTU.

[0136] It is preferable to wash out the insoluble condensate by rinsing the surfaces of naturally derived fibers after taking out the naturally derived fibers from the treating agent in the step (ii). That is, it is preferable to carry out the following step (iii) after the step (ii).

[0137] (iii) Rinsing naturally derived fibers taken out

[0138] It is desirable that the rinsing in the step (iii) be performed using a composition containing the component (D). The rinsing composition may be composed only of the component (D), or may contain water in addition to the component (D). When water is contained, the content of the component (D) in the rinsing composition is preferably 60 mass % or more, more preferably 80 mass % or more, further more preferably 95 mass % or more.

[Optionally Added Treatment]

[0139] In the method for treating fibers according to the present invention, one or more treatments selected from the group consisting of bleaching, dyeing, surface finish for imparting hydrophobicity and reducing friction, and heating

treatment for further improving fiber stretchability (tenacity) may be performed in addition to the steps (i) to (iii).

[0140] Here, the treatments of bleaching and dyeing may be performed before or after the steps (i) to (iii), or between the steps (i) to (iii). A plurality of steps may be combined and added, and when both bleaching and dyeing are added, any of the treatments may be performed first except that it is necessary to perform bleaching before dyeing. It is also possible to perform another treatment between bleaching and dyeing.

[0141] On the other hand, it is necessary that surface finish for imparting hydrophobicity and reducing friction and heating treatment for further improving fiber stretchability (tenacity) be performed after the steps (i) to (iii). As long as surface finish for imparting hydrophobicity and reducing friction and heating treatment for further improving fiber stretchability (tenacity) are performed after the steps (i) to (iii) as described above, their treatment order relation with bleaching and dyeing is not particularly limited. One of surface finish for imparting hydrophobicity and reducing friction and heating treatment for further improving fiber stretchability (tenacity) may be performed before or after the other.

(Bleaching)

[0142] The bleaching is performed by immersing naturally derived fibers in a bleach composition containing an alkali agent, an oxidizing agent and water. The bleach composition is typically of two-part type. The first part contains an alkali agent and water, and the second part contains an oxidizing agent and water. These two parts are typically stored separately, and mixed before immersion of naturally derived fibers.

[0143] Examples of the suitable alkali agent include, but are not limited thereto, ammonia and salts thereof; alkanolamines (monoethanolamine, isopropanolamine, 2-amino-2-methylpropanol, 2-aminobutanol and the like) and salts thereof; alkanediamines (1,3-propanediamine and the like) and salts thereof; carbonates (guanidine carbonate, sodium carbonate, potassium carbonate, sodium hydrogen carbonate, potassium hydrogen carbonate and the like); and mixtures thereof.

[0144] The content of the alkali agent in the bleach composition (mixture of first part and second part for two-agent type) is preferably 0.1 mass % or more, more preferably 0.5 mass % or more, further more preferably 1 mass % or more, and preferably 15 mass % or less, more preferably 10 mass % or less, further more preferably 7.5 mass % or less).

[0145] Examples of the suitable oxidizing agent include, but are not limited thereto, hydrogen peroxide, urea peroxide, melamine peroxide and sodium bromate. Among these oxidizing agents, hydrogen peroxide is preferable.

[0146] The content of the oxidizing agent in the bleach composition is preferably 1 mass % or more, more preferably 2 mass % or more, and preferably 15 mass % or less, more preferably 12 mass % or less, further more preferably 9 mass % or less.

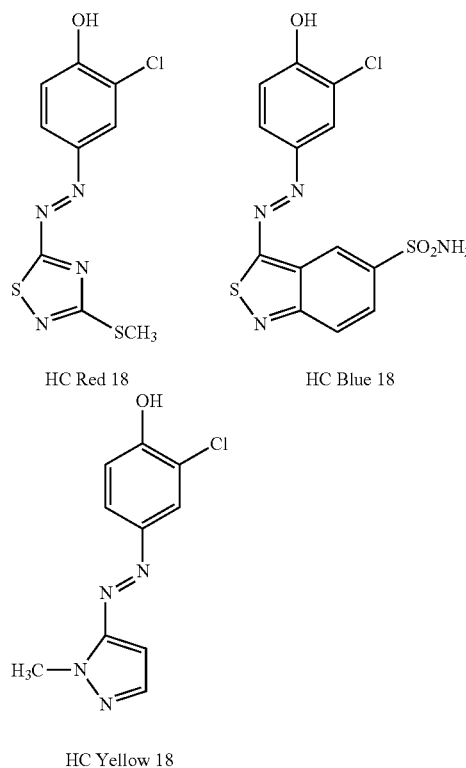
[0147] When the first part and the second part are stored separately, the pH of the second part at 25° C. is preferably 2 or more, more preferably 2.5 or more, and preferably 6 or less, more preferably 4 or less. The pH can be adjusted by a suitable buffering agent. The pH of the bleach composition at 25° C. is preferably 6 or more, more preferably 6.5 or

more, further more preferably 6.8 or more, and preferably 11 or less, more preferably 10.5 or less, further more preferably 10 or less.

(Dyeing)

[0148] The dyeing is performed by immersing naturally derived fibers in a dyeing composition. The dyeing composition contains a dye, and optionally contains an alkali agent or an acid, an oxidizing agent or the like. Examples of the dye include direct dyes, oxidizing dyes, and combinations thereof.

[0149] The type of the direct dye is not particularly limited, and any direct dye suitable for dyeing can be used. Examples of the direct dye include anionic dyes, nitro dyes, disperse dyes, cationic dyes, and dyes having an azo-phenol structure selected from the group consisting of the following HC Red 18, HC Blue 18 and HC Yellow 16, salts thereof, and mixtures thereof.



[0150] Examples of the cationic dye include, but are not limited thereto, Basic Blue 6, Basic Blue 7, Basic Blue 9, Basic Blue 26, Basic Blue 41, Basic Blue 99, Basic Brown 4, Basic Brown 16, Basic Brown 17, Natural Brown 7, Basic Green 1, Basic Orange 31, Basic Red 2, Basic Red 12, Basic Red 22, Basic Red 51, Basic Red 76, Basic Violet 1, Basic Violet 2, Basic Violet 3, Basic Violet 10, Basic Violet 14, Basic yellow 57, Basic Yellow 87, and mixtures thereof. Basic Red 51, Basic Orange 31, Basin Yellow 87 and Mixtures thereof are particularly preferable.

[0151] Examples of the anionic dye include, but are not limited thereto, Acid Black 1, Acid Blue 1, Acid Blue 3, Food Blue 5, Acid Blue 7, Acid Blue 9, Acid Blue 74, Acid Orange 3, Acid Orange 4, Acid Orange 6, Acid Orange 7,

Acid Orange 10, Acid Red 1, Acid Red 14, Acid Red 18, Acid Red 27, Acid Red 33, Acid Red 50, Acid Red 52, Acid Red 73, Acid Red 87, Acid Red 88, Acid Red 92, Acid Red 155, Acid Red 180, Acid Violet 2, Acid Violet 9, Acid Violet 43, Acid Violet 49, Acid Yellow 1, Acid Yellow 10, Acid Yellow 23, Acid Yellow 3, Food Yellow No. 8, D&C Brown No. 1, D&C Green No. 5, D&C Green No. 8, D&C Orange No. 4, D&C Orange No. 10, D&C Orange No. 11, D&C Red No. 21, D&C Red No. 27, D&C Red No. 33, D&C Violet 2, D&C Yellow No. 7, D&C Yellow No. 8, D&C Yellow No. 10, FD&C Red 2, FD&C Red 40, FD&C Red No. 4, FD&C Yellow No. 6, FD&C Blue 1, Food Black 1, Food Black 2, alkali metal salts (sodium salts, potassium salts and the like), and mixtures thereof.

[0152] Among them, preferred anionic dyes are Acid Black 1, Acid Red 52, Acid Violet 2, Acid Violet 43, Acid Red 33, Acid Orange 4, Acid Orange 7, Acid Red 27, Acid Yellow 3, Acid Yellow 10, and salts thereof. More preferred anionic dyes are Acid Red 52, Acid Violet 2, Acid red 33, Acid Orange 4, Acid Yellow 10, and salts and mixtures thereof.

[0153] Examples of the nitro dye include, but are not limited thereto, HC Blue No. 2, HC Blue No. 4, HC Blue No. 5, HC Blue No. 6, HC Blue No. 7, HC Blue No. 8, HC Blue No. 9, HC Blue No. 10, HC Blue No. 11, HC Blue No. 12, HC Blue No. 13, HC Brown No. 1, HC Brown No. 2, HC Green No. 1, HC Orange No. 1, HC Orange No. 2, HC Orange No. 3, HC Orange No. 5, HC Red BN, HC Red No. 1, HC Red No. 3, HC Red No. 7, HC Red No. 8, HC Red No. 9, HC Red No. 10, HC Red No. 11, HC Red No. 13, HC Red No. 54, HC Red No. 14, HC Violet BS, HC Violet No. 1, HC Violet No. 2, HC Yellow No. 2, HC Yellow No. 4, HC Yellow No. 5, HC Yellow No. 6, HC Yellow No. 7, HC Yellow No. 8, HC Yellow No. 9, HC Yellow No. 10, HC Yellow No. 11, HC Yellow No. 12, HC Yellow No. 13, HC Yellow No. 14, HC Yellow No. 15, 2-amino-6-chloro-4-nitrophenol, picramic acid, 1,2-diamino-4-nitrobenzol, 1,4-diamino-2-nitrobenzol, 3-nitro-4-aminophenol, 1-hydroxy-2-amino-3-nitrobenzol, 2-hydroxyethylpicramic acid, and mixtures thereof.

[0154] Examples of the disperse dye include, but are not limited thereto, Disperse Blue 1, Disperse Black 9, Disperse Violet 1, and mixtures thereof.

[0155] One of these direct dyes may be used alone, or two or more types may be used in combination. Direct dyes different in ionicity may be used in combination.

[0156] The content of the direct dye in the dyeing composition is preferably 0.001 mass % or more, more preferably 0.01 mass % or more, further more preferably 0.05 mass % or more, from the viewpoint of obtaining sufficient dyeability, and preferably 10 mass % or less, more preferably 7.5 mass % or less, further more preferably 5.0 mass % or less, further more preferably 3.0 mass % or less, from the viewpoint of compatibility.

[0157] When the dyeing composition contains only direct dyes, an oxidizing agent is not necessary for dyeing naturally derived fibers. When it is desirable that naturally derived fibers be light-colored, the composition may contain an oxidizing agent.

[0158] When the dyeing composition contains an oxidizing dye, the composition is typically two-part type. The first part contains an oxidizing dye intermediate (precursor and coupler) and an alkali agent, and the second part contains an

oxidizing agent such as hydrogen peroxide. These two parts are typically stored separately, and mixed before immersion of naturally derived fibers.

[0159] The oxidizing dye intermediate is not particularly limited, and it is possible to suitably use any known of precursors and couplers which are commonly used for dyeing products.

[0160] Examples of the precursor include, but are not limited thereto, paraphenylenediamine, toluene-2,5-diamine, 2-chloro-paraphenylenediamine, N-methoxyethylpara-phenylenediamine, N-phenylparaphenylenediamine, N,N-bis(2-hydroxyethyl)-paraphenylenediamine, 2-(2-hydroxyethyl)-paraphenylenediamine, 2,6-dimethyl-paraphenylenediamine, 4,4'-diaminodiphenylamine, 1,3-bis(N-(2-hydroxyethyl)-N-(4-aminophenyl)amino)-2-propanol, PEG-3,3,2'-paraphenylenediamine, paraaminophenol, paramethylaminophenol, 3-methyl-4-aminophenol, 2-aminomethyl-4-aminophenol, 2-(2-hydroxyethylaminoethyl)-4-aminophenol, ortho-aminophenol, 2-amino-5-methylphenol, 2-amino-6-methylphenol, 2-amino-5-acetamidophenol, 3,4-diaminobenzoic acid, 5-aminosalicylic acid, 2,4,5,6-tetraaminopyrimidine, 2,5,6-triamino-4-hydroxypyrimidine, 4,5-diamino-1-(4'-chlorobenzyl)pyrazole, 4,5-diamino-1-hydroxyethylpyrazole, salts of these substances, and mixture thereof.

[0161] Examples of the coupler include, but are not limited thereto, metaphenylenediamine, 2,4-diaminophenoxyethanol, 2-amino-4-(2-hydroxyethylamino)anisole, 2,4-diamino-5-methylphenetole, 2,4-diamino-5-(2-hydroxyethoxy)toluene, 2,4-dimethoxy-1,3-diaminobenzene, 2,6-bis(2-hydroxyethylamino)toluene, 2,4-diamino-5-fluorotoluene, 1,3-bis(2,4-diaminophenoxy)propane, metaaminophenol, 2-methyl-5-aminophenol, 2-methyl-5-(2-hydroxyethylamino)phenol, 2,4-dichloro-3-aminophenol, 2-chloro-3-amino-6-methylphenol, 2-methyl-4-chloro-5-aminophenol, N-cyclopentylmetaaminophenol, 2-methyl-4-methoxy-5-(2-hydroxyethylamino)phenol, 2-methyl-4-fluoro-5-aminophenol, paraaminoorthocresol, resorcin, 2-methylresorcin, 4-chlororesorcin, 1-naphthol, 1,5-dihydroxynaphthalene, 1,7-dihydroxynaphthalene, 2,7-dihydroxynaphthalene, 2-isopropyl-5-methylphenol, 4-hydroxyindole, 5-hydroxyindole, 6-hydroxyindole, 7-hydroxyindole, 6-hydroxybenzomorpholine, 3,4-methylenedioxyphenol, 2-bromo-4,5-methylenedioxyphenol, 3,4-methylenedioxyaniline, 1-(2-hydroxyethyl)amino-3,4-methylenedioxybenzene, 2,6-dihydroxy-3,4-dimethylpyridine, 2,6-dimethoxy-3,5-diaminopyridine, 2,3-diamino-6-methoxypyridine, 2-methylamino-3-amino-6-methoxypyridine, 2-amino-3-hydroxypyridine, 2,6-diaminopyridine, salts of these substances, and mixtures thereof.

[0162] The content of each of the precursor and the coupler in the dyeing composition is preferably 0.01 mass % or more, more preferably 0.1 mass % or more, and preferably 10 mass % or less, more preferably 7.5 mass % or less, further more preferably 5 mass % or less.

[0163] When the dyeing composition contains an oxidizing dye, the dyeing composition further contains an alkali agent. Examples of the suitable alkali agent include, but are not limited thereto, ammonia and salts thereof; alkanolamines (monoethanolamine, isopropanolamine, 2-amino-2-methylpropanol, 2-aminobutanol and the like) and salts thereof; alkanediamines (1,3-propanediamine and the like) and salts thereof; carbonates (guanidine carbonate, sodium

carbonate, potassium carbonate, sodium hydrogen carbonate, potassium hydrogen carbonate and the like); and mixtures thereof.

[0164] The content of the alkali agent in the dyeing composition is preferably 0.1 mass % or more, more preferably 0.5 mass % or more, further more preferably 1 mass % or more, and preferably 15 mass % or less, more preferably 10 mass % or less, further more preferably 7.5 mass % or less.

[0165] The composition containing an oxidizing agent (second part) when the dyeing composition contains an oxidizing dye is stored separately from the composition containing an oxidizing agent (first part), and mixed before naturally derived fibers are immersed. Examples of the suitable oxidizing agent include, but are not limited thereto, hydrogen peroxide, urea peroxide, melamine peroxide and sodium brominate. Among these oxidizing agents, hydrogen peroxide is preferable.

[0166] The content of the oxidizing agent in the dyeing composition is preferably 1 mass % or more, more preferably 2 mass % or more, and preferably 15 mass % or less, more preferably 12 mass % or less, further more preferably 9 mass % or less.

[0167] When the first part and the second part are stored separately, the pH of the second part at 25° C. is preferably 2 or higher, more preferably 2.5 or higher, and preferably 6 or less, more preferably 4 or less. The pH can be adjusted by a suitable buffering agent. The pH of the dyeing composition obtained by mixing the first part and the second part at 25° C. is preferably 6 or higher, more preferably 6.5 or higher, further more preferably 6.8 or higher, and preferably 11 or less, more preferably 10.5 or less, further more preferably 10 or less.

[0168] When the dyeing composition contains an oxidizing dye, the dyeing composition may further contain any of the direct dyes exemplified above.

[0169] Preferably, the dyeing composition may further contain the following surfactant, conditioning component and the like. Preferably, the dyeing composition can be in the form of solution, emulsion, cream, paste and mousse.

[0170] The temperature of the dyeing composition is preferably 0° C. or higher, more preferably 10° C. or higher, further more preferably 20° C. or higher, and preferably 90° C. or lower, more preferably 80° C. or lower, from the viewpoint of efficiently infiltrating and diffusing the dyeing composition into naturally derived fibers to enhance the effect of dyeing.

(Surface Finish for Imparting Hydrophobicity and Reducing Friction)

[0171] The surface finish for imparting hydrophobicity and reducing friction is performed by immersing naturally derived fibers in the following surface finish agent after the steps (i) to (iii), or alternatively, when step (iv) for improving the feel is performed, after the step (iv).

[0172] The surface finish agent comprises the following component (F) and water.

[0173] (F) epoxyaminosilane copolymer which is a reaction product of the following compounds (a) to (d):

[0174] (a) polysiloxane having at least two oxiranyl groups or oxetanyl groups;

[0175] (b) polyether having at least two oxiranyl groups or oxetanyl groups;

[0176] (c) aminopropyltrialkoxysilane; and

[0177] (d) a compound selected from the group consisting of the following primary and secondary amines:

[0178] primary amine: methylamine, ethylamine, propylamine, ethanolamine, isopropylamine, butylamine, isobutylamine, hexylamine, dodecylamine, oleylamine, aniline, aminopropyltrimethylsilane, aminopropyltriethylsilane, aminomorpholine, aminopropyl-diethylamine, benzylamine, naphthylamine, 3-amino-9-ethylcarbazole, 1-aminoheptafluorohexane and 2,2,3,3,4,4,5,5,6,6,7,7,8,8,8-pentadecafluoro-1-octaneamine; and

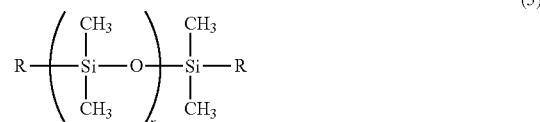
[0179] secondary amine: methylethylamine, methyloctadecylamine, diethanolamine, dibenzylamine, dihexylamine, dicyclohexylamine, piperidine, pyrrolidine phthalimide and polymer amine.

[Component (F): Epoxyaminosilane Copolymer]

[0180] The epoxyaminosilane copolymer as the component (F) is a reaction product of the following compounds (a) to (d).

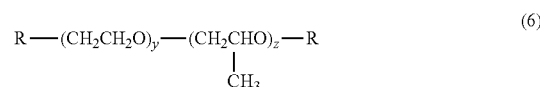
<Compounds (a) and (b)>

[0181] The compound (a) is polysiloxane having at least two oxiranyl groups or oxetanyl groups, and examples thereof include compounds of the following formula (5):



[0182] wherein R represents a hydrocarbon group having 1 to 6 carbon atoms and an oxiranyl group or an oxetanyl group at the terminal and optionally having a hetero atom, and x represents a number of 1 to 1,000.

[0183] The compound (b) is polyether having at least two oxiranyl groups or oxetanyl groups, and examples thereof include compounds of the following formula (6):



[0184] wherein R represents the same meaning as described above, y is 1 to 100, z is 0 to 100, and y+z represents a number of 1 to 200.

[0185] In the formulae (5) and (6), the hetero atom optionally contained in R is preferably an oxygen atom. Examples of R include an oxiranylmethyl group (glycidyl group), an oxiranylmethoxy group (glycidylmethoxy group), an oxiranylmethoxypropyl group (glycidylmethoxypropyl group), an oxetanylmethyl group, an oxetanylmethoxy group, an oxetanylmethoxypropyl group and a 3-ethyloxetanylmethyl group. Among them, hydrocarbon groups having 1 to 4 carbon atoms and an oxiranyl group and optionally having a hetero oxygen atom are preferable, and at least one selected from the group consisting of an oxiranylmethyl group (glycidyl group), an oxiranylmethoxy group (glycidylmethoxy group) and

an oxetanylmethyl group, an oxiranylmethoxypropyl group (glycidylxypropyl group) is more preferable.

<Compound (c)>

[0186] The compound (c) is aminopropyltrialkoxysilane. Examples of the alkoxy group in the compound (c) include alkoxy groups having 1 to 6 carbon atoms, preferably 2 to 4 carbon atoms, more preferably 3 carbon atoms, and among them, an isopropoxy group is preferable. Examples of the compound (c) include aminopropyltrimethoxysilane, aminopropyltriethoxysilane, aminopropyltripropoxysilane, aminopropyltriisopropoxysilane, aminopropyltributoxysilane, and aminopropyltri-tert-butoxysilane, and among them, aminopropyltriisopropoxysilane is preferable. Any one compound (c) may be used alone, or two or more compounds (c) may be used in combination.

<Compound (d)>

[0187] The compound (d) is a compound selected from the group consisting of the following primary and secondary amines:

[0188] primary amine: methylamine, ethylamine, propylamine, ethanolamine, isopropylamine, butylamine, isobutylamine, hexylamine, dodecylamine, oleylamine, aniline, aminopropyltrimethylsilane, aminopropyltriethylsilane, aminomorpholine, aminoethylmethylamine, aminoethyldiethylamine, aminoethyl dibutylamine, aminopropyl dimethylamine, aminopropyl diethylamine, aminopropyl dibutylamine, benzylamine, naphthylamine, 3-amino-9-ethylcarbazole, 1-aminoheptafluorohexane and 2,2,3,3,4,4,5,5,6,6,7,7,8,8,8-pentadecafluoro-1-octaneamine

[0189] secondary amine: methylethylamine, methyl octadecylamine, diethanolamine, dibenzylamine, dihexylamine, dicyclohexylamine, piperidine, pyrrolidine phthalimide and polymer amine.

[0190] Among them, primary amines are preferable, and one selected from the group consisting of aminopropyl diethylamine, aminopropyl dimethylamine and aminopropyl dibutylamine is more preferable. One compound (d) may be used alone, or two or more types may be used in combination.

[0191] The reaction of the compounds (a) to (d) is performed by, for example, refluxing the compounds in a solvent such as isopropanol for a certain time. Here, the molar ratio of oxiranyl groups or oxetanyl groups of compounds (a) and (b) to amino groups of the compound (c) is preferably 1 or more, more preferably 1.1 or more, further more preferably 1.2 or more, and preferably 4 or less, more preferably 3.9 or less, further more preferably 3.8 or less.

[0192] Examples of the component (F) include those having the INCI name of polysilicone-29, and examples of the commercially available product thereof include Silsoft CLX-E (containing an active ingredient at 15 mass %, dipropylene glycol and water) from Momentive Performance Materials Company.

[0193] The content of the component (F) in the surface finish agent is preferably 0.01 mass % or more, more preferably 0.05 mass % or more, further more preferably 0.10 mass % or more, further more preferably 0.20 mass % or more, from the viewpoint of imparting sufficient hydrophobicity to naturally derived fibers, and preferably 15.00 mass % or less, more preferably 10.00 mass % or less, further more preferably 8.00 mass % or less, further more preferably 6.00 mass % or less, from the viewpoint that a sticky feel is not given.

[0194] From the viewpoint of increasing the reaction rate of the trialkoxysilane part of the component (F) in an acidic region or a basic region, the pH of the surface finish agent at 25° C. is preferably in the following range. When the surface finish agent is set as an acidic region, the pH is preferably 1 or higher, more preferably 1.5 or higher, further more preferably 2 or higher, and preferably 5 or lower, more preferably 4.0 or lower, further more preferably 3.5 or lower. When the surface finish agent is set as a basic region, the pH is preferably 7 or higher, more preferably 7.5 or higher, further more preferably 8.0 or higher, and preferably 11 or lower, more preferably 10.5 or lower, further more preferably 10 or lower. The surface finish agent may appropriately contain a pH adjuster for adjusting the pH of the surface finish agent to be within the above-described range. As the pH adjuster, alkanol amines such as monoethanolamine, isopropanolamine, 2-amino-2-methylpropanol and 2-aminobutanol, or salts thereof; alkanediamines such as 1,3-propanediamine, or salts thereof; carbonates such as guanidine carbonate, sodium carbonate, potassium carbonate, sodium hydrogen carbonate and potassium hydrogen carbonate; hydroxides such as sodium hydroxide, potassium hydroxide; and the like can be used as the alkali agent. As the acid agent, inorganic acids such as hydrochloric acid and phosphoric acid, hydrochlorides such as monoethanolamine hydrochloride, phosphates such as monopotassium dihydrogen phosphate and disodium monohydrogen phosphate, and organic acids such as lactic acid and malic acid, and the like can be used.

[0195] The amount of the surface finish agent in which naturally derived fibers are immersed is preferably 2 or more, more preferably 5 or more, further more preferably 10 or more, and preferably 100 or less, more preferably 50 or less, further more preferably 20 or less, in terms of bath ratio to the mass of the naturally derived fibers (mass of surface finish agent/mass of naturally derived fibers).

(Post-Heating: Heating Treatment for Further Improving Fiber Stretchability (Tenacity))

[0196] Further, from the viewpoint of more effectively improving the stretchability of naturally derived fibers, naturally derived fibers can be heated while being stretched by applying tension to the fibers. When the naturally derived fibers are small in amount, it is preferable to use a hair iron for the heating, and when the naturally derived fibers are large in amount, an equivalent result can be obtained by, for example, hot air heating while applying tension by a rewinder.

[0197] The fiber draw ratio during heating is preferably 0.1% or higher, more preferably 0.2% or higher, further more preferably 0.5% or higher, from the viewpoint of more effectively improving the stretchability of the fibers, and preferably 10% or lower, more preferably 5% or lower, further more preferably 2% or lower, from the viewpoint of suppressing damage to the fibers.

[0198] The heating temperature is preferably 120° C. or higher, more preferably 140° C. or higher, further more preferably 160° C. or higher, from the viewpoint of more effectively improving the stretchability of the fibers, and preferably 240° C. or lower, more preferably 220° C. or lower, further more preferably 200° C. or lower, from the viewpoint of suppressing damage to the fibers.

[0199] The heating time is preferably 1 second or more, more preferably 3 seconds or more, further more preferably

5 seconds or more, from the viewpoint of more effectively improving the stretchability of the fibers, and preferably 60 seconds or less, more preferably 30 seconds or less, further more preferably 20 seconds or less, from the viewpoint of suppressing damage to the fibers.

[0200] After heating, from the viewpoint of more effectively improving the stretchability of the fibers, naturally derived fibers can be left to stand in water while being stretched by applying tension to the fibers.

[0201] The draw ratio here is preferably 0.1% or higher, more preferably 0.2% or higher, further more 0.5% or higher, from the viewpoint of more effectively improving the stretchability of the fibers, and preferably 10% or lower, more preferably 5% or lower, further more preferably 2% or lower, from the viewpoint of suppressing damage to the fibers.

[0202] The water temperature is preferably 5° C. or higher, more preferably 20° C. or higher, further more preferably 30° C., from the viewpoint of more effectively improving the stretchability of the fibers, and preferably 80° C. or lower, more preferably 60° C. or lower, further more preferably 50° C. or lower, from the viewpoint of suppressing damage to the fibers.

[0203] The time for leaving the fibers to stand in water is preferably 1 minute or more, more preferably 5 minutes or more, further more preferably 30 minutes or more, from the viewpoint of more effectively improving the stretchability of the fibers, and preferably 48 hours or less, more preferably 24 hours or less, further more preferably 3 hours or less, from the viewpoint of suppressing damage to the fibers.

[0204] Depending on conditions for polymerization in the steps (i) to (iii), stretchability equivalent to that of human hair can be achieved during drying of the fibers.

(Suppression or Elimination of Coloring)

[0205] Further, the naturally derived fibers subjected to the above treatment can be treated with the composition containing the component (E) for the purpose of suppressing or eliminating coloring in the fibers. The preferred component (E) is as described above. The composition is preferably an aqueous solution of the component (E). The pH of the composition is preferably 2.0 or higher, more preferably 3.0 or higher, further more preferably 4.0 or higher, and preferably 9.0 or lower, more preferably 7.0 or lower, further more preferably 6.0 or lower, from the viewpoint of preventing a decrease in strength of naturally derived fibers.

[0206] The content of the component (E) in the composition is preferably 0.5 mass % or more, more preferably 1.0 mass % or more, further more preferably 2.0 mass % or more, from the viewpoint of exhibiting an effect of suppressing or eliminating coloring of naturally derived fibers, and preferably 20 mass % or less, more preferably 10 mass % or less, further more preferably 5.0 mass % or less, from the viewpoint of preventing a decrease in strength of naturally derived fibers by a reducing action.

[0207] The temperature for the treatment with the composition containing the component (E) is preferably 5° C. or higher, more preferably 10° C. or higher, further more preferably 20° C. or higher, from the viewpoint of exhibiting an effect of suppressing or eliminating coloring of naturally derived fibers, and preferably 100° C. or lower, more preferably 60° C. or lower, further more preferably 40° C. or lower, from the viewpoint of avoiding the onset of yellowish coloring.

[0208] The time for the treatment with a composition containing the component (E) is preferably 1 second or more, more preferably 30 seconds or more, further more preferably 1 minute or more, from the viewpoint of exhibiting an effect of suppressing or eliminating coloring of naturally derived fibers, and preferably 60 minutes or less, more preferably 30 minutes or less, further more preferably 15 minutes or less, from the viewpoint of avoiding the onset of yellowish coloring.

[0209] For the purpose of suppressing or eliminating coloring in the naturally derived fibers treated with the fiber-treating agent of the present invention, the naturally derived fibers can be treated with a composition containing a component (G) as in the treatment with a composition containing the component (E).

Component (G): Compound Having Chelating Action

[Component (G): Compound Having Chelating Action]

[0210] Examples of the component (G) include compounds in which the total number of hydroxy groups, carboxy groups and phosphoric acid groups is 2 or more, and specifically, etidronic acid, disodium ethylenediaminetetraacetate, disodium catechol-3,5-disulfonate monohydrate and phytic acid are preferably exemplified.

[0211] The composition containing the component (G) is preferably an aqueous solution. The pH of the composition is preferably 2.0 or higher, more preferably 3.0 or higher, further more preferably 4.0 or higher, and preferably 9.0 or lower, more preferably 7.0 or lower, further more preferably 6.0 or lower, from the viewpoint of preventing a decrease in strength of naturally derived fibers.

[0212] Any one component (G) may be used alone, or two or more types may be used in combination. The content of the component (G) in the composition containing the component (G) is preferably 0.1 mass % or more, more preferably 0.5 mass % or more, furthermore preferably 2.0 mass % or more, from the viewpoint of exhibiting an effect of suppressing or eliminating coloring of naturally derived fibers, and preferably 20 mass % or less, more preferably 10 mass % or less, further more preferably 5.0 mass % or less, from the viewpoint of suppressing a decrease in fiber strength.

[0213] The temperature for the treatment with the composition containing the component (G) is preferably 5° C. or higher, more preferably 10° C. or higher, further more preferably 20° C. or higher, from the viewpoint of exhibiting an effect of suppressing or eliminating coloring of naturally derived fibers, and preferably 100° C. or lower, more preferably 60° C. or lower, further more preferably 40° C. or lower, from the viewpoint of suppressing a decrease in fiber strength.

[0214] The time for the treatment with the composition containing the component (G) is preferably 1 second or more, more preferably 30 seconds or more, further more preferably 1 minute or more, from the viewpoint of exhibiting an effect of suppressing or eliminating coloring of naturally derived fibers, and preferably 72 hours or less, more preferably 48 hours or less, further more preferably 24 hours or less, from the viewpoint of suppressing a decrease in fiber strength.

[0215] It is more preferable that the treatment with the composition containing the component (E) and the treatment with the composition containing the component (G) be

performed in combination as the treatment for suppressing or eliminating coloring of naturally derived fibers. Coloring of fibers which is caused by treatment with the fiber-treating agent of the present invention is considered to include both brownish coloring by oxidation (which can be countered by treatment with a sulfur-containing reducing agent as the component (E)) and yellowish coloring by a catechin-metal complex (which can be countered by a chelating agent as the component (G)), and it may be possible to more adequately suppress coloring of the fibers by performing bleaching treatment corresponding to each case.

[0216] When the treatment with the composition containing the component (E) and the treatment with the composition containing the component (G) are performed in combination, the treatments with the compositions may be performed in a sequential order (the treatment order is not limited), and it is also possible to perform the treatments as one treatment using a single composition containing the components (E) and (G). Here, the contents of each of components in the composition, the treatment temperature and the treatment time are the same as in the case where separate compositions are used. With regard to the treatment time, the upper limit for the composition containing the component (G) is longer than that for the composition containing the component (E), and in the case of the treatment with a single composition containing both the components, the treatment time may be in the treatment time range for the composition containing the component (E) from the viewpoint of avoiding the onset of yellowish coloring.

[0217] When naturally derived fibers are treated by the above method for treating fibers, the fibers contain a condensate formed from the components (A) and (B), so that it is possible to produce fibers for hair ornament products in which the fibers are excellent in shape sustainability and tensile elastic modulus and the stretchability (tenacity) of the naturally derived fibers is highly improved, and it is also possible to produce a hair ornament product using the fibers.

[0218] In the present invention, examples of the hair ornament product include hair wigs, weavings, hair extensions, blade hairs, hair accessories, and doll hairs.

[0219] Concerning the embodiments described above, preferred aspects of the present invention will be further disclosed below.

[0220] <1> A fiber-treating agent comprising the following components (A) to (C) and having a turbidity of 1,000 NTU or less, wherein a part or all of the components (A) and (B) are optionally a condensate formed from the components:

[0221] (A): formaldehyde or a hydrate thereof;

[0222] (B): a phenolic compound having an electron donating group on at least one of meta-positions and a hydrogen atom on at least one of ortho-positions and a para-position, wherein the electron donating group on the meta-position optionally forms, together with adjacent carbon atoms, a benzene ring optionally substituted with a hydroxy group; and

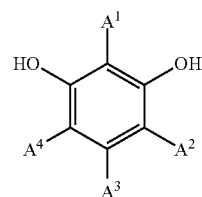
[0223] (C): water.

[0224] <2> The fiber-treating agent according to <1>, wherein a content of a constituent element derived from the component (A) in the fiber-treating agent is preferably 0.1 mass % or more, more preferably 0.2 mass % or more, further more preferably 0.3 mass % or more, even more preferably 0.5 mass % or more, and

preferably 80 mass % or less, more preferably 60 mass % or less, further more preferably 50 mass % or less, even more preferably 40 mass % or less, even more preferably 30 mass % or less.

[0225] <3> The fiber-treating agent according to <1> or <2>, wherein the component (B) is preferably one or more selected from the group consisting of the following components (B1), (B2) and (B3):

[0226] (B1) a resorcin derivative of formula (1):

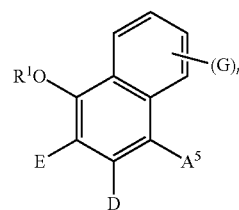


(1)

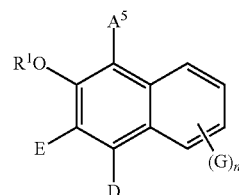
[0227] wherein

[0228] A¹ to A⁴ are the same or different, and each represents a hydrogen atom, a hydroxy group, a halogen atom, a carboxyl group or a salt thereof, a sulfonic acid group or a salt thereof, a linear or branched alkyl group or alkenyl group having 1 to 6 carbon atoms, or a linear or branched alkoxy group or alkenyloxy group having 1 to 6 carbon atoms;

[0229] (B2) a naphthol derivative of formula (2) or (3):



(2)



(3)

[0230] wherein

[0231] R¹ represents a hydrogen atom or a methyl group,

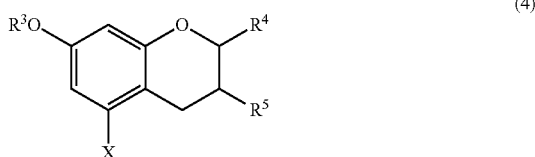
[0232] A⁵ represents a hydrogen atom, a linear or branched alkyl group or alkenyl group having 1 to 12 carbon atoms, an optionally substituted aralkyl group or arylalkenyl group having 7 to 12 carbon atoms, a linear or branched alkoxy group or alkenyloxy group having 1 to 6 carbon atoms, a halogen atom or —CO—R² (R² is a linear or branched alkyl group or alkenyl group having 1 to 12 carbon atoms, an optionally substituted aralkyl group or arylalkenyl group having 7 to 12 carbon atoms, or an optionally substituted aromatic hydrocarbon group having 6 to 12 carbon atoms),

[0233] D represents a hydrogen atom, a hydroxy group, a methyl group, or a linear or branched alkoxy group or alkenyloxy group having 1 to 12 carbon atoms,

[0234] E represents a hydrogen atom, a hydroxy group, a linear or branched alkyl group or alkenyl group having 1 to 6 carbon atoms, or a linear or branched alkoxy group or alkenyloxy group having 1 to 6 carbon atoms, and

[0235] G represents a hydroxy group, a linear or branched alkyl group or alkenyl group having 1 to 6 carbon atoms, or an alkoxy group having 1 to 6 carbon atoms, and n represents an integer of 0 to 2; and

[0236] (B3) a flavan-3-ol derivative of formula (4):



[0237] wherein

[0238] R³ represents a hydrogen atom or a methyl group,

[0239] X represents a hydrogen atom, a hydroxy group or a methoxy group,

[0240] R⁴ represents an aromatic hydrocarbon group optionally substituted with up to 3 hydroxy groups or methoxy groups and optionally forming a fused ring with 1,3-dioxolane, and

[0241] R⁵ represents a hydroxy group, a methoxy group, an aromatic hydrocarbon group optionally substituted with up to 3 hydroxy groups or methoxy groups and optionally forming a fused ring with 1,3-dioxolane, or an arylcarbonyloxy group or aralkylcarbonyloxy group optionally substituted with up to 3 hydroxy groups or methoxy groups, more preferably one or more selected from the group consisting of resorcin, 1-naphthol, 2-naphthol, 3-methylnaphthalen-1-ol, naphthalene-1-,5-diol, naphthalene-1,8-diol, catechin, epicatechin, epigallocatechin, catechin gallate, epicatechin gallate, epigallocatechin gallate and a tea extract, further more preferably one or more selected from the group consisting of resorcin, catechin, epicatechin, epigallocatechin, catechin gallate, epicatechin gallate, epigallocatechin gallate and a tea extract.

[0242] <4> The fiber-treating agent according to any one of <1> to <3>, wherein a content of a constituent element derived from the component (B) in the fiber-treating agent is preferably 0.1 mass % or more, more preferably 1 mass % or more, further more preferably 1.5 mass % or more, even more preferably 3 mass % or more, even more preferably 5 mass % or more, and preferably 80 mass % or less, more preferably 60 mass % or less, further more preferably 50 mass % or less, even more preferably 40 mass % or less, even more preferably 30 mass % or less, even more preferably 25 mass % or less, even more preferably 20 mass % or less.

[0243] <5> The fiber-treating agent according to any one of <1> to <4>, wherein the component (B) is the component (B1) or the component (B2).

[0244] <6> The fiber-treating agent according to <5>, wherein the content of the constituent element derived from the component (A) in the fiber-treating agent is preferably 0.1 mass % or more, more preferably 1 mass % or more, further more preferably 3 mass % or more, even more preferably 5 mass % or more, and preferably 80 mass % or less, more preferably 60 mass % or less, further more preferably 50 mass % or less, even more preferably 40 mass % or less, even more preferably 30 mass % or less.

[0245] <7> The fiber-treating agent according to <5> or <6>, wherein the content of the constituent element derived from the component (B) in the fiber-treating agent is preferably 0.1 mass % or more, more preferably 1 mass % or more, further more preferably 2.5 mass % or more, even more preferably 5 mass % or more, and preferably 60 mass % or less, more preferably 50 mass % or less, further more preferably 40 mass % or less, even more preferably 35 mass % or less, even more preferably 30 mass % or less.

[0246] <8> The fiber-treating agent according to any one of <5> to <7>, wherein a total content of the constituent element derived from the component (A) and the constituent element derived from the component (B) in the fiber-treating agent is preferably 1 mass % or more, more preferably 5 mass % or more, further preferably 10 mass % or more, even more preferably 20 mass % or more, and preferably 80 mass % or less, more preferably 60 mass % or less, further more preferably 50 mass % or less, even more preferably 40 mass % or less, even more preferably 30 mass % or less.

[0247] <9> The fiber-treating agent according to any one of <1> to <4>, wherein the component (B) is the component (B3).

[0248] <10> The fiber-treating agent according to <9>, wherein the content of the constituent element derived from the component (A) in the fiber-treating agent is preferably 0.1 mass % or more, more preferably 0.2 mass % or more, further more preferably 0.3 mass % or more, even more preferably 0.5 mass % or more, and preferably 50 mass % or less, more preferably 40 mass % or less, further more preferably 30 mass % or less, even more preferably 20 mass % or less, even more preferably 10 mass % or less.

[0249] <11> The fiber-treating agent according to <9> or <10>, wherein the content of the constituent element derived from the component (B) in the fiber-treating agent is preferably 0.1 mass % or more, more preferably 0.2 mass % or more, further more preferably 0.5 mass % or more, even more preferably 1 mass % or more, and preferably 50 mass % or less, more preferably 40 mass % or less, further more preferably 30 mass % or less, even more preferably 20 mass % or less, even more preferably 15 mass % or less.

[0250] <12> The fiber-treating agent according to any one of <9> to <11>, wherein the total content of the constituent element derived from the component (A) and the constituent element derived from the component (B) in the fiber-treating agent is preferably 0.1 mass % or more, more preferably 1 mass % or more, further more preferably 2.5 mass % or more, even more preferably 4 mass % or more, even more preferably 5

mass % or more, and preferably 50 mass % or less, more preferably 30 mass % or less, further more preferably 20 mass % or less, even more preferably 15 mass % or less.

[0251] <13> The fiber-treating agent according to any one of <1> to <12>, wherein a molar ratio of the constituent element derived from the component (A) to the constituent element derived from the component (B), (A)/(B), is preferably 0.005 or more, more preferably 0.01 or more, further more preferably 0.05 or more, even more preferably 0.1 or more, even more preferably 0.5 or more, and preferably less than 5, more preferably 4 or less, further more preferably 3 or less, even more preferably 2 or less.

[0252] <14> The fiber-treating agent according to any one of <1> to <13>, wherein a content of the component (C) in the fiber-treating agent is preferably 10 mass % or more, more preferably 20 mass % or more, further more preferably 30 mass % or more, even more preferably 40 mass % or more, and preferably 99 mass % or less, more preferably 97 mass % or less, further more preferably 95 mass % or less, even more preferably 90 mass % or less.

[0253] <15> The fiber-treating agent according to any one of <1> to <14>, preferably further comprising the following component (D):

[0254] (D): an organic compound having a Hansen solubility parameter SP value of 16 Mpa^{1/2} or more and 40 Mpa^{1/2} or less, provided that organic salts and compounds having an aldehyde group and having a molecular weight of 150 or less are excluded.

[0255] <16> The fiber-treating agent according to <15>, wherein the component (D) is preferably at least one selected from the group consisting of a monohydric alcohol, a dihydric alcohol, a dihydric alcohol derivative, a polyhydric alcohol with a valence number of 3 or more, lactam, imidazolidinone, pyrimidinone, lactone, alkylene carbonate and a general-purpose organic solvent, more preferably at least one selected from the group consisting of a dihydric alcohol, lactam and imidazoline, further more preferably at least one selected from the group consisting of diethylene glycol, triethylene glycol, N-methylpyrrolidone, 1,3-dimethyl-2-imidazolidinone and DMDM hydantoin.

[0256] <17> The fiber-treating agent according to <15> or <16>, wherein Hansen solubility parameter SP value of the component (D) is preferably 35.8 Mpa^{1/2} or less, more preferably 34.7 Mpa^{1/2} or less, further more preferably 29.2 Mpa^{1/2} or less, and preferably 17.8 Mpa^{1/2} or more, more preferably 21.1 Mpa^{1/2} or more, further more preferably 22.0 Mpa^{1/2} or more.

[0257] <18> The fiber-treating agent according to any one of <15> to <17>, wherein a content of the component (D) in the fiber-treating agent is preferably 10 mass % or more, more preferably 15 mass % or more, further more preferably 25 mass % or more, and preferably 80 mass % or less, more preferably 60 mass % or less, further more preferably 45 mass % or less.

[0258] <19> The fiber-treating agent according to any one of <1> to <18>, preferably further comprising the following component (E):

[0259] (E): a sulfur-containing reducing agent.

[0260] <20> The fiber-treating agent according to <19>, wherein the component (E) is one or more selected

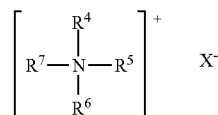
from the group consisting of a sulfurous acid salt and a thiol compound, more preferably one or more selected from the group consisting of sodium sulfite, sodium pyrosulfite, thioglycerol and Mesna (sodium 2-mercaptoethanesulfonate), further more preferably sodium sulfite.

[0261] <21> The fiber-treating agent according to <19> or <20>, wherein a content of the component (E) in the fiber-treating agent is preferably 0.1 mass % or more, more preferably 0.5 mass % or more, further more preferably 2.0 mass % or more, and preferably 20 mass % or less, more preferably 10 mass % or less, further more preferably 5.0 mass % or less.

[0262] <22> The fiber-treating agent according to any one of <19> to <21>, wherein a molar ratio of the component (E) to the component (A), (E)/(A), is preferably 0.1 or more, more preferably 0.3 or more, further more preferably 0.5 or more, and preferably 3.0 or less, more preferably 1.5 or less, further more preferably 1.0 or less.

[0263] <23> The fiber-treating agent according to any one of <1> to <22>, preferably further comprising a cationic surfactant.

[0264] <24> The fiber-treating agent according to <23>, wherein the cationic surfactant is preferably a long chain monoalkyl quaternary ammonium salt having one alkyl group having 8 to 24 carbon atoms and three alkyl groups having 1 to 4 carbon atoms, more preferably at least one selected from the group consisting of compounds of the following formula:



[0265] wherein R⁴ is a saturated or unsaturated linear or branched alkyl group having 8 to 22 carbon atoms, R⁰—CO—NH—(CH₂)_m— or R⁸—CO—O—(CH₂)_m— (R⁰ represents a saturated or unsaturated linear or branched alkyl chain having 7 to 21 carbon atoms, and m represents an integer of 1 to 4), R⁵, R⁶ and R⁷ independently represent an alkyl group having 1 to 4 carbon atoms, or a hydroxyalkyl group having 1 to 4 carbon atoms, and X—represents a hydrochloride ion, a bromide ion, a methosulfate ion or an ethosulfate ion,

further more preferably at least one selected from the group consisting of cetyltrimethylammonium chloride, myristyltrimethylammonium chloride, behenyltrimethylammonium chloride, cetyltrimethylammonium bromide and stearamidopropyltrimethylammonium chloride.

[0266] <25> The fiber-treating agent according to <23> or <24>, wherein a content of the cationic surfactant is preferably 0.05 mass % or more, more preferably 0.10 mass % or more, and preferably 10 mass % or less, more preferably 5 mass % or less.

[0267] <26> The fiber-treating agent according to any one of <1> to <25>, preferably further comprising a silicone, more preferably one or more selected from the group consisting of dimethylpolysiloxane and amino acid-modified silicone.

- [0268] <27> The fiber-treating agent according to <26>, wherein a content of the silicone is preferably 0.1 mass % or more, more preferably 0.2 mass % or more, further more preferably 0.5 mass % or more, and preferably 20 mass % or less, more preferably 10 mass % or less, further more preferably 5 mass % or less.
- [0269] <28> The fiber-treating agent according to any one of <1> to <27>, preferably further comprising a cationic polymer.
- [0270] <29> The fiber-treating agent according to <28>, wherein a content of the cationic polymer is preferably 0.001 mass % or more, more preferably 0.01 mass % or more, further more preferably 0.05 mass % or more, and preferably 20 mass % or less, more preferably 10 mass % or less.
- [0271] <30> The fiber-treating agent according to any one of <1> to <29>, wherein a turbidity is preferably 500 NTU or less, more preferably 100 NTU or less, further more preferably 20 NTU or less.
- [0272] <31> The fiber-treating agent according to any one of <1> to <30>, wherein a pH is preferably 3.0 or higher, more preferably 3.5 or higher, further more preferably 4.0 or higher, and preferably 11.0 or lower, more preferably 9.0 or lower, further more preferably 7.0 or lower.
- [0273] <32> The fiber-treating agent according to any one of <1> to <31>, wherein the fiber-treating agent is a treating agent preferably for naturally derived fibers, more preferably for fibers taken from a natural animal or plant, or fibers artificially produced using keratin, collagen, casein, soybeans, peanuts, corn, silk flocks, silk fibroin or the like as a raw material, further more preferably for regenerated protein fibers selected from the group consisting of regenerated collagen fibers made from collagen as a raw material and regenerated silk fibers made from silk fibroin as a raw material, even more preferably for regenerated collagen fibers.
- [0274] <33> A method for treating fibers, comprising the following step (i):
- [0275] (i) immersing fibers in the fiber-treating agent according to any one of <1> to <32> to treat the fibers while maintaining a state in which the turbidity of the treating agent is 1,000 NTU or less.
- [0276] <34> The method for treating fibers according to <33>, wherein the following step (0) is performed before the step (i):
- [0277] (0) heating the fiber-treating agent.
- [0278] <35> The method for treating fibers according to <34>, wherein, when T is a heating time until the treating agent has a turbidity of more than 1,000 NTU after the treating agent is heated immediately after being prepared by mixing the components, the heating time in the step (0) is preferably 0.2 T or more, more preferably 0.3 T or more, further more preferably 0.4 T or more, and preferably 0.8 T or less, more preferably 0.7 T or less, further more preferably 0.6 T or less.
- [0279] <36> The method for treating fibers according to any one of <33> to <35>, wherein an amount of the fiber-treating agent in which the fibers are immersed in the step (i) is preferably 2 or more, more preferably 3 or more, further more preferably 5 or more, even more preferably 10 or more, even more preferably 20 or more, and preferably 500 or less, more preferably 250 or less, further more preferably 100 or less, in terms of bath ratio to a mass of the fibers (mass of fiber-treating agent/mass of fibers).
- [0280] <37> The method for treating fibers according to any one of <33> to <36>, wherein a temperature of the fiber-treating agent in the step (i) is preferably 20° C. or higher, more preferably 35° C. or higher, further more preferably 45° C. or higher, and preferably lower than 100° C., more preferably 80° C. or lower, further more preferably 70° C. or lower, further more preferably 60° C. or lower.
- [0281] <38> The method for treating fibers according to any one of <33> to <37>, wherein, when T is a heating time until the treating agent has a turbidity of more than 1,000 NTU after the treating agent is heated immediately after being prepared by mixing the components, an immersion time in the step (i) is preferably 0.3 T or more, more preferably 0.4 T or more, further more preferably 0.5 T or more, and preferably 0.95 T or less, more preferably 0.90 T or less, further more preferably 0.85 T or less.
- [0282] <39> The method for treating fibers according to any one of <33> to <38>, wherein preferably, the following step (ii) is performed after the step (i), and the step (i) and the step (ii) are repeated two or more times:
- [0283] (ii) taking out the fibers from the treating agent before the turbidity of the treating agent exceeds 1,000 NTU.
- [0284] <40> The method for treating fibers according to <39>, wherein the following step (iii) is performed after the step (ii):
- [0285] (iii) rinsing the fibers taken out.
- [0286] <41> The method for treating fibers according to <40>, wherein preferably, the rinsing in the step (iii) is performed using a rinsing composition containing a component (D):
- [0287] (D): an organic compound having a Hansen solubility parameter SP value of 16 Mpa^{1/2} or more and 40 Mpa^{1/2} or less, provided that organic salts and compounds having an aldehyde group and having a molecular weight of 150 or less are excluded.
- [0288] <42> The method for treating fibers according to <41>, wherein the rinsing composition contains water in addition to the component (D), and the content of the component (D) in the rinsing composition is preferably 60 mass % or more, more preferably 80 mass % or more, further more preferably 95 mass % or more.
- [0289] <43> The method for treating fibers according to any one of <33> to <42>, wherein the step of immersing the fibers in a surface finish agent containing the following components (F) and (C) is further performed after the steps (i) to (iii):
- [0290] (F) an epoxyaminosilane copolymer which is a reaction product of the following compounds (a) to (d):
- [0291] (a) polysiloxane having at least two oxiranyl groups or oxetanyl groups;
- [0292] (b) polyether having at least two oxiranyl groups or oxetanyl groups;
- [0293] (c) aminopropyltrialkoxysilane; and
- [0294] (d) a compound selected from the group consisting of the following primary and secondary amines:

- [0295] primary amine: methylamine, ethylamine, propylamine, ethanamine, isopropylamine, butylamine, isobutylamine, hexylamine, dodecylamine, oleylamine, aniline, aminopropyltrimethylsilane, aminopropyltriethylsilane, aminomorpholine, aminopropyl-diethylamine, benzylamine, naphthylamine, 3-amino-9-ethylcarbazole, 1-aminoheptafluorohexane and 2,2,3,3,4,4,5,5,6,6,7,7,8,8,8-pentadecafluoro-1-octanamine; and
- [0296] secondary amine: methylethylamine, methyloctadecylamine, diethanolamine, dibenzylamine, dihexylamine, dicyclohexylamine, piperidine, pyrrolidine phthalimide and polymer amine; and
- [0297] (C) water.
- [0298] <44> The method for treating fibers according to <43>, wherein preferably, the component (F) is polysilicone-29.
- [0299] <45> The method for treating fibers according to <43> or <44>, wherein a content of the component (F) in the surface finish agent is preferably 0.01 mass % or more, more preferably 0.05 mass % or more, further more preferably 0.10 mass % or more, further more preferably 0.20 mass % or more, and preferably 15.00 mass % or less, more preferably 10.00 mass % or less, further more preferably 8.00 mass % or less, further more preferably 6.00 mass % or less.
- [0300] <46> The method for treating fibers according to any one of <33> to <45>, wherein preferably, the fibers are heated while being stretched by applying tension to the fibers.
- [0301] <47> The method for treating fibers according to <46>, wherein a fiber draw ratio during the heating is preferably 0.1% or higher, more preferably 0.2% or higher, further more preferably 0.5% or higher, and preferably 10% or lower, more preferably 5% or lower, further more preferably 2% or lower.
- [0302] <48> The method for treating fibers according to <46> or <47>, wherein a heating temperature is preferably 120° C. or higher, more preferably 140° C. or higher, further more preferably 160° C. or higher, and preferably 240° C. or lower, more preferably 220° C. or lower, further more preferably 200° C. or lower.
- [0303] <49> The method for treating fibers according to any one of <46> to <48>, wherein a heating time is preferably 1 second or more, more preferably 3 seconds or more, further more preferably 5 seconds or more, and preferably 60 seconds or less, more preferably 30 seconds or less, further more preferably 20 seconds or less.
- [0304] <50> The method for treating fibers according to any one of <46> to <49>, wherein preferably, the fibers are left to stand in water while being stretched by applying tension to the fibers.
- [0305] <51> The method for treating fibers according to <50>, wherein the draw ratio is preferably 0.1% or higher, more preferably 0.2% or higher, further more preferably 0.5% or higher, and preferably 10% or lower, more preferably 5% or lower, further more preferably 2% or lower.
- [0306] <52> The method for treating fibers according to <50> or <51>, wherein a water temperature is preferably 5° C. or higher, more preferably 20° C. or higher, further more preferably 30° C. or higher, and preferably 80° C. or lower, more preferably 60° C. or lower, further more preferably 50° C. or lower.
- [0307] <53> The method for treating fibers according to any one of <50> to <52>, wherein a time for leaving the fibers to stand in water is preferably 1 minute or more, more preferably 5 minutes or more, further more preferably 30 minutes or more, and preferably 48 hours or less, more preferably 24 hours or less, further more preferably 3 hours or less.
- [0308] <54> The method for treating fibers according to any one of <33> to <53>, wherein further, the treated fibers are treated with a composition containing the following component (E):
- [0309] (E): a sulfur-containing reducing agent.
- [0310] <55> The method for treating fibers according to any one of <33> to <54>, wherein further, the treated fibers are treated with a composition containing the following component (G):
- [0311] (G): a compound having a chelating action.
- [0312] <56> The method for treating fibers according to any one of <33> to <53>, wherein further, the treated fibers are treated with a composition containing the following components (E) and (G).
- [0313] (E): a sulfur-containing reducing agent; and
- [0314] (G): a compound having a chelating action.
- [0315] <57> The method for treating fibers according to any one of <33> to <56>, wherein the fibers to be treated are preferably naturally derived fibers, more preferably fibers taken from a natural animal or plant, or fibers artificially produced using keratin, collagen, casein, soybeans, peanuts, corn, silk fibroin or the like as a raw material, further more preferably regenerated protein fibers selected from the group consisting of regenerated collagen fibers made from collagen as a raw material and regenerated silk fibers made from silk fibroin as a raw material, even more preferably regenerated collagen fibers.
- [0316] <58> A method for producing fibers for hair ornament products, comprising the step of treating fibers by the method for treating fibers according to any one of <33> to <57>.
- [0317] <59> A method for producing a hair ornament product, comprising the step of treating fibers by the method for treating fibers according to any one of <33> to <57>.
- [0318] <60> A fiber for hair ornament products comprising a condensate formed from components (A) and (B):
- [0319] (A): formaldehyde or a hydrate thereof; and
- [0320] (B): a phenolic compound having an electron donating group on at least one of meta-positions and a hydrogen atom on at least one of ortho-positions and a para-position, wherein the electron donating group on the meta-position optionally forms, together with adjacent carbon atoms, a benzene ring optionally substituted with a hydroxy group.
- [0321] <61> A produced hair ornament product having, as a constituent element, fibers comprising a condensate formed from components (A) and (B):
- [0322] (A): formaldehyde or a hydrate thereof; and
- [0323] (B): a phenolic compound having an electron donating group on at least one of meta-positions and a hydrogen atom on at least one of ortho-positions and a para-position, wherein the electron donating

group on the meta-position optionally forms, together with adjacent carbon atoms, a benzene ring optionally substituted with a hydroxy group.

[0324] <62> A fiber-treating agent comprising the following components (A) to (C):

[0325] (A) formaldehyde: 0.1 to 30 mass %;

[0326] (B) resorcin or catechins: 1 to 30 mass %; and

[0327] (C) water: balance.

[0328] <63> The fiber-treating agent according to <62>, further comprising the following component (D):

[0329] (D) one or more selected from the group consisting of diethylene glycol, triethylene glycol, N-methylpyrrolidone and 1,3-dimethyl-2-imidazolidinone: 15 to 45 mass %

[0330] <64> A fiber-treating agent comprising the following components (A) to (C) and (E):

[0331] (A) formaldehyde: 0.1 to 30 mass %;

[0332] (B) resorcin or catechins: 1 to 30 mass %;

[0333] (C) water: balance; and

[0334] (E) one or more selected from the group consisting of sodium sulfite, thioglycerol and Mesna (sodium 2-mercaptoethanesulfonate): 2 to 10 mass %.

[0335] <65> The fiber-treating agent according to any one of <62> to <64>, wherein the fiber-treating agent is a treating agent preferably for naturally derived fibers, more preferably for fibers taken from a natural animal or plant, or fibers artificially produced using keratin, collagen, casein, soybeans, peanuts, corn, silk flocks, silk fibroin or the like as a raw material, further more preferably for regenerated protein fibers selected from the group consisting of regenerated collagen fibers made from collagen as a raw material and regenerated silk fibers made from silk fibroin as a raw material, even more preferably for regenerated collagen fibers.

[0336] <66> A fiber-treating agent kit comprising the fiber-treating agent according to any one of <62> to <64>, and a surface finish agent containing components (F) and (C):

[0337] (F) polysilicone-29: 0.10 to 15 mass %; and

[0338] (C) water: balance.

EXAMPLES

Examples 1 to 6 and Comparative Examples 1 to 3

[0339] Using compositions having formulations shown in Table 1, regenerated collagen fibers were treated by the following method, and various properties were evaluated. The pH of each composition was measured with the prepared composition directly applied to a pH meter (F-52 manufactured by HORIBA, Ltd.) at room temperature (25° C.). The turbidity of the composition was measured with a fiber-treating agent directly placed in a measurement cell (φ25×60 mm borosilicate glass) of a digital turbidimeter (manufactured by AS ONE Corporation/model: TB700/measurement method: equivalent to ISO 7027, Nephelometry (90°)/light source: infrared emitting diode (850 nm)/detector: crystal silicon solar cell module) at room temperature (25° C.).

<Treatment Method (the Following Cycle Repeated a Predetermined Number of Times when the Number of Treatments was 2 or More)>

[0340] 1. A 22 cm-long tress with 0.5 g of regenerated collagen fibers (*) was immersed in a container containing 40 g of the fiber-treating agent, the opening of the container was closed, the container was immersed together with its contents in a water bath (manufacturer: TOYO SEISAKUSHO, Ltd./Model: TBS221FA) at 50° C., followed by heating for a predetermined time. The heating time was fixed to a time equivalent to about 0.8 T (T is as described above).

[0341] *: Regenerated collagen fibers manufactured by Kaneka Corporation were purchased in the form of a commercially available extension product, and cut, and the cut fibers were segmented into tresses, and used for evaluation. In this evaluation, extension products having a notation of the use of Ultima 100% as a fiber species and being brown with a color number of 3 and straight in shape, were used.

[0342] 2. The container containing the tress was taken out from the water bath, and brought back to room temperature.

[0343] 3. The tress was taken out from the container, immersed in 50 g of triethylene glycol for 30 seconds, then rinsed with running tap water at 30° C. for 30 seconds, lathered with evaluating shampoo for 60 seconds, rinsed with running tap water at 30° C. for 30 seconds, and lightly drained with a towel, and the tress was blown by a hot air dryer (Nobby White NB 3000 manufactured by TESCO Company) while being combed. At this time, the tress remained straight.

<Increase in Average Breaking Elongation During Fiber Tensioning>

[0344] As an index of stretchability (tenacity) during fiber tensioning, an average breaking elongation, that is, an average value in evaluation on a plurality of fibers (ten fibers) for the percentage by which the fiber was stretched by tensioning with respect to the original fiber length when rupture occurred was used. The evaluation was performed in the following procedure using a tress immediately after treatment performed as described in <Treatment method> above.

[0345] 1. Ten fibers were cut from the root of the tress. A 3 cm fiber fragment was taken from near the center between the root and the hair tip of each fiber, so that a total of ten 3 cm hair fragments were obtained.

[0346] 2. The fiber fragment was set in "MTT690 Miniature Tensile Tester" manufactured by DIASTRON Limited, automatic measurement was started, and an average breaking elongation was determined when the fiber was in a wet. A large numerical value indicates that the fiber has high stretchability, and is excellent in tenacity and excellent in durability.

[0347] The degree of increase (C %) in average breaking elongation of the treated tress (B %) with respect to an untreated state when the average breaking elongation during fiber tensioning in an intact state (untreated) at the time of being cut from the commercially available product (A %) is used as a reference is determined by the following formula, and shown as "ratio of increase in average breaking elongation during fiber tensioning [%]" in the table.

$$C(\%)=B(\%)-A(\%)$$

<Increase in Average Breaking Load During Fiber Tensioning>

[0348] Evaluation of the average breaking load during fiber tensioning was performed using a tress immediately after treatment performed as described in <Treatment method> above. As a numerical value, an average value in evaluation on a plurality of fibers (ten fibers) was used. The evaluation was performed in the following procedure.

[0349] 1. Ten fibers were cut from the root of the tress. A 3 cm fiber fragment was taken from near the center between the root and the hair tip of each fiber, so that a total of ten 3 cm hair fragments were obtained.

[0350] 2. The fiber fragment was set in "MTT690 Miniature Tensile Tester" manufactured by DIA-STRON Limited, automatic measurement was started, and a breaking load was determined when the fiber stretched in a wet state. A large numerical value indicates that the fiber has suppleness and resilience, and is insusceptible to stretching by an external force, and excellent in durability.

[0351] The degree of increase (Y (gf)) in average breaking load of the treated tress (W_1 (gf)) with respect to an untreated state when the average breaking load during fiber tensioning in an intact state (untreated) at the time of being cut from the commercially available product (W_0 (gf)) is used as a reference is determined by the following formula, and shown as "amount of increase in average breaking load during fiber tensioning [gf]" in the table.

$$Y(\text{gf})=W_1(\text{gf})-W_0(\text{gf})$$

<Suppression of Shrinkage During Set with Iron at High Temperature>

[0352] Suppression of shrinkage during a set with an iron at a high temperature was performed using a tress immediately after treatment performed as described in <Treatment method> above. As a numerical value, an average value in evaluation on a plurality of fibers (ten fibers) was used. The evaluation was performed in the following procedure.

[0353] 1. Ten fibers were cut from the root of the tress, an average value of the lengths of the fibers was recorded (length L_1), the fibers were bundled together with two untreated tresses with 0.5 g of regenerated collagen fibers, and a flat iron (manufactured by Miki Denki Sangyo K.K./Model: AHI-938) set at 180° C. was applied ten times over the whole tress at a rate of 5 cm/sec.

[0354] 2. After the iron operation, ten fibers were taken out, and an average value of the lengths of the fibers were recorded again (length L_2).

[0355] 3. The shrinkage ratio during a set with an iron at a high temperature was defined as $S=\{1-(L_2/L_1)\} \times 100$ [%]. When S is close to 0%, the fiber is hardly shrunk, and thus excellent in heat resistance.

<Heat Shape Memory Ability>

[0356] Evaluation of heat shape memory ability was performed using a tress immediately after treatment performed as described in <Treatment method> above. When the value of the result of "I: shaping (curl)" was 5% or less, it was determined that there was no effect, and subsequent treatment and evaluation were not performed.

[0357] I: Shaping (curl)

[0358] 1. A 22 cm-long tress with 0.5 g of regenerated collagen fibers was wetted with tap water at 30° C. for 30 seconds, and the wet tress was then wound around a plastic rod having a diameter of 14 mm, and fixed with a clip.

[0359] 2. The tress wound around the rod was immersed together with the rod in a water bath (manufacturer: TOYO SEISAKUSHO, Ltd./Model: TBS221FA) at 60° C., and heated for 1 minute. 1 g of the treating agent was applied to the tress, the entire rod was wrapped to seal the tress, followed by heating for 1 hour in an oven set at 90° C.

[0360] 3. The tress was taken out from the water bath, and immersed in water at 25° C. for 1 minute to be brought back to room temperature.

[0361] 4. The tress was removed from the rod, combed three times, and then hung, and photographed right from the side.

(Evaluation Criteria)

[0362] The curling-up ratio= ratio of decrease in tress length (I) (%) determined by the following formula, where L_0 is an untreated tress length (22 cm) and L is a treated tress length, was defined as curling strength.

$$I=[(L_0-L)/L_0] \times 100$$

[0363] II: Reshaping (straight)

[0364] 1. The tress evaluated in I was combed to eliminate entanglement, and a flat iron (manufactured by Miki Denki Sangyo K.K./Model: AHI-938) at a measured temperature of 140° C. was then slid over the tress six times at a rate of 5 cm/sec.

[0365] 2. The tress was rinsed with running tap water at 30° C. for 30 seconds, lathered with evaluating shampoo for 60 seconds, then rinsed with running tap water at 30° C. for 30 seconds, and dried with a towel.

[0366] 3. The tress was dried (without using a dryer) while being vibrated so as to obtain a natural shape as hair, and was combed, then hung, and visually observed right from the side.

(Evaluation Criteria)

[0367] The straightening ratio (S) (%) determined by the following formula, where L_0 is an untreated tress length (22 cm) and L is a treated tress length, was defined as a degree of attainment straightening. The tress is completely straightened when S is 100%.

$$S=[1-(L_0-L)/L_0] \times 100$$

[0368] III: Re-Reshaping (Curl)

[0369] 1. The tress evaluated in II was wetted with tap water at 30° C. for 30 seconds, and the wet tress was then wound around a plastic rod having a diameter of 14 mm, and fixed with a clip.

[0370] 2. The tress wound around the rod was immersed together with the rod in a water bath (manufacturer: TOYO SEISAKUSHO, Ltd./Model: TBS221FA) at 60° C., and heated for 1 minute.

[0371] 3. The tress was taken out from the water bath, and immersed in water at 25° C. for 1 minute to be brought back to room temperature.

[0372] 4. The tress was removed from the rod, combed three times, and then hung, and photographed right from the side.

TABLE 3-continued

		Example					
		8	9	10	11	12	13
Heat shape memory ability	I: Shaping (curl)	—	67	—	40	—	48
	II: Reshaping (straight)	—	94	—	97	—	90
	III: Re-reshaping (curl)	—	62	—	33	—	49
	Surface feel quality	16	17	15	16	17	19

Examples 14 to 22 (Heating after Treatment, and Water Immersion)

[0394] Using compositions having formulations shown in Table 4, the regenerated collagen fibers were treated in the same manner as in the above-described method.

[0395] Subsequently, a flat iron (manufactured by Miki Denki Sangyo K.K./Model: AHI-938) at a measured temperature as shown in the table was slid at a rate of 5 cm/sec a number of times as shown in the table.

[0396] Further, for the tresses treated with an iron as described above, the tress was drawn with each of its both ends held by a hairpin for applying tension to the extent that each fiber forming the tress was stretched at 0.1 to 0.5% on average, and in this state, the tress was left to stand in water at 40° C. for 1 hour with the hairpins fixed to the wall of a water bath by a tape, and was then blown with a dryer. Various properties were evaluated.

[0397] Table 4 shows the results.

TABLE 4

			Example										
			14	15	16	17	18	19	20	21	22		
Treating agent (mass %)	(A)	Formaldehyde	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		
	(B)	Tea extract (*1)	11.25	11.25	11.25	11.25	11.25	11.25	11.25	11.25	11.25		
	(C)	Water	Balance	Balance	Balance	Balance	Balance	Balance	Balance	Balance	Balance		
	(E)	Sodium sulfite	—	—	—	4.10	—	—	—	—	4.10	—	
		Sodium 2-mercaptoethanesulfonate	—	—	—	—	5.30	—	—	—	—	5.30	
		Thioglycerol	—	—	—	—	—	3.50	—	—	—	—	
		Cysteamine	—	—	—	—	—	—	3.70	—	—	—	
		Thioglycolic acid	—	3.00	3.00	—	—	—	—	—	—	—	
	pH adjuster	Hydrochloric acid or sodium hydroxide	*2	*2	*2	*2	*2	*2	*2	*2	*2	*2	
		Total	100	100	100	100	100	100	100	100	100	100	
	pH (25° C.)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		
	Molar ratio (A)/(B)	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1		
	Molar ratio (A)/(E)	—	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0		
Treatment with treating agent	Bath ratio (mass ratio of treating agent to fibers)	Treatment for preventing formulation turbidity from exceeding 1,000 NTU during immersion of fibers.	80	80	80	80	80	80	80	80	80		
		Heating condition	50° C. 30 min	50° C. 1.5 h	50° C. 1.0 h	50° C. 1.0 h	50° C. 1.0 h	50° C. 1.0 h	50° C. 1.0 h	50° C. 1.0 h	50° C. 2.0 h	50° C. 2.0 h	
	Hair iron treatment		160° C. × 3 times	160° C. × 3 times	160° C. × 3 times	160° C. × 3 times	160° C. × 3 times	160° C. × 3 times	160° C. × 3 times	160° C. × 3 times	200° C. × 6 times	200° C. × 6 times	
		Water immersion treatment	40° C. 1 h	40° C. 1 h	40° C. 1 h	40° C. 1 h	40° C. 1 h	40° C. 1 h	40° C. 1 h	40° C. 1 h	40° C. 1 h	40° C. 1 h	
	Effect	Durability improvement	Ratio of increase in average breaking elongation during fiber tensioning [%]	7.6	5.3	5.9	5.9	6.9	4.9	6.6	7.6	6.9	
			Amount of increase in average breaking load during fiber tensioning [gf]	33.9	32.3	27.7	16.2	26.4	26.0	22.6	19.1	27.0	
			Suppression of shrinkage during set with iron at high temperature	—	—	—	—	—	—	—	—	-1.5	—
		Heat shape memory ability	I: Shaping (curl)	—	—	—	—	—	—	—	—	38	48
			II: Reshaping (straight)	—	—	—	—	—	—	—	—	92	94
		III: Re-reshaping (curl)	—	—	—	—	—	1	1	40	44	44	

TABLE 4-continued

	Example								
	14	15	16	17	18	19	20	21	22
Surface feel quality	15	16	16	18	17	17	17	18	17
Coloring	—	—	12.6	11.5	12.7	13.6	15.5	—	—

*1: the same as described above.

*2: the same as described above.

[0398] The tresses treated in Examples above can all be directly used as extensions by attachment to head hair with pins or the like, and can exhibit sufficient performance on the human head.

Reference Example

[0399] The same effects as those of the present invention were obtained by immersing fibers (regenerated collagen fibers) sequentially in the first part containing components (B) and (C) and the second part containing components (A) and (C) as shown in Table 5 below. The treatment procedure is as follows.

<Treatment Method>

[0400] 1. A 22 cm-long tress with 0.5 g of regenerated collagen fibers (*) was immersed in a container containing 40 g of the first part, the opening of the container was closed, the container was immersed together with its contents in a water bath (manufacturer: TOYO SEISAKUSHO, Ltd./Model: TBS221FA) at 50° C., followed by heating for 4 hours.

*: Regenerated collagen fibers manufactured by Kaneka Corporation were purchased in the form of a commercially available extension product, and cut, and the cut fibers were segmented into tresses, and used for evaluation. In this evaluation, extension products having a notation of the use of Ultima 100% as a fiber species and being brown with a color number of 3 and straight in shape, were used.

[0401] 2. The container containing the tress was taken out from the water bath, and brought back to room temperature.

[0402] 3. The tress was taken out from the container, rinsed with running tap water at 30° C. for 30 seconds, lathered with evaluating shampoo for 60 seconds, rinsed with running tap water at 30° C. for 30 seconds, and lightly drained with a towel, and the tress was then blown by a hot air dryer (Nobby White NB 3000 manufactured by TESCOM Company) while being combed.

[0403] 4. The tress was immersed in a container containing 40 g of the second part, the opening of the container was closed, the container was immersed together with its contents in a water bath (manufacturer: TOYO SEISAKUSHO, Ltd./Model: TBS221FA) at 50° C., and followed by heating for 4 hours.

[0404] 5. The container containing the tress was taken out from the water bath, and brought back to room temperature.

[0405] 6. The tress was taken out from the container, immersed in 50 g of triethylene glycol for 30 seconds, then rinsed with running tap water at 30° C. for 30 seconds, lathered with evaluating shampoo for 60 seconds, rinsed with running tap water at 300 for 30

seconds, and lightly drained with a towel, and the tress was then blown by a hot air dryer (Nobby White NB 3000 manufactured by TESCOM Company) while being combed. At this time, the tress remained straight.

TABLE 5

Reference Example			
First part (mass %)	(B)	Tea extract (*1)	11.3
	(C)	Water	Balance
Second part (mass %)	pH adjuster	Hydrochloric acid or sodium hydroxide	*2
		Total	100
	Bath ratio (mass ratio of treating agent to fibers)	pH (25° C.)	4.0
		Formaldehyde	5.0
Effect	(A)	Water	Balance
	(C)	Water	Balance
Effect	Durability improvement	pH adjuster	*2
		Total	100
	Heat shape memory ability	PH (25° C.)	4.0
		Bath ratio (mass ratio of treating agent to fibers)	80
	Surface feel quality	Ratio of increase in average breaking elongation during fiber tensioning [%]	2.3
		Amount of increase in average breaking load during fiber tensioning [gf]	35.3
	Surface feel quality	I: Shaping (curl)	42
		II: Reshaping (straight)	93
	Surface feel quality	III: Re-reshaping (curl)	45
		Surface feel quality	20

*1: the same as described above.

*2: the same as described above.

1. A fiber-treating agent comprising the following components (A) to (C) and having a turbidity of 1,000 NTU or less, wherein a part or all of the components (A) and (B) are optionally a condensate formed from the components:

(A): formaldehyde or a hydrate thereof;

(B): a phenolic compound having an electron donating group on at least one of meta-positions and a hydrogen atom on at least one of ortho-positions and a para-position, wherein the electron donating group on the meta-position optionally forms, together with adjacent carbon atoms, a benzene ring optionally substituted with a hydroxy group; and

(C): water.

2. The fiber-treating agent according to claim 1, wherein a content of a constituent element derived from the component (A) in the fiber-treating agent is 0.1 mass % or more and 80 mass % or less.

3. The fiber-treating agent according to claim 1, wherein a content of a constituent element derived from the component (B) in the fiber-treating agent is 0.1 mass % or more and 80 mass % or less.

4. The fiber-treating agent according to claim 1, wherein a total content of a constituent element derived from the

component (A) and a constituent element derived from the component (B) in the fiber-treating agent is 0.1 mass % or more and 80 mass % or less.

5. The fiber-treating agent according to claim 1, wherein a molar ratio of a constituent element derived from the component (A) to a constituent element derived from the component (B), (A)/(B), is 0.005 or more and less than 5.

6. The fiber-treating agent according to claim 1, further comprising the following component (D):

(D): an organic compound having a Hansen solubility parameter SP value of $16 \text{ Mpa}^{1/2}$ or more and $40 \text{ Mpa}^{1/2}$ or less, excluding organic salts and compounds having an aldehyde group and having a molecular weight of 150 or less.

7. The fiber-treating agent according to claim 1, further comprising the following component (E):

(E): a sulfur-containing reducing agent.

8. A method for treating fibers, comprising immersing the fibers in the fiber-treating agent according to claim 1 to treat the fibers while maintaining a state in which a turbidity of the fiber-treating agent is 1,000 NTU or less.

9. The method for treating fibers according to claim 8, further comprising, prior to the immersing, heating the fiber-treating agent.

10. The method for treating fibers according to claim 9, wherein a heating time is 0.2 T or more and 0.8 T or less, wherein T is a heating time until the fiber-treating agent has a turbidity of more than 1,000 NTU after the fiber-treating agent is heated immediately after being prepared by mixing the components.

11. The method for treating fibers according to claim 8, further comprising,

taking out the fibers from the fiber-treating agent before the turbidity of the treating agent exceeds 1,000 NTU, wherein the immersing and the taking out are performed one or more times.

12. The method for treating fibers according to claim 11, further comprising, following the taking out, optionally rinsing the fibers.

13. The method for treating fibers according to claim 12, wherein the rinsing is performed using a composition containing a component (D):

(D): an organic compound having a Hansen solubility parameter SP value of $16 \text{ Mpa}^{1/2}$ or more and $40 \text{ Mpa}^{1/2}$ or less, excluding organic salts and compounds having an aldehyde group and having a molecular weight of 150 or less.

14. The method for treating fibers according to claim 12, further comprising, immersing the fibers in a surface finish agent containing the following components (F) and (C), following the immersing, the rinsing, and the taking out:

(F) an epoxyaminosilane copolymer which is a reaction product of the following compounds (a) to (d):

(a) a polysiloxane having at least two oxiranyl groups or oxetanyl groups;

(b) a polyether having at least two oxiranyl groups or oxetanyl groups;

(c) aminopropyltrialkoxysilane; and

(d) a compound selected from the group consisting of

methylamine, ethylamine, propyleneamine, ethanolamine, isopropylamine, butylamine, isobutylamine, hexylamine, dodecylamine, oleylamine, aniline, aminopropyltrimethylsilane, aminopropyltriethylsilane, aminomorpholine, aminopropyl-diethylamine, benzylamine, naphthylamine, 3-amino-9-ethylcarbazole, 1-aminoheptafluorohexane, 2,2,3,3,4,4,5,5,6,6,7,7,8,8,8-pentadecafluoro-1-octaneamine, methylethylamine, methyloctadecylamine, diethanolamine, dibenzylamine, dihexylamine, dicyclohexylamine, piperidine, pyrrolidine, phthalimide and polymer amine; and (C) water.

15. A method for producing fibers for hair ornament products, comprising treating fibers by the method according to claim 8.

16. A method for producing a hair ornament product, comprising treating fibers by the method according to claim 8.

17. Regenerated protein fibers for hair ornament products, wherein a condensate formed from components (A) and (B) is contained in the fibers:

(A): formaldehyde or a hydrate thereof; and

(B): a phenolic compound having an electron donating group on at least one of meta-positions and a hydrogen atom on at least one of ortho-positions and a para-position, wherein the electron donating group on the meta-position optionally forms, together with adjacent carbon atoms, a benzene ring optionally substituted with a hydroxy group.

18. A hair ornament product having, as a constituent element, regenerated protein fibers comprising a condensate formed from components (A) and (B):

(A): formaldehyde or a hydrate thereof; and

(B): a phenolic compound having an electron donating group on at least one of meta-positions and a hydrogen atom on at least one of ortho-positions and a para-position, wherein the electron donating group on the meta-position optionally forms, together with adjacent carbon atoms, a benzene ring optionally substituted with a hydroxy group.

19. The method for treating fibers according to claim 12, wherein one or more treatment selected from bleaching and hair dyeing is further performed before, after, or in between the immersing, the taking out and the rinsing.

20. The method for treating fibers according to claim 8, further comprising heating the fibers while stretching by applying tension to the fibers.

21. The method for treating fibers according to claim 8, wherein the fibers are further treated with a composition selected from the group consisting of a composition containing a following component (E), and a composition containing a following component (G), or both in a sequential order, wherein a treatment order is not limited:

(E): a sulfur-containing reducing agent;

(G): a compound having chelating action.

22. The hair ornament product according to claim 18, wherein the hair ornament product is selected from hair wigs, wigs, weavings, hair extensions, blade hairs, hair accessories, and doll hairs.

* * * * *