

DESCRIPTION

Title of Invention:

FIBER FOR ARTIFICIAL HAIR AND HAIR ACCESSORY PRODUCT

Technical Field

[0001]

The present invention relates to a fiber for artificial hair and a hair accessory product.

Background Art

[0002]

In hair accessory products such as wigs, hair wigs, hair extensions, hair bands, and doll hair, the importance of artificial hair as a substitute for human hair has been increasing. As materials constituting a fiber for artificial hair, there are acrylic-based resins, vinyl chloride-based resins, or polyester-based resins, and fibers for artificial hair made of these resins are commercially available.

[0003]

Patent Literature 1 discloses an artificial hair characterized by containing a hollow fiber having a hollow portion with a hollow ratio of 10% to 50%. Furthermore, Patent Literature 2 discloses a fiber for artificial hair, wherein a void is present in a central part of a fiber cross-section, a ratio of an area of the void to a total area of the fiber cross-section is 5% or more and 50% or less, a cross-sectional shape of the fiber cross-section is a flat multilobal shape, and the void has a first side and a second side with an inclination of 70 degrees or more and 110 degrees or less with respect to a major axis of the fiber cross-section.

Citation List

Patent Literature

[0004]

Patent Literature 1: JP 2008-285772 A

Patent Literature 2: WO 2014/196642 A1

Summary of Invention

Technical Problem

[0005]

In recent years, weight reduction has been demanded for a fiber for artificial hair, and for example, Patent Literature 1 and Patent Literature 2 disclose a fiber for artificial hair having a hollow portion. However, conventional fibers for artificial hair have high glossiness and thus have an artificial glossy feeling, and there has been a problem that it is difficult to achieve a natural appearance close to that of human hair.

[0006]

The present invention has been made in view of such circumstances, and provides a fiber for artificial hair with reduced glossiness.

Solution to Problem

[0007]

The present inventors have conducted intensive studies and found that the above-described problem can be solved by providing a specific structure of hollow portions in a fiber for artificial hair, and have completed the present invention.

[0008]

According to the present invention, the following is provided.

[1] A fiber for artificial hair, comprising a plurality of hollow portions extending in a longitudinal direction.

[2] The fiber for artificial hair of [1], wherein: a first hollow portion of the plurality of hollow portions is located substantially at a center in a fiber cross-section perpendicular to the longitudinal direction of the fiber for artificial hair; and one or more second hollow portions of the plurality of hollow portions are each located radially outward of the first hollow portion in the fiber cross-section.

[3] The fiber for artificial hair of [1], wherein: a largest hollow portion of the plurality of hollow portions occupies from 5% to 50% of a cross-sectional area in a fiber cross-section perpendicular to the longitudinal direction; and one or more other hollow portions on average occupy from 0.1% to 4% of the cross-sectional area in the fiber cross-section.

[4] The fiber for artificial hair of [3], wherein: the largest hollow portion is located substantially at a center in the fiber cross-section perpendicular to the longitudinal direction of the fiber for artificial hair; and the one or more other hollow portions are each located radially outward of the largest hollow portion in the fiber cross-section.

[5] The fiber for artificial hair of any one of [1] to [4], wherein SM/SO is from 5 to 40, where SM is an area of a largest hollow portion of the plurality of hollow portions in a fiber cross-section perpendicular to the longitudinal direction, and SO is a sum of areas of one or more other hollow portions in the fiber cross-section.

[6] The fiber for artificial hair of any one of [1] to [5], wherein LM/LO is from 1.3 to 3.8, where LM is a length of an outer edge of a largest hollow portion of the plurality of hollow portions in a fiber cross-section perpendicular to the longitudinal direction, and LO is a sum of lengths of outer edges of one or more other hollow portions in the fiber cross-section.

[7] The fiber for artificial hair of any one of [1] to [6], wherein a shortest distance between outer edges of hollow portions adjacent to each other among the plurality of hollow portions is from 3 μm to 30 μm .

[8] The fiber for artificial hair of any one of [2] to [7], comprising, in the fiber cross-section, at least one selected from the group consisting of: an inner protruding portion protruding from one or more other hollow portions toward one hollow portion of the plurality of hollow portions; and an outer protruding portion protruding from one or more hollow portions of the plurality of hollow portions toward an outer edge of the fiber for artificial hair.

[9] The fiber for artificial hair of any one of [1] to [8], wherein the number of the plurality of hollow portions is 3 or more.

[10] The fiber for artificial hair of any one of [1] to [9], comprising a vinyl chloride-based resin.

[11] A hair accessory product comprising the fiber for artificial hair of any one of [1] to [10].

[12] The hair accessory product of [11], comprising a braid.

[0009]

According to the present invention, a fiber for artificial hair with reduced glossiness can be provided.

Brief Description of Drawings

[0010]

FIG. 1 is a cross-sectional view showing a fiber cross-section perpendicular to a longitudinal direction of a fiber for artificial hair according to a first embodiment.

FIG. 2 is a cross-sectional view showing a fiber cross-section perpendicular to a longitudinal direction of a fiber for artificial hair in one embodiment of the present invention. Regarding the shapes of the fiber cross-sections of the fiber for artificial hair:

FIG. 2A shows a two-lobed shape in which two C-shapes are joined; FIG. 2B shows a three-lobed shape in which three C-shapes are joined; FIG. 2C shows a substantially triangular shape; and FIG. 2D shows a substantially quadrangular shape.

FIG. 3 is a cross-sectional view showing a fiber cross-section perpendicular to a longitudinal direction of a fiber for artificial hair in one embodiment of the present invention. FIG. 3A shows a fiber for artificial hair provided with neither an inner protruding portion nor an outer protruding portion; FIG. 3B shows a fiber for artificial hair provided with only an outer protruding portion; and FIG. 3C shows a fiber for artificial hair provided with both an inner protruding portion and an outer protruding portion.

FIG. 4 is an enlarged photograph of a fiber cross-section of a fiber for artificial hair of an example.

Description of Embodiments

[0011]

The present invention will be described in detail below. The present invention is not limited to these descriptions. The features of the embodiments shown below can be combined with each other. In addition, the invention is established independently for each feature.

[0012]

<Explanation of Terms>

In the present specification, for example, the description "X to Y" means being equal to or greater than X and being equal to or less than Y.

[0013]

1 Fiber for Artificial Hair

1.1 Shape of Fiber for Artificial Hair

Embodiments of the present invention will be described below with reference to the drawings. In the present specification and drawings, components denoted by the same reference numerals shall have substantially the same structure or function. In addition, the scale of the drawings may differ from the actual scale to facilitate understanding.

[0014]

1.1.1 First Embodiment

FIG. 1 is a cross-sectional view showing a fiber cross-section (hereinafter, simply referred to as a "fiber cross-section") perpendicular to a longitudinal direction of a fiber for artificial hair 10 according to the present embodiment. As shown in FIG. 1, the fiber for artificial hair 10 according to the present embodiment comprises four hollow portions 20 (one hollow portion 20A and three hollow portions 20B) extending in the longitudinal direction. More specifically, the fiber for artificial hair 10 comprises the hollow portion 20A and a solid portion 30 covering it. Furthermore, the solid portion 30 comprises three hollow portions 20B. Note that, in the present specification, a "hollow portion" may be one that is continuously present for 10 cm or more in the longitudinal direction of the fiber for artificial hair 10 and has a major axis of 3 μm or more in the fiber cross-section. Since the fiber for artificial hair 10 according to the present embodiment comprises the hollow portions 20, it is lightweight and brings about many advantages such as being able to form a desired voluminous hairstyle with a small amount of attached hair, realizing a wide range of hairstyles including substantial long styles, reducing damage to natural hair and the scalp, and reducing waste and environmental load.

[0015]

Regarding the hollow portions 20 according to the present embodiment, as shown in FIG. 1, the hollow portion 20A is located substantially at a center in the fiber cross-section, and the other hollow portions 20B are each located radially outward of the hollow portion 20A in the fiber cross-section (hereinafter, a hollow portion 20 located substantially at a

center in a fiber cross-section is referred to as a "first hollow portion," and a hollow portion 20 located radially outward of the first hollow portion in a fiber cross-section is particularly referred to as a "second hollow portion"). Here, the phrase "a hollow portion is located substantially at a center in a fiber cross-section" indicates that the center of the fiber cross-section is within the hollow portion. By the hollow portions 20 of the fiber for artificial hair 10 being arranged in this way, the glossiness of a fiber bundle for artificial hair is reduced, resulting in a natural appearance.

[0016]

The outer edge shape of the fiber cross-section of the fiber for artificial hair 10 according to the present embodiment is circular, but is not particularly limited. FIGs. 2 and 3 show examples of fiber cross-sections of the fiber for artificial hair 10 according to one embodiment of the present invention. The outer edge shape of the fiber cross-section may be any one selected from a circular shape (FIG. 1 and FIG. 3A), an elliptical shape and a substantially circular shape (FIG. 3B and FIG. 3C), a two-lobed shape in which two C-shapes are joined (FIG. 2A), a three-lobed shape in which three C-shapes are joined (FIG. 2B), a multilobal shape in which four or more C-shapes are joined, a substantially triangular shape (FIG. 2C), a substantially quadrangular shape (FIG. 2D), and a substantially polygonal shape.

[0017]

In the fiber for artificial hair 10 according to the present embodiment, a major axis M1 in a fiber cross-section is preferably from 30 to 300 μm , and more preferably from 50 to 150 μm . The major axis M1 in the fiber cross-section may be, for example, 30, 40, 50, 60, 70, 80, 90, 100, 110, 120, 130, 140, 150, 160, 170, 180, 190, 200, 210, 220, 230, 240, 250, 260, 270, 280, 290, or 300 μm , and may be within a range between any two of the numerical values exemplified here. When the major axis M1 in the fiber cross-section of the fiber for artificial hair 10 is in such a range, the texture of the fiber bundle for artificial hair is improved, resulting in a natural appearance.

[0018]

While the shape of the hollow portion 20A in the fiber cross-section according to the present embodiment is a substantially circular shape and the shape of the hollow portions 20B is a circular shape, the shape of the hollow portions 20 in the fiber cross-section is not particularly limited. The shape of the hollow portion 20 in the fiber cross-section may be any one selected from a circular shape (the hollow portions 20B in FIGs. 1 to 3, the hollow portion 20A in FIG. 3A, and the hollow portion 20A in FIG. 3B), a substantially circular shape (the hollow portion 20A in FIG. 1 and the hollow portion 20A in FIG. 3C), an elliptical shape and a substantially elliptical shape, a two-lobed shape (the hollow portion 20A in FIG. 2A), a three-lobed shape (the hollow portion 20A in FIG. 2B) and a multilobal shape, as well as a substantially triangular shape (the hollow portion 20A in FIG. 2C), a substantially quadrangular shape (the hollow portion 20A in FIG. 2D), and a substantially polygonal shape. The shape in the fiber cross-section of one or more hollow portions 20 other than the largest hollow portion among the hollow portions 20 (the hollow portions 20B in the present embodiment) is preferably an elongated substantially elliptical shape or an elongated substantially polygonal shape.

[0019]

Among the hollow portions 20 according to the present embodiment, the largest hollow portion (the hollow portion 20A in the present embodiment) preferably has a major axis M2 in the fiber cross-section of from 10 to 200 μm , and more preferably from 20 to 100 μm . The major axis M2 in the fiber cross-section of the largest hollow portion may be, for example, 10, 11, 15, 20, 25, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75, 80, 85, 90, 95, 100, 110, 120, 130, 140, 150, 160, 170, 180, 190, or 200 μm , and may be within a range between any two of the numerical values exemplified here. When the major axis M2 in the fiber cross-section of the largest hollow portion is in such a range, the fiber bundle for

artificial hair is excellent in lightweight properties and can ensure sufficient structural retention properties.

[0020]

Among the hollow portions 20 according to the present embodiment, the one or more hollow portions other than the largest hollow portion (the hollow portions 20B in the present embodiment) preferably have a major axis M3 in the fiber cross-section of from 3 to 30 μm , and more preferably from 5 to 15 μm . The major axis M3 in the fiber cross-section of the one or more hollow portions other than the largest hollow portion (the hollow portions 20B in the present embodiment) may be, for example, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, or 30 μm , and may be within a range between any two of the numerical values exemplified here. When the major axis M3 in the fiber cross-section of the one or more hollow portions other than the largest hollow portion is in such a range, sufficient structural retention properties of the fiber bundle for artificial hair can be ensured, and glossiness is reduced, resulting in a natural appearance.

[0021]

Among the hollow portions 20 according to the present embodiment, the largest hollow portion (the hollow portion 20A in the present embodiment) preferably occupies from 5% to 50% of the area in the fiber cross-section. The largest hollow portion may occupy, for example, 5%, 10%, 15%, 20%, 25%, 30%, 35%, 40%, 45%, or 50% of the area in the fiber cross-section, and may be within a range between any two of the numerical values exemplified here. When the area ratio of the largest hollow portion in the fiber cross-section is in such a range, the fiber bundle for artificial hair is excellent in lightweight properties and can ensure sufficient structural retention properties. Note that the area ratio occupied by the hollow portion 20 in the fiber cross-section can be determined by the following formula:

(Area ratio occupied by hollow portion 20 in fiber cross-section) = {(area surrounded by outer edge 21 of hollow portion 20) / (area surrounded by outer edge 11 of fiber for artificial hair 10)} $\times$ 100.

The area surrounded by the outer edge 11 of the fiber for artificial hair 10 means a cross-sectional area in a case where it is assumed that the fiber for artificial hair 10 does not have the hollow portion 20. The area ratio occupied by the hollow portion 20 in the fiber cross-section can be determined by cutting the fiber for artificial hair 10 perpendicularly to the longitudinal direction, observing the cut surface with a laser microscope, a scanning electron microscope, or the like, and performing image analysis, and specifically can be determined by the method described in the Examples.

[0022]

Among the hollow portions 20 according to the present embodiment, the one or more hollow portions other than the largest hollow portion (the hollow portions 20B in the present embodiment) preferably occupy, on average, from 0.1% to 4% of the area in the fiber cross-section. The one or more hollow portions other than the largest hollow portion may occupy, on average, for example, 0.1%, 0.2%, 0.3%, 0.4%, 0.5%, 0.6%, 0.7%, 0.8%, 0.9%, 1%, 2%, 3%, or 4% of the area in the fiber cross-section, and may be within a range between any two of the numerical values exemplified here. When the one or more hollow portions other than the largest hollow portion occupy such an area in the fiber cross-section, the glossiness of the fiber bundle for artificial hair is reduced, resulting in a natural appearance.

[0023]

In the present embodiment, the hollow portion 20A is the largest hollow portion and is located substantially at a center in the fiber cross-section. Further, the hollow portions 20B are each a hollow portion other than the largest hollow portion and are located radially outward of the hollow portion 20A in the fiber cross-section toward the outer edge

11 of the fiber for artificial hair 10. As described above, among the hollow portions 20, it is preferable that the largest hollow portion is the first hollow portion and the one or more hollow portions other than the largest hollow portion are the second hollow portions. With such a structure of the hollow portions 20, the structure can be maintained even if subjected to gear processing or the like.

[0024]

In the hollow portions 20 according to the present embodiment, SM/SO is preferably from 5 to 40, where SM is an area of the largest hollow portion (the hollow portion 20A in the present embodiment) in the fiber cross-section, and SO is a sum of areas of the one or more other hollow portions (the hollow portions 20B in the present embodiment) in the fiber cross-section. Note that SM/SO may be calculated by replacing SM and SO with an area ratio occupied by the largest hollow portion in the fiber cross-section and a sum of area ratios occupied by the one or more other hollow portions in the fiber cross-section, respectively. SM/SO may be, for example, 5, 6, 7, 8, 9, 10, 15, 20, 25, 30, 35, or 40, and may be within a range between any two of the numerical values exemplified here. When SM/SO is such a value, the fiber for artificial hair 10 is excellent in structural retention properties, and the glossiness of the fiber bundle for artificial hair is reduced, resulting in a natural appearance.

[0025]

In the hollow portions 20 according to the present embodiment, LM/LO is preferably from 1.3 to 3.8, where LM is a length of an outer edge 21 of the largest hollow portion (the hollow portion 20A in the present embodiment) in the fiber cross-section, and LO is a sum of lengths of outer edges 21 of the one or more other hollow portions (the hollow portions 20B in the present embodiment) in the fiber cross-section. LM/LO may be, for example, 1.3, 1.4, 1.6, 1.8, 2.0, 2.2, 2.4, 2.6, 2.8, 3.0, 3.2, 3.4, 3.6, or 3.8, and may be within a range between any two of the numerical values exemplified here. When LM/LO is such a value, the fiber for artificial hair 10 is excellent in structural retention properties, and the glossiness of the fiber bundle for artificial hair is reduced, resulting in a natural appearance. The length of the outer edge 21 of the hollow portion 20 in the fiber cross-section can be determined by cutting the fiber for artificial hair 10 perpendicularly to the longitudinal direction, observing the cut surface with a laser microscope, a scanning electron microscope, or the like, and performing image analysis, and specifically can be determined by the method described in the Examples.

[0026]

A shortest distance D between outer edges 21 of hollow portions 20 adjacent to each other according to the present embodiment is preferably from 3 to 30 μm . The shortest distance D may be, for example, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, or 30 μm , and may be within a range between any two of the numerical values exemplified here. When the lower limit value of the shortest distance D is such a value, the fiber for artificial hair 10 is excellent in structural retention properties. Further, when the upper limit value of the shortest distance D is such a value, the fiber for artificial hair 10 is excellent in lightweight properties. The shortest distance D between the outer edges 21 of the hollow portions 20 can be determined by cutting the fiber for artificial hair 10 perpendicularly to the longitudinal direction, observing the cut surface with a laser microscope, a scanning electron microscope, or the like, and performing image analysis, and specifically can be determined by the method described in the Examples.

[0027]

The fiber for artificial hair 10 according to the present embodiment further comprises, in the fiber cross-section, inner protruding portions 22 protruding from a plurality of the other hollow portions 20B toward one hollow portion 20A among the plurality of hollow portions 20. As described above, it is preferable that an inner protruding portion 22

protruding from one or more other hollow portions 20 toward one hollow portion 20 among the plurality of hollow portions 20 is provided. Further, FIG. 3 is a cross-sectional view showing a fiber cross-section perpendicular to the longitudinal direction of a fiber for artificial hair 10 according to another embodiment. As shown in FIG. 3A, an embodiment in which neither the inner protruding portion 22 nor an outer protruding portion 24 described later is provided is also one aspect of the present application. On the other hand, as shown in FIG. 3B, a fiber for artificial hair 10 according to another embodiment comprises, in the fiber cross-section, outer protruding portions 24 protruding from a plurality of hollow portions 20B among the plurality of hollow portions 20 toward the outer edge 11 of the fiber for artificial hair 10. As shown in FIG. 3C, a fiber for artificial hair 10 according to another embodiment comprises, in the fiber cross-section, inner protruding portions 22 protruding from the other plurality of hollow portions 20B toward one hollow portion 20A among the plurality of hollow portions 20, and comprises outer protruding portions 24 protruding from a plurality of hollow portions 20B among the plurality of hollow portions 20 toward the outer edge 11 of the fiber for artificial hair 10. As described above, it is preferable that outer protruding portions 24 protruding from one or more hollow portions 20 among the plurality of hollow portions 20 toward the outer edge 11 of the fiber for artificial hair 10 are provided in the fiber cross-section. It is preferable to comprise at least one of the inner protruding portion 22 and the outer protruding portion 24 in the fiber cross-section. When the fiber for artificial hair 10 has such a structure, it is excellent in structural retention properties. Further, from the viewpoint of improving the texture of the fiber for artificial hair 10, it is preferable that the size and frequency of the outer protruding portions 24 be small, and it is preferable that the outer protruding portions 24 be smaller than or less frequent than the inner protruding portions 22, and it is more preferable to comprise only the inner protruding portions 22.

[0028]

The number of hollow portions 20 according to the present embodiment is four, but is not particularly limited as long as it is two or more. The number of hollow portions 20 may be 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, or 15, and may be within a range between any two of the numerical values exemplified here. When the lower limit of the number of hollow portions 20 is such a value, the glossiness of the fiber bundle for artificial hair is reduced, resulting in a natural appearance. When the upper limit of the number of hollow portions 20 is such a value, the fiber for artificial hair 10 is excellent in structural retention properties.

[0029]

Next, modified examples of the fiber for artificial hair 10 of the above-described embodiment will be described. In the fiber for artificial hair 10 according to the present embodiment, the plurality of hollow portions 20 extending in the longitudinal direction may all have the same size (major axis, area occupied in the fiber cross-section). Note that, in this case, any one can be selected as the "largest hollow portion." Further, in the fiber for artificial hair 10 according to the present embodiment, among the hollow portions 20 extending in the longitudinal direction, the largest hollow portion may not be located substantially at a center. Such a fiber for artificial hair 10 is also one embodiment of the present invention.

[0030]

1.2 Composition

The resin composition constituting the fiber for artificial hair 10 according to the present embodiment is not particularly limited, and may comprise at least one selected from the group consisting of polyamide-based resins, polyester-based resins, vinyl chloride-based resins, AS-based resins (acrylonitrile-styrene-based resins), PP resins, PET resins, PE resins, PAN-based resins, and PLA-based resins (polylactic acid-based resins). From the

viewpoint of easily obtaining a die swell effect to be described later, the fiber for artificial hair 10 according to the present embodiment preferably comprises a vinyl chloride-based resin. Further, the fiber for artificial hair 10 according to the present embodiment preferably comprises a vinyl chloride-based resin and an AS-based resin.

[0031]

The vinyl chloride-based resin according to the present embodiment may comprise a vinyl chloride-based polymer comprising monomer units derived from a vinyl chloride monomer (vinyl chloride monomer units). The vinyl chloride-based resin according to the present invention may comprise a homopolymer obtained by homopolymerizing a vinyl chloride monomer, and/or a copolymer comprising monomer units derived from a vinyl chloride monomer and another monomer copolymerizable with the vinyl chloride monomer.

Examples of the copolymer include copolymers of vinyl chloride and vinyl esters such as a vinyl chloride-vinyl acetate copolymer and a vinyl chloride-vinyl propionate copolymer; copolymers of vinyl chloride and olefins such as a vinyl chloride-ethylene copolymer and a vinyl chloride-propylene copolymer; and a vinyl chloride-acrylonitrile copolymer. Further, the vinyl chloride-based resin according to the present embodiment may consist of one kind of vinyl chloride-based polymer, or may comprise two or more kinds of vinyl chloride-based polymers.

[0032]

The resin composition constituting the fiber for artificial hair 10 according to the present embodiment contains from 50% to 99% by mass of a vinyl chloride-based resin in 100% by mass of the resin composition, preferably from 65% to 95% by mass, and more preferably from 65% to 90% by mass. Specifically, it is, for example, 50, 55, 60, 65, 70, 75, 80, 85, 90, 95, or 99% by mass, and may be within a range between any two of the numerical values exemplified here.

[0033]

An AS-based resin (acrylonitrile-styrene-based resin) is a copolymer having styrene-based monomer units and acrylonitrile-based monomer units, and may comprise other monomer units copolymerizable therewith as necessary. The AS-based resin comprises, for example, 60, 65, 70, 75, 80, 85, or 90% by mass of styrene-based monomer units with respect to 100% by mass of the AS resin, and may be within a range between any two of the numerical values exemplified here. The AS-based resin comprises, for example, 10, 15, 20, 25, 30, 35, or 40% by mass of acrylonitrile-based monomer units with respect to 100% by mass of the AS resin, and may be within a range between any two of the numerical values exemplified here.

[0034]

The fiber for artificial hair 10 according to the present embodiment may also contain other components as necessary. Examples of other components include an antistatic agent, a heat stabilizer, a lubricant, a colorant, a processing aid, a plasticizer, a reinforcing agent, an ultraviolet absorber, an antioxidant, a filler, a flame retardant, a pigment, an initial coloration improver, a conductivity-imparting agent, and a fragrance.

[0035]

1.3 Manufacturing Method for Fiber for Artificial Hair

The manufacturing method for the fiber for artificial hair 10 according to the present embodiment includes a step of preparing a resin composition for a fiber for artificial hair and a spinning step, and may further include a drawing step, a heat treatment step, and a gear processing step.

[0036]

1.3.1 Step of Preparing Resin Composition for Fiber for Artificial Hair

In the step of preparing the resin composition for a fiber for artificial hair, raw materials including a resin are mixed, whereby a resin composition for a fiber for artificial hair may

be obtained. Here, the raw materials include a base resin and may include other components as necessary.

[0037]

The mixing method is not particularly limited, and a conventionally known method may be employed. For example, a powdery resin composition (powder compound) may be obtained using a known mixing device such as a Henschel mixer, a super mixer, or a ribbon blender, and the powder compound may be melt-mixed to obtain a pellet-shaped resin composition (pellet compound). A method for producing the powder compound may be hot blending or cold blending, and as an example, in order to reduce volatile content from the resin composition, hot blending may be performed at a cut temperature during mixing of from 105 to 155°C. A method for producing the pellet compound may be a method similar to a method for producing a pellet compound of a general vinyl chloride-based resin. For example, the pellet compound may be produced using a kneading machine such as a single-screw extruder, a counter-rotating twin-screw extruder, a conical twin-screw extruder, a co-rotating twin-screw extruder, a co-kneader, a planetary gear extruder, or a roll kneader. Conditions for producing the pellet compound are not particularly limited, but the resin temperature is preferably set to be 185°C or lower in order to prevent thermal degradation of the resin composition. In addition, a mesh may be installed near the tip of the screw in order to remove metal fragments of the screw or fibers on protective gloves that may be mixed in a small amount into the pellet compound. A cold cut method may be employed for the production of pellets. A means for removing cutting chips (fine powder generated during pellet production) or the like that may be mixed in during the cold cut may be employed. Further, since the cutter may chip after long-term use and cutting chips tend to be generated, it is preferable to replace the cutter as appropriate.

[0038]

1.3.2 Spinning Step

In the spinning step, the resin composition for a fiber for artificial hair is melt-spun to obtain the fiber for artificial hair 10. As an example, the resin composition (for example, a pellet compound) may be extruded from a heated cylinder through a nozzle and melt-spun. As the extruder, a conventionally known extruder may be used, and examples thereof include a single-screw extruder, a counter-rotating twin-screw extruder, and a conical twin-screw extruder.

[0039]

Conditions for melt spinning may be appropriately set according to the type of the resin composition so that the resin melts and the hollow portions 20B may be formed. As an example, the cylinder temperature may be from 150 to 190°C, and the nozzle temperature may be from 155 to 195°C. Further, the extrusion speed is preferably from 5 to 20 kg/h, and more preferably from 8 to 18 kg/h. When the temperature and the extrusion speed are in such ranges, the hollow portions 20B are easily formed and have a suitable size.

[0040]

Undrawn yarn melt-spun from the nozzle is introduced into a heating cylinder (for example, a heating cylinder temperature of 250°C) to be instantaneously heat-treated, and may be wound up by a take-up machine installed at a position directly below the nozzle (for example, approximately 4.5 m).

[0041]

A nozzle for melt extrusion of the fiber for artificial hair 10 according to the present embodiment may be appropriately selected according to the shape of the fiber for artificial hair 10 to be obtained, the hollow ratio, the number of hollows, the size of hollows, and the like. As an example, in a case where the fiber for artificial hair 10 having a circular or substantially circular cross-section shown in FIGs. 1 and 3 and having three hollow portions 20B is produced, a nozzle having three shallow C-shaped nozzle holes may be

used; in a case where the fiber for artificial hair 10 having a two-lobed cross-section shown in FIG. 2A and having two hollow portions 20B is produced, a nozzle having two deep C-shaped nozzle holes may be used; and in a case where the fiber for artificial hair 10 having a three-lobed cross-section shown in FIG. 2B and having three hollow portions 20B is produced, a nozzle having three deep C-shaped nozzle holes may be used. Further, in a case where the fiber for artificial hair 10 having a substantially triangular cross-section shown in FIG. 2C and having three hollow portions 20B is produced, a nozzle having three rod-shaped nozzle holes may be used, and in a case where the fiber for artificial hair 10 having a substantially quadrangular cross-section shown in FIG. 2D and having four hollow portions 20B is produced, a nozzle having four rod-shaped nozzle holes may be used. In this way, the number of nozzle holes may be set according to the number of hollow portions 20B located toward the outer edge 11 of the fiber for artificial hair 10 from the hollow portion 20A located substantially at the center, or the number of hollow portions 20 located near the outer edge 11 (in other words, the solid portion 30) of the fiber for artificial hair 10. In addition, due to the presence of separated portions between nozzle holes, at least a part of the resin composition is divided during melt extrusion, but after being discharged from the nozzle holes, pieces of the resin composition may come into contact with each other and be fused to form the hollow portions 20. Further, in one embodiment of the present invention, the resin composition discharged from the nozzle holes may swell due to a die swell effect, whereby the inner protruding portions 22 and/or the outer protruding portions 24 may be formed.

[0042]

1.3.4 Drawing Step and Heat Treatment Step

The manufacturing method for the fiber for artificial hair 10 according to one embodiment of the present invention may also include a drawing step and a heat treatment step. In the drawing step, the undrawn fiber for artificial hair 10 obtained in the melt spinning step may be drawn with a drawing machine to obtain a drawn fiber for artificial hair 10. As an example, in the drawing step, the undrawn fiber for artificial hair 10 may be drawn, for example, from 2 to 5 times at from 90 to 110°C in an air atmosphere. Further, in the heat treatment step, the drawn fiber for artificial hair 10 may be heat-treated using a heat treatment machine. As an example, in the heat treatment step, the drawn fiber for artificial hair 10 may be heat-treated at from 90 to 110°C in an air atmosphere to be 0.5 to 0.99 times, and the total fiber length may be heat-shrunk, whereby the heat-treated fiber for artificial hair 10 having a desired fineness may be obtained.

[0043]

1.3.5 Gear Processing Step

The manufacturing method for the fiber for artificial hair 10 according to the present embodiment may also include a gear processing step. In the gear processing step, crimping may be performed by passing a fiber bundle between two meshing high-temperature gears. The material of the gears used in the gear processing step, the shape of the gear waves, the number of gear teeth, and the like are not particularly limited. In the gear processing step, the shape of the obtained fiber for artificial hair 10 may be controlled by appropriately adjusting the depth of gear waveform grooves, the gear surface temperature, the processing speed, pressure conditions between gears, and the like, in consideration of the fiber material and fineness. These processing conditions are not particularly limited, but as an example, the depth of the gear waveform grooves may be from 0.2 to 6 mm, preferably from 0.5 to 5 mm, the gear surface temperature may be from 30 to 100°C, preferably from 40 to 80°C, and the processing speed may be from 0.5 to 10 m/min, preferably from 1.0 to 8.0 m/min.

[0044]

The manufacturing method for the fiber for artificial hair 10 according to one embodiment of the present invention may also include other steps, and for example, may include a step of applying a surface treatment agent.

[0045]

Note that, in the present invention, the fiber for artificial hair 10 includes the fiber for artificial hair 10 after spinning, and encompasses the fiber for artificial hair 10 before the drawing step, after the drawing step, before the heat treatment step, after the heat treatment step, before the gear processing step, and after the gear processing step.

[0046]

2 Fiber Bundle for Artificial Hair

The fiber bundle for artificial hair according to the present embodiment comprises the above-described fiber for artificial hair 10. The fiber bundle for artificial hair according to the present embodiment preferably consists of the above-described fiber for artificial hair 10. Note that the above-mentioned "major axis M1 in a fiber cross-section of a fiber for artificial hair," "major axis of a hollow portion in a fiber cross-section," "area ratio occupied by a hollow portion in a fiber cross-section," "length of an outer edge of a hollow portion in a fiber cross-section," "number of hollow portions," "SM/SO," and "LM/LO" in the fiber bundle for artificial hair refer to average values of the contained fibers for artificial hair 10. These values may be, for example, average values based on observation results of fiber cross-sections with sample size $n=30$.

[0047]

2.1 Volume

The fiber bundle for artificial hair according to the present embodiment preferably has a volume (specific volume) of 5 cc/g or more, and more preferably 9 cc/g or more. The volume is, for example, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, or 20 cc/g, and may be within a range between any two of the numerical values exemplified here.

[0048]

2.2 Glossiness

The fiber bundle for artificial hair according to the present embodiment preferably has a glossiness of 6.6 or less, more preferably 6.5 or less, and even more preferably 6.2 or less. A lower limit value for the fiber bundle for artificial hair according to the present embodiment is not particularly limited, but is, for example, 4.0. The glossiness is, for example, 4.0, 4.1, 4.2, 4.3, 4.4, 4.5, 4.6, 4.7, 4.8, 4.9, 5.0, 5.1, 5.2, 5.3, 5.4, 5.5, 5.6, 5.7, 5.8, 5.9, 6.0, 6.1, 6.2, 6.3, 6.4, 6.5, or 6.6, and may be within a range between any two of the numerical values exemplified here. The glossiness may be measured using a photometer, and specifically may be measured by the method described in the Examples.

[0049]

2.3 Appearance

The fiber bundle for artificial hair according to the present embodiment preferably has a good appearance. Having a good appearance means having natural variations in color and gloss like human hair. The appearance of the fiber bundle for artificial hair may be evaluated by visual inspection by an artificial hair fiber processing technician (with 5 years or more of practical experience).

[0050]

2.3 Structural Retention Properties

The fiber bundle for artificial hair according to the present embodiment preferably has a structural retention rate of a fiber cross-section of the fiber for artificial hair 10 of 90% or more. The structural retention rate is, for example, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, or 100%, and may be within a range between any two of the numerical values exemplified here. The structural retention rate represents a ratio of the fiber for artificial hair 10 having a cross-section in which the entirety of the hollow portion 20 is covered by the solid portion 30 and the hollow portion 20 is not crushed, and specifically, the structural

retention rate may be calculated by a method described in the Examples; for example, it may be calculated based on an observation result of fiber cross-sections with sample size n300 according to the following formula:

Structural retention rate = $(300 - i - j) / 300$

i: number of fibers having one or more hollow portions 20 that are not entirely covered by the solid portion 30

j: number of fibers in which a hollow portion is crushed and inner surfaces thereof are in contact with each other

"A fiber having a hollow portion not entirely covered by a solid portion" refers to, for example, in a case where the fiber cross-section has a circular outer edge shape, a state where the cross-section is not a doughnut shape but a C-shape and a part thereof is separated.

[0051]

3 Hair Accessory Product

The hair accessory product according to the present embodiment comprises the above-described fiber for artificial hair. Further, the hair accessory product according to one embodiment of the present invention comprises the above-described fiber bundle for artificial hair.

[0052]

The fiber bundle for artificial hair according to the present embodiment may be used for hair accessory products. Examples of the hair accessory products include wigs, hairpieces, braids, extension hair, doll hair, hair wigs, hair patches, hair bands, and the like. A hair accessory product obtained from the fiber bundle for artificial hair according to the present embodiment has color and gloss like human hair, resulting in a natural appearance.

[0053]

Further, since a hollow structure of each fiber is maintained with high probability, the hair accessory product obtained from the fiber bundle for artificial hair according to the present embodiment is lightweight and brings about many advantages such as being able to form a desired voluminous hairstyle with a small amount of attached hair, realizing a wide range of hairstyles including substantial long styles, reducing damage to natural hair and the scalp, and reducing waste and environmental load. The hair accessory product according to one embodiment of the present invention having the above-mentioned features is applicable to various styles, and is particularly suitable for a braid including weave such as plaiting and twisting.

[0054]

EXAMPLES

Hereinafter, the present invention will be described in more detail based on Examples. Note that the Examples described below show an example of representative Examples of the present invention, and the scope of the present invention is not to be interpreted narrowly thereby.

[0055]

(Example 1)

<Step of Preparing Resin Composition for Fiber for Artificial Hair>

70 parts by mass of a vinyl chloride-based resin (manufactured by Taiyo Vinyl Corporation, product name: TH1000), 30 parts by mass of a vinyl-based copolymer resin (manufactured by Denka Co., Ltd., GR-AT-6S) having 68% by mass of styrene monomer units and 32% by mass of acrylonitrile monomer units, 5 parts by mass in total of additives such as a plasticizer, a stabilizer, and a lubricant (specifically, 3 parts by mass of a stabilizer composition, 1 part by mass of epoxidized soybean oil, 0.4 parts by mass of a phosphorus-based chelating agent, and 0.6 parts by mass of polyethylene wax), and 0.5 parts by mass of carbon black were mixed with a blender. The blended materials were

kneaded using a single-screw extruder with $\phi 40$ mm, whereby a pellet-shaped resin composition for a fiber for artificial hair for spinning may be obtained.

The stabilizer composition used to obtain the resin composition has the following components and composition:

- Hydrotalcite compound ($\text{Mg}_4\text{Al}_2(\text{OH})_{12}\text{CO}_3 \cdot 3\text{H}_2\text{O}$): 72.6 parts by mass
- Zinc stearate: 13.1 parts by mass
- Silica ("CARPLEX (registered trademark) #80," manufactured by DSL. Japan Co., Ltd.): 2.2 parts by mass
- Dibenzoylmethane: 2.3 parts by mass
- Dipentaerythritol: 0.9 parts by mass
- Vinyl chloride resin (manufactured by Taiyo Vinyl Corporation, product name: TH1000): 8.9 parts by mass

Other additives used to obtain the resin composition are as follows:

- Epoxidized soybean oil: "ADK CIZER (registered trademark) O-130P," manufactured by ADEKA CORPORATION
- Phosphorus-based chelating agent: "ADK STAB (registered trademark) 1030," manufactured by ADEKA CORPORATION
- Polyethylene wax: manufactured by Mitsui Chemicals, Inc.

[0056]

<Spinning Step>

The obtained pellet-shaped resin composition for a fiber for artificial hair was spun with a $\phi 40$ mm single-screw melt spinning machine. Table 1 shows the number of nozzle holes and the extrusion speed at this time. Undrawn yarn was produced from the molten resin discharged from the nozzle. The cylinder temperature of the spinning machine was set to 180°C, and the nozzle temperature was set to 190°C.

[0057]

<Drawing Step and Heat Treatment Step>

The obtained undrawn yarn was drawn at 100°C, and then annealing was performed at from 100 to 200°C to obtain a fiber for artificial hair. The draw ratio was 3 times, and the relaxation ratio during annealing was from 0.5 to 0.99 times. The relaxation ratio during annealing is a value calculated by (rotational speed of a take-up roller during annealing) / (rotational speed of a delivery roller during annealing).

[0058]

(Examples 2 to 8 and Comparative Example 1)

Fibers for artificial hair having different sizes and numbers of hollow portions were obtained by changing the nozzle used in the spinning step and conditions of the spinning step, the drawing step, and the heat treatment. Table 1 shows the results of tests and evaluations described later performed on the fibers for artificial hair of Examples and Comparative Examples produced in this way.

[0059]

<Observation of Fiber Cross-section>

First, a yarn bundle obtained by cutting a plurality of fibers for artificial hair into appropriate lengths was wrapped with a vinyl tape, and the fiber bundle for artificial hair was cut with a cutter knife so as to be perpendicular to the longitudinal direction, whereby a fiber cross-section was prepared. Using a laser microscope, a cross-sectional photograph of the fiber was taken at a magnification of 400 times. FIG. 4 shows an enlarged photograph of a fiber cross-section of the fiber for artificial hair of Example 3. As shown in FIG. 4, in all of the fibers for artificial hair obtained in Examples and Comparative Examples, the outer edge shape in the fiber cross-section was a substantially circular shape. Further, the largest hollow portion was located substantially at the center in the fiber cross-section (that is, the largest hollow portion was the first hollow portion), and other hollow portions were located toward the outer edge of the fiber for artificial hair

from the largest hollow portion (that is, the other hollow portions were the second hollow portions). Furthermore, in the fiber cross-section of each Example, inner protruding portions protruding from the other hollow portions (second hollow portions) toward the largest hollow portion (first hollow portion) were provided. Based on the obtained photographs of the fiber cross-sections, major axes of the fiber for artificial hair and the hollow portions, the number of hollow portions, the shortest distance between outer edges of hollow portions adjacent to each other, an area ratio occupied by the hollow portion in the fiber cross-section, and a length of the outer edge of the hollow portion in the fiber cross-section were respectively measured. Note that each value was calculated as an average with sample size $n=30$ using a controller VK-X150 manufactured by KEYENCE CORPORATION. The major axis M1 in the fiber cross-section of the fiber for artificial hair obtained in each of Examples and Comparative Examples was from 50 to 150 μm . The major axis M2 in the fiber cross-section of the largest hollow portion (first hollow portion) was within a range from 20 to 100 μm . Furthermore, the major axis M3 in the fiber cross-section of the hollow portion other than the largest hollow portion (second hollow portion) was within a range from 5 to 15 μm .

[0060]

<Volume>

Using the fiber for artificial hair cut into 120 cm, 120 g of a fiber bundle for artificial hair was prepared, and the fiber bundle for artificial hair was folded back and installed in a length of 60 cm in a partition with a width of 39.5 mm. Thereafter, the height of the sample was measured, and a specific volume was calculated based on the following formula:

Width of partition plate $\times$ length of sample $\times$ height of sample $\div$ fiber mass = specific volume (cc/g)

[0061]

<Glossiness>

Using the fiber for artificial hair cut into an appropriate length, a fiber bundle for artificial hair was prepared. Glossiness of each fiber bundle for artificial hair was measured with the following device and conditions:

Device: Goniophotometer Model GP-700 manufactured by Murakami Color Research Laboratory Co., Ltd.

Incident angle: 45°

Sensitivity adjustment dial value (COARSE): 906

Sensitivity adjustment dial value (FINE): 737

[0062]

<Appearance>

The appearance was evaluated based on visual determination by 10 artificial hair fiber processing technicians (with 5 years or more of practical experience) for a fiber bundle for artificial hair obtained by bundling the fibers for artificial hair of Examples and Comparative Examples into a length of 250 mm and a mass of 20 g, according to the following evaluation criteria. Having a good appearance means having natural variations in color and gloss like human hair.

A: 9 or more technicians evaluated that the appearance was good.

B: 6 to 8 technicians evaluated that the appearance was good.

C: 3 to 5 technicians evaluated that the appearance was good.

D: 2 or less technicians evaluated that the appearance was good.

[0063]

<Structural Retention Properties>

Similarly to the above <Observation of Fiber Cross-section>, fiber cross-sections were photographed at a magnification of 400 times using a laser microscope. Thereafter, with

sample size $n=300$, a structural retention rate was calculated based on the following formula:

Structural retention rate = $(300 - i - j) / 300$

i: number of fibers having one or more hollow portions 20 that are not entirely covered by the solid portion 30

j: number of fibers in which a hollow portion is crushed and inner surfaces thereof are in contact with each other

"A fiber having a hollow portion not entirely covered by a solid portion" refers to a state where the cross-section is not a doughnut shape but a C-shape and a part thereof is separated.

Table 1			Unit	Example								Comparative Example
				1	2	3	4	5	6	7	8	1
Fiber cross-section observation results	Number of hollow portions		count	2	3	4	5	4	4	4	4	1
	Number of hollow portions other than the largest hollow portion		count	1	2	3	4	3	3	3	3	0
	Shortest distance between outer edges of hollow portions adjacent to each other		$\mu\text{ m}$	17	17	17	17	31	2	17	17	—
	Area ratio S_{M} of the largest hollow portion		%	30	30	30	30	5	50	30	30	30
	Total area ratio S_{O} of other hollow portions		%	1.3	1.3	1.3	1.3	0.2	2.2	7.5	0.7	—
	Area ratio of other hollow portions (per portion)		%	1.3	0.7	0.4	0.3	0.1	0.7	2.5	0.2	—
	$S_{\text{M}}/S_{\text{O}}$		-	23	23	23	23	23	23	4	41	—
	Length L_{M} of the outer edge of the largest hollow portion		$\mu\text{ m}$	140	140	140	140	55	180	140	140	140
	Total length L_{O} of outer edges of other hollow portions		$\mu\text{ m}$	37	41	50	58	20	65	120	36	—
	$L_{\text{M}}/L_{\text{O}}$		-	3.8	3.4	2.8	2.4	2.8	2.8	1.2	3.9	—
Properties	Volume		cc/g	9	9	9	9	8	10	9	9	9
	Glossiness (half-width)		-	6.3	6.3	6.0	6.0	6.2	5.8	5.8	6.5	6.7
	Appearance		-	B	B	A	A	B	A	A	C	C
	Structural retention rate of cross-sectional structure		%	98	98	97	97	99	95	95	98	99
Manufacturing Conditions	Number of nozzle holes		-	1	2	3	4	3	3	3	3	3
	Extrusion speed		kg/h	11	13	15	17	18	11	7	19	21

[0064]
[Table 1]

Description of Reference Numerals

[0065]

10: fiber for artificial hair

11: outer edge of fiber for artificial hair

20: hollow portion

20A: hollow portion located substantially at a center in a fiber cross-section

20B: hollow portion located toward an outer edge of a fiber for artificial hair from a hollow portion located substantially at a center in a fiber cross-section

21: outer edge of hollow portion

22: inner protruding portion

24: outer protruding portion

30: solid portion

M1: major axis of fiber for artificial hair in fiber cross-section

M2: major axis of hollow portion 20A in fiber cross-section

M3: major axis of hollow portion 20B in fiber cross-section

Claims

[Claim 1]

A fiber for artificial hair, comprising a plurality of hollow portions extending in a longitudinal direction.

[Claim 2]

The fiber for artificial hair of claim 1, wherein: a first hollow portion of the plurality of hollow portions is located substantially at a center in a fiber cross-section perpendicular to the longitudinal direction of the fiber for artificial hair; and one or more second hollow portions of the plurality of hollow portions are each located radially outward of the first hollow portion in the fiber cross-section.

[Claim 3]

The fiber for artificial hair of claim 1, wherein: a largest hollow portion of the plurality of hollow portions occupies from 5% to 50% of a cross-sectional area in a fiber cross-section perpendicular to the longitudinal direction; and one or more other hollow portions on average occupy from 0.1% to 4% of the cross-sectional area in the fiber cross-section.

[Claim 4]

The fiber for artificial hair of claim 3, wherein: the largest hollow portion is located substantially at a center in the fiber cross-section perpendicular to the longitudinal direction of the fiber for artificial hair; and the one or more other hollow portions are each located radially outward of the largest hollow portion in the fiber cross-section.

[Claim 5]

The fiber for artificial hair of claim 1, wherein S_M/S_O is from 5 to 40, where S_M is an area of a largest hollow portion of the plurality of hollow portions in a fiber cross-section perpendicular to the longitudinal direction, and S_O is a sum of areas of one or more other hollow portions in the fiber cross-section.

[Claim 6]

The fiber for artificial hair of claim 1, wherein L_M/L_O is from 1.3 to 3.8, where L_M is a length of an outer edge of a largest hollow portion of the plurality of hollow portions in a fiber cross-section perpendicular to the longitudinal direction, and L_O is a sum of lengths of outer edges of one or more other hollow portions in the fiber cross-section.

[Claim 7]

The fiber for artificial hair of any one of claims 1 to 6, wherein a shortest distance between outer edges of hollow portions adjacent to each other among the plurality of hollow portions is from 3 μm to 30 μm .

[Claim 8]

The fiber for artificial hair of any one of claims 2 to 6, comprising, in the fiber cross-section, at least one selected from the group consisting of:
an inner protruding portion protruding from one or more other hollow portions toward one hollow portion of the plurality of hollow portions; and
an outer protruding portion protruding from one or more hollow portions of the plurality of hollow portions toward an outer edge of the fiber for artificial hair.

[Claim 9]

The fiber for artificial hair of any one of claims 1 to 6, wherein the number of the plurality of hollow portions is 3 or more.

[Claim 10]

The fiber for artificial hair of any one of claims 1 to 6, comprising a vinyl chloride-based resin.

[Claim 11]

A hair accessory product comprising the fiber for artificial hair of any one of claims 1 to 6.

[Claim 12]

The hair accessory product of claim 11, comprising a braid.