

Specification

TITLE OF INVENTION: Fiber for artificial hair, hair ornament, and method for producing fiber for artificial hair

TECHNICAL FIELD

[0001]

The present invention relates to a fiber for artificial hair, a hair ornament product, and a method for producing the fiber for artificial hair.

BACKGROUND ART

[0002]

In hair ornament products such as wigs, hairpieces, hairbands, doll hair, and the like, the importance of artificial hair substituting for human hair is increasing. As a material constituting the fiber for artificial hair, there are an acrylic resin, a vinyl chloride-based resin, or a polyester-based resin, and fibers for artificial hair comprising 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%. Further, Patent Literature 2 discloses a fiber for artificial hair characterized in that it has a void in a central portion 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 multi-lobal shape, and the void has a first side and a second side inclined at an angle 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

SUMMARY OF INVENTION

TECHNICAL PROBLEM

[0005]

In recent years, weight reduction has been demanded for the fiber for artificial hair. For example, Patent Literature 1 and Patent Literature 2 disclose the fiber for artificial hair having the hollow portion. Further, depending on an application, the fiber for artificial hair may be subjected to a hot water treatment in which it is immersed in hot water after processing such as braiding and the like, but the texture (color and glossiness) of the fiber for artificial hair may

deteriorate after the hot water treatment. Such a tendency was particularly remarkable in the fiber for artificial hair having the hollow portion.

[0006]

The present invention has been made in view of such circumstances, and provides a fiber for artificial hair excellent in texture and lightweight feeling after a hot water treatment.

SOLUTION TO PROBLEM

[0007]

According to the present invention, provided is a fiber for artificial hair, comprising a hollow portion extending in a longitudinal direction of the fiber for artificial hair, wherein, when the fiber for artificial hair is heat-treated at 120°C for 5 minutes to obtain a fiber for artificial hair after 120°C heat treatment, and the fiber for artificial hair after 120°C heat treatment is further immersed in water at 90°C for 30 seconds and then dried to obtain a fiber for artificial hair after 90°C hot water treatment, a color difference ΔE^* between the fiber for artificial hair after 120°C heat treatment and the fiber for artificial hair after 90°C hot water treatment is 5 or less.

[0008]

As a result of intensive studies, the present inventors have found that, in the fiber for artificial hair comprising the hollow portion, by controlling the color difference ΔE^* , which is a difference between a color tone of the fiber for artificial hair when a heat treatment is performed under a specific condition and a color tone of the fiber for artificial hair when a hot water immersion treatment is further performed under a specific condition, within a specific numerical range, the fiber for artificial hair becomes excellent in texture and lightweight feeling after the hot water treatment, and have completed the present invention.

[0009]

Various embodiments of the present invention will be exemplified below. The embodiments shown below can be combined with each other.

[1] A fiber for artificial hair, comprising a hollow portion extending in a longitudinal direction of the fiber for artificial hair, wherein, when the fiber for artificial hair is heat-treated at 120°C for 5 minutes to obtain a fiber for artificial hair after 120°C heat treatment, and the fiber for artificial hair after 120°C heat treatment is further immersed in water at 90°C for 30 seconds and then dried to obtain a fiber for artificial hair after 90°C hot water treatment, a color difference ΔE^* between the fiber for artificial hair after 120°C heat treatment and the fiber for artificial hair after 90°C hot water treatment is 5 or less.

[2] The fiber for artificial hair of [1], wherein a color difference ΔL^* between the fiber for artificial hair after 120°C heat treatment and the fiber for artificial hair after 90°C hot water treatment is 3 or less.

[3] The fiber for artificial hair of [1] or [2], wherein the hollow portion occupies 5 to 50% of an area of a cross section perpendicular to the longitudinal direction of the fiber for artificial hair.

[4] The fiber for artificial hair of any one of [1] to [3], comprising a vinyl chloride-based resin.

[5] The fiber for artificial hair of any one of [1] to [4], wherein the fiber for artificial hair has a surface treatment composition on at least a part of a surface of a synthetic fiber.

[6] The fiber for artificial hair of any one of [1] to [5], which is for use in a hair ornament product including a braid.

[7] A hair ornament product comprising the fiber for artificial hair of any one of [1] to [6].

[8] A method for producing the fiber for artificial hair of any one of [1] to [7], wherein the method for producing comprises a surface treatment composition attaching step, a standing step, and a heat treatment step, in the surface treatment composition attaching step, a surface treatment agent is attached to a surface of a synthetic fiber using a surface treatment composition to obtain a surface treatment agent-attached fiber for artificial hair, in the standing step, the surface treatment agent-attached fiber for artificial hair is left to stand at 30°C or lower to obtain a fiber for artificial hair after standing, in the heat treatment step, the fiber for artificial hair after standing is heat-treated to obtain the fiber for artificial hair, and the standing step starts when the surface treatment agent is attached to the surface of the synthetic fiber and ends when the heat treatment step starts, and a duration of the standing step is less than 90 minutes.

ADVANTAGEOUS EFFECTS OF INVENTION

[0010]

The fiber for artificial hair according to the present invention is excellent in texture and lightweight feeling after the hot water treatment. The fiber for artificial hair according to the present invention is particularly suitable for an application exposed to the hot water treatment of immersing in hot water, for example, for a hair ornament product including a braid. Further, the hair ornament product according to the present invention is excellent in texture and lightweight feeling after the hot water treatment, and can be used for, for example, a braid and the like. According to the method for producing the fiber for artificial hair according to one embodiment of the present invention, a fiber for artificial hair excellent in texture and lightweight feeling after a hot water treatment can be obtained.

BRIEF DESCRIPTION OF DRAWINGS

[0011]

Fig. 1 is a schematic cross-sectional view of a fiber for artificial hair according to one embodiment of the present invention. Fig. 1A shows a circular cross section, Fig. 1B shows a circular cross section having an inner projecting portion and an outer projecting portion, Fig. 1C shows a two-lobal cross section in which two C-shapes are joined, Fig. 1D shows a three-lobal cross section in which three C-shapes are joined, Fig. 1E shows a substantially triangular cross section, and Fig. 1F shows a substantially rectangular cross section.

DESCRIPTION OF EMBODIMENTS

[0012]

Hereinafter, the present invention will be described in detail by exemplifying embodiments of the present invention. The present invention is not limited by these descriptions at all. Each feature of the embodiments of the present invention shown below can be combined with each other. In addition, an invention is established independently for each feature.

[0013]

1. Fiber for Artificial Hair

The fiber for artificial hair according to the present invention comprises the hollow portion extending in the longitudinal direction of the fiber for artificial hair, wherein, when the fiber for artificial hair is heat-treated at 120°C for 5 minutes to obtain the fiber for artificial hair after 120°C heat treatment, and the fiber for artificial hair after 120°C heat treatment is further immersed in water at 90°C for 30 seconds and then dried to obtain the fiber for artificial hair after 90°C hot water treatment, the color difference ΔE^* between the fiber for artificial hair after 120°C heat treatment and the fiber for artificial hair after 90°C hot water treatment is 5 or less.

[0014]

1.1 Shape of Fiber for Artificial Hair

The fiber for artificial hair according to the present invention comprises the hollow portion extending in the longitudinal direction of the fiber for artificial hair. In the fiber for artificial hair according to the present invention, the hollow portion can be present continuously for 10 cm or more in the longitudinal direction of the fiber for artificial hair. Since the fiber for artificial hair according to the present invention comprises the hollow portion, it is lightweight, can form a target voluminous hairstyle with a small amount of attachment, can realize a wide range of hairstyles including a heavy long style, can reduce damage to one's own hair and scalp, and brings about many merits such as being able to reduce waste and environmental load.

[0015]

Fig. 1 shows examples of cross sections perpendicular to the longitudinal direction of the fiber for artificial hair according to one embodiment of the present invention. A shape of the cross section perpendicular to the longitudinal direction of the fiber for artificial hair according to one embodiment of the present invention can be any one selected from the circular shape (Fig. 1A and Fig. 1B) and an elliptical shape, the two-lobal shape in which two C-shapes are joined (Fig. 1C), the three-lobal shape in which three C-shapes are joined (Fig. 1D), a four or more-lobal shape in which four or more C-shapes are joined, the substantially triangular shape (Fig. 1E), the substantially rectangular shape (Fig. 1F), and a substantially polygonal shape.

[0016]

Although a method for producing the fiber for artificial hair according to the present invention is not particularly limited, the fiber for artificial hair is generally obtained by melt-spinning a resin composition for a fiber for artificial hair. The fiber for artificial hair having the

hollow portion is melt-extruded and formed from a nozzle having one C-shaped nozzle hole as shown in Fig. 1 of Patent Literature 1, for example, or a nozzle having a plurality of holes. Here, at least a part of the resin composition is divided while passing through the nozzle, but after being discharged from the nozzle hole, the resin compositions contact and fuse with each other to form the hollow portion. The fiber for artificial hair according to one embodiment of the present invention can have a joining surface 14 (shown by a broken line in Fig. 1) where the resin compositions are fused to each other in a melt extrusion process. In addition, a joining portion 13, which is a region including the joining surface 14, may comprise at least one of the inner projecting portion 16 projecting toward the hollow portion and the outer projecting portion 17 projecting toward the outside of the fiber for artificial hair (Fig. 1B). Although Fig. 1B shows a case where a fiber cross section is circular, when the hollow portion has another shape, at least one of the inner projecting portion projecting toward the hollow portion and the outer projecting portion projecting toward the outside of the fiber for artificial hair can similarly be provided at the joining portion. Thus, by providing the projecting portion, thickening the joining portion 13, and increasing an area of the joining surface 14 where the resin compositions are fused to each other, a joining strength can be improved. The production method will be described later.

[0017]

The fiber for artificial hair according to one embodiment of the present invention may have a major axis of 30 to 300 μm in the cross section perpendicular to the longitudinal direction of the fiber for artificial hair. The major axis is, 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.

[0018]

In the fiber for artificial hair according to one embodiment of the present invention, when an area ratio occupied by a hollow portion 15 in the cross section perpendicular to the longitudinal direction of the fiber for artificial hair is defined as a hollow ratio, the hollow ratio is preferably 5 to 50%. The hollow ratio is, for example, 5, 10, 15, 20, 25, 30, 35, 40, 45, or 50%, and may be within a range between any two of the numerical values exemplified here.

[0019]

The hollow ratio can be obtained by the following formula.

Hollow ratio = (area enclosed by an inner surface 12)/(area enclosed by an outer surface 11) $\times$ 100

The area enclosed by the outer surface 11 means a cross-sectional area assuming that the fiber for artificial hair does not have the hollow portion.

The hollow ratio can be determined by cutting the fiber for artificial hair perpendicular to the longitudinal direction, observing a cut surface with a laser microscope, a scanning electron microscope, or the like, and performing image analysis. Specifically, it can be determined by a

method described in Examples. By setting the hollow ratio to the above lower limit or more, advantages due to having the hollow portion can be obtained more reliably. If the hollow ratio exceeds the above upper limit, it leads to an increase in structural defects (an increase in fibers with separated joining portions or crushed hollow portions), an increase in rigidity due to an increase in fiber diameter, and a deterioration in tactile sensation, which is not preferable.

[0020]

It is considered that the deterioration of texture after hot water immersion, which is one of the problems of the present invention, occurs particularly remarkably in the fiber for artificial hair comprising the hollow portion. The reason why the deterioration of texture after hot water immersion is likely to occur in the fiber for artificial hair comprising the hollow portion is not clear, but it is presumed that this is because the fiber for artificial hair comprising the hollow portion has a structurally larger distribution of strain than a solid fiber for artificial hair, and micro defects such as voids and the like are likely to occur due to hot water immersion. In the prior art, it was difficult to suppress the deterioration of texture after hot water immersion in the fiber for artificial hair comprising the hollow portion, but according to the present invention, it is considered that the generation of micro defects such as voids and the like due to hot water immersion can be suppressed by highly adjusting a manufacturing condition so that ΔE^* falls within a specific numerical range, whereby a fiber for artificial hair excellent in texture and lightweight feeling after hot water treatment can be obtained.

[0021]

1.2 Constituent Materials of Fiber for Artificial Hair

1.2.1 Synthetic Fiber

The fiber for artificial hair according to one embodiment of the present invention may comprise the synthetic fiber (base material), and the fiber for artificial hair according to one embodiment of the present invention can have the synthetic fiber and the surface treatment composition on at least a part of the surface of the synthetic fiber.

The synthetic fiber can be composed of the resin composition for a fiber for artificial hair. A resin contained in the resin composition for a fiber for artificial hair is not particularly limited, and can comprise at least one of a polyamide-based resin, a polyester-based resin, the vinyl chloride-based resin, an AS-based resin (acrylonitrile styrene-based resin), a PP resin, a PET resin, a PE resin, a PAN-based resin, and a PLA-based resin (polylactic acid-based resin). The fiber for artificial hair according to one embodiment of the present invention preferably comprises the synthetic fiber containing the vinyl chloride-based resin from the viewpoint that a die swell effect is easily obtained, a structure having a projecting portion in which the area of the joining surface where the resin compositions are fused is increased can be obtained, and a fiber for artificial hair having a structure with improved joining strength is easily obtained. Further, the fiber for artificial hair according to one embodiment of the present invention preferably comprises the synthetic fiber containing at least one of the vinyl chloride-based resin and the AS-based resin (acrylonitrile styrene-based resin).

[0022]

The vinyl chloride-based resin according to one embodiment of the present invention can comprise a vinyl chloride-based polymer containing a monomer unit derived from a vinyl chloride monomer (vinyl chloride monomer unit). The vinyl chloride-based resin according to the present invention can comprise a homopolymer obtained by homopolymerizing a vinyl chloride monomer, and/or a copolymer containing a monomer unit 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 invention can be composed of one kind of vinyl chloride-based polymer, or can comprise two or more kinds of vinyl chloride-based polymers.

[0023]

The resin composition for a fiber for artificial hair constituting the synthetic fiber according to one embodiment of the present invention contains 50 to 99% by mass of the vinyl chloride-based resin, preferably 65 to 98% by mass, and more preferably 65 to 97% by mass in 100% by mass of the resin composition. 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.

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

[0024]

The AS-based resin (acrylonitrile styrene-based resin) is a copolymer having a styrene-based monomer unit and an acrylonitrile-based monomer unit, and may contain another monomer unit copolymerizable with these, if necessary. The AS-based resin contains the styrene-based monomer unit in an amount of, for example, 60, 65, 70, 75, 80, 85, or 90% by mass with respect to 100% by mass of the AS-based resin, and may be within a range between any two of the numerical values exemplified here. The AS-based resin contains the acrylonitrile-based monomer unit in an amount of, for example, 10, 15, 20, 25, 30, 35, or 40% by mass with respect to 100% by mass of the AS-based resin, and may be within a range between any two of the numerical values exemplified here.

[0025]

It is considered that the deterioration of texture after hot water immersion, which is one of the problems of the present invention, occurs particularly remarkably in a fiber for

artificial hair comprising a synthetic fiber containing a resin having a low water absorption rate. Therefore, when the synthetic fiber contains a resin having a low water absorption rate, for example, a vinyl chloride-based resin, an AS-based resin containing a styrene-based monomer unit, and the like, it is considered that an effect of suppressing the deterioration of texture after hot water immersion by adjusting ΔE^* appears particularly highly.

[0026]

The synthetic fiber according to one embodiment of the present invention can also contain other components as needed. Examples of the 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 coloring improver, a conductivity imparting agent, a fragrance, and the like.

[0027]

The synthetic fiber according to one embodiment of the present invention preferably contains the colorant. Carbon black can be given as the colorant. The resin composition constituting the synthetic fiber according to one embodiment of the present invention can contain 0.1 to 5 parts by mass of the colorant (especially carbon black) with respect to 100 parts by mass of the resin contained in the resin composition. A content of the colorant (especially carbon black) with respect to 100 parts by mass of the resin contained in the resin composition is, for example, 0.1, 0.2, 0.3, 0.4, 0.5, 1.0, 1.5, 2.0, 2.5, 3.0, 3.5, 4.0, 4.5, or 5.0 parts by mass, and may be within a range between any two of the numerical values exemplified here.

[0028]

1.2.2 Surface Treatment Composition

The surface treatment composition according to one embodiment of the present invention preferably contains at least one of an oil and a surfactant, and preferably contains an oil and a surfactant.

[0029]

The oil is not particularly limited, and examples thereof include a fatty acid skeleton-containing compound, a polyalkylene glycol, a silicone, liquid paraffin, and the like.

[0030]

Examples of the fatty acid skeleton-containing compound include saturated fatty acids such as stearic acid, palmitic acid, myristic acid, lauric acid, and capric acid, fatty acids such as unsaturated fatty acids such as oleic acid and the like, glycerides such as monostearic acid glyceride, monopalmitic acid glyceride, monomyristic acid glyceride, monolauric acid glyceride, monocapric acid glyceride, and diglycerides and triglycerides thereof, and organic acid glycerides such as citric acid monoglyceride, succinic acid monoglyceride, and lactic acid monoglyceride.

[0031]

Examples of the polyalkylene glycol include polyethylene glycol, polypropylene glycol, and a polyethylene glycol-polypropylene glycol copolymer. An average degree of polymerization

of the polyalkylene glycol is preferably 2 to 50, more preferably 3 to 40, further preferably 4 to 30, and particularly preferably 4 to 20. The average degree of polymerization of the polyalkylene glycol may be, for example, 2, 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, 30, 35, 40, 45, or 50, and may be within a range between any two of the numerical values exemplified here. When the average degree of polymerization of the polyalkylene glycol is in such a range, the fiber for artificial hair has more appropriate non-slip properties.

[0032]

The oil may be used singly or in combination of two or more kinds thereof. By having the oil in the surface treatment composition, a fiber bundle becomes difficult to slip, and softness as a fiber bundle can also be improved.

[0033]

The surfactant is not particularly limited, and examples thereof include a nonionic surfactant, a cationic surfactant, and an anionic surfactant. Among these, it is preferable to contain at least one of a nonionic surfactant and a cationic surfactant.

[0034]

Examples of the nonionic surfactant include polyoxyethylene fatty acid ester, polyoxyalkylene alkyl ether, polyoxyethylene alkyl ether, polyoxyethylene hydrogenated castor oil ether, polyoxyethylene alkylphenyl ether, sorbitan fatty acid ester, polyoxyethylene sorbitan fatty acid ester, sucrose fatty acid ester, glycerin fatty acid ester, polyoxyethylene polyoxypropylene block polymer, polyoxyethylene alkylamine ether, and fatty acid alkanolamide.

[0035]

Examples of the cationic surfactant include a quaternary ammonium salt having an oxyalkylene group, a quaternary ammonium salt having an alkyl group such as an alkyltrimethylammonium salt, a dialkyldimethylammonium salt, and an alkyldimethylethylammonium salt, a stearoxyethylpyridinium salt, an ammonium salt having an ester bond such as fatty acid triethanolamine and fatty acid triethanolamine formate, and an amine derivative having an alkyl chain such as polyoxyethylene alkylamine, N-alkylpropyleneamine, N-alkylpolyethylenepolyamine, and the like.

[0036]

The surfactant may be used singly or in combination of two or more kinds thereof. By having the surfactant, softness, non-slip properties, combability, and cohesiveness tend to be further improved.

[0037]

The surface treatment composition according to one embodiment of the present invention may contain other components as needed within a range not inhibiting the effects of the present invention. Examples of the other components include an alkyl alkylate, a silicone oil (e.g., amino-modified silicone), mineral oil, and the like.

[0038]

Since the fiber for artificial hair according to one embodiment of the present invention is configured to have the surface treatment composition on at least a part of the surface of the synthetic fiber, ease of penetration of hot water can be adjusted, and it is considered that ΔE^* can be adjusted. That is, ΔE^* can be adjusted by adjusting a type and amount of each agent contained in the surface treatment composition.

[0039]

The adhesion amount of the surface treatment composition in the fiber for artificial hair according to one embodiment of the present invention may be 0.05 to 1.0% by mass with respect to 100% by mass of the synthetic fiber. The adhesion amount of the surface treatment composition with respect to 100% by mass of the synthetic fiber may be, for example, 0.05, 0.06, 0.07, 0.08, 0.09, 0.1, 0.2, 0.3, 0.4, 0.5, 0.6, 0.7, 0.8, 0.9, or 1.0% by mass, and may be within a range between any two of the numerical values exemplified here. When a lower limit value of the adhesion amount of the surface treatment composition in the fiber for artificial hair is such a value, an artificial hair fiber bundle is excellent in combability. When an upper limit value of the adhesion amount of the surface treatment composition in the fiber for artificial hair is such a value, the artificial hair fiber bundle has more appropriate non-slip properties.

[0040]

1.3 Characteristics of Fiber for Artificial Hair

In the fiber for artificial hair according to the present invention, when the fiber for artificial hair is heat-treated at 120°C for 5 minutes to obtain the fiber for artificial hair after 120°C heat treatment, and the fiber for artificial hair after 120°C heat treatment is further immersed in water at 90°C for 30 seconds and then dried to obtain the fiber for artificial hair after 90°C hot water treatment, the color difference ΔE^* between the fiber for artificial hair after 120°C heat treatment and the fiber for artificial hair after 90°C hot water treatment is 5 or less.

[0041]

Depending on the application, the fiber for artificial hair may be subjected to the hot water treatment in which it is immersed in hot water after processing such as braiding and the like, but the texture (color and glossiness) of the fiber for artificial hair may deteriorate after the hot water treatment. Such a tendency was remarkable in, for example, the fiber for artificial hair having the hollow portion. Here, the reason why the texture of the fiber for artificial hair deteriorates after the hot water treatment is not clear, but it is considered to be related to the occurrence of micro defects such as voids and the like due to hot water immersion. In the prior art, it was difficult to suppress the deterioration of texture after hot water immersion in the fiber for artificial hair, but according to the present invention, by highly adjusting the manufacturing condition so that ΔE^* falls within the specific numerical range, it is considered that a fiber for artificial hair in which micro defects such as voids and the like due to hot water immersion are unlikely to occur is obtained, whereby a fiber for artificial hair excellent in texture and lightweight feeling after hot water treatment can be obtained.

[0042]

A method for measuring the color difference ΔE^* can be as described in Examples. Specifically, the fibers for artificial hair are bundled into a length of 400 mm and a mass of 5.1 g to prepare an artificial hair fiber bundle for evaluation.

First, the artificial hair fiber bundle for evaluation is heat-treated at 120°C for 5 minutes to obtain the fiber for artificial hair after 120°C heat treatment, and a color tone of the fiber for artificial hair after 120°C heat treatment is measured with a color tone measuring instrument. Here, the heating at 120°C for 5 minutes may be a dry step in an air atmosphere.

Next, the fiber for artificial hair after 120°C heat treatment is immersed in water at 90°C for 30 seconds and then dried to obtain the fiber for artificial hair after 90°C hot water treatment, and a color tone of the fiber for artificial hair after 90°C hot water treatment is measured with a color tone measuring instrument.

Subsequently, ΔE^* and ΔL^* are calculated from a difference between the color tone of the fiber for artificial hair after 120°C heat treatment and the color tone of the fiber for artificial hair after 90°C hot water treatment. In addition, ΔE^* and ΔL^* can be calculated as follows when the color tone of the fiber for artificial hair after 120°C heat treatment is $L^*=L_{120}^*$, $a^*=a_{120}^*$, and $b^*=b_{120}^*$, and the color tone of the fiber for artificial hair after 90°C hot water treatment is $L^*=L_{90}^*$, $a^*=a_{90}^*$, and $b^*=b_{90}^*$.

$$\Delta L^* = |L_{90}^* - L_{120}^*|$$

$$\Delta a^* = |a_{90}^* - a_{120}^*|$$

$$\Delta b^* = |b_{90}^* - b_{120}^*|$$

$$\Delta E^* = [(\Delta L^*)^2 + (\Delta a^*)^2 + (\Delta b^*)^2]^{1/2}$$

[0043]

In the above measurement method, the step of heat-treating the fiber for artificial hair at 120°C for 5 minutes is performed with an intention of resetting a change in color tone caused by the hot water treatment step. A color tone of the fiber for artificial hair (e.g., the fiber for artificial hair comprising the hollow portion) may change after passing through the hot water treatment step, but by performing the step of heat-treating at 120°C for 5 minutes, the color tone returns to a level equivalent to that before the hot water treatment step. Therefore, according to the above measurement method, even if the fiber for artificial hair to be evaluated has already undergone the hot water treatment step, a change in color tone is reset and then the hot water treatment step is performed. Thus, regardless of whether the object to be evaluated is a fiber for artificial hair that has undergone the hot water treatment step or a fiber for artificial hair that has not undergone the hot water treatment step, it is possible to evaluate a change in color difference that can occur in a single hot water treatment step under specific conditions.

[0044]

The color difference ΔE^* between the fiber for artificial hair after 120°C heat treatment and the fiber for artificial hair after 90°C hot water treatment is 5 or less, and more preferably

3 or less. The color difference ΔE^* is, for example, 0, 1, 2, 3, 4, or 5, and may be within a range between any two of the numerical values exemplified here.

[0045]

The color difference ΔE^* can be adjusted by highly controlling the manufacturing condition of the fiber for artificial hair. For example, it can be controlled by adjusting a type and a blending amount of a resin and a colorant contained in the resin composition for a fiber for artificial hair, a draw ratio, a standing time, a heat treatment temperature, and the like.

[0046]

The color difference ΔL^* between the fiber for artificial hair after 120°C heat treatment and the fiber for artificial hair after 90°C hot water treatment is 3 or less, and more preferably 2 or less. The color difference ΔL^* is, for example, 0, 1, 2, or 3, and may be within a range between any two of the numerical values exemplified here.

[0047]

The color difference ΔL^* can be adjusted by highly controlling the manufacturing condition of the fiber for artificial hair. For example, it can be controlled by adjusting the type and the blending amount of the resin and the colorant contained in the resin composition for a fiber for artificial hair, the draw ratio, the standing time, the heat treatment temperature, and the like.

[0048]

L_{120}^* of the fiber for artificial hair after 120°C heat treatment is preferably 25 or less. L_{120}^* of the fiber for artificial hair after 120°C heat treatment is, for example, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, or 25, and may be within a range between any two of the numerical values exemplified here. Generally, the fiber for artificial hair after 90°C hot water treatment is associated with having more micro defects than the fiber for artificial hair after 120°C heat treatment, and L_{90}^* is often larger than L_{120}^* .

[0049]

L_{120}^* of the fiber for artificial hair after 120°C heat treatment can be adjusted by highly controlling the manufacturing condition of the fiber for artificial hair. For example, it can be controlled by adjusting the type and the blending amount, and the like of the colorant contained in the resin composition for a fiber for artificial hair. When L_{120}^* of the fiber for artificial hair after 120°C heat treatment is low, that is, in a dark-colored fiber for artificial hair, the deterioration of texture after hot water immersion tends to be noticeable, and it is considered that the effect of suppressing the deterioration of texture after hot water immersion by adjusting ΔE^* appears particularly highly.

[0050]

1.4 Application of Fiber for Artificial Hair

The fiber for artificial hair according to one embodiment of the present invention can be for a hair ornament product, and in particular, can be for a hair ornament product including a braid. The fiber for artificial hair according to one embodiment of the present invention has a

hollow portion, and has numerous advantages of having a hollow portion, while being excellent in texture and lightweight feeling after hot water treatment. Therefore, it is suitable for a hair ornament product, particularly for a hair ornament product including a braid.

[0051]

2. Method for Producing Artificial Hair Fiber

The method for producing the fiber for artificial hair of the present invention is not particularly limited. The method for producing the fiber for artificial hair according to one embodiment of the present invention can comprise the surface treatment composition attaching step, the standing step, and the heat treatment step. In the surface treatment composition attaching step, the surface treatment agent is attached to the surface of the synthetic fiber to obtain the surface treatment agent-attached fiber for artificial hair. In the standing step, the surface treatment agent-attached fiber for artificial hair is left to stand at 30°C or lower to obtain the fiber for artificial hair after standing. In the heat treatment step, the fiber for artificial hair after standing is heat-treated to obtain the fiber for artificial hair. The standing step may start when the surface treatment agent is attached to the surface of the synthetic fiber and end when the heat treatment step starts, and a duration of the standing step can be less than 90 minutes.

The method for producing the fiber for artificial hair according to one embodiment of the present invention may comprise a resin composition preparation step for a fiber for artificial hair, a spinning step, a drawing step, and a gear processing step.

[0052]

2.1 Resin Composition Preparation Step for Fiber for Artificial Hair

In the resin composition preparation step for a fiber for artificial hair, raw materials containing a resin can be mixed to obtain the resin composition for a fiber for artificial hair. Here, the raw materials contain a base resin, and can contain other components as needed. The resin composition for a fiber for artificial hair is as described above.

[0053]

A mixing method is not particularly limited, and a conventionally known method may be adopted. For example, a powdery resin composition (powder compound) can be obtained using a known mixing apparatus such as a Henschel mixer, a super mixer, or a ribbon blender, and the powder compound can be melt-mixed to obtain a pellet-shaped resin composition (pellet compound). A production method of the powder compound may be hot blending or cold blending. As one example, in order to reduce volatile components from the resin composition, hot blending can be performed with a cut temperature during mixing set to 105 to 155°C. A production method of the pellet compound can be the same method as a general method for producing a pellet compound of a vinyl chloride-based resin. For example, a pellet compound can be obtained using a kneader 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 in order to prevent thermal degradation of the resin composition, it is

preferable to set a resin temperature to 185°C or less. Further, in order to remove metal pieces of a screw and fibers attached to protective gloves which may be mixed in a small amount into the pellet compound, a mesh can be installed near a tip of the screw. A cold cut method can be adopted for producing pellets. Means for removing chips (fine powder generated during pellet production) and the like that may be mixed during cold cutting may be adopted. In addition, when used for a long time, the cutter blade becomes chipped, and chips are easily generated, so it is preferable to replace it appropriately.

[0054]

3.2 Spinning Step

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

[0055]

Melt spinning conditions can be appropriately set depending on a type of the resin composition so that a resin melts and a structure in which joining portions are joined can be formed. As one example, a cylinder temperature can be 150 to 190°C, and a nozzle temperature can be $180 \pm 15^\circ\text{C}$.

[0056]

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

[0057]

A nozzle for melt extrusion of the synthetic fiber according to one embodiment of the present invention can be appropriately selected according to a shape and a hollow ratio of the fiber for artificial hair to be obtained.

As one example, when manufacturing the fiber for artificial hair having the circular cross section shown in Fig. 1A, a nozzle having a C-shaped nozzle hole can be used. When manufacturing the fiber for artificial hair having the two-lobal cross section in which two C-shapes are joined as shown in Fig. 1C, a nozzle having two C-shaped nozzle holes can be used. When manufacturing the fiber for artificial hair having the three-lobal cross section in which three C-shapes are joined as shown in Fig. 1D, a nozzle having three C-shaped nozzle holes can be used. Further, when manufacturing the fiber for artificial hair having the substantially triangular cross section as shown in Fig. 1E, a nozzle having three rod-shaped nozzle holes can be used. When manufacturing the fiber for artificial hair having the substantially rectangular cross section as shown in Fig. 1F, a nozzle having four rod-shaped nozzle holes can be used.

[0058]

3.3 Drawing Step

In the drawing step, the undrawn synthetic fiber obtained in the melt spinning step can be drawn by a drawing machine to obtain a synthetic fiber after drawing. As one example, in the drawing step, the undrawn synthetic fiber can be drawn 2 to 5 times at 90 to 110°C in an air atmosphere. The draw ratio is, for example, 2.0, 2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 2.7, 2.8, 2.9, 3.0, 3.1, 3.2, 3.3, 3.4, 3.5, 3.6, 3.7, 3.8, 3.9, 4.0, 4.1, 4.2, 4.3, 4.4, 4.5, 4.6, 4.7, 4.8, 4.9, or 5.0 times, and may be within a range between any two of the numerical values exemplified here. ΔE^* can be adjusted by adjusting drawing conditions, particularly the draw ratio.

In the present invention, the "synthetic fiber" is a synthetic fiber after spinning, and includes a synthetic fiber before attaching the surface treatment composition.

[0059]

3.4 Surface Treatment Composition Attaching Step

In the surface treatment composition attaching step, the surface treatment agent can be attached to the surface of the synthetic fiber using a surface treatment composition to obtain the surface treatment agent-attached fiber for artificial hair. In the surface treatment composition attaching step, an arbitrary attaching method can be used. For example, the surface treatment agent may be attached by bringing the synthetic fiber into contact with the surface treatment composition by a roll transfer method, or by immersing the synthetic fiber in the surface treatment composition. The adhesion amount of the surface treatment composition can be adjusted by adjusting a charging amount or adjusting a concentration of each component other than a solvent of the surface treatment composition.

[0060]

3.5 Standing Step

In the standing step, the surface treatment agent-attached fiber for artificial hair is left to stand at 30°C or lower to obtain the fiber for artificial hair after standing. The standing step starts when the surface treatment agent is attached to the surface of the synthetic fiber (synthetic fiber after drawing), and ends when the heat treatment step starts. Here, the standing step can start at the end of the surface treatment composition attaching step, that is, when the surface treatment agent is attached to the surface of the synthetic fiber after drawing for artificial hair. The standing step can end at the start of the heat treatment step, that is, when the fiber for artificial hair after standing is put into a heat treatment machine that performs heat treatment. A temperature in the standing step can be 10 to 30°C, and is, for example, 10, 15, 20, 25, or 30°C, and may be within a range between any two of the numerical values exemplified here. A time from the start to the end of the standing step (a duration of standing time) is preferably less than 90 minutes. The standing time is, for example, 1, 5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75, 80, or 85 minutes, and may be within a range between any two of the numerical values exemplified here.

ΔE^* can be adjusted by adjusting standing conditions, particularly the standing time. Although a mechanism by which ΔE^* can be adjusted by adjusting the standing time is not clear, it is presumed to be related to the occurrence of relaxation of orientation after the drawing step

while left to stand at a relatively low temperature (for example, 10 to 30°C).

[0061]

3.6 Heat Treatment Step

In the heat treatment step, the fiber for artificial hair after standing can be heat-treated to obtain the fiber for artificial hair. As one example, in the heat treatment step, the fiber for artificial hair after standing is heat-treated at 90 to 120°C in an air atmosphere, and an entire length of the fiber is heat-shrunk so that a relaxation ratio after heat treatment becomes 0.50 to 0.99 times, thereby obtaining the fiber for artificial hair (after heat treatment) having a desired fineness. The relaxation ratio during heat treatment is a value calculated by (rotation speed of take-up roller during annealing)/(rotation speed of delivery roller during annealing).

The heat treatment temperature is, for example, 90, 95, 100, 105, 110, 115, or 120°C, and may be within a range between any two of the numerical values exemplified here. A heat treatment time may be 3 to 10 minutes. The heat treatment time is, for example, 3, 4, 5, 6, 7, 8, 9, or 10 minutes, and may be within a range between any two of the numerical values exemplified here. The start of the heat treatment step can be defined as a time when the fiber for artificial hair begins to be exposed to a set temperature, for example, an atmosphere of 90°C or higher. A heat treatment apparatus used in the heat treatment step is preferably heated to the heat treatment temperature in advance, and the heat treatment step can start when the fiber for artificial hair after standing is put into a furnace heated to a preset temperature.

ΔE^* can be adjusted by adjusting heat treatment conditions, particularly the heat treatment temperature.

[0062]

3.7 Gear Processing Step

The method for producing the fiber for artificial hair according to one embodiment of the present invention can also comprise a gear processing step.

In the gear processing step, crimping can be performed by passing a fiber bundle between two meshing high-temperature gears. A material of gears, a shape of a wave of the gears, the number of teeth of the gears, and the like used in the gear processing step are not particularly limited. In the gear processing step, a shape of the obtained fiber for artificial hair can be controlled by appropriately adjusting a depth of a groove of a gear waveform, a surface temperature of the gear, a processing speed, pressure conditions between gears, and the like in consideration of a fiber material and fineness. Although these processing conditions are not particularly limited, As one example, the depth of the groove of the gear waveform can be 0.2 mm to 6 mm, preferably 0.5 mm to 5 mm, the surface temperature of the gear can be 30°C to 100°C, preferably 40°C to 80°C, and the processing speed can be 0.5 to 10 m/min, preferably 1.0 m/min to 8.0 m/min.

[0063]

3.8 Other Steps

The method for producing the fiber for artificial hair according to one embodiment of

the present invention can also comprise other steps as needed, and can comprise, for example, a processing step for making a hair ornament product (specifically, a processing step such as braiding and the like) and a hot water treatment step of immersing in hot water.

In the present invention, the fiber for artificial hair includes a fiber for artificial hair after spinning, and includes a fiber for artificial hair before a drawing step, after a drawing step, before a surface treatment composition attaching step, after a surface treatment composition attaching step, before a standing step, after a standing step, before a heat treatment step, after a heat treatment step, before a gear processing step, after a gear processing step, before a processing step for making a hair ornament product, after a processing step for making a hair ornament product, before a hot water treatment step of immersing in hot water, and after a hot water treatment step of immersing in hot water.

[0064]

4. Artificial Hair Fiber Bundle and Hair Ornament Product

An artificial hair fiber bundle according to one embodiment of the present invention comprises the above fiber for artificial hair. Further, a hair ornament product according to one embodiment of the present invention comprises the above artificial hair fiber bundle.

[0065]

The fiber for artificial hair according to the present invention can be used for a hair ornament product. Examples of the hair ornament product include a wig, a hairpiece, a braid, extension hair, doll hair, a hair wig, a partial wig, a hairband, and the like. The hair ornament product obtained from the fiber for artificial hair according to the present invention has a hollow portion, and is excellent in texture and lightweight feeling after hot water treatment. Since the hair ornament product obtained from the fiber for artificial hair according to one embodiment of the present invention has numerous advantages of having a hollow portion while being excellent in texture and lightweight feeling after hot water treatment, it is lightweight, can form a target voluminous hairstyle with a small amount of attachment, can realize a wide range of hairstyles including a heavy long style, can reduce damage to one's own hair and scalp, can reduce waste and environmental load, and has a small change in texture even after processing, thereby bringing about many merits such as providing a finish exactly as targeted by a customer.

The hair ornament product according to one embodiment of the present invention having the above characteristics is applicable to various styles, and is particularly suitable for a braid including braiding such as a three-strand braid, a twist, and the like.

EXAMPLES

[0066]

Hereinafter, the present invention will be described in more detail based on Examples, but the present invention is not construed as being limited to these.

[0067]

(Example 1)

100 parts by mass of a vinyl chloride-based resin (manufactured by Taiyo Vinyl

Corporation, product name: TH1000), 0.5 parts by mass of carbon black (manufactured by Mitsubishi Chemical Corporation, product name: #950 Carbon), and a total of 5 parts by mass of additives such as a plasticizer, a stabilizer, a lubricant, and the like (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) were mixed using a blender. The blended materials were kneaded using a single-screw extruder of $\phi 40$ mm to obtain a pellet-shaped resin composition for a fiber for artificial hair for spinning.

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: "Adekacizer (registered trademark) O-130P" manufactured by ADEKA Corporation

Phosphorus-based chelating agent: "Adekastab (registered trademark) 1030" manufactured by ADEKA Corporation

Polyethylene wax: manufactured by Mitsui Chemicals, Inc.

[0068]

The obtained pellet-shaped resin composition for a fiber for artificial hair was spun with a $\phi 40$ mm single-screw melt spinning machine. A discharge amount and a winding speed were adjusted, and an undrawn yarn was produced from the molten resin discharged from a nozzle. A nozzle having three C-shaped nozzle hole cross-sectional shapes was used as the nozzle. A cylinder temperature and a nozzle temperature of the spinning machine were set to 140 to 190°C.

[0069]

<Drawing Step, Surface Treatment Composition Attaching Step, Standing Step, and Heat Treatment Step>

The obtained undrawn yarn (undrawn synthetic fiber) was drawn with a drawing machine at 100°C at a draw ratio of 3 times to obtain a synthetic fiber after drawing.

By immersing the synthetic fiber after drawing in a surface treatment composition containing polyethylene glycol (manufactured by Aoki Oil Industrial Co., Ltd., product name: PEG-200, average degree of polymerization 4) and a quaternary ammonium salt type cationic surfactant (manufactured by Yoshimura Oil Chemical Co., Ltd., product name: F-20), the surface

treatment composition was attached to the synthetic fiber after drawing to obtain a surface treatment agent-attached fiber for artificial hair.

The surface treatment agent-attached fiber for artificial hair was left to stand at room temperature (23°C) for 10 minutes from a time when the surface treatment composition adhered to the fiber for artificial hair after drawing, to obtain a fiber for artificial hair after standing.

The fiber for artificial hair after standing was put into a heat treatment apparatus simultaneously with an end of the 10-minute standing step, and a heat treatment step was started at 115°C, and after the end of the heat treatment step, a fiber for artificial hair was obtained. The heat treatment apparatus was preheated in advance, and the fiber for artificial hair after standing was put into the heat treatment apparatus having an atmospheric temperature in a furnace of 115°C. A relaxation ratio during heat treatment was 0.50 to 0.99 times. The relaxation ratio during heat treatment is a value calculated by (rotation speed of take-up roller during annealing) / (rotation speed of delivery roller during annealing).

[0070]

(Examples 2 to 10, Comparative Examples 1 to 3)

Fibers for artificial hair were obtained in the same manner as in Example 1 except that a composition of the resin composition for a fiber for artificial hair, a type of nozzle, a draw ratio, a standing time, and a heat treatment temperature were changed.

In Example 10, as the AS-based resin, a vinyl-based copolymer resin of 68% by mass of a styrene monomer unit and 32% by mass of an acrylonitrile monomer unit (manufactured by Denka Company Limited, product name: GR-AT-6S) was used. Moreover, in Example 8, Example 9, Example 10, and Comparative Example 2, nozzles having different nozzle hole cross-sectional shapes were respectively used to adjust a hollow ratio.

[0071]

The obtained fibers for artificial hair were evaluated by the following methods. A fiber bundle obtained by cutting a fiber for artificial hair to an appropriate length was wound with vinyl tape, and the fiber bundle was cut with a utility knife so as to be perpendicular to a longitudinal direction to prepare a cross section, and cross section observation was performed. Using a laser microscope, a cross-sectional photograph of the fiber was taken at a magnification of 400 times, and an area ratio (hollow ratio) of a hollow portion in the cross section was measured.

Hollow ratio = Area enclosed by inner surface/Area enclosed by outer surface×100

For calculation of the hollow ratio, Controller VK-X150 manufactured by Keyence Corporation was used. The hollow ratio was an average value of 50 samples (n=50).

[0072]

<L* Value before Immersion, ΔE^* , ΔL^* >

Fibers for artificial hair of Examples and Comparative Examples were bundled into a length of 400 mm and a mass of 5.1 g to prepare an artificial hair fiber bundle for evaluation.

First, the artificial hair fiber bundle for evaluation was heat-treated at 120°C for 5 minutes in a perfect oven (manufactured by ESPEC Corp., PH302) in an air atmosphere to obtain a fiber for artificial hair after 120°C heat treatment. A color tone of the fiber for artificial hair after 120°C heat treatment was measured with a color tone measuring instrument (manufactured by Konica Minolta, Inc., CM-36dGV).

Next, the fiber for artificial hair after 120°C heat treatment was immersed in water at 90°C for 30 seconds and then dried to obtain a fiber for artificial hair after 90°C hot water treatment. A color tone of the fiber for artificial hair after 90°C hot water treatment was measured with a color tone measuring instrument (manufactured by Konica Minolta, Inc., CM-36dGV).

ΔE^* and ΔL^* were calculated from a difference between the color tone of the fiber for artificial hair after 120°C heat treatment and the color tone of the fiber for artificial hair after 90°C hot water treatment. In addition, ΔE^* and ΔL^* can be calculated as follows when the color tone of the fiber for artificial hair after 120°C heat treatment is $L^*=L_{120}^*$, $a^*=a_{120}^*$, and $b^*=b_{120}^*$, and the color tone of the fiber for artificial hair after 90°C hot water treatment is $L^*=L_{90}^*$, $a^*=a_{90}^*$, and $b^*=b_{90}^*$.

$$\Delta L^* = |L_{90}^* - L_{120}^*|$$

$$\Delta a^* = |a_{90}^* - a_{120}^*|$$

$$\Delta b^* = |b_{90}^* - b_{120}^*|$$

$$\Delta E^* = [(\Delta L^*)^2 + (\Delta a^*)^2 + (\Delta b^*)^2]^{1/2}$$

[0073]

For the artificial hair fiber bundle for evaluation according to Example 1, after the color tone measurement was once performed by the above measurement method (that is, for the fiber for artificial hair that was heat-treated at 120°C for 5 minutes, immersed in water at 90°C for 30 seconds, and then dried), when the color tone measurement was performed again on the same artificial hair fiber bundle for evaluation by the above measurement method, ΔE^* was 1, and a result of the second measurement was the same as a result of the first measurement. Also for the artificial hair fiber bundle for evaluation according to Comparative Example 1, similarly, after the color tone measurement was once performed by the above measurement method, when the color tone measurement was performed again on the same artificial hair fiber bundle for evaluation by the above measurement method, ΔE^* was 6, and a result of the second measurement was the same as a result of the first measurement.

[0074]

Using the fibers for artificial hair of Examples and Comparative Examples having a length of 400 mm and a mass of 5.1 g, a three-strand braided structure was produced, and then this braided structure was immersed in water at 90°C for 30 seconds. Next, after taking the braided structure out of water, water was wiped off by lightly rubbing a surface of the braided structure 3 times. Then, by leaving it to stand at room temperature (25°C) for 24 hours or longer, it was naturally dried, and then a color tone and glossiness were evaluated visually and by touch. Ten hair fiber processing technicians (with 5 or more years of practical experience) evaluated visually

and by touch in two ranks of "good texture" or "poor texture", and evaluated according to the following criteria.

A: 9 or more people evaluated that texture is good.

B: 5 to 8 people evaluated that texture is good.

C: 1 to 4 people evaluated that texture is good.

D: 0 people evaluated that texture is good.

[0075]

Using the fibers for artificial hair of Examples and Comparative Examples having a length of 400 mm and a mass of 5.1 g, a three-strand braided structure was produced, and then this braided structure was immersed in water at 90°C for 30 seconds. Next, after taking the braided structure out of water, water was wiped off by lightly rubbing a surface of the braided structure 3 times. Then, by leaving it to stand at room temperature (25°C) for 24 hours or longer, it was naturally dried, and then evaluated whether it felt lightweight when touched by hand. Ten hair fiber processing technicians (with 5 or more years of practical experience) evaluated in two ranks of "having a lightweight feeling" or "having no lightweight feeling", and evaluated according to the following criteria.

A: 9 or more people evaluated that there is a lightweight feeling.

B: 5 to 8 people evaluated that there is a lightweight feeling.

C: 1 to 4 people evaluated that there is a lightweight feeling.

D: 0 people evaluated that there is a lightweight feeling.

[0076]

Table 1

Table 1				Unit	Example										Comparative Example		
Resin composition for fiber for artificial hair	Resin	Vinyl chloride-based resin	100		100	100	100	100	100	100	100	100	100	75	100	100	100
		AS-based resin															
	Colorant	Carbon black	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
	Production conditions	Draw ratio		times	3	3	2.5	3.5	3	5	3	3	3	3	3	5	3
Standing time		minutes	10	10	10	10	10	10	10	10	10	10	10	10	10	90	
Heat treatment temperature		°C	115	120	115	115	110	115	105	115	115	115	115	105	115	115	
Hollow ratio		%	25	25	25	25	25	25	25	40	4	25	25	0	25		
Characteristics	L120* of the fiber for artificial hair after 120°C heat treatment			17	17	17	17	17	17	17	17	17	18	17	17	17	17
	ΔE*			1	1	1	2	2	4	4	2	1	1	6	1	6	
	ΔL*			1	1	1	2	2	3	3	1	1	1	6	1	6	
	Texture			A	A	A	B	B	C	C	B	A	A	D	A	D	
Evaluation	Lightweight feeling			A	A	A	A	A	A	A	A	C	A	A	D	A	

REFERENCE SIGNS LIST

[0077]

100: Cross section of fiber for artificial hair, 11: Outer surface, 12: Inner surface, 13: Joining portion, 14: Joining surface, 15: Hollow portion, 16: Inner projecting portion, 17: Outer projecting portion

Claims

[Claim 1]

A fiber for artificial hair, comprising:

a hollow portion extending in a longitudinal direction of the fiber for artificial hair,

wherein, when the fiber for artificial hair is heat-treated at 120°C for 5 minutes to obtain a fiber for artificial hair after 120°C heat treatment, and the fiber for artificial hair after 120°C heat treatment is further immersed in water at 90°C for 30 seconds and then dried to obtain a fiber for artificial hair after 90°C hot water treatment, a color difference ΔE^* between the fiber for artificial hair after 120°C heat treatment and the fiber for artificial hair after 90°C hot water treatment is 5 or less.

[Claim 2]

The fiber for artificial hair of Claim 1, wherein a color difference ΔL^* between the fiber for artificial hair after 120°C heat treatment and the fiber for artificial hair after 90°C hot water treatment is 3 or less.

[Claim 3]

The fiber for artificial hair of Claim 1 or Claim 2, wherein the hollow portion occupies 5 to 50% of an area of a cross section perpendicular to the longitudinal direction of the fiber for artificial hair.

[Claim 4]

The fiber for artificial hair of Claim 1 or Claim 2, comprising a vinyl chloride-based resin.

[Claim 5]

The fiber for artificial hair of Claim 1 or Claim 2, wherein the fiber for artificial hair has a surface treatment composition on at least a part of a surface of a synthetic fiber.

[Claim 6]

The fiber for artificial hair of Claim 1 or Claim 2, which is for use in a hair ornament product including a braid.

[Claim 7]

A hair ornament product comprising the fiber for artificial hair of Claim 1 or Claim 2.

[Claim 8]

A method for producing the fiber for artificial hair of Claim 1 or Claim 2,

wherein the method for producing comprises a surface treatment composition attaching step, a standing step, and a heat treatment step,

in the surface treatment composition attaching step, a surface treatment agent is attached to a surface of a synthetic fiber using a surface treatment composition to obtain a surface treatment agent-attached fiber for artificial hair,

in the standing step, the surface treatment agent-attached fiber for artificial hair is left to stand at 30°C or lower to obtain a fiber for artificial hair after standing,

in the heat treatment step, the fiber for artificial hair after standing is heat-treated to obtain the fiber for artificial hair, and

the standing step starts when the surface treatment agent is attached to the surface of the synthetic fiber and ends when the heat treatment step starts, and a duration of the standing step is less than 90 minutes.