

DESCRIPTION

Title of Invention: HAIR COMPOSITION

Technical Field

5 [0001]

The present invention relates to a hair composition, in particular, a hair composition for improving hair quality, which is capable of imparting body and stiffness to the hair, and, by being used during hair styling, more easily imparting a sense of
10 hair volume, as well as an excellent feel and softness of the hair.

Background Art

[0002]

15 Many people are still frustrated by failing to create a desired hairdo. Since hair styling is usually performed in the morning when time is limited, consumers want to achieve an auxiliary method that enables them to quickly, easily, and desirably set their hair. Quick and desirable hair styling is
20 particularly difficult for people having thin and soft hair or people who are experiencing a reduction in hair thickness or losing hair due to aging; therefore, these people particularly have a strong demand for the development of an auxiliary hair styling method. Since such a failure to create a desired hairdo
25 has been an issue for a long time, there have been many suggestions to date. In the early years, in an attempt to increase the hair rigidity and thereby impart body and stiffness to the hair by applying a film-coating substance to the hair surface so as to easily create a voluminous hairdo, various hair
30 styling coating resins were developed. However, these hair styling coating resins have unsolved drawbacks including a significant decrease of the feel of the hair surface, a loss of hair softness, as well as a loosening of the hair set due to a loss of the coating rigidity under a high-humidity environment,
35 and easy loosening of the hair set by combing.

[0003]

In view of these problems, there have been various new suggestions. Examples of methods for alleviating the disadvantages of coating resins by compounds to be used with the resin include the use of cation, higher alcohol, and branched ester compound with the resin (Patent Document 1); the use of plant extract with the resin (Patent Document 2); the use of a plurality of cationic polymers with the resin (Patent Document 3); and the use of cation, ampholytic surfactant, and long-chain aliphatic alcohol with the resin (Patent Document 4). Examples of compounds suggested as a replacement for a coating resin include wheat protein hydrolysate (Patent Document 5); eucalyptus extract (Patent Document 6); the combined use of cation, silicone, long chain alcohol, and hydrogenated jojoba oil (Patent Document 7); and the combined use of cation, amino-modified silicone, and heavy liquid isoparaffin (Patent Document 8). Further, examples of techniques of modifying the nature of hair itself by permeating the hair with a compound include compound-focused methods, such as a method using a substance with oxidation or reduction activity (Patent Document 9) or a method using a hair permeation promoter (Patent Documents 10 to 12); and application method-focused technologies, such as a method using an aerosol formulation (Patent Document 13), or a method using a 2-agent type formulation (Patent Document 14). However, insufficient modification of the nature of the hair or an inevitable decrease of the feel of the hair cannot be solved by application only to the hair surface. On the other hand, problems such as an insufficient permeation amount and insufficient retention inside the hair after permeation cannot be solved by the method of permeating the hair with an improver. Thus, satisfactory techniques have not been discovered.

Citation List

Patent Documents

[0004]

Patent Document 1: JP2011-098927A

Patent Document 2: JP2011-037780A

Patent Document 3: JP2012-232945A

Patent Document 4: JP2012-232919A

5 Patent Document 5: JPH05-000921A

Patent Document 6: JP2006-238635A

Patent Document 7: JP2012-097047A

Patent Document 8: JP2009-320871A

Patent Document 9: JP2012-149028A

10 Patent Document 10: JPH10-029917A

Patent Document 11: JP2001-072553A

Patent Document 12: JP2010-172134A

Patent Document 13: JP2002-128644A

Patent Document 14: JP2013-40153A

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Summary of Invention

Technical Problem

[0005]

20 An object of the present invention is to provide a hair composition for improving hair quality ensuring excellent stability over time and capable of imparting finger-combing smoothness or gloss to the hair after styling without causing a stiff or greasy feel of the hair, although the composition also imparts superior body and stiffness of the hair.

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Solution to Problem

[0006]

30 The present inventors newly found that one of the reasons for the failure to solve the above long-discussed problems is a failure to find optimal conditions because the development and consideration have been performed based on improper objective evaluation methods. More specifically, in the previous analyses of objective evaluations regarding the body and stiffness of the samples, which were obtained by application to a hair bundle or by actual use, the measured values of all samples

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or the measured values of most of the samples excluding some samples were analyzed through various operations. However, the inventors realized that the correlation between the analysis results obtained in this method and the sensory evaluation of body and stiffness of the hair is insufficient; the inventors further found that by rearranging the all measured values of the samples obtained as above in descending order, and assuming that, for example, a greater value of the body and stiffness degree indicates a higher body and stiffness, a sufficient correlation between the obtained analysis results and the sensory evaluation of the body and stiffness of the hair can be obtained to an extent unobtainable from the previous method by using only upper measured values (for example, about 10% to about 15% of the upper values). By developing such an evaluation or analysis method, an objective comparative evaluation with many samples can be easily performed. The inventors of the present invention conducted extensive research in view of the above finding, and found that an effect of superior improvement in the body and stiffness of the hair can be obtained by spraying a composition containing a zinc compound together with negative ions. With this finding, the inventors completed the present invention.

[0007]

Specifically, the present invention provides, in particular, the following inventions.

25

Item 1. A charged hair composition, comprising at least one zinc compound selected from the group consisting of zinc acetate, zinc gluconate, zinc chloride, zinc lactate, and zinc pyrrolidonecarboxylate, the charged hair composition being negatively charged.

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Item 2. The charged hair composition according to Item 1, wherein the content of the zinc compound is 0.1 to 5 mass %.

Item 3. The charged hair composition according to any one of Items 1 to 3, wherein the charged hair composition is a liquid composition containing water.

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Item 4. A hair composition for a spray device having a negative ion generator, comprising at least one zinc compound selected from the group consisting of zinc acetate, zinc gluconate, zinc chloride, zinc lactate, and zinc pyrrolidonecarboxylate.

5 Item 5. A method for improving hair quality, comprising applying to hair a hair composition comprising at least one zinc compound selected from the group consisting of zinc acetate, zinc gluconate, zinc chloride, zinc lactate, and zinc
10 pyrrolidonecarboxylate, using a spray device having a negative ion generator.
[0008]

The present invention also provides the following inventions.

15 Item 6. Use of the charged hair composition according to any one of Items 1 to 3 for improving hair quality.

Item 7. Use of the charged hair composition according to Item 4 for improving hair quality.

Item 8. A method for improving hair quality, comprising:

20 negatively charging a hair composition comprising at least one zinc compound selected from the group consisting of zinc acetate, zinc gluconate, zinc chloride, zinc lactate, and zinc pyrrolidonecarboxylate; and

spraying the negatively-charged hair composition to
25 hair.
[0009]

The present invention provides a hair composition for improving hair quality, which imparts superior body and stiffness to the hair particularly by being used during styling; the
30 present invention further provides a hair composition for improving hair quality while ensuring excellent stability over time and a capability of imparting finger-combing smoothness or gloss without causing a stiff or greasy feel after use, although the composition also imparts superior body and stiffness to the
35 hair.

[0010]

Terms

In this specification of the present invention, the term "hair composition" means a composition intended to be used for hair.

In this specification of the present invention, the term "hair composition" means a composition for hair.

[0011]

Charged Hair Composition

A charged hair composition of the present invention comprises a zinc compound.

The zinc compound used for the present invention is at least one member selected from the group consisting of zinc acetate, zinc gluconate, zinc chloride, zinc lactate, and zinc PCA. These compounds may be used solely or in a combination of two or more. Among these, zinc gluconate, zinc chloride, and zinc lactate are preferable because they ensure higher effects of the present invention. In the composition of the present invention, the zinc compound may be in the form of, for example, a salt, an ion, a solvate, a combined form thereof, or the like. The amount of the zinc compound may be 0.1 to 5 mass %, preferably 0.3 to 4 mass %, further preferably 0.5 to 3 mass %, and most preferably 0.5 to 2 mass %, based on the entire amount of the hair composition.

[0012]

The charged hair composition of the present invention is a negatively-charged hair composition.

The charged hair composition of the present invention does not have to be always negatively charged insofar as it is negatively charged, for example, when being applied to hair as a hair composition.

More specifically, the charged hair composition of the present invention is preferably negatively charged when it is applied to hair.

Further, one aspect of the charged hair composition of

the present invention may be a hair composition comprising a zinc compound, which is intended to be negatively charged when it is applied to hair. Examples of such compositions include a composition having a package or an instruction for informing the user that the composition is used by being charged.

Further, one aspect of the charged hair composition of the present invention may be a hair composition comprising a zinc compound, which is intended to be negatively charged on the assumption that it is to be applied to hair. Examples of such compositions include a composition negatively charged for a test performed in a state of being applied to hair.

[0013]

The charge amount (this amount may also be referred to as "specific charge amount" in this specification) of the charged hair composition of the present invention for 1 g of the hair per unit time is preferably 0.01 $\mu\text{C/s}$ or more, more preferably 0.012 $\mu\text{C/s}$, and further preferably 0.014 $\mu\text{C/s}$. By applying the charged hair composition of the present invention, which is charged to such a specific charge amount, to hair, as described later, it is possible to preferably improve hair quality. In this specification, "1 g of hair" means dry hair (i.e., unwet hair), unless otherwise specified.

In view of the effects of the present invention, the upper limit of the specific charge amount is not particularly limited; however, in view of preventing troubles due to electrostatic generation, the specific charge amount is preferably 0.33 $\mu\text{C/s}$ or less.

The specific charge amount is determined by a charge amount determined by the following measurement method using a Faraday gauge.

▪ Measurement Method Using a Faraday Gauge

An outer conductive enclosure and an inner conductive enclosure are insulated from each other, and then a zinc-containing composition is sprayed toward the inner conductive

enclosure for a certain period of time (5 seconds) from a spray device equipped with a negative ion generator, thereby adhering the composition to the conductive enclosure. The electric energy generated in the inner conductive enclosure from the adhered charged therapeutic agent is measured using an electrostatic sensor, and the charge amount is calculated based on the resistance (fixed value) of the device.

[0014]

The negative charging of the hair composition can be appropriately performed, for example, by making a mist of the hair composition while adhering negative ions to the hair composition using a spray device equipped with a negative ion generator.

The "spray device equipped with a negative ion generator" used in the specification of the present invention is a known technology, and an example of the device is disclosed, for example, in JP2009-297087A. The device at least includes a storage unit for storing a liquid composition, a device unit for spraying the composition in the form of a mist, and a device unit for generating negative ions.

[0015]

Examples of the method for spraying a mist of the composition include a method of making the composition to be present together with a gas that does not turn into a liquid by compression, in a pressurized state, and making a mist of the liquid using an aerosol mechanism; a method of making a mist by spraying a steam generated by heating a liquid with a heater from a nozzle; a method of turning a liquid into a mist using an ultrasonic wave generating device and spraying the mist; and a method using a mist nozzle having a Venturi structure, which converts a liquid into a mist using a pressurized gas. Among these methods, the method of converting a liquid into a mist using a pressurized gas allows easy miniaturization of the device, and also allows spraying of a small amount of the composition; therefore, this method is most preferable to be used for the

application of the hair composition of the present invention. Examples of the methods for generating a pressurized gas include a method using gas cylinders of liquefied gas or compressed gas, and a method using a compressed gas generated by sending a gas to
5 a compression unit such as a tank using an air pump or the like. Particularly preferable examples of a spray device used in these methods include the spray device disclosed in WO2015/034002.

[0016]

The phrase "negative ion" used in the specification of
10 the present invention means "negatively-charged particles in a gas." For example, it is known that, when electrons are released using an electrical means, the released electrons adhere to or combine with molecules of a gas or water, thereby forming negative ions; thereafter, the electrons immediately combine with
15 ambient molecules of a gas or water, thereby forming a "negative ion molecular group." The "negatively-charged particles in a gas" mainly means the "negative ion molecular group". In the present invention, a negative ion molecular group in which several to several tens of water molecules are combined is preferably used.

20 [0017]

Examples of the methods for generating negative ions include, but are not particularly limited to, the Lenard method, a corona discharge method, an electron emission method, a creeping discharge method, a piezoelectric transformer method and
25 methods using plasma. Of these, the corona discharge method, electron emission method, and piezoelectric transformer method are preferable, and the corona discharge method is most preferable. More specifically, for example, a method using a device having a corona discharge unit with a discharge needle and
30 a semicylindrical counter substrate, and causing discharge by applying a high voltage between the discharge needle and the counter substrate, thereby generating negative ions; a method using a device having a central electrode, a cylindrical counter electrode surrounding the central electrode, and a dielectric
35 unit for insulating them from each other, and causing discharge

by applying a high voltage between these electrodes, thereby generating negative ions; a method using a device having a plurality of needle-like electrodes and a flat plate electrode disposed on the opposite side, and causing discharge by applying a high voltage between these electrodes, thereby generating negative ions; and a method of generating an intermittent high voltage using a high-voltage DC power unit, and causing discharge by applying the voltage to an electrode with a needle-like end, thereby generating negative ions. Since the negative ion generator may cause a flammable gas to catch fire, if the negative ion generator has a mechanism that may cause a flammable gas to catch fire, a method of converting a liquid into a mist using an aerosol mechanism using flammable liquefied gas must not be used.

[0018]

The negative ions are preferably adhered to the hair composition immediately after the hair composition is converted into a mist. More specifically, the adhesion of negative ions is performed by providing a negative ion emission unit in the vicinity of an ejection unit of the atomizer device. For example, a preferable example may be a method of bringing negative ions generated by a negative ion generator into contact with the mist particles of the hair composition using an air current. In this case, since negative ions are adsorbed to an easily-polarizable resin, metal, or the like and thereby disappear, the negative ion generator is provided in a position as close as possible to the negative ion emission unit (emission outlet), thereby bringing the generated negative ions into contact with the mist particles of the hair composition as quickly as possible. Further, by causing the spray device and the negative ion generator to operate together, it is possible to easily generate mist particles of the hair composition to which negative ions are adhered. The amount of negative ions in contact with the mist particles depends on the negative ion generating capability of the negative ion generator and the wind speed of the air current.

The present invention uses a spray device with a negative ion generator capable of generating negative ions so that preferably 600,000 or more, more preferably 1 million or more, and further preferably 2 million or more negative ions are present per cubic centimeter in a region about 2 cm distant from the negative ion emission outlet. The measurement of negative ions may be performed using a known ion measurement device. Examples of ion measurement devices include an AIC-3000 air ion measurement device (product name, Sato Shoji Corporation), a KEC-900 air ion measurement device (product name, Alton), an NT-CA air ion counter (product name, Andes Electric Co., Ltd.), and an NKMH-103 air ion counter (product name, Hokuto Electronics, inc.).

[0019]

Such a hair composition with negative ions adhered by using a spray device having a negative ion generator is applied to hair in an amount according to the preferable specific charge amount described above.

By spraying the hair composition of the present invention from the spray device having a negative ion generator, it is possible to apply the hair composition of the present invention to hair.

The conditions in the application of the hair composition of the present invention to the hair are preferably set so that the specific charge amount of the hair composition of the present invention falls to the preferable specific charge amount described above.

For example, when a spray device having a negative ion generator with a smaller negative ion generation capability is used, it is preferable to set a small distance between the negative ion emission outlet of the spray device having a negative ion generator and the hair. In contrast, when a spray device having a negative ion generator with a greater negative ion generation capability is used, it is possible to set a longer distance between the negative ion emission outlet of the spray device having a negative ion generator and the hair. More

specifically, when the spray device having a negative ion generator described above is used, the application of the hair composition of the present invention to hair is performed so that the distance between the negative ion emission outlet of the spray device having a negative ion generator and the hair is preferably in a range of about 1 to 40 cm, more preferably in a range of about 3 to 30 cm, and further preferably in a range of about 5 to 20 cm.

[0020]

The mean particle diameter of the droplets of the charged hair composition of the present invention sprayed by using a spray device having a negative ion generator is preferably in a range of 20 to 100 μm , more preferably in a range of 40 to 80 μm , and further more preferably in a range of about 50 to 60 μm . For example, by using a device disclosed in WO2015/034002, the composition of the present invention with droplets having the above mean particle diameter may suitably be obtained.

In this specification, a "mean particle diameter" is more specifically a Sauter mean particle diameter.

[0021]

The hair composition of the present invention preferably contains hydrocarbons such as squalane, α -olefin oligomers having a polymerization degree of 2 to 7, and isoparaffin having a polymerization degree of 3 to 10. By using these hydrocarbons solely or in a combination of two or more together with the metal compound, it becomes possible to impart further body and stiffness to the hair, thereby obtaining superior effects of the present invention. These hydrocarbons may be used solely or in a combination of two or more. Examples of isoparaffin having a polymerization degree of 3 to 10 include light liquid isoparaffins having a polymerization degree of 4 to 6, and liquid isoparaffins having a polymerization degree of 5 to 10. The content of the hydrocarbon may be 0.5 to 8 mass %, preferably 1 to 6 mass %, and most preferably 2 to 5 mass %, and most preferably 2 to 5 mass %.

based on the entire amount of the hair composition.

[0022]

Further, the hair composition of the present invention preferably contains dimethylpolysiloxane. Although the
5 dimethylpolysiloxane is not particularly limited, the terminal thereof preferably has trimethyl. There are various dimethylpolysiloxanes depending on the polymerization degree, ranging from a low viscosity liquid to a solid form. All of these dimethylpolysiloxanes may be used. Further, these
10 dimethylpolysiloxanes may be used solely or in a combination of two or more. In particular, combined use of highly-polymerized dimethylpolysiloxane having a polymerization degree of about 700 to 9000 and dimethylpolysiloxane oil having a kinetic viscosity of about 0.65 to 50 centistokes at 25°C is preferable because it
15 increases the effects of the present invention. When a combination of highly polymerized dimethylpolysiloxane (A) having a polymerization degree of 700 to 9000 and dimethylpolysiloxane oil (B) having a kinetic viscosity of 0.65 to 50 centistokes at 25°C is used, the mixing ratio (A:B) by mass of highly
20 polymerized dimethylpolysiloxane (A) to dimethylpolysiloxane oil (B) is preferably 8:92 to 40:60, more preferably 11:89 to 35:65, and most preferably 25:75 to 35:65. Further, for dimethylpolysiloxane oil having a kinetic viscosity of 0.65 to 50 centistokes at 25°C, the kinetic viscosity is preferably 2 to 50
25 centistokes, more preferably 5 to 30 centistokes, and most preferably 10 to 20 centistokes. The content of dimethylpolysiloxane is, for example, 0.1 to 15 mass %, preferably 0.5 to 10 mass %, more preferably 1 to 7 mass %, and most preferably 4 to 7 mass %, based on the entire amount of the
30 hair composition.

[0023]

There is no particular limitation in the use of the hair composition of the present invention insofar as the composition has a form that enables it to be applied in the form
35 of a mist. The hair composition of the present invention is

preferably a liquid containing water (e.g., a solution, a suspension, a dispersion, or a mixture thereof). The hair composition of the present invention is preferably in the form of an aqueous solution containing water either entirely or partially
5 (more preferably entirely). The viscosity of the composition is preferably 50 mPa/s or less; however, for example, when a microemulsion gel that is formed by using agar and can be easily discharged in a spray form by applying pressure is used, it will not be affected by the viscosity of the composition. However, a
10 composition containing a component imparting spinnability to the composition, such as a cellulose-based thickener, is not preferable even if the viscosity of the composition is 50 mPa/s or less, because, when the composition has spinnability, it becomes difficult to spray the composition in the form of a mist.
15 The presence or absence of spinnability of the composition may be determined by placing the composition in a beaker, inserting a glass rod into the composition, and pulling out the glass rod. Spinnability is determined when a pulling thread of 2 cm or more is observed from the liquid surface of the composition at room
20 temperature (about 25°C).

In this specification, the viscosity is measured as follows.

▪ Method for Determining Viscosity

A Brookfield rotational viscometer is used.

25 A spindle with a reading range of 30-70 is selected.

Measurement temperature: 25°C

Measurement time: 60 seconds

[0024]

The hair composition according to the present invention
30 may contain, in addition to the compound described later, components that may be commonly contained in hair compositions, as long as the effects of the invention are not impaired. Examples include surfactants, fatliquors, hair protectants, moisturizing agents, polymers, ultraviolet absorbers,
35 sequestrants, solvents, pH adjusting agents, vitamins,

antioxidants, antioxidant auxiliaries, preservatives, flavoring agents, and the like. These can be used alone or in a combination of two or more.

[0025]

5 Examples of surfactants include anionic surfactants, cationic surfactants, amphoteric surfactants, oleophilic nonionic surfactants, hydrophilic nonionic surfactants, and the like. These can be used alone or in a combination of two or more.

[0026]

10 Examples of anionic surfactants include higher alkyl sulfates such as sodium lauryl sulfate and potassium lauryl sulfate; alkyl ether sulfates such as POE-triethanolamine lauryl sulfate and POE-sodium lauryl sulfate; N-acyl sarcosinates such as sodium lauroyl sarcosinate; higher fatty acid amide sulfonates
15 such as sodium N-myristoyl-N-methyl taurate, sodium coconut oil fatty acid methyl taurate, and sodium lauryl methyl taurate; phosphates such as sodium POE oleylether phosphate and POE stearylether phosphate; sulfosuccinates such as sodium di-2-ethylhexylsulfosuccinate, sodium monolauroyl monoethanolamide
20 polyoxyethylene sulfosuccinate, and sodium lauryl polypropylene glycol sulfosuccinate; alkyl benzene sulfonates such as sodium n-dodecyl benzene sulfonate, triethanolamine n-dodecyl benzene sulfonate, and dodecyl benzene sulfonate; N-acyl glutamates such as monosodium N-lauroyl glutamate, disodium N-stearoyl glutamate,
25 and monosodium N-myristoyl-L-glutamate; higher fatty acid ester sulfates such as sodium hydrogenated coconut oil fatty acid glyceryl sulfate; POE-alkyl ether carboxylates; POE-alkyl allyl ether carboxylates; α -olefin sulfonates; higher fatty acid ester sulfonates; secondary alcohol sulfates; higher fatty acid
30 alkylolamide sulfates; sodium lauroyl monoethanolamide succinate; di-triethanolamine N-palmitoylaspartate; casein sodium; and the like.

[0027]

 Examples of cationic surfactants include quaternary
35 ammonium salt-type cationic surfactants, poly(N,N'-dimethyl-3,5-

methylenepiperidinium)chloride, alkyl isoquinolinium salts, dialkyl morpholinium salts, POE-alkylamines, alkylamine salts, polyamine fatty acid derivatives, amyl alcohol fatty acid derivatives, benzalkonium chloride, benzethonium chloride, and
5 the like. Among these, quaternary ammonium salt-type cationic surfactants are preferable in view of improving flexibility and tactile sensation (particularly smoothness) of hair. Examples of quaternary ammonium salt-type cationic surfactants include stearyl trimethyl ammonium chloride, cetyl trimethyl ammonium
10 chloride, behenyl trimethyl ammonium chloride, stearyl trimethyl ammonium bromide, distearyl dimethyl benzyl ammonium chloride, lauryl benzyl dimethyl ammonium chloride, and the like. Among these, stearyl trimethyl ammonium chloride, cetyl trimethyl ammonium chloride, and behenyl trimethyl ammonium chloride are
15 preferable, and stearyl trimethyl ammonium chloride and cetyl trimethyl ammonium chloride are most preferable. The cationic surfactant content may be, for example, based on the total amount of the hair composition, 0.01 to 1.5 mass%, preferably 0.07 to 1.0 mass%, still more preferably 0.1 to 0.7 mass%, and most
20 preferably 0.2 to 0.5 mass%.

[0028]

Examples of amphoteric surfactants include imidazoline-based amphoteric surfactants such as sodium 2-undecyl-N,N,N-(hydroxyethylcarboxymethyl)-2-imidazoline; betaine-based
25 surfactants such as 2-heptadecyl-N-carboxymethyl-N-hydroxyethylimidazolinium betaine, betaine lauryldimethylaminoacetate, alkyl betaine, amidobetaine, sulfobetaine, and the like.

[0029]

30 Examples of lipophilic nonionic surfactants include sorbitan fatty acid esters such as sorbitan monooleate, sorbitan monoisostearate, sorbitan monolaurate, sorbitan monopalmitate, and sorbitan monostearate; glycerol fatty acids such as glycerol monoerucate, glycerol sesquioleate, and glycerol monostearate;
35 propylene glycol fatty acid esters such as propylene glycol

monostearate; hydrogenated castor oil derivatives; glycerol alkyl ethers; and the like.

[0030]

Examples of hydrophilic nonionic surfactants include

5 POE sorbitan fatty acid esters, such as POE-sorbitan monooleate and POE-sorbitan monostearate; POE sorbitol fatty acid esters, such as POE-sorbitol monolaurate and POE sorbitol monooleate; POE-glycerol fatty acid esters, such as POE-glycerol monostearate, POE-glycerol monoisostearate, and POE-glycerol triisostearate;

10 POE fatty acid esters, such as POE-monooleate, POE-distearate, and POE-monodioleate; POE-alkyl ethers, such as POE-lauryl ether, POE-oleyl ether, POE-stearyl ether, and POE-behenyl ether; POE-alkyl phenyl ethers, such as POE-octyl phenyl ether, POE-nonyl phenyl ether, and POE-dinonyl phenyl ether; Pluronic-type

15 surfactants, such as Pluronic; POE·POP alkyl ethers, such as POE·POP cetyl ether, POE·POP 2-decyltetradecyl ether, POE·POP monobutyl ether, and POE·POP hydrogenated lanolin; tetra POE·tetra POP ethylenediamine condensates, such as Tetronic; POE castor oil or hydrogenated castor oil derivatives, such as POE-

20 castor oil, POE-hydrogenated castor oil, and POE-hydrogenated castor oil monoisostearate; POE beeswax·lanolin derivatives, such as POE sorbitol beeswax; alkanolamides, such as coconut oil fatty acid diethanolamide, lauric acid monoethanolamide, and fatty acid isopropanolamides; POE-propylene glycol fatty acid esters, POE-

25 alkylamines, POE-fatty acid amides, sucrose fatty acid esters, POE-nonylphenyl formaldehyde condensates, alkylethoxydimethylamine oxides, and the like.

[0031]

Examples of fatliquors include oils and fats, waxes,

30 hydrocarbons, higher fatty acids, higher alcohols, synthetic ester oils, and the like. These can be used alone or in a combination of two or more.

[0032]

Examples of oils and fats include avocado oil, camellia

35 oil, almond oil, macadamia nut oil, corn oil, grape seed oil,

meadowfoam oil, olive oil, rapeseed oil, yolk oil, sesame oil, wheat germ oil, sasanqua oil, castor oil, safflower oil, cottonseed oil, soybean oil, peanut oil, tea seed oil, kaya oil, rice bran oil, jojoba oil, germ oil, cacao butter, coconut oil, horse fat, hydrogenated coconut oil, palm oil, beef tallow, mutton tallow, hydrogenated beef tallow, palm kernel oil, lard, Japan wax kernel oil, hydrogenated castor oil, and the like.

These can be used alone or in a combination of two or more.

[0033]

Examples of waxes include beeswax, candelilla wax, cotton wax, carnauba wax, Japan wax, bayberry wax, *Ericerus pela* wax, whale wax, montan wax, bran wax, lanolin, kapok wax, acetic acid lanolin, liquefied lanolin, sugarcane wax, reduced lanolin, jojoba wax, hard lanolin, shellac wax, POE lanolin alcoholic ether, and the like.

[0034]

Examples of hydrocarbons include liquid paraffin, ozokerite, squalene, paraffin, ceresin, Vaseline, microcrystalline wax, and the like. These can be used alone or in a combination of two or more.

[0035]

Examples of higher fatty acids include lauric acid, myristic acid, palmitic acid, stearic acid, behenic acid, oleic acid, 12-hydroxystearic acid, undecylenic acid, tall oil acid, isostearic acid, linoleic acid, linolenic acid, eicosapentaenoic acid (EPA), docosahexaenoic acid (DHA), and the like. These can be used alone or in a combination of two or more.

[0036]

Examples of higher alcohols include linear alcohols such as lauryl alcohol, cetyl alcohol, stearyl alcohol, behenyl alcohol, myristyl alcohol, oleyl alcohol, and cetostearyl alcohol; branched alcohols such as monostearyl glycerol ether (batyl alcohol), 2-decyl tetradecynol, lanolin alcohol, cholesterol, phytosterol, hexyl dodecanol, isostearic alcohol, and octyl dodecanol. These can be used alone or in a combination

of two or more.

[0037]

Examples of synthetic ester oils include isopropyl myristate, cetyl octanoate, octyldodecyl myristate, isopropyl
5 palmitate, butyl stearate, hexyl laurate, myristyl myristate, decyl oleate, hexyldecyl dimethyl octanoate, cetyl lactate, myristyl lactate, acetylated lanolin, isocetyl stearate, isocetyl isostearate, ethylene glycol di-2-ethylhexanoate, dipentaerythritol fatty acid ester, N-alkyl glycol
10 monoisostearate, neopentyl glycol dicaprate, diisostearyl malate, glycerin di-2-heptylundecanoate, trimethylolpropane tri-2-ethylhexanoate, trimethylolpropane triisostearate, pentaerythritol tetra-2-ethylhexanoate, glyceryl tri-2-ethylhexanoate, trimethylolpropane triisostearate, cetyl 2-
15 ethylhexanoate, 2-ethylhexylpalmitate, glycerin trimyristate, tri-2-heptyl undecanoic acid glyceride, castor oil fatty acid methyl ester, oleyl oleate, cetostearyl alcohol, acetoglyceride, 2-heptyl undecyl palmitate, diisobutyl adipate, N-lauroyl-L-glutamic acid-2-octyldodecylester, di-2-heptyl undecyl adipate,
20 ethyl laurate, di-2-ethylhexyl sebacate, 2-hexyldecyl myristate, 2-hexyldecyl palmitate, 2-hexyldecyl adipate, diisopropyl sebacate, 2-ethylhexyl succinate, glyceryl trioctanoate, glyceryl triisopalmitate, isopropyl lanolate, hexyl laurate, and the like. These can be used alone or in a combination of two or more.

25 [0038]

Examples of hair protectants include silicones other than dimethylpolysiloxane. Examples of such silicones include chain polysiloxanes such as methylphenylpolysiloxane and methylhydrogenpolysiloxane; cyclic polysiloxanes such as
30 decamethylpolysiloxane, dodecamethylpolysiloxane, and tetramethylhydrogenpolysiloxane; silicone resins; and the like. These can be used alone or in a combination of two or more.

[0039]

Examples of moisturizing agents include polyethylene
35 glycol, propylene glycol, glycerin, glycerol, 1,3-butylene glycol,

sorbitol, maltitol, maltotriose, mannitol, sucrose, erythritol, glucose, fructose, starch-degraded sugar, maltose, xylitol, and starch-degraded sugar-reduced alcohol, and like sugar alcohols; amino acids, chondroitin sulfate, hyaluronic acid, mucoitin
5 sulfuric acid, collagen derivatives, cholesteryl 12-hydroxystearate, sodium lactate, bile salt, seawater (including dried solid seawater) deep seawater (including dried solid deep seawater), chitosan derivatives, sodium pyrrolidone carboxylate, diglycerin·ethylene oxide·propylene oxide adducts, and the like.

10 These can be used alone or in a combination of two or more.

[0040]

Examples of polymers include natural water-soluble polymers, semi-synthetic water-soluble polymers, synthetic water-soluble polymers, inorganic water-soluble polymers, and the like.

15 These can be used singly or in a combination of two or more.

However, some of the polymers, when used alone or in combination with one or more other components, may make the resulting composition stringy. Therefore, when polymer(s) are used, the starting materials and the amounts are preferably selected within
20 the range that does not impart stringiness.

[0041]

Examples of natural polymers include vegetable polymers such as gum arabic, tragacanth gum, galactan, guar gum, carob gum, karaya gum, carrageenan, pectin, agar, quince seed (marmelo),
25 algae colloid (brown algae extract), and starches (rice, corn, potato, and wheat); microbial polymers such as dextran, succinoglucan, and pullulan; animal polymers such as collagen, casein, albumin, and gelatin; and the like.

[0042]

30 Examples of semi-synthetic water-soluble polymers include starch-based polymers such as carboxymethyl starch and methylhydroxypropyl starch; cellulose-based polymers such as methylcellulose, ethylcellulose, methylhydroxypropylcellulose, hydroxyethylcellulose, sodium cellulose sulfate,

35 hydroxypropylcellulose, sodium carboxymethylcellulose (CMC),

crystalline cellulose, and cellulose powder; and alginic acid-based polymers such as sodium alginate and propylene glycol alginate.

[0043]

5 Examples of synthetic water-soluble polymers include vinyl-based polymers such as polyvinyl alcohol, polyvinyl methyl ether, polyvinyl pyrrolidone, and carboxy vinyl polymer; polyoxyethylene polymers such as polyethylene glycol 20,000, polyethylene glycol 40,000, and polyethylene glycol 60,000; 10 copolymerized polymers such as polyoxyethylene polyoxypropylene copolymer; and acrylic polymers such as sodium polyacrylate, polyethyl acrylate, and polyacrylamide; polyethyleneimine; cationic polymer; and the like.

[0044]

15 Examples of inorganic water-soluble high polymers include bentonite, aluminum magnesium silicate (bea gum), laponite, hectorite, silicic anhydride, and the like.

[0045]

 Examples of ultraviolet absorbers include benzoic acid- 20 based ultraviolet absorbers such as p-aminobenzoic acid, ethyl p-aminobenzoate, glyceryl p-aminobenzoate, amyl p-dimethylaminobenzoate, octyl p-dimethylaminobenzoate, and ethyl 4-[N,N-di(2-hydroxypropyl)amino]benzoate; anthranilic acid-based ultraviolet absorbers such as homomenthyl-N-acetylanthranilate; 25 salicylic acid-based ultraviolet absorbers such as ethylene glycol salicylate, phenyl salicylate, octyl salicylate, benzyl salicylate, p-tert-butylphenyl salicylate, and homomentyl salicylate; cinnamic acid-based ultraviolet absorbers such as benzyl cinnamate, 2-ethoxyethyl p-methoxycinnamate, octyl p-methoxycinnamate, a glycerol ester of mono-2-ethylhexanoic acid 30 and di-p-methoxycinnamic acid, and a mixture of isopropyl p-methoxycinnamate and an ester of diisopropylcinnamic acid; and urocanic acid-based ultraviolet absorbers such as urocanic acid and ethyl urocanate; benzophenone-based ultraviolet absorbers 35 such as hydroxymethoxybenzophenone,

hydroxymethoxybenzophenonesulfonic acid, sodium hydroxymethoxybenzophenonesulfonate, dihydroxymethoxybenzophenone, sodium dihydroxydimethoxybenzophenone disulfonate, dihydroxybenzophenone, and tetrahydroxybenzophenone; 4-tert-butyl
5 4'-methoxy-dibenzoylmethane, 2,4,6-trianilino-p-(carbo-2'-ethylhexyl-1'-oxy)-1,3,5-triazine, 2-(2-hydroxy-5-methylphenyl)benzotriazole, and the like. These can be used alone or in a combination of two or more.

[0046]

10 Examples of sequestrants include alanine, trisodium hydroxyethyl ethylenediamine triacetate, disodium edetate, trisodium edetate, tetrasodium edetate, sodium citrate, sodium polyphosphate, sodium metaphosphate, gluconic acid, tartaric acid, succinic acid, edetic acid, phytic acid, and the like. These can
15 be used alone or in a combination of two or more.

[0047]

 Examples of solvents include waters such as tap water, ion-exchanged water, and pure water; lower alcohols such as methanol, propanol, isopropanol, isobutyl alcohol, and t-butyl
20 alcohol; dihydric alcohols such as ethylene glycol, propylene glycol, trimethylene glycol, 1,2-butylene glycol, and 1,3-butylene glycol; trihydric alcohols such as glycerin, trimethylolpropane, and 1,2,6-hexanetriol; tetravalent alcohols such as pentaerythritol; pentavalent alcohols such as xylitol;
25 hexavalent alcohols such as sorbitol and mannitol; polyhydric alcohol polymers such as diethylene glycol, dipropylene glycol, triethylene glycol, polypropylene glycol, tetraethylene glycol, diglycerin, polyethylene glycol, triglycerin, tetraglycerin, and polyglycerin; dihydric alcohol alkyl ethers such as ethylene
30 glycol monomethyl ether; dihydric alcohol alkyl ethers such as diethylene glycol monomethyl ether and diethylene glycol monoethyl ether; dihydric alcohol ether esters such as ethylene glycol monomethyl ether acetate; glycerin monoalkyl ethers such as xylyl alcohol, selachyl alcohol, and batyl alcohol; and the
35 like. These can be used alone or in a combination of two or more.

[0048]

Examples of pH adjusting agents include citric acid, lactic acid, acetic acid, hydrochloric acid, potassium hydroxide, sodium hydroxide, sodium lactate, sodium citrate, sodium lactate, and the like. These can be used alone or in a combination of two or more. Such solvents can be used not only for adjusting the pH but also for buffering the adjusted pH.

[0049]

Examples of vitamins include vitamin A, vitamin B1, vitamin B2, vitamin B6, vitamin E, derivatives of these vitamins, pantothenic acid, derivatives of pantothenic acid, and the like.

[0050]

Examples of antioxidants include tocopherols, dibutylhydroxytoluene, butylhydroxyanisole, gallic acid esters, and the like.

Examples of preservatives include organic acids such as benzoic acid, sodium benzoate, undecylenic acid, salicylic acid, sorbic acid, and p-hydroxybenzoic acid salts; phenols such as isopropylmethyl phenol; phenoxyethanol; 1,2-hexanediol; 1,2-pentanediol; and the like.

[0051]

The amount of the charged hair composition of the present invention to be applied to hair, in terms of zinc, is preferably 0.25 mg or more, more preferably 0.3 mg or more, and still more preferably 0.5 mg or more, per gram of hair. The upper limit of the application amount is not particularly limited. For example, the upper limit may be 6 mg.

[0052]

The amount of the charged hair composition of the present invention to be applied to hair, in terms of charge amount, is preferably 0.0025 μC or more, more preferably 0.003 μC or more, and still more preferably 0.005 μC or more, per gram of hair. The upper limit of the application amount is not particularly limited. For example, the upper limit may be 0.33 μC .

[0053]

The frequency of the application of the charged hair composition of the present invention is not particularly limited. For example, the frequency may be once or twice per day.

[0054]

5 The duration of applying the charged hair composition of the present invention per gram of hair is preferably about 0.25 to 5 seconds, more preferably 0.3 to 3 seconds, and still more preferably 0.4 to 1 second, per gram of hair.

[0055]

10 The hair to which the charged hair composition of the present invention is applied may be wet or dry. Wet hair is preferable.

[0056]

15 The charged hair composition of the present invention is advantageously applied to hair with poor body and stiffness.

 The charged hair composition of the present invention is advantageously applied to hair having a zinc content of 50 to 250 ppm (wt/wt), and more preferably 50 to 200 ppm (wt/wt).

[0057]

20 Hair composition for a spray device having a negative ion generator

 The "hair composition for a spray device having a negative ion generator" according to the present invention is used in a spray device equipped with a negative ion generator.
25 This enables the hair composition to be sprayed in a negatively charged state. The hair composition can be better understood with reference to the above detailed description of the charged hair composition of the present invention.

[0058]

30 Method for improving hair quality

 In the method for improving hair quality according to the present invention, at least one zinc compound selected from the group consisting of zinc acetate, zinc gluconate, zinc chloride, zinc lactate, and zinc pyrrolidonecarboxylate is
35 applied to hair using a spray device having a negative ion

generator in such a manner that the zinc compound is negatively charged and sprayed.

5 The method for improving hair quality according to the present invention can be better understood with reference to the above detailed description of the charged hair composition of the present invention and that of the hair composition for a spray device having a negative ion generator of the present invention.

Examples

10 [0059]

The present invention is described in more detail below. However, the present invention is not limited to the following Examples. Hereinbelow, the "%" refers to "mass%," and "ppm" refers to "ppm (wt/wt)," unless otherwise specified.

15 [0060]

Test (I): Sensory Evaluation (1)

(I-1) Evaluation of Hair-Quality Improving Effect of Various Metal Compounds

20 In the evaluation, hair bundles prepared in the following manner were used. Specifically, hair bundles each having a full length of about 25 cm and a mass of about 3 g were prepared using virgin hair with no chemical treatment history obtained from an identical person (hair of an adult Chinese person, about 30-cm length, produced by Beaulax), washed with an aqueous solution containing sodium lauryl sulfate (about 10%,
25 wt/wt), rinsed thoroughly with running water, and dried. The hair bundles in this state were referred to as "untreated hair bundles," and used as a sample representing the state of original hair before being damaged or before aging.

30 For use as a sample representing the state of hair whose body and stiffness were deteriorated due to damage or aging, the "untreated hair bundles" in a dried state were subjected to a treatment in which the bundles were immersed in an aqueous formic acid solution for 15 minutes, rinsed thoroughly with running
35 water, and dried. The hair bundles treated in this manner were

hereinafter referred to as "formic acid-treated hair bundles."

To confirm the effect of negative ions, a metal compound alone or a combination of a metal compound and negative ions was adhered to the "formic acid-treated hair bundles" in the following manner, and a sensory evaluation was performed. More specifically, the "formic acid-treated hair bundles" were immersed in ion-exchanged water for 10 minutes to allow the bundles to contain sufficient moisture, and excess water was removed by lightly sandwiching the bundles three times between a towel. Immediately after this treatment, about 1.8 g of an aqueous solution containing each zinc compound (1%, wt/wt) was uniformly applied to each bundle using a spray device having a negative ion generator that generates 2000×10^4 negative ions/cm³ or more (the application time was about 15 seconds), and the applied substance was sufficiently worked through the hair by sandwiching the bundle 50 times between three fingers wearing a rubber glove. Among the applied amount of 1.8 g, the amount adhered to the hair (i.e., the amount actually applied to the hair) was about 0.5 g. The bundles of hair after the application were left to dry at room temperature for about 15 minutes while being suspended with threads, followed by drying using a dryer that was set at 55°C for 60 minutes. The application to the samples was performed under two different conditions in which negative ions were generated and in which negative ions were not generated, and the effect achieved with the coexistence of negative ions was evaluated by comparing these two results. Further, to adjust the evaluation scores of evaluation groups, the untreated hair bundle and the formic acid-treated hair bundle were immersed in ion-exchanged water for 10 minutes to allow the bundles to contain sufficient moisture, and excess water was removed by lightly sandwiching the bundle three times between a towel, followed by drying under similar conditions to the above, which were then subjected to evaluation. For reference, the evaluation was also performed with the use of an aqueous solution containing zinc gluconate (2%, wt/wt). To reduce the burden of

panel evaluators and help them to perform a rigorous evaluation, the processes from the pretreatment of hair to the completion of the evaluation were consistently performed: additionally, substances used in the treatment were limited to one or two metal compounds. The expert panel for evaluation consisted of 9 to 14 members, and the sensory evaluation was performed according to the evaluation criteria shown later.

After the evaluation, the scores of each member on the expert panel were totaled for each sample, and the average values of the evaluation scores were calculated. Subsequently, relative values were calculated as improvement rates, based on the evaluation scores of the samples considering the evaluation score for the "formic acid-treated hair bundle" as 0% and that for the "untreated hair bundle" as 100%. As is understood from the above, this "improvement rate" has the same definition as the "recovery rate" to hair quality that is similar to the hair quality of the "untreated hair bundle," and when this "improvement rate" exceeds 100%, the hair quality is improved to more than that of the "untreated hair bundle." Tables 1 and 2 show the evaluation results and calculation results.

In Table 1, the "Evaluation series" shows numbers in order of performing the sensory evaluation test, which was performed 7 times. In each evaluation series, the date that the evaluation was conducted, the number of members on the evaluation panel, and the evaluators were different; thus, to enable comparison between the evaluation results, the evaluation of the untreated hair bundles and formic acid-treated hair bundles was performed in all of the evaluation series.

In the table, the term "ions" refers to conditions in which negative ions were generated.

The "zinc PCA" refers to "zinc pyrrolidonecarboxylate."

The treatment described above in which a metal compound is adhered without negative ion adhesion (i.e., under conditions in which negative ions are not generated) may sometimes be referred to as an "independent treatment."

The treatment described above in which both a metal compound and negative ions are adhered may sometimes be referred to as an "ion-added treatment." Examples of "negative-ion added treatment" also include a treatment performed without a metal
5 compound.

Evaluation Criteria of Body and Stiffness

	Strong body and stiffness	5 points
	Moderate body and stiffness	4 points
10	Slight body and stiffness	3 points
	Almost no body and stiffness	2 points
	No body and stiffness	1 points

[0062]

Table 2

Treatment metal compound	Compound concentration	Improvement rate in independent treatment	Improvement rate in ion-added treatment	Improvement degree
Zinc lactate	1%	60%	200%	+140%
Zinc acetate	1%	20%	80%	+60%
Zinc chloride	1%	-8%	58%	+66%
Zinc PCA	1%	-8%	58%	+58%
Zinc gluconate	1%	-36%	36%	+72%
	2%	40%	100%	+60%
Zinc glycinate	1%	20%	40%	+20%

[0063]

5 As shown in Table 2, the independent treatment under conditions in which a solution containing zinc lactate, zinc acetate, zinc chloride, zinc gluconate, or zinc pyrrolidonecarboxylate (1%, wt/wt) was applied improved or did not improve the body and stiffness of hair. In contrast, all of

10 the negative ion-added treatment groups under the conditions above showed an improvement in the body and stiffness of hair. Further, the difference between the improvement rates of the body and stiffness of hair with and without the addition of negative ions (i.e., between ion-added treatment and independent

15 treatment) (i.e., improvement degree achieved with the addition of negative ions) was about 60 to 140%. Thus, regardless of whether the improvement rate in the independent treatment was minus or plus (that is, even when the independent treatment showed no improvement or showed an improvement), the addition of

20 negative ions increased the improvement rate. However, the improvement degree was 20% when zinc glycinate was used, which clarified that the presence or absence of the addition of negative ions shows no great effect on the improvement in the body and stiffness of hair.

25 [0064]

(I-2) Evaluation of Influence of Difference in Concentrations of

Compounds on the Hair-Quality Improving Effect

As shown in Table 2, zinc gluconate at both concentrations of 1% (wt/wt) and 2% (wt/wt) showed an effect of improving the body and stiffness of hair (i.e., an improving effect in which the body and stiffness of weakened hair are recovered) in the negative ion-added treatment groups. It was also confirmed that the addition of negative ions achieved an effect of increasing the improvement rate.

[0065]

(I-3) Evaluation of Influence of Difference in Amounts of Negative Ions Added on the Hair-Quality Improving Effect

The influence of difference in amounts of negative ions added during the application to hair on the hair-quality improving effect was evaluated as in the manner described in the evaluation above. Specifically, the evaluation was performed with the use of an aqueous solution containing zinc gluconate (1%, wt/wt) using a spray device having a negative ion generator that generates about 600×10^4 negative ions/cm³ and about 1000×10^4 negative ions/cm³. Table 3 shows the evaluation results. To avoid redundant description in the Examples, for example, the addition of negative ions using a spray device having a negative ion generator that generates about 600×10^4 negative ions/cm³ may be sometimes abbreviated as "the addition of negative ions in an amount of 600."

[0066]

Table 3

	Number of evaluation panelists	Evaluation series 7		
		11 members		
Evaluation sample	Amount of negative ions added	Evaluation score average value	Improvement rate (%)	
Untreated hair bundle	-	4.5	(100)	
Formic acid-treated hair bundle	-	3.4	(0)	
Zinc gluconate	-	3.0	-33	Improvement degree
Zinc gluconate + ions	600	3.5	17	+50
Zinc gluconate + ions	1000	3.8	42	+75

[0067]

5 As shown in Table 3, the amount of negative ions added had an influence on the effect of improving the body and stiffness of hair. At least within a range of the amount of negative ions added of about 600×10^4 negative ions/cm³ to about 1000×10^4 negative ions/cm³, a greater amount of negative ions added achieved a greater effect of improving the body and stiffness of hair (i.e., an improving effect in which the body and stiffness of weakened hair are recovered). Further, a greater amount of negative ions added also achieved a greater improvement degree in the ion-added treatment, compared with the independent treatment.

[0068]

Test (II): Sensory Evaluation (2)

20 A sensory evaluation (2) was performed in a similar manner to the sensory evaluation (1). The results of this sensory evaluation (2) were obtained using magnesium acetate or using no metal compound (i.e., only ion exchanged water), in place of zinc compounds.

Further, the results of the sensory evaluation (2) were obtained in relation to the addition of negative ions in an amount of 2000, in addition to the addition of negative ions in amounts of 600 and 1000.

5 The expert panel for evaluation consisted of 9 to 15 members.

Tables 4-1 to 4-3 show the results. For reference, Tables 4-1 to 4-3 show sorted information to help simplify analysis, and some data overlap between the tables. Some data are
10 from the sensory evaluation (1) for comparison.

[0069]

Table 4-1

Treatment metal compound	Compound concentration	Number of evaluation panelists	Improvement rate in independent treatment	Improvement rate in ion-added treatment	Improvement degree
Zinc lactate	1%	15	-25%	88%	113%
Zinc gluconate	1%	15	-11%	89%	100%
Zinc chloride	1%	10	-8%	58%	66%
Zinc PCA	1%	10	-8%	50%	58%
Zinc acetate	1%	14	20%	73%	53%
Zinc glycinate	1%	13	-25%	-25%	0%
Magnesium acetate	1%	10	-100%	-233%	-133%
No metal compound	0%	11	38%	0%	-38%

[0070]

Table 4-2

Treatment metal compound	Compound concentration	Number of evaluation panelists	Improvement rate in independent treatment	Improvement rate in ion-added treatment	Improvement degree
Zinc gluconate	1%	15	-11%	89%	100%
Zinc gluconate	2%	10	40%	100%	60%

15 [0071]

Table 4-3

Treatment metal compound	Compound concentration	Amount of negative ions added	Number of evaluation panelists	Improvement rate in independent treatment	Improvement rate in ion-added treatment	Improvement degree
Zinc gluconate	1%	600	11	-33%	17%	50%
Zinc gluconate	1%	1000	11	-33%	42%	75%
Zinc gluconate	1%	2000	15	-11%	89%	100%

[0072]

(II-1) Evaluation of Hair-Quality Improving Effect of Various Zinc Compounds and Magnesium Acetate

5 As shown in Table 4-1, as in the results of the sensory evaluation (1), the independent treatment under conditions in which a solution containing zinc lactate, zinc acetate, zinc chloride, zinc gluconate, or zinc pyrrolidonecarboxylate (1%, wt/wt) was applied improved or did not improve the body and
10 stiffness of hair. In contrast, all of the negative ion-added treatment groups under the conditions above showed an improvement in the body and stiffness of hair. Further, the difference between the improvement rates of the body and stiffness of hair with and without the addition of negative ions (i.e., between
15 ion-added treatment and independent treatment) (i.e., improvement degree achieved with the addition of negative ions) was about 50 to 110%. Thus, regardless of whether the improvement rate in the independent treatment was minus or plus (that is, even when the independent treatment showed no improvement or showed an
20 improvement), the addition of negative ions increased the improvement rate.

 However, the improvement degree was 0% when zinc glycinate was used, which clarified that the presence or absence of the addition of negative ions did not show a great effect on
25 the improvement in the body and stiffness of hair.

 Further, the improvement degree was less than 0% when magnesium acetate was used, which clarified that the addition of negative ions did not improve the body and stiffness of hair when magnesium acetate was used.

30 Additionally, the improvement degree was less than 0% when no metal compound was used (i.e., only ion exchanged water was used), which clarified that the addition of negative ions did not improve the body and stiffness of hair when no metal compound was used.

35 [0073]

(II-2) Evaluation of Influence of Difference in Concentrations of Compounds on the Hair-Quality Improving Effect

As shown in Table 4-2, as in the results of the sensory evaluation (1), zinc gluconate at both concentrations of 1% (wt/wt) and 2% (wt/wt) showed an effect of improving the body and stiffness of hair in the negative ion-added treatment groups. It was also confirmed that the addition of negative ions achieved an effect of increasing the improvement rate.

[0074]

(II-3) Evaluation of Influence of Difference in Amounts of Negative Ions Added on the Hair-Quality Improving Effect

The results shown in Table 4-3 showed no inconsistency with the results of the sensory evaluation (1). Specifically, the amount of negative ions added had an influence on the effect of improving the body and stiffness of hair. At least within a range of the amount of negative ions added of about 600×10^4 negative ions/cm³ to about 2000×10^4 negative ions/cm³, a greater amount of negative ions added achieved a greater effect of improving the body and stiffness of hair (i.e., an improving effect in which the body and stiffness of weakened hair are recovered). Further, a greater amount of negative ions added also achieved a greater improvement degree in the ion-added treatment, compared with the independent treatment.

[0075]

Test (III): Objective Evaluation (Bending Rigidity Evaluation)

In the "sensory test (2)" described later, 200 hairs each were randomly taken from each treated hair bundle, and the bending elastic modulus of each hair was measured one by one. The measurement was performed using a single fiber bending tester (KES-FB2-SH, produced by Kato Tech Co., Ltd.) under conditions of 25°C and 50% RH. The obtained measured values were listed in descending order, and the average value of the top 10% measured values was calculated, which was considered as the bending elasticity value of hair. The "bending elasticity of hair" is one of the main factors constructing the body and stiffness of hair,

and the bending elasticity value correlates with the evaluation of the body and stiffness of hair in the sensory evaluation. Subsequently, relative values were calculated as improvement rates, based on the bending elasticity values of the samples considering the bending elasticity value of the "formic acid-treated hair bundle" as 0% and that of the "untreated hair bundle" as 100%. Finally, the difference between the improvement rate of ion-added treatment and the improvement rate of independent treatment was calculated as an improvement degree achieved by the addition of negative ions. Tables 5-1 to 5-3 show the results. For reference, Tables 5-1 to 5-3 show sorted information to help simplify analysis, and some data overlap between the tables.

[0076]

Table 5-1

Treatment metal compound	Compound concentration	Amount of negative ions added	Improvement rate in independent treatment	Improvement rate in ion-added treatment	Improvement degree
Zinc lactate	1%	2000	-4%	91%	95%
Zinc gluconate	1%	2000	22%	155%	133%
Zinc chloride	1%	2000	-112%	77%	189%
Zinc PCA	1%	2000	-70%	141%	211%
Zinc acetate	1%	2000	13%	82%	69%
Zinc glycinate	1%	2000	-103%	-493%	-390%
No metal compound	0%	2000	-8%	-58%	-50%

[0077]

Table 5-2

Treatment metal compound	Compound concentration	Amount of negative ions added	Improvement rate in independent treatment	Improvement rate in ion-added treatment	Improvement degree
Zinc gluconate	0.5%	2000	-16%	37%	53%
Zinc gluconate	1%	2000	22%	155%	133%
Zinc gluconate	2%	2000	-6%	82%	88%

[0078]

Table 5-3

Treatment metal compound	Compound concentration	Amount of negative ions added	Improvement rate in independent treatment	Improvement rate in ion-added treatment	Improvement degree
Zinc gluconate	1%	600	-13%	10%	23%
Zinc gluconate	1%	1000	-13%	39%	52%
Zinc gluconate	1%	2000	22%	155%	133%

[0079]

5 (III-1) Evaluation of Hair Quality-Improving Effect of Various Zinc Compounds in Terms of Bending Elasticity

As shown in Table 5-1, the independent treatment under conditions in which a solution containing zinc lactate, zinc acetate, zinc chloride, zinc gluconate, or zinc pyrrolidonecarboxylate (1%, wt/wt) was applied improved the bending elasticity of hair (i.e., a higher bending elasticity was obtained) or did not improve the bending elasticity of hair (i.e., a higher bending elasticity was not obtained). In contrast, all of the negative ion-added treatment groups under the conditions above showed an improvement in the bending elasticity of hair. Further, the difference between the improvement rates of the bending elasticity with and without the addition of negative ions (i.e., between ion-added treatment and independent treatment) (i.e., degree of improvement in bending elasticity achieved with the addition of negative ions) was about 70 to 210%. Thus, regardless of whether the improvement rate in the independent treatment was minus or plus (that is, even when the independent treatment showed no improvement or showed an improvement), the addition of negative ions increased the improvement rate. When zinc glycinate was used, however, the improvement degree was less than 0%, which clarified that the addition of negative ions did not improve the bending elasticity of hair.

[0080]

(III-2)

30 As shown in Table 5-2, when the concentration of zinc

gluconate was at least within a range of 0.5% (wt/wt) to 2% (wt/wt), the bending elasticity was improved with the addition of negative ions.

[0081]

5 As shown in Table 5-3, the amount of negative ions added had an influence on the effect of improving the bending elasticity of hair. At least within a range of the amount of negative ions added of about 600×10^4 negative ions/cm³ to about 2000×10^4 negative ions/cm³, a greater amount of negative ions
10 added achieved a greater effect of improving the bending elasticity of hair in the ion-added treatment. Further, a greater amount of negative ions added also achieved a greater degree of improvement in the bending elasticity in the ion-added treatment, compared with the independent treatment.

15 [0082]

 As shown in these test results, the effects demonstrated by the sensory evaluations were also supported by the objective evaluation.

[0083]

20 Test (IV): Measurement of Zinc Amount Retained in Hair

Hair (a) treated with zinc chloride, zinc gluconate, zinc lactate, zinc acetate, zinc PCA, or zinc glycinate under the same conditions as test (I) using a spray device having a negative ion generator (ion-added treatment), and hair (b) treated with the
25 same under the same conditions as test (I) using a spray device not having a negative ion generator (independent treatment) were prepared. About 5 cm was cut off from the middle section of each of the above hair samples (a) and (b), as well as (c) "formic acid-treated hair" and (d) "untreated hair," and the amount (ppm)
30 of zinc contained in the hair was measured using an ICP mass spectrometer (produced by Agilent Technologies). Based on the obtained results, relative values (improvement rates) were calculated considering the zinc amount in (c) "formic acid-treated hair bundle" as 0% and the zinc amount in (d) "untreated
35 hair bundle" as 100%. Further, the difference of the zinc amount

after ion-added treatment (improvement rate) from the zinc amount after independent treatment (improvement rate) was calculated as an improvement degree. Tables 6-1 to 6-3 show the results.

5 Table 6-1

Treatment metal compound	Compound concentration	Amount of negative ions added	Amount of zinc after independent treatment	Amount of zinc after ion-added treatment	Amount of zinc improvement degree
Zinc lactate	1%	2000	300.3%	146.0%	-154.3%
Zinc gluconate	1%	2000	8.9%	58.4%	49.5%
Zinc chloride	1%	2000	879.7%	598.9%	-280.8%
Zinc PCA	1%	2000	134.6%	255.9%	121.3%
Zinc acetate	1%	2000	364.1%	305.4%	-58.7%
Zinc glycinate	1%	2000	218.1%	323.8%	105.7%

[0084]

Table 6-2

Treatment metal compound	Compound concentration	Amount of negative ions added	Amount of zinc after independent treatment	Amount of zinc after ion-added treatment	Amount of zinc improvement degree
Zinc gluconate	0.5%	2000	352.7%	-70.3%	-423.0%
Zinc gluconate	1%	2000	8.9%	58.4%	49.5%
Zinc gluconate	2%	2000	735.3%	923.9%	188.6%

[0085]

Table 6-3

Treatment metal compound	Compound concentration	Amount of negative ions added	Amount of zinc after independent treatment	Amount of zinc after ion-added treatment	Amount of zinc improvement degree
Zinc gluconate	1%	600	431.3%	-11.3%	-442.6%
Zinc gluconate	1%	1000	431.3%	743.2%	311.9%
Zinc gluconate	1%	2000	8.9%	58.4%	49.5%

10 [0086]

As shown in Tables 6-1 to 6-3, the addition or non-addition of negative ions, as well as the degree of the addition, had no correlation with the amount of zinc retained in hair (and the improvement degree).

15 From these results and from a comparison with each of the above tests, it was presumed that the effect of the present invention is not based on a mechanism in which the addition of negative ions promotes zinc introduction into hair.

[0087]

Spray Device Having a Negative Ion Generator

(1) The spray device having a negative ion generator used in each Example above was provided with the spray device disclosed in WO 2015/034002. A test was separately performed to confirm that the mean particle diameter of the droplets sprayed from this spray device having a negative ion generator was within a range of about 50 to 60 μm when the viscosity (of water) was at least within a range of 5 or less to 1560 c.p., regardless of the concentration of the liquid to be sprayed.

(2) The amount of negative ions added in each Example by using the spray device having a negative ion generator (the amount of negative ions added), i.e., about 600×10^4 negative ions/ cm^3 to about 2000×10^4 negative ions/ cm^3 , almost corresponds to the charge amount of 0.1 to 0.15 $\mu\text{C/g}$ per unit mass of droplets actually sprayed from the device. This fact was confirmed by measuring actual droplets using a Faraday gauge.

The measurement using a Faraday gauge was performed as follows.

▪ Measurement Method Using a Faraday Gauge

An outer conductive enclosure and an inner conductive enclosure were insulated from each other, and then a zinc-containing composition was sprayed toward the inner conductive enclosure for a certain period of time (5 seconds) from a spray device equipped with a negative ion generator, thereby adhering the composition to the conductive enclosure. The electric energy generated in the inner conductive enclosure from the adhered charged therapeutic agent was measured using an electrostatic sensor, and the charge amount was calculated based on the resistance (fixed value) of the device.

This viscosity is a viscosity determined as follows.

▪ Method for Determining Viscosity

A Brookfield rotational viscometer is used.

A spindle with a reading range of 30-70 is selected.

Measurement temperature: 25°C

Measurement time: 60 seconds

Claims

1. A charged hair composition, comprising at least one zinc compound selected from the group consisting of zinc acetate, zinc gluconate, zinc chloride, zinc lactate, and zinc pyrrolidonecarboxylate, the charged hair composition being negatively charged.
2. The charged hair composition according to claim 1, wherein the content of the zinc compound is 0.1 to 5 mass %.
3. The charged hair composition according to any one of claims 1 to 3, wherein the charged hair composition is a liquid composition containing water.
4. A hair composition for a spray device having a negative ion generator, comprising at least one zinc compound selected from the group consisting of zinc acetate, zinc gluconate, zinc chloride, zinc lactate, and zinc pyrrolidonecarboxylate.
5. A method for improving hair quality, comprising applying to hair a hair composition comprising at least one zinc compound selected from the group consisting of zinc acetate, zinc gluconate, zinc chloride, zinc lactate, and zinc pyrrolidonecarboxylate, using a spray device having a negative ion generator.