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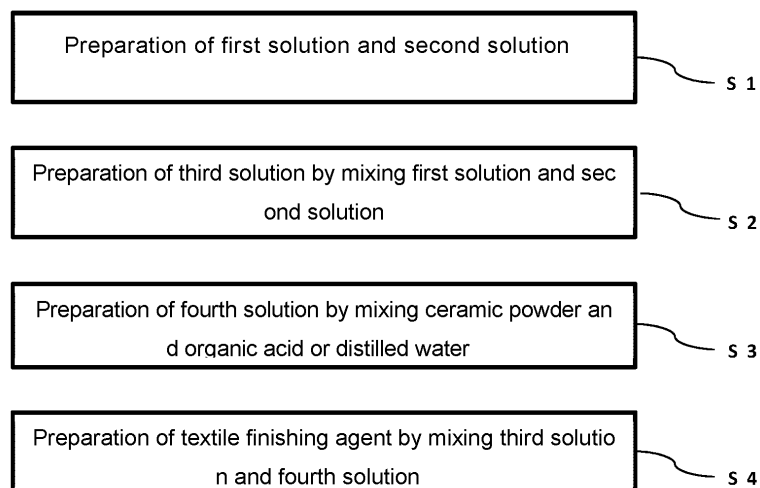
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(54) **ANTIBACTERIAL AND DEODORIZING FINISHING AGENT COMPOSITION USING ECO-FRIENDLY BIOPOLYMER**

(57) The present invention relates to a method for preparing a textile finishing agent based on an eco-friendly, renewable, and biodegradable biopolymer, and, specifically, to a method for preparing a textile finishing agent, comprising the steps of: forming, at room temper-

ature, a solution comprising an organic acid and the balance of a solvent; stirring chitosan and a base solvent in the solution; and preparing a solution in which a mineral material is dissolved.

[FIG. 1]



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**Description****[Technical Field]**

5 **[0001]** The present invention relates to a biopolymer-based textile finishing agent that is eco-friendly, renewable, and biodegradable, and more particularly, to a textile finishing agent that can maintain comfort by emitting far-infrared rays while having antibacterial and deodorizing functions when applied to clothes, by mixing a mineral substance and a ceramic dispersion solution in a solution of chitosan dissolved in an organic acid.

10 **[Background Art]**

**[0002]** Conventionally, a zeolite-based antibacterial agent containing heavy metal ions such as zinc, silver, and copper ions is known as an antibacterial agent whose antibacterial effect against bacteria and fungi lasts for a long period of time. In particular, as for the types of heavy metal ions, silver ions are widely used in recent years due to their superiority, particularly in the area of safety. As for the bactericidal power efficacy and deodorizing power efficacy immediately after the treatment, silver ions do not provide sufficient bactericidal performance compared to oxidizing agents such as chlorine-based bactericides, and to solve this problem, in place of a zeolite-based antibacterial agent, an antibacterial agent is proposed that contains a silver-chloro complex salt and oxidizing agent. However, it is apparent that, so long as fast-acting silver ions can be produced from a silver zeolite, then odor-generating bacteria can be killed and deodorization can be achieved as a result. However, despite the special deodorizing and antibacterial abilities of silver ions, the regulation of silver ions-containing products is restricted worldwide due to the harmfulness of heavy metals to the human body, and in the future, it will be difficult to change the perception of silver ions and their harmfulness to the human body.

**[0003]** On the other hand, polyhexamethyleneguanidine (polyhexamethyleneguanidine phosphate, hereinafter PHMG), ethoxyethylguanine chloride (oligo-[2-(2-ethoxy)-ethoxyethyl]-guanidinium-chlorid, hereafter PGH) are guanidine-based disinfectants and have been used variously as an anti-infective and antibacterial agent. These disinfectants were used as humidifier disinfectants in Korea. However, when dozens of people died in 2011, it was designated as hazardous chemicals and their use are gradually being banned in the United States and Europe.

**[0004]** Substances such as PGH and PHMG have excellent bactericidal power efficacy, but several problems have been reported. Since they are not biodegradable, there is concern about environmental pollution, and aquatic toxicity is serious, showing very high toxicity even at 10 µg/L (0.000001 %, 0.054 µm, 0.01 ppm). In addition, the substances are prohibited to use as a spray due to inhalation toxicity, and it can be very dangerous if the substances are manufactured and used as a product by arbitrarily and indiscriminately applied without regulation. Since the PGH and PHMG ingredients show a sterilization efficacy by destroying phospholipid bilayers, there is a possibility of destroying cellular phospholipids in humans, and there is a risk of destroying the skin barrier. Therefore, if these ingredients are used frequently on the skin, such as wet wipes, they are more likely to cause dermatitis. Therefore, it is necessary to continuously study the harmfulness related to antibacterial and deodorant.

**[0005]** Meanwhile, in general, the use of a synthetic binder having adhesive properties in order to provide semi-permanent durability even after washing is essential for a textile finishing agent used for fabrics. As synthetic binders used, there are acrylic binders, urethane binders, and the like, but the harmfulness of these synthetic binders in the manufacturing process has not been properly verified.

**[0006]** Currently, the textile industry is replacing fabric materials with recycled polyethylene terephthalate (recycle PET) and nylon for sustainable and eco-friendly production and consumption. It is important to replace fabric materials, but it is also necessary to replace fabric processing materials with materials that can be produced and consumed in a sustainable and eco-friendly manner.

45 **[DISCLOSURE]****[Technical Problem]**

50 **[0007]** An object of the present invention is to provide a textile finishing agent that can maintain comfort by emitting far-infrared rays while having antibacterial and deodorizing functions when applied to clothes by mixing a mineral substance and a ceramic dispersion solution in a solution of chitosan dissolved in an organic acid.

**[Technical Solution]**

55 **[0008]** According to achieve the above object, an embodiment of the present invention provides a textile finishing agent composition containing 0.01 to 5 % by weight of chitosan, 0.01 to 5 % by weight of an organic acid, 0.01 to 5 % by weight of ceramic powder, and balance of a base solution.

**[0009]** According to achieve the above object, an embodiment of the present invention provides a textile finishing agent composition containing 0.01 to 5 % by weight of chitosan, 0.01 to 5 % by weight of an organic acid, 0.01 to 5 % by weight of ceramic powder, 0.01 to 5 % by weight of a mineral solution, and balance of a base solution.

**[0010]** As an embodiment of the present invention, a skin hypoallergenic textile finishing agent may be characterized in that the base solution is distilled water or an aqueous solution obtained by diluting at least one of peppermint extract, lemongrass extract, moringa leaf extract, rosemary extract, penny royal extract, eucalyptus extract, and coffee grounds extract.

**[0011]** As an embodiment of the present invention, a skin hypoallergenic textile finishing agent may be characterized in that a deacetylation degree of the chitosan is 80 to 99.99 %.

**[0012]** As an embodiment of the present invention, a skin hypoallergenic textile finishing agent may be characterized in that a molecular weight of the chitosan is 10,000 to 1,000,000 g/mol.

**[0013]** As an embodiment of the present invention, a skin hypoallergenic textile finishing agent may be characterized in that a viscosity of the chitosan is 500 to 1200 cps.

**[0014]** As an embodiment of the present invention, a skin hypoallergenic textile finishing agent may be characterized in that a viscosity of the textile finishing agent composition is 500 to 6000 cps.

**[0015]** As an embodiment of the present invention, a skin hypoallergenic textile finishing agent may be characterized in that the textile finishing agent composition has a pH of 2 to 4.

**[0016]** As an embodiment of the present invention, a skin hypoallergenic textile finishing agent may be characterized in that the organic acid is at least one selected from the group consisting of mandelic acid, malic acid, lactic acid, citric acid, alginic acid, acetic acid, ascorbic acid, calcium acetate, formic acid, monohydrate, butyl lactic acid, ethyl lactic acid, and glycerine.

**[0017]** As an embodiment of the present invention, a skin hypoallergenic textile finishing agent may be characterized in that the ceramic powder is at least one selected from the group consisting of diatomaceous earth, biotite, sericite, muscovite, tourmaline, zeolite, charcoal, graphene, bentonite, germanium, magnetite, graphite, jade, and zirconium oxide.

**[0018]** As an embodiment of the present invention, a skin hypoallergenic textile finishing agent may be characterized in that the mineral solution is at least one selected from sodium chloride, magnesium chloride, calcium chloride, potassium chloride, and sodium gluconate.

**[Advantageous Effect]**

**[0019]** The present invention can provide a textile finishing agent that is much more eco-friendly and safer than conventional antibacterial agents or chemicals by manufacturing a textile finishing agent using substances such as chitosan, an organic acid, and ceramic powder.

**[0020]** In addition, the textile finishing agent has an effect of maintaining comfort by emitting far-infrared rays as well as antibacterial and deodorizing functions when applied to clothes.

## **[Description of Drawings]**

**[0021]**

FIG. 1 is a flowchart illustrating a method for manufacturing a textile finishing agent composition according to an embodiment of the present invention.

FIG. 2 is a flowchart illustrating a method for manufacturing a textile finishing agent composition according to another embodiment of the present invention

FIG. 3 shows that a strain is inoculated into a medium treated with a textile finishing agent composition containing distilled water as a base solution of the present invention and a textile finishing agent composition containing a base solution obtained by diluting 1 % by weight of peppermint extract with distilled water, respectively.

S10: preparing step of a first aqueous solution and a second aqueous solution

S20: preparing step of a third aqueous solution by mixing the first aqueous solution and the second aqueous solution

S30: preparing step of a fourth aqueous solution by mixing ceramic powder and an organic acid solution or distilled water

S40: preparing step of a textile finishing agent by mixing the third aqueous solution and the fourth aqueous solution

S10': preparing step of a first aqueous solution

5 S20': preparing step of a fourth aqueous solution by mixing ceramic powder and an organic acid solution or distilled water

S30': preparing step of a textile finishing agent by mixing the first aqueous solution and the fourth aqueous solution

10 **[Best Mode for Invention]**

**[0022]** Hereinafter, specific embodiments are provided to help the understanding of the present invention. However, the following embodiments are provided only for easier understanding of the present invention, and the content of the present invention is not limited by the embodiments.

15

**Example 1: Preparation of a textile finishing agent composition and its application to fabric 1**

**[0023]**

20 1. 50 g of a solution in which chitosan was dissolved was prepared by stirring 1 g of chitosan and 3 g of citric acid in 46 g of a base solution containing 1 % by weight of peppermint extract at 300 rpm for 24 hours at room temperature (25°C).

25 2. A sea salt solution was prepared by dissolving 0.833 g of sea salt containing 98 % or more of sodium chloride in 5 ml of a base solution containing 1 % by weight of peppermint extract at 300 rpm for 30 minutes at room temperature (25°C).

30 3. 1 g of sericite powder was mixed with 50 ml of a base solution containing 1 % by weight of peppermint extract and stirred at room temperature (25°C) for 1 hour to prepare a dispersion.

4. A textile finishing agent composition was prepared by mixing 55 g of a mixture of the solution prepared in step 1 and the solution prepared in step 2 and 50 ml of the solution prepared in step 3, and the fabric was processed by mixing the prepared textile finishing agent composition with distilled water in a ratio of 1:10 during tenter treatment.

35 5. The finally prepared textile finishing agent composition was subjected to a tentering process at a temperature condition of 120 to 180 °C with a pickup rate of 50 to 80 % of the fabric. The density and dimensions of the fabric were adjusted during the tentering process by adjusting the density of the fabric prepared in a weaving stage to a certain level required as a product.

40 6. After the tentering process, the fabric was cooled using a cooling cylinder and then wound up to finish the processing process.

**Example 2: Preparation of a textile finishing agent composition and its application to fabric 2**

45 **[0024]**

1. 50 g of a solution in which chitosan was dissolved was prepared by stirring 1 g of chitosan and 3 g of citric acid in 46 g of a base solution containing 1 % by weight of peppermint extract at 300 rpm for 24 hours at room temperature (25°C).

50

2. 1 g of sericite powder was mixed with 50 ml of a base solution containing 1 % by weight of peppermint extract and stirred at room temperature (25°C) for 1 hour to prepare a dispersion.

55 3. A textile finishing agent composition was prepared by mixing 50 g of the solution prepared in step 1 and 50 ml of the solution prepared in step 2, and the fabric was processed by mixing the prepared textile finishing agent composition with distilled water in a ratio of 1:10 during tenter treatment.

4. The finally prepared textile finishing agent composition was subjected to a tentering process at a temperature

condition of 120 to 180 °C with a pickup rate of 50 to 80 % of the fabric. The density and dimensions of the fabric were adjusted during the tentering process by adjusting the density of the fabric prepared in a weaving stage to a certain level required as a product.

- 5            5. After the tentering process, the fabric was cooled using a cooling cylinder and then wound up to finish the processing process.

**Example 3: Measurement of pH and viscosity after preparation of a textile finishing agent composition**

- 10        < Preparation of 100 ml of textile finishing agent composition in which the ratio of chitosan, citric acid and zirconium oxide is 1:1:1 >

**[0025]**

- 15            1. 1 g of citric acid was added to 50 ml of a base solution containing 1 % by weight of peppermint extract, and the mixture was sufficiently stirred at room temperature for 1 hour, and then 1 g of chitosan was added and dissolved to prepare a solution.
- 20            2. 1 g of zirconium oxide was mixed with 50 ml of a base solution containing 1 % by weight of peppermint extract and the mixture was stirred at room temperature (25°C) for 1 hour prepare a dispersion.
3. A textile finishing agent composition was prepared by mixing 50 ml of the solution prepared in step 1 and 50 ml of the solution prepared in step 2.

- 25        < Preparation of 100 ml of textile finishing agent composition in which the ratio of chitosan, citric acid and zirconium oxide is 1:3:1 >

**[0026]**

- 30            1. 3 g of citric acid was added to 50 ml of a base solution containing 1 % by weight of peppermint extract, and the mixture was sufficiently stirred at room temperature for 1 hour, and then 1 g of chitosan was added and dissolved to prepare a solution.
- 35            2. 1 g of zirconium oxide was mixed with 50 ml of a base solution containing 1 % by weight of peppermint extract and the mixture was stirred at room temperature (25°C) for 1 hour prepare a dispersion.
3. A textile finishing agent composition was prepared by mixing 50 ml of the solution prepared in step 1 and 50 ml of the solution prepared in step 2.

- 40        < Preparation of 100 ml of textile finishing agent composition in which the ratio of chitosan, citric acid and zirconium oxide is 1:5:1 >

**[0027]**

- 45            1. 5 g of citric acid was added to 50 ml of a base solution containing 1 % by weight of peppermint extract, and the mixture was sufficiently stirred at room temperature for 1 hour, and then 1 g of chitosan was added and dissolved to prepare a solution.
- 50            2. 1 g of zirconium oxide was mixed with 50 ml of a base solution containing 1 % by weight of peppermint extract and the mixture was stirred at room temperature (25°C) for 1 hour prepare a dispersion.
3. A textile finishing agent composition was prepared by mixing 50 ml of the solution prepared in step 1 and 50 ml of the solution prepared in step 2.

- 55        < Preparation of 100 ml of textile finishing agent composition in which the ratio of chitosan, citric acid and zirconium oxide is 1:5:3 >

**[0028]**

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1. 5 g of citric acid was added to 50 ml of a base solution containing 1 % by weight of peppermint extract, and the mixture was sufficiently stirred at room temperature for 1 hour, and then 1 g of chitosan was added and dissolved to prepare a solution.

2. 3 g of zirconium oxide was mixed with 50 ml of a base solution containing 1 % by weight of peppermint extract and the mixture was stirred at room temperature (25°C) for 1 hour prepare a dispersion.

3. A textile finishing agent composition was prepared by mixing 50 ml of the solution prepared in step 1 and 50 ml of the solution prepared in step 2.

< Preparation of 100 ml of textile finishing agent composition in which the ratio of chitosan, citric acid and zirconium oxide is 1:5:5 >

### [0029]

1. 5 g of citric acid was added to 50 ml of a base solution containing 1 % by weight of peppermint extract, and the mixture was sufficiently stirred at room temperature for 1 hour, and then 1 g of chitosan was added and dissolved to prepare a solution.

2. 5 g of zirconium oxide was mixed with 50 ml of a base solution containing 1 % by weight of peppermint extract and the mixture was stirred at room temperature (25°C) for 1 hour prepare a dispersion.

3. A textile finishing agent composition was prepared by mixing 50 ml of the solution prepared in step 1 and 50 ml of the solution prepared in step 2.

[0030] The results of measuring the pH and viscosity of the textile finishing agent composition according to the ratio of the chitosan, citric acid, and zirconium oxide are shown in Table 1 below. The pH was measured using a PH meter from OHAUS, and the viscosity was measured using a Brookfield viscometer at the condition of Spindle 63, 10 rpm.

[0031] As a result, it can be seen that as the organic acid concentration increased, the pH increased, but the viscosity decreased, and as the content of the ceramic powder increased, the viscosity slightly increased.

[Table 1]

| Chitosan: citric acid: zirconium oxide in 100mL of textile finishing agent composition | pH  | Viscosity (cps) |
|----------------------------------------------------------------------------------------|-----|-----------------|
| 1:1:1                                                                                  | 3   | 5376            |
| 1:3:1                                                                                  | 2.8 | 4356            |
| 1:5:1                                                                                  | 2.6 | 2784            |
| 1:5:3                                                                                  | 3   | 2856            |
| 1:5:5                                                                                  | 3   | 2976            |

### Comparative Example 1: Fabric processing without an application of a textile finishing agent composition

[0032] In Example 1 or Example 2, the processing process was finished by cooling the fabric that was subject to the tendering process without processing the textile finishing agent composition using a cooling cylinder and then winding the cooled fabric.

### Comparative Example 2: Fabric processing with a textile finishing agent composition containing no ceramic powder

### [0033]

1. 1 g of chitosan and 3 g of citric acid were stirred in 46 g of a base solution containing 1 % by weight of peppermint extract at room temperature (25 °C) at 300 rpm for 24 hours to prepare 50 g of a solution in which chitosan was dissolved.

2. A sea salt solution was prepared by dissolving 0.833 g of sea salt containing 98 % or more sodium chloride in 5 ml of a base solution containing 1 % by weight of peppermint extract at 300 rpm for 30 minutes at room temperature (25 °C).

3. A textile finishing agent composition was prepared by mixing 55 g of a mixture of the solution generated in step 1 and the solution generated in step 2, and the fabric was processed by mixing the textile finishing agent composition with distilled water at a ratio of 1:10 during tenter treatment.

4. The prepared textile finishing agent composition was subjected to a tenting process at a temperature condition of 120 to 180 °C with a pickup rate of 50 to 80 % of the fabric. The density and dimensions of the fabric were adjusted during the tenting process by adjusting the density of the fabric prepared in a weaving stage to a certain level required as a product.

5. After the tenting process, the fabric was cooled using a cooling cylinder and then wound up to finish the processing process.

#### Experimental Example 1: Antibacterial performance test

<Antibacterial performance test of Examples 1 and 2>

**[0034]** The antibacterial performance test of the fabric treated with the textile finishing agent composition prepared in Example 1 was performed. Swiss Universal Standard Technical Service Co., Ltd. (abbreviated as SGS) was requested to test the antibacterial performance, and the results were shown in Table 2. The test strains were *Staphylococcus aureus* ATCC 6538 and *Klebsiella pneumoniae* ATCC 4352, and were tested according to the antimicrobial finishing method for textile materials (AATCC 100-2012). 1mL of the strain was inoculated into a circular fabric sample with a diameter of 4.8 cm.

**[0035]** As a result of recovering live cells from the fabric sample 24 hours after inoculation, the decrease rates of both *Staphylococcus aureus* and *Pneumonia* were a 99.9%.

[Table 2]

| Test strain                            | bacteria concentration (cfu/mL) | The number of viable cells recovered over time |                           |                             | Decrease rate (%) |
|----------------------------------------|---------------------------------|------------------------------------------------|---------------------------|-----------------------------|-------------------|
|                                        |                                 |                                                | After 0 hour (cfu/sample) | After 24 hours (cfu/sample) |                   |
| <i>Staphylococcus aureus</i> ATCC 6538 | 1.6X10 <sup>5</sup>             | sample                                         | 1.0X10 <sup>2</sup>       | 1.0X10 <sup>2</sup>         | >99.9             |
|                                        |                                 | control sample                                 | 1.5X10 <sup>5</sup>       | 5.2×10 <sup>7</sup>         |                   |
| <i>Klebsiella Pneumoniae</i> ATCC 4352 | 1.5X10 <sup>5</sup>             | sample                                         | 1.0X10 <sup>2</sup>       | 1.0X10 <sup>2</sup>         | >99.9             |
|                                        |                                 | control sample                                 | 1.4X10 <sup>5</sup>       | 2.4X10 <sup>7</sup>         |                   |

**[0036]** On the other hand, the antibacterial performance test of the fabric treated with the textile finishing agent composition prepared in Example 2 was conducted. The antibacterial performance was tested by the Guang inspection testing and certification group, a nationally-accredited testing institution in China, and the results were listed in Table 3. The test strains were *Staphylococcus aureus*, *Colon bacilli*, and *Candida albicans*. It was tested by the Shaking flask method specified in FZ/T 73023-2006 ANNEX D, an industry standard for antibacterial knitwear in China, and the decrease rate was measured after the fabrics to which the textile finishing agent composition was applied were washed 50 times. The size of the fabric sample was 70 cm wide and 70 cm long, and the weight of the fabric sample was 98 g. As a result of the test, *Staphylococcus aureus* showed a decrease rate of 97.0 %, *Escherichia coli* showed a decrease rate of 97 %, and *Candida albicans* showed a decrease rate of 91.52 %.

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[Table 3]

| Test item              | Test method                                                        | Requirement                                                                                                                | Test result                                                                                                 | Conclusion |
|------------------------|--------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------|------------|
| ANTIMICROBIAL ACTIVITY | FZ/T 73023-2006 ANNEX D SHAKE FLASK METHOD AFTE R50 WASHING CYCLES | INHIBITION: <i>Staphylococcus aureus</i> $\geq 80\%$ <i>Colon bacillus</i> $\geq 70\%$ <i>Candida albicans</i> $\geq 60\%$ | INHIBITION: <i>Staphylococcus aureus</i> 97.07% <i>Colon bacillus</i> 97.00% <i>Candida albicans</i> 91.52% | PASS       |

<Antibacterial performance test of Comparative Example 1>

**[0037]** The antibacterial performance test was performed on the fabric of Comparative Example 1. The antibacterial performance was tested by the FITI test lab, and the results were listed in Table 4. The test strain was *Staphylococcus aureus* ATCC 6538, and the test was conducted according to an antimicrobial finishing method for fabric materials (AATCC 100-2012). As a result of recovering live cells from the fabric sample after 18 hours, it was found that the number of bacteria hardly decreased.

[Table 4]

|                               | Control           | Comparative Example |
|-------------------------------|-------------------|---------------------|
| After 0 hour (cfu/mL)         | $1.7 \times 10^5$ | $1.7 \times 10^5$   |
| After 18 hours (cfu/mL)       | $2.0 \times 10^8$ | $1.6 \times 10^5$   |
| Decrease rate of bacteria (%) | -                 | 0                   |

### Experimental Example 2: Deodorization performance test

<Deodorization performance test of Examples 1 and 2>

**[0038]** The deodorization performance test of ammonia was performed with the fabric treated with the textile finishing agent composition prepared in Example 1. The ammonia deodorization performance was tested by the Swiss Universal Standard Technical Service Co., Ltd. (abbreviated as SGS). Ammonia deodorization evaluation was measured according to ISO 17299-2 by a detector tube method.

**[0039]** 1 g of the fabric sample treated with the textile finishing agent composition prepared in Example 1 was put into a 3L tedlar bag, ammonia with an initial concentration of 100 ppm was injected, and the residual ammonia concentration was measured with a detector tube after 2 hours to calculate the deodorization rate (%) by the following method. When the fabric containing the ammonia with an initial concentration of 100 ppm was washed according to the JIS L-0217 103 method, the acceptability criterion for the deodorization test of the Japan Textile Evaluation Technology Council was 70 % of the deodorization rate. When it was determined that this acceptability criterion was a sufficient deodorization rate in general, the deodorization rate of the fabric sample treated with the textile finishing agent composition was 87.0 %, which had a significant deodorization efficacy.

$$\text{Deodorization rate (\%)} = (B - A) / B \times 100\%$$

B: Control group, residual ammonia concentration in the tedlar bag after 2 hours

A: Fabric sample, residual ammonia concentration in tedlar bag after 2 hours

**[0040]** The fabric treated with the textile finishing agent composition prepared in Example 2 was also subjected to a deodorization performance test in the same manner as in Example 1.



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**[0041]** 1 g of the fabric sample treated with the textile finishing agent composition prepared in the above example was put in a 3L tedlar bag, ammonia with an initial concentration of 100 ppm was injected, and the residual ammonia concentration was measured with a detector tube after 2 hours to calculate the deodorization rate (%) by the following method. When the fabric containing the ammonia with an initial concentration of 100 ppm was washed according to the JIS L-0217 103 method, the acceptability criterion for the deodorization test of the Japan Textile Evaluation Technology Council was 70 % of the deodorization rate. When it was determined that this acceptability criterion was a sufficient deodorization rate in general, the deodorization rate of the fabric sample treated with the textile finishing agent composition was 79.8%, which had a satisfactory deodorization efficacy.

$$\text{Deodorization rate (\%)} = (B-A)/B \times 100\%$$

B: Control, residual ammonia concentration in the tedlar bag after 2 hours

A: Fabric sample, residual ammonia concentration in tedlar bag after 2 hours

**[0042]** Table 5 below shows the deodorization performance test results of Examples 1 and 2

[Table 5]

|           | Deodorization rate of sample | Acceptability criterion for deodorization test (Washing according to JIS L-0217103 method) |
|-----------|------------------------------|--------------------------------------------------------------------------------------------|
| Example 1 | 87.0%                        | 70%                                                                                        |
| Example 2 | 79.8%                        | 70%                                                                                        |

<Deodorization performance test of Comparative Example 1>

**[0043]** The deodorization performance test of ammonia was performed with the fabric prepared in Comparative Example 1. The ammonia deodorization performance was tested by the Swiss Universal Standard Technical Service Co., Ltd. (abbreviated as SGS). Ammonia deodorization evaluation was measured according to ISO 17299-2 by a detector tube method.

**[0044]** 1 g of the fabric sample prepared in the above Comparative Example 1 was put in a 3L tedlar bag, ammonia with an initial concentration of 100 ppm was injected, and the residual ammonia concentration was measured with a detector tube after 2 hours to calculate the deodorization rate (%) by the following method. When the fabric containing the ammonia with an initial concentration of 100 ppm was washed according to the JIS L-0217 103 method, the acceptability criterion for the deodorization test of the Japan Textile Evaluation Technology Council was 70 % of the deodorization rate. When it was determined that this acceptability criterion was a sufficient deodorization rate in general, the deodorization rate of the fabric sample not treated with the textile finishing agent composition was 10.1 %, which did not satisfy the acceptability criterion.

$$\text{Deodorization rate (\%)} = (B-A)/B \times 100\%$$

B: Control, residual ammonia concentration in the tedlar bag after 2 hours

A: Fabric sample, residual ammonia concentration in tedlar bag after 2 hours

**[0045]** Table 6 below shows the deodorization performance test result of Comparative Example 1.

[Table 6]

|                       | Deodorization rate of sample | Acceptability criterion for deodorization test (Washing according to JIS L-0217 103 method) |
|-----------------------|------------------------------|---------------------------------------------------------------------------------------------|
| Comparative Example 1 | 10.1%                        | 70%                                                                                         |

**Experimental Example 3: Far-infrared emissivity performance test**

<Far-infrared emissivity performance test of Examples 1 and 2>

**[0046]** The far-infrared emissivity performance test was performed with the fabric treated with the textile finishing agent composition prepared in Example 1. The far-infrared emissivity performance was tested by the Korea Far Infrared Application Evaluation Institute (KIFA). The emissivity and radiant energy measurement tests were performed using the textile of the fabric product treated with the textile finishing agent composition prepared in Example 1 as a specimen by the KFIA-FI-1005 method of the Korea Far Infrared Application Evaluation Institute.

**[0047]** This test was carried out at 37 °C and was measured against a black body using a Fourier transform infrared spectroscopy (FT-IR) spectrometer.

**[0048]** It was confirmed that the fabric treated with the textile finishing agent composition prepared in Example 1 had an emissivity of 0.888 in a wavelength range of 5 to 20  $\mu\text{m}$ , and a radiation energy of  $3.42 \times 10^2 \text{ W/m}^2 \cdot \mu\text{m}$ .

**[0049]** The fabric treated with the textile finishing agent composition prepared in Example 2 was also subjected to the far-infrared emissivity performance test in the same manner as in Example 1.

**[0050]** It was confirmed that the fabric treated with the textile finishing agent composition prepared in Example 2 had an emissivity of 0.886 in a wavelength range of 5 to 20  $\mu\text{m}$ , and a radiation energy of  $3.42 \times 10^2 \text{ W/m}^2 \cdot \mu\text{m}$ .

**[0051]** Considering the fact that the far-infrared emissivity is recognized as excellent worldwide when the far-infrared emissivity is 0.850 or more, it was confirmed that the fabrics treated with the textile finishing agent prepared in Examples 1 and 2 according to the present invention had very excellent far-infrared emissivity.

**[0052]** Table 7 below shows the far-infrared emissivity performance tests of Examples 1 and 2.

[Table 7]

|                                                                                                                                                 | Emissivity (5 to 20 $\mu\text{m}$ ) | Radiation energy ( $\text{W/m}^2 \cdot \mu\text{m}$ , 37 °C) |
|-------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------|--------------------------------------------------------------|
| Example 1                                                                                                                                       | 0.888                               | $3.42 \times 10^2$                                           |
| Example 2                                                                                                                                       | 0.886                               | $3.42 \times 10^2$                                           |
| * Note 1) Test method: KFIA-FI-1005, 2) Test temperature: 37 °C, 3) Measurement method: Blackbody contrast measurement using FT-IR spectrometer |                                     |                                                              |

<Far-infrared emissivity performance test of Comparative Example 2>

**[0053]** The far-infrared emissivity performance test was performed with the fabric prepared in Comparative Example 2. The far-infrared emissivity performance was tested by the Korea Far Infrared Application Evaluation Institute (KIFA). The emissivity and radiant energy measurement tests were performed using the textile of the fabric product treated with the textile finishing agent prepared in the Example as a specimen by the KFIA-FI-1005 method of the Korea Far Infrared Application Evaluation Institute.

**[0054]** It was confirmed that the fabric treated with the textile finishing agent composition prepared in Comparative Example 2 had an emissivity of 0.844 in a wavelength range of 5 to 20  $\mu\text{m}$ , and a radiation energy of  $3.25 \times 10^2 \text{ W/m}^2 \cdot \mu\text{m}$ . The results were less than the far-infrared emissivity of Examples 1 and 2.

**[0055]** Table 8 below shows the far-infrared emissivity performance test of Comparative Example 2.

[Table 8]

|                                                                                                                                                 | Emissivity (5 to 20 $\mu\text{m}$ ) | Radiation energy ( $\text{W/m}^2 \cdot \mu\text{m}$ , 37 °C) |
|-------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------|--------------------------------------------------------------|
| Comparative Example 1                                                                                                                           | 0.844                               | $3.25 \times 10^2$                                           |
| * Note 1) Test method: KFIA-FI-1005, 2) Test temperature: 37 °C, 3) Measurement method: Blackbody contrast measurement using FT-IR spectrometer |                                     |                                                              |

**Experimental Example 4: Measurement of human skin irritation**

**[0056]** In Example 1 or Example 2, the textile finishing agent composition before being applied to the fabric was subjected to an irritation test on the skin of 32 subjects. The average age of the subjects in this test was 33.2 years old, there were no specific skin symptoms, and there was no disease or drug history that could affect the test.

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**[0057]** After wiping the test sites of 32 subjects with 70 % (v/v) ethanol and drying the sites, a skin patch test was performed. An IQ chamber in which 20  $\mu$ l of the textile finishing agent composition was dripped was attached to the upper arm, which was the test site, for 24 hours.

**[0058]** After removing the patch, the test site was marked with a marking pen, and the reaction of the skin was observed with a magnifying glass after 30 minutes and 24 hours, respectively. The degrees of irritation of skin reactions were classified according to the criteria of the International Contact Dermatitis Research Group (ICDRG) as follows. The presence or absence of irritation was determined according to the criteria table in Table 9, and the results are shown in Table 10.

**[0059]** As shown in the following results, it was confirmed that the textile finishing agent composition before application to the fabric in Example 1 or Example 2 exhibits non-irritating properties.

[Table 9]

| ICDRG criteria                                                                                                                                                                                                                                                                                                                                                                                                                                                          |            |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| Determination                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Mean score |
| Negative reaction (1)                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 0.00~0.75  |
| Doubtful reaction (2)                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 0.76~1.50  |
| Weak reaction (3)                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 1.51~2.50  |
| Strong reaction (4)                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 2.51~4.00  |
| Extreme reaction (5)                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 4.01~      |
| (1) Negative(-): negative reaction (2) Doubtful or slight reaction and erythema(i): doubtful reaction (Faint or barely detectable mild erythema) (3) erythema + Induration(+): weak reaction (demarcated but mild erythema, edema and papules) (4) erythema + Induration + vesicle(++): strong reaction (distinct erythema, papules and vesicles) (5) erythema + Induration + bullae(+++): Extreme reaction (intense erythema and coalescing vesicles, crust formation) |            |

[Table 10]

| Name of Sample | ICDRG Criteria |                   |
|----------------|----------------|-------------------|
|                | Mean score     | Determination     |
| Example 1      | 0.00           | Negative reaction |
| Example 2      | 0.00           | Negative reaction |

### Experimental Example 5: Measurement of exercise physiological effects

**[0060]** A total of 15 subjects were asked to wear the clothing containing the fibers of Example 2 and the clothing of Comparative Example 1, and their blood lactate concentration and skin surface temperature were compared and analyzed.

**[0061]** Subjects were 15 males in their 20s, who had no problems with the musculoskeletal system, those who were not taking drugs for disease, and those who had no difficulty in performing exercise. Table 11 shows the physical characteristics of the 15 subjects.

[Table 11]

| Variables                            | Subjects (n=15)   |
|--------------------------------------|-------------------|
| Age (years)                          | 22.47 $\pm$ 1.60  |
| Height (cm)                          | 173.87 $\pm$ 5.11 |
| Weight (kg)                          | 75.37 $\pm$ 14.48 |
| Body mass index (kg/m <sup>2</sup> ) | 24.82 $\pm$ 3.85  |
| Body fat percentage (%)              | 20.39 $\pm$ 6.18  |
| Body fat mass (kg)                   | 15.94 $\pm$ 8.05  |

(continued)

| Variables      | Subjects (n=15) |
|----------------|-----------------|
| Lean mass (kg) | 59.43 ± 8.10    |

**[0062]** Based on one subject, the interval of the tests was set to one week, and a total of two repeated tests were performed, and the test was carried out through the clothing composed of the fibers of Example 2 and the clothing composed of the fibers of Comparative Example 1, respectively. Each type of clothing was treated with blinds so that the subject could not recognize the difference in clothing, and all environments between the two tests such as laboratory temperature, condition of the subject, underwear, socks, and shoes were maintained the same.

**[0063]** Blood lactate concentration and skin surface temperature were measured at three time points: immediately before exercise, immediately after exercise, and 30 minutes after exercise.

< Measurement of blood lactate concentration >

**[0064]** Lactic acid is a metabolite that reflects body fatigue. Depending on the intensity of exercise, the blood lactate level increases and then is recovered after a certain period of time.

**[0065]** In this test, an exercise load test was performed to artificially induce a load by having the subjects run on a trade mill, and the clothes made of the fabrics of Example 2 and the clothes made of the fabrics of Comparative Example 1 were applied to the subjects, and the change pattern of blood lactate was examined.

**[0066]** As a result, the clothing composed of the fabrics of Comparative Example 1 showed a 411 % increase in lactic acid immediately after exercise, whereas the clothing composed of the fabrics of Example 2 exhibited an increase in lactic acid of 223%. At the time of rest, the clothing composed of the fabrics of Comparative Example 1 showed a recovery of about 40%, whereas the clothing composed of the fabrics of Example 2 showed a recovery of 44%.

**[0067]** This can be interpreted as indicating that exercise in the state of wearing the clothing composed of the fabrics of Example 2 generates less lactic acid, and exhibits a tendency of faster lactic acid removal 30 minutes after the end of exercise.

**[0068]** Table 12 below compares the blood lactate concentration at each time point according to the clothing type.

[Table 12] (mean ± SD)

| Variable             | Type                  | Immediately before exercise | Immediately after exercise | 30 minutes after exercise | Δ%                                              |                                                        |                                    |
|----------------------|-----------------------|-----------------------------|----------------------------|---------------------------|-------------------------------------------------|--------------------------------------------------------|------------------------------------|
|                      |                       |                             |                            |                           | Immediately before - immediately after exercise | Immediately after exercise - 30 minutes after exercise | Before exercise - 30 minutes after |
| Lactic acid (mmol/L) | Example 2             | 3.49 ± 1.82                 | 11.29 ± 1.79               | 6.29 ± 1.38               | 223.50                                          | -44.29                                                 | 80.23                              |
|                      | Comparative Example 1 | 2.40 ± 1.32                 | 12.28 ± 1.74               | 7.36 ± 1.57               | 411.67                                          | -40.07                                                 | 206.67                             |

<Measurement of skin surface temperature>

**[0069]** In this test, an exercise load test was performed that artificially induces a load by having the subjects run a trade mill. The subjects wore the clothes composed of the fabrics of Example 2 and the clothes composed of the fabrics of Comparative Example 1, and the changes in skin surface temperature of the subjects were examined.

**[0070]** The skin surface temperature was measured in a total of 8 parts, and the change in body temperature was examined by having the subjects wear the clothes made of the fabrics of Example 2 and the clothes made of the fabrics of Comparative Example 1.

**[0071]** In the case of skin surface temperature, when the subjects wore the clothing composed of the fabrics of Comparative Example 1 as a whole, a higher body temperature was induced. Since high body temperature during

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exercise leads to an increase in fatigue, it can be interpreted that the clothing made of the fabrics of Example 1 is more suitable for sports functions.

**[0072]** Table 13 below compares the skin surface temperature at each time point according to the clothing type.

[Table 13]

| Part        | Type                  | Immediately before exercise | Immediately after exercise | 30 minutes after exercise | $\Delta\%$                                      |                                                        |                                    |
|-------------|-----------------------|-----------------------------|----------------------------|---------------------------|-------------------------------------------------|--------------------------------------------------------|------------------------------------|
|             |                       |                             |                            |                           | Immediately before - immediately after exercise | Immediately after exercise - 30 minutes after exercise | Before exercise - 30 minutes after |
| Thorax      | Example 2             | $29.37 \pm 1.74$            | $29.48 \pm 1.45$           | $28.57 \pm 1.98$          | 0.37                                            | -3.09                                                  | -2.72                              |
|             | Comparative Example 1 | $30.03 \pm 3.09$            | $31.87 \pm 3.62$           | $29.75 \pm 2.88$          | 6.13                                            | -6.65                                                  | -0.93                              |
| Right palm  | Example 2             | $29.41 \pm 1.84$            | $27.50 \pm 1.99$           | $31.95 \pm 1.30$          | -6.49                                           | 16.18                                                  | 8.64                               |
|             | Comparative Example 1 | $30.39 \pm 1.58$            | $27.22 \pm 1.67$           | $32.55 \pm 1.48$          | -10.43                                          | 19.58                                                  | 7.11                               |
| Left palm   | Example 2             | $29.08 \pm 2.20$            | $27.32 \pm 1.94$           | $31.94 \pm 1.38$          | -6.05                                           | 16.91                                                  | 9.83                               |
| Right thigh | Comparative Example 1 | $30.21 \pm 1.78$            | $27.27 \pm 2.06$           | $32.69 \pm 1.36$          | -9.73                                           | 19.88                                                  | 8.21                               |
|             | Example 2             | $28.92 \pm 1.65$            | $28.91 \pm 1.15$           | $30.17 \pm 0.81$          | -0.03                                           | 4.36                                                   | 4.32                               |
|             | Comparative Example 1 | $29.72 \pm 1.61$            | $29.19 \pm 1.31$           | $30.97 \pm 1.51$          | -1.78                                           | 6.10                                                   | 4.21                               |
| Left thigh  | Example 2             | $28.81 \pm 1.71$            | $28.71 \pm 1.33$           | $30.04 \pm 0.89$          | -0.35                                           | 4.63                                                   | 4.27                               |
|             | Comparative Example 1 | $29.69 \pm 1.14$            | $29.12 \pm 1.55$           | $30.87 \pm 1.40$          | -1.92                                           | 6.01                                                   | 3.97                               |

(continued)

| Part            | Type                  | Immediately before exercise | Immediately after exercise | 30 minutes after exercise | $\Delta\%$                                      |                                                        |                                    |
|-----------------|-----------------------|-----------------------------|----------------------------|---------------------------|-------------------------------------------------|--------------------------------------------------------|------------------------------------|
|                 |                       |                             |                            |                           | Immediately before - immediately after exercise | Immediately after exercise - 30 minutes after exercise | Before exercise - 30 minutes after |
| Right lower leg | Example 2             | $28.49 \pm 1.30$            | $28.31 \pm 1.23$           | $29.39 \pm 0.75$          | -0.63                                           | 3.81                                                   | 3.16                               |
|                 | Comparative Example 1 | $30.69 \pm 1.81$            | $30.28 \pm 1.90$           | $31.15 \pm 1.36$          | -1.34                                           | 2.87                                                   | 1.50                               |
| Left lower leg  | Example 2             | $28.77 \pm 1.16$            | $29.15 \pm 1.03$           | $29.45 \pm 0.96$          | 1.32                                            | 1.03                                                   | 2.36                               |
|                 | Comparative Example 1 | $30.79 \pm 1.56$            | $30.37 \pm 1.83$           | $31.31 \pm 1.72$          | -1.36                                           | 3.10                                                   | 1.69                               |
| Cervix          | Example 2             | $32.23 \pm 1.55$            | $31.53 \pm 1.41$           | $30.59 \pm 2.92$          | -2.17                                           | -2.98                                                  | -5.09                              |
|                 | Comparative Example 1 | $31.95 \pm 2.02$            | $31.16 \pm 1.81$           | $31.83 \pm 1.73$          | -2.47                                           | 2.15                                                   | -0.38                              |

**[Mode for Invention]**

**[0073]** The present invention maximizes antibacterial and deodorizing functions by mixing chitosan in an organic acid solution to prepare a solution, and then mixing ceramic powder with the solution to prepare an eco-friendly textile finishing agent composition.

**[0074]** A first solution of the present invention may include an organic acid and chitosan, and a mixing ratio of organic acid to chitosan may be a ratio of 1:5 to 5:1 by weight.

**[0075]** The first solution of the present invention may be prepared by stirring an organic acid solution containing an organic acid in a base solution, and a chitosan solution containing chitosan in the base solution at room temperature at a speed of 100 to 1000 rpm. The temperature range of room temperature may be 0 to 80 °C, preferably 15 to 50 °C. When preparing by stirring the organic acid solution and the chitosan solution at room temperature at a speed of 100 to 1000 rpm, there is an effect that the chitosan of high viscosity and high molecular weight is completely dispersed and dissolved in the solution.

**[0076]** The organic acid solution may contain 0.01 to 5 % by weight of an organic acid, preferably 0.01 to 1 % by weight of an organic acid. When the organic acid solution contains 0.01 to 5 % by weight of the organic acid, as a functional textile finishing agent, it is processed into fabrics, making the change of touch appropriate, and can be commercialized as a product.

**[0077]** The organic acid may be at least one selected from the group consisting of mandelic acid, malic acid, lactic acid, citric acid, alginic acid, ascorbic acid, formic acid, monohydrate, butyl lactic acid, ethyl lactic acid, and glycerine, and the organic acid may be preferably citric acid.

**[0078]** The organic acid is used to dissolve the chitosan in the base solution, and among them, citric acid is combined with the chitosan to maximize antibacterial properties.

**[0079]** On the other hand, the chitosan solution may contain 0.01 to 5 % by weight of chitosan, preferably 0.01 to 1 % by weight of chitosan. When the chitosan solution contains 0.01 to 5 % by weight of chitosan, the antibacterial, deodorizing, and far-infrared emission effects can be maximized.

**[0080]** The deacetylation degree of the chitosan may be 50 to 99.99 %, preferably 80 to 99.99 %. In general, as the deacetylation degree increases, the antibacterial, deodorizing, and far-infrared emission effects increase. Also, even in

the present invention, the antibacterial property is increased when the deacetylation degree of the chitosan is 80 to 99.99 %, and when the deacetylation degree of the chitosan is lower than 80 %, there may be a problem in that the antibacterial and deodorizing properties of a product are lowered.

**[0081]** The viscosity of the chitosan may be 500 to 1200 cps, preferably 700 to 1200 cps. When the viscosity of the chitosan is lower than 500 cps, there may be a problem in durability during fabric processing, and when the viscosity of the chitosan is higher than 1200 cps, the compatibility that can be applied to fabrics is lowered.

**[0082]** The molecular weight of the chitosan may be 1,000 to 2,000,000 g/mol. When the molecular weight of the chitosan is 1,000 g/mol or less, the properties of chitosan as a polymer inevitably decrease, and when the molecular weight is 2,000,000 g/mol or more, the bonding between the chitosan and the organic acid is not formed well.

**[0083]** The molecular weight of the chitosan may be preferably 10,000 to 1,000,000 g/mol. When the molecular weight of chitosan is lower than 10,000 g/mol, there may be a problem in the role as a natural binder during processing of fabrics, and when the molecular weight of chitosan is higher than 1,000,000 g/mol, there may be a problem in the touch performance of fabrics.

**[0084]** The second solution of the present invention may include a mineral solution, and a mixing ratio of the mineral solution may be in a ratio of 1:10 to 1:1000 by weight. By mixing the mineral solution and the base solution in the same ratio as described above, the mineral solution can be sufficiently dissolved in the base solution.

**[0085]** The mineral solution may be added to the first solution to further maximize the antibacterial and deodorizing functions, and may also serve as a preservative of the first solution.

**[0086]** The mineral solution may include at least one selected from sodium chloride, magnesium chloride, calcium chloride, potassium chloride, and sodium gluconate.

**[0087]** The third solution of the present invention may be a solution in which a mixing ratio of the first solution to the second solution is a ratio of 2:1 to 10:1 by weight. By mixing the first solution and the second solution in the same ratio as above, the dispersion and solubility of the chitosan solution are increased, and the antibacterial, deodorizing and far-infrared emission functions can be further maximized by adding the mineral solution.

**[0088]** The fourth solution of the present invention may be a solution in which a mixing ratio of the ceramic powder to the organic acid solution or base solution may be a ratio of 1:20 to 1: 1000. By mixing the ceramic powder and the organic acid solution or base solution in the same ratio as described above, the ceramic powder is dispersed in a solvent so that it can be made into a solution state that can be mixed with the chitosan solution.

**[0089]** The ceramic powder may be at least one selected from the group consisting of diatomaceous earth, biotite, sericite, muscovite, tourmaline, zeolite, charcoal, graphene, bentonite, germanium, magnetite, graphite, jade, and zirconium oxide.

**[0090]** The ceramic powder may have an average particle diameter of 0.01 to 5.0  $\mu\text{m}$ , preferably 0.1 to 3.0  $\mu\text{m}$ , and more preferably 0.1 to 1.0  $\mu\text{m}$  or less.

**[0091]** When the average particle diameter of the ceramic powder exceeds 5.0  $\mu\text{m}$ , in a case that the prepared textile finishing agent composition is applied to clothes, the fabric permeability of the ceramic powder is lowered and the ceramic powder is quickly detached between the fabrics, thereby reducing durability and far-infrared emission function. In addition, in the manufacturing process, the mixing and dispersing with the chitosan and organic acid solutions are not done properly, and the ceramic powder is precipitated, so that a stable solution state cannot be maintained.

**[0092]** On the other hand, when the average particle diameter of the ceramic powder is 0.1 to 1.0  $\mu\text{m}$ , the fabric permeability of the ceramic powder is strengthened and fabric adhesion is strengthened, thereby maximizing the far-infrared emission function. In addition, the ceramic powder having a size of 1.0  $\mu\text{m}$  or less is well bound to the molecules of a solution in a high viscosity state, so that the ceramic powder is not precipitated and can maintain a stable state.

**[0093]** The average density of the ceramic powder may be 0.1 to 5 g/cm<sup>3</sup>, preferably 0.3 to 3 g/cm<sup>3</sup>.

**[0094]** When the average density of the ceramic powder exceeds 5 g/cm<sup>3</sup>, the ceramic powder sinks and cannot be maintained in a stable state during the manufacturing process. When the average density of the ceramic powder is less than 0.1 g/cm<sup>3</sup>, there may be a problem in that the ceramic powder may float on the surface and may not be well mixed into the solution, or there may be a problem in that the ceramic powder is dispersed into the air during stirring.

**[0095]** The textile finishing agent composition of the present invention is prepared by mixing the fourth solution with the first solution in a ratio of 1:5 to 5:1, or mixing the fourth solution with the third solution in a ratio of 1:5 to 5:1. By mixing in such a mixing ratio, the chitosan solution and the ceramic dispersion solution are properly mixed, so that the ceramic powder does not sink even after a sufficient time has elapsed and can maintain a stable state.

**[0096]** The base solution may be distilled water or an aqueous solution obtained by diluting a natural substance. The natural substance may be at least one of peppermint extract, lemongrass extract, moringa leaf extract, rosemary extract, penny royal extract, eucalyptus extract, and coffee grounds extract.

**[0097]** The finally prepared textile finishing agent composition can enhance antibacterial, deodorizing and far-infrared emission functions by including the base solution that is the aqueous solution diluted with natural substances.

**[0098]** Hereinafter, a method for producing a textile finishing agent composition according to an embodiment of the present invention will be described in detail.

**[0099]** FIG. 1 is a flowchart illustrating a method for manufacturing a textile finishing agent composition according to an embodiment of the present invention.

**[0100]** Referring to FIG. 1, a method for manufacturing a textile finishing agent composition according to an embodiment of the present invention includes the steps of preparing a first solution and a second solution (S10), preparing a third aqueous solution by mixing the first solution and the second solution (S20), preparing a fourth solution by mixing ceramic powder and an organic acid or distilled water (S30), and preparing a textile finishing agent composition by mixing the third solution and the fourth solution (S40).

**[0101]** In the step (S10), after sufficiently dissolving 0.01 to 5 % by weight of an organic acid such as lactic acid, citric acid, mandelic acid, and acetic acid in a base solution at room temperature of 15 to 50 °C, 0.01 to 5 % by weight of high molecular weight chitosan with a deacetylation degree of 80 to 99.99 % and a viscosity of 500 to 1200 CPS are sufficiently dissolved in the base solution while being stirred at 200 to 300 rpm at room temperature for 24 hours, thereby preparing the first solution. Also, the second solution is prepared by dissolving the base solution and a sea salt containing 98 % or more of sodium chloride in a ratio of 2:1 to 10:1 by weight at room temperature of 15 to 50 °C for about 30 minutes. Here, the sea salt may be replaced with at least one substance selected from the group consisting of magnesium chloride, alginic acid, malic acid, acetic acid, citric acid, calcium acetate monohydrate, butyl lactate, ethyl lactate, and glycerine.

**[0102]** In the step (S20), the third solution in which a mixing ratio of the first solution to the second solution is a ratio of 2:1 to 10:1 by weight is prepared.

**[0103]** In the step (S30), the fourth solution is prepared by mixing zeolite powder with the organic acid in a ratio of 1:20 to 1:1000 by weight and dissolving the mixture at room temperature of 15 to 50 °C.

**[0104]** In the step (S40), a mixing ratio of the fourth solution to the third solution may be a ratio of 1:5 to 5:1 by weight to prepare a textile finishing agent composition. The zeolite powder may be replaced with at least one substance selected from the group consisting of illite powder, montmorillonite powder, mica powder, diatomaceous earth powder, zirconia powder, and carbon powder. Here, after mixing the third solution and the fourth solution, the mixture is stirred at room temperature of 15 to 50 °C to finally prepare a textile finishing agent composition.

**[0105]** FIG. 2 is a flowchart showing a method for manufacturing a textile finishing agent composition according to another embodiment of the present invention.

**[0106]** Referring to FIG. 2, a method for manufacturing a textile finishing agent composition according to another embodiment of the present invention includes the steps of preparing a first solution (S10'), preparing a fourth solution by mixing ceramic powder and an organic acid or base solution (S20'), and preparing a textile finishing agent composition by mixing the first solution and the fourth solution (S30').

**[0107]** In the step (S10'), after sufficiently dissolving 0.01 to 5 % by weight of an organic acid such as lactic acid, citric acid, mandelic acid, and acetic acid in a base solution at room temperature of 15 to 50 °C, 0.01 to 5 % by weight of high molecular weight chitosan with a deacetylation degree of 80 to 99.99 % and a viscosity of 500 to 1200 CPS are sufficiently dissolved in the base solution while being stirred at room temperature for 24 hours at 200 to 300 rpm, thereby preparing the first solution.

**[0108]** In the step (S20'), the fourth solution is prepared by mixing the zeolite powder with the organic acid in a ratio of 1:20 to 1:1000 by weight and dissolving the mixture at room temperature of 15 to 50 °C.

**[0109]** In the step (S30'), a mixing ratio of the first solution to the fourth solution may be a ratio of 1:5 to 5:1 by weight to prepare a textile finishing agent. The zeolite powder may be replaced with at least one substance selected from the group consisting of illite powder, montmorillonite powder, mica powder, diatomaceous earth powder, zirconia powder, and carbon powder. Here, after mixing the first solution and the fourth solution, the mixture is stirred at room temperature of 15 to 50 °C, thereby finally preparing a textile finishing agent composition.

**[0110]** The fabric treated with the above textile finishing agent composition has a far-infrared emissivity of 87 to 90 % at a wavelength of 5 to 20  $\mu\text{m}$ , and a far-infrared radiation energy of  $3.35 \times 10^2$  to  $3.63 \times 10^2 \text{ W/m}^2 \cdot \mu\text{m}$  at 30 to 45 °C.

**[0111]** The textile finishing agent composition of the present invention is prepared by a relatively simple method of mixing the fourth solution with the first solution in a ratio of 1:5 to 5:1, or mixing the fourth solution with the third solution in a ratio of 1:5 to 5:1. After the first solution or the third solution is completely reacted, the fourth solution is finally added, so that chitosan is completely dispersed and dissolved in the organic acid solution, and the ceramic powder does not sink even after a sufficient time has elapsed and can maintain a stable state.

**[0112]** Therefore, in applying the fabric processing agent composition to a fabric, when the textile finishing agent composition is manufactured by the manufacturing method of the present invention, the chitosan and the ceramic powder are evenly dispersed throughout the fabric, thereby maximizing the antibacterial, deodorizing and far-infrared emission effects.

**[0113]** When a user wears clothes made of fabrics treated with the textile finishing agent composition having the above-described far-infrared emissivity and radiation energy range, the amount of far-infrared radiation may be increased due to direct contact and friction with the human body. As a result, the far-infrared radiation energy absorbed by the skin expands micro-vessels to promote blood circulation, and the far-infrared wavelength that penetrates deep into the body raises the body temperature evenly throughout our body, so that the effect of exercising just by wearing clothes made



of fabrics treated with the textile finishing agent can be achieved.

**[0114]** On the other hand, even if the fabric to which the textile finishing agent composition is applied is washed 50 times or more, it has an excellent characteristic that antibacterial properties are not inhibited, which is due to the fact that the antibacterial function is maintained semi-permanently by optimizing the uniform mixing and dispersing by the manufacturing method of finally adding the fourth solution after completely reacting the first solution or the third solution.

**[0115]** Hereinafter, in another embodiment of the present invention, the textile finishing agent composition finally prepared in the above steps (S40, S30) will be described in detail.

**[0116]** The textile finishing agent composition finally prepared in the step (40) may contain 0.01 to 5 % by weight of chitosan, 0.01 to 5 % by weight of an organic acid, 0.01 to 5 % by weight of ceramic powder, 0.01 to 5 % by weight of a mineral solution, and a base solution.

**[0117]** The textile finishing agent composition finally prepared in the step (30') may contain 0.01 to 5 % by weight of chitosan, 0.01 to 5 % by weight of an organic acid, 0.01 to 5 % by weight of ceramic powder, and a base solution.

**[0118]** The chitosan contained in the textile finishing agent composition prepared in the above steps (S40, S30') of the present invention may contain 0.01 to 5 % by weight, preferably 0.01 to 1 % by weight. When the textile finishing agent composition contains 0.01 to 5 % by weight of the chitosan, the antibacterial, deodorizing and far-infrared emission functions can be maximized.

**[0119]** The organic acid contained in the textile finishing agent composition prepared in the above steps (S40, S30') of the present invention may contain 0.01 to 5 % by weight, preferably 0.01 to 1 % by weight. When the organic acid is contained in an amount of 0.01 to 5 % by weight in the textile finishing agent composition, the change in touch after processing fabric as a functional textile finishing agent is appropriate and can be commercialized as a product.

**[0120]** The deacetylation degree of the chitosan contained in the textile finishing agent composition prepared in the above steps (S40, S30') of the present invention may be 50 to 99.99 %, preferably 80 to 99.99 %. In general, as the degree of deacetylation increases, the effects of antibacterial, deodorizing and far-infrared emission increase. Also, even in the present invention, the antibacterial property is increased when the deacetylation degree of the chitosan is 80 to 99.99 %, and when the deacetylation degree of the chitosan is lower than 80 %, there may be a problem in that the antibacterial and deodorizing properties of a product are lowered.

**[0121]** The viscosity of the chitosan contained in the textile finishing agent composition prepared in the above steps (S40, S30') of the present invention may be 500 to 1200 cps, preferably 700 to 1200 cps. When the viscosity of the chitosan is lower than 500 cps, there may be a problem in durability during fabric processing, and when the viscosity of the chitosan is higher than 1200 cps, the compatibility that can be applied to fabrics is lowered.

**[0122]** The molecular weight of the chitosan contained in the textile finishing agent composition prepared in the above steps (S40, S30') of the present invention may be 1,000 to 2,000,000 g/mol. When the molecular weight of the chitosan is 1,000 g/mol or less, the properties of chitosan as a polymer inevitably decrease, and when the molecular weight is 2,000,000 g/mol or more, the bonding between the chitosan and the organic acid is not formed well.

**[0123]** The molecular weight of the chitosan may be preferably 10,000 to 1,000,000 g/mol. When the molecular weight of the chitosan is lower than 10,000 g/mol, there may be a problem in the role as a natural binder during processing of fabrics, and when the molecular weight of the chitosan is higher than 1,000,000 g/mol, there may be a problem in the touch performance of fabrics.

**[0124]** The organic acid contained in the textile finishing agent composition prepared in the above steps (S40, S30') of the present invention may be at least one selected from the group consisting of mandelic acid, malic acid, lactic acid, citric acid, alginic acid, acetic acid, ascorbic acid, calcium acetate, formic acid, monohydrate, butyl lactic acid, ethyl lactic acid, and glycerine.

**[0125]** The ceramic powder contained in the textile finishing agent composition prepared in the above steps (S40, S30') of the present invention may be at least one selected from the group consisting of diatomaceous earth, biotite, sericite, muscovite, tourmaline, zeolite, charcoal, graphene, bentonite, germanium, magnetite, graphite, jade, and zirconium oxide.

**[0126]** The ceramic powder may have an average particle diameter of 0.01 to 5.0  $\mu\text{m}$ , preferably 0.1 to 3.0  $\mu\text{m}$ , and more preferably 0.1 to 1.0  $\mu\text{m}$  or less.

**[0127]** When the average particle diameter of the ceramic powder exceeds 5.0  $\mu\text{m}$ , in a case that the prepared textile finishing agent composition is applied to clothes, the fabric permeability of the ceramic powder is lowered and the ceramic powder is quickly detached between the fabrics, thereby reducing durability and far-infrared emission function. In addition, in the manufacturing process, the mixing and dispersing with the chitosan and organic acid solutions are not done properly, and the ceramic powder is precipitated, so that a stable solution state cannot be maintained.

**[0128]** On the other hand, when the average particle diameter of the ceramic powder is 0.1 to 1.0  $\mu\text{m}$ , the fabric permeability of the ceramic powder is strengthened and fabric adhesion is strengthened, thereby maximizing the far-infrared emission function. In addition, the ceramic powder having a size of 1.0  $\mu\text{m}$  or less is well bound to the molecules of a solution in a high viscosity state, so that the ceramic powder is not precipitated and can maintain a stable state.

**[0129]** The average density of the ceramic powder may be 0.1 to 5 g/cm<sup>3</sup>, preferably 0.3 to 3 g/cm<sup>3</sup>.

**[0130]** When the average density of the ceramic powder exceeds 5 g/cm<sup>3</sup>, the ceramic powder sinks and cannot be maintained in a stable state during the manufacturing process. When the average density of the ceramic powder is less than 0.1 g/cm<sup>3</sup>, there may be a problem in that the ceramic powder may float on the surface and may not be well mixed into the solution, or there may be a problem in that the ceramic powder is dispersed into the air during stirring.

**[0131]** The base solution of the textile finishing agent composition finally prepared in the above steps (S40, S30') may be distilled water or an aqueous solution obtained by diluting natural substance. The natural substance may be at least one of peppermint extract, lemongrass extract, moringa leaf extract, rosemary extract, penny royal extract, eucalyptus extract, and coffee grounds extract.

**[0132]** The finally prepared textile finishing agent composition can enhance antibacterial, deodorizing and far-infrared emission functions by including the base solution that is the aqueous solution diluted with natural substances.

**[0133]** The at least one of peppermint extract, lemongrass extract, moringa leaf extract, rosemary extract, penny royal extract, eucalyptus extract, and coffee grounds extract may be diluted with distilled water in the range of 0.01 to 5 % by weight and used, and when used within the range, antibacterial and deodorizing functions may increase.

**[0134]** FIG. 3 shows the colony growth when *Staphylococcaceae aureus* was inoculated into the same medium treated with a textile finishing agent composition containing distilled water as a base solution and a textile finishing agent composition containing a base solution in which 1 % by weight of peppermint extract is diluted with distilled water.

**[0135]** FIG. 3 (a) shows the medium treated with the textile finishing agent composition containing distilled water as a base solution, FIG. 3 (b) shows the medium treated with the textile finishing agent composition containing a base solution in which 1 % by weight of peppermint extract is diluted with distilled water.

**[0136]** As shown in FIG. 3, it can be seen that the antibacterial effect is enhanced when the aqueous solution diluted with the above natural substances is included in the base solution.

**[0137]** The mineral solution contained in the textile finishing agent composition prepared in the above step (S40) may be at least one selected from sodium chloride, magnesium chloride, calcium chloride, potassium chloride, and sodium gluconate

**[0138]** The mineral solution increases the dispersibility and solubility of the chitosan solution, and by adding the mineral solution, it is possible to further maximize the antibacterial, deodorizing and far-infrared emission functions.

**[0139]** The textile finishing agent composition finally prepared in the above steps (S40, S30') may have a viscosity of 500 to 6,000 cps. When the finally prepared textile finishing agent composition within the above viscosity range is applied to fabrics, the durability of the clothing can be optimized.

**[0140]** When the viscosity of the textile finishing agent composition is 500 cps or less, there may be a problem in durability during fabric processing, and when the viscosity is 6,000 cps or more, the compatibility that can be applied to the fabric is lowered.

**[0141]** The textile finishing agent composition finally prepared in the above steps (S40, S30') may have a pH of 2 to 4. In a state within the above pH range, the solubility of chitosan having a high molecular weight increases, so that aggregation or precipitation in aqueous solution does not occur.

**[0142]** When the pH of the finally prepared textile finishing agent composition is 2 or less, skin irritation may occur when wearing the clothes to which the composition is applied, and when the pH is 4 or more, the high molecular weight chitosan does not dissolve well, so the components of the composition are not well mixed, deposits may occur, and compatibility may be reduced.

**[0143]** In addition, the composition within the above range is an acidic material, but normal human skin exhibits weak acidity of pH of 5 to 6, and the textile finishing agent composition contains natural extracts such as chitosan and ceramics as components, so there is little skin irritation.

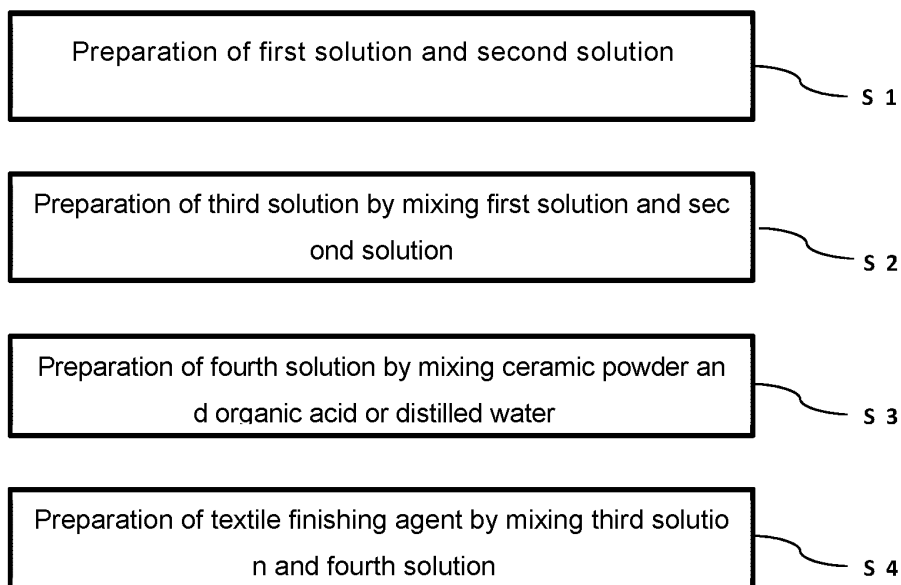
## Claims

1. A skin hypoallergenic textile finishing agent composition, comprising 0.01 to 5 % by weight of chitosan, 0.01 to 5 % by weight of an organic acid, 0.01 to 5 % by weight of ceramic powder, and balance of a base solution.
2. A skin hypoallergenic textile finishing agent composition, comprising 0.01 to 5 % by weight of chitosan, 0.01 to 5 % by weight of an organic acid, 0.01 to 5 % by weight of ceramic powder, 0.01 to 5 % by weight of a mineral solution, and balance of a base solution.
3. The skin hypoallergenic textile finishing agent composition according to claim 1 or 2, wherein the base solution is distilled water or an aqueous solution obtained by diluting at least one of peppermint extract, lemongrass extract, moringa leaf extract, rosemary extract, penny royal extract, eucalyptus extract, and coffee grounds extract.
4. The skin hypoallergenic textile finishing agent composition according to claim 1 or 2, wherein a deacetylation degree

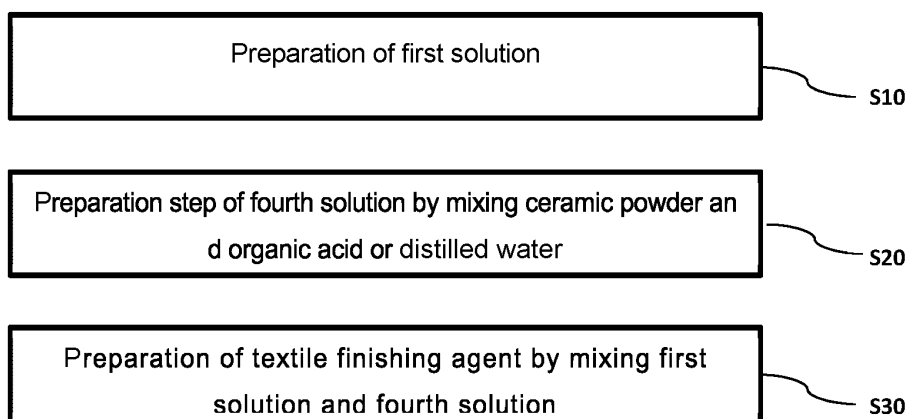
of the chitosan is 80 to 99.9 %.

- 5 5. The skin hypoallergenic textile finishing agent composition according to claim 1 or 2, wherein a molecular weight of the chitosan is 10,000 to 1,000,000 g/mol.
6. The skin hypoallergenic textile finishing agent composition according to claim 1 or 2, wherein a viscosity of the chitosan is 500 to 1200 cps.
- 10 7. The skin hypoallergenic textile finishing agent composition according to claim 1 or 2, wherein a viscosity of the textile finishing agent composition is 500 to 6000 cps.
8. The skin hypoallergenic textile finishing agent composition according to claim 1 or 2, wherein the textile finishing agent composition has a pH of 2 to 4.
- 15 9. The skin hypoallergenic textile finishing agent composition according to claim 1 or 2, wherein the organic acid is at least one selected from the group consisting of mandelic acid, malic acid, lactic acid, citric acid, alginic acid, acetic acid, ascorbic acid, calcium acetate, formic acid, monohydrate, butyl lactic acid, ethyl lactic acid, and glycerin.
- 20 10. The skin hypoallergenic textile finishing agent composition according to claim 1 or 2, wherein the ceramic powder is at least one selected from the group consisting of diatomaceous earth, biotite, sericite, muscovite, tourmaline, zeolite, charcoal, graphene, bentonite, germanium, magnetite, graphite, jade, and zirconium oxide.
- 25 11. The skin hypoallergenic textile finishing agent composition according to claim 2, wherein the mineral solution is at least one selected from sodium chloride, magnesium chloride, calcium chloride, potassium chloride, and sodium gluconate.

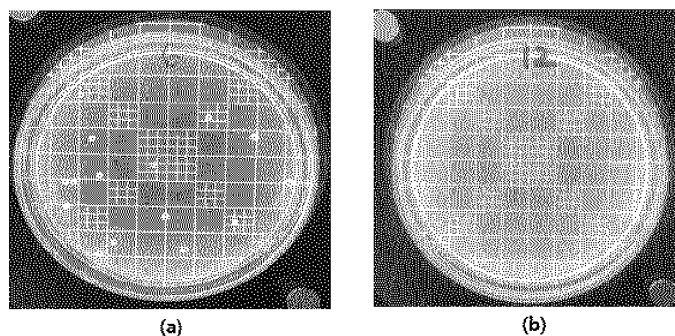
[FIG. 1]



[FIG. 2]



[FIG. 3]



## INTERNATIONAL SEARCH REPORT

International application No.

PCT/KR2020/005690

| <b>A. CLASSIFICATION OF SUBJECT MATTER</b><br><b>D06M 15/03(2006.01)i; D06M 13/184(2006.01)i; D06M 13/207(2006.01)i; D06M 11/79(2006.01)i; D06M 11/74(2006.01)i; D06M 11/46(2006.01)i; D06M 11/13(2006.01)i; D06M 11/155(2006.01)i; D06M 13/148(2006.01)i; D06M 13/00(2006.01)i</b><br>According to International Patent Classification (IPC) or to both national classification and IPC                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                  |                                                                                    |                       |        |                                                                                                                                |                    |   |                                                                                |     |   |                                                                    |     |   |                                                                                           |    |  |
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| <b>B. FIELDS SEARCHED</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                  |                                                                                    |                       |        |                                                                                                                                |                    |   |                                                                                |     |   |                                                                    |     |   |                                                                                           |    |  |
| Minimum documentation searched (classification system followed by classification symbols)<br>D06M 15/03; A23L 3/3526; A61K 31/255; B82B 3/00; B82Y 30/00; B82Y 40/00; D06M 13/144; D06M 15/647; D06M 13/184; D06M 13/207; D06M 11/79; D06M 11/74; D06M 11/46; D06M 11/13; D06M 11/155; D06M 13/148; D06M 13/00                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                  |                                                                                    |                       |        |                                                                                                                                |                    |   |                                                                                |     |   |                                                                    |     |   |                                                                                           |    |  |
| Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched<br>Korean utility models and applications for utility models: IPC as above<br>Japanese utility models and applications for utility models: IPC as above                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                  |                                                                                    |                       |        |                                                                                                                                |                    |   |                                                                                |     |   |                                                                    |     |   |                                                                                           |    |  |
| Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)<br>eKOMPASS (KIPO internal) & keywords: 키토산(chitosan), 세라믹 분말(ceramic powder), 섬유가공제(textile processing agent), 미네랄 용액(mineral solution), 유기산(organic acid)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                  |                                                                                    |                       |        |                                                                                                                                |                    |   |                                                                                |     |   |                                                                    |     |   |                                                                                           |    |  |
| <b>C. DOCUMENTS CONSIDERED TO BE RELEVANT</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                  |                                                                                    |                       |        |                                                                                                                                |                    |   |                                                                                |     |   |                                                                    |     |   |                                                                                           |    |  |
| <table border="1"> <thead> <tr> <th>Category*</th> <th>Citation of document, with indication, where appropriate, of the relevant passages</th> <th>Relevant to claim No.</th> </tr> </thead> <tbody> <tr> <td data-bbox="242 862 375 929"> X<br/>Y </td> <td data-bbox="375 862 1173 929">           KR 10-0767336 B1 (SEO, Pyeong Won et al.) 18 October 2007. See paragraphs [0012], [0037] and [0043]; and claims 1, 3-7 and 11. </td> <td data-bbox="1173 862 1375 929">           1-3,9,10<br/>4-8,11 </td> </tr> <tr> <td data-bbox="242 929 375 996"> Y </td> <td data-bbox="375 929 1173 996">           KR 10-0144507 B1 (CHON, Dong Won et al.) 15 July 1998. See page 4, lines 6-10. </td> <td data-bbox="1173 929 1375 996">           4-6 </td> </tr> <tr> <td data-bbox="242 996 375 1064"> Y </td> <td data-bbox="375 996 1173 1064">           JP 2012-072539 A (LION CORP.) 12 April 2012. See paragraph [0066]. </td> <td data-bbox="1173 996 1375 1064">           7,8 </td> </tr> <tr> <td data-bbox="242 1064 375 1131"> Y </td> <td data-bbox="375 1064 1173 1131">           JP 2001-081027 A (ICHIMARU PHARCOS CO., LTD. et al.) 27 March 2001. See paragraph [0045]. </td> <td data-bbox="1173 1064 1375 1131">           11 </td> </tr> </tbody> </table> | Category*                                                                                                                                                                                                                                        | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. | X<br>Y | KR 10-0767336 B1 (SEO, Pyeong Won et al.) 18 October 2007. See paragraphs [0012], [0037] and [0043]; and claims 1, 3-7 and 11. | 1-3,9,10<br>4-8,11 | Y | KR 10-0144507 B1 (CHON, Dong Won et al.) 15 July 1998. See page 4, lines 6-10. | 4-6 | Y | JP 2012-072539 A (LION CORP.) 12 April 2012. See paragraph [0066]. | 7,8 | Y | JP 2001-081027 A (ICHIMARU PHARCOS CO., LTD. et al.) 27 March 2001. See paragraph [0045]. | 11 |  |
| Category*                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Citation of document, with indication, where appropriate, of the relevant passages                                                                                                                                                               | Relevant to claim No.                                                              |                       |        |                                                                                                                                |                    |   |                                                                                |     |   |                                                                    |     |   |                                                                                           |    |  |
| X<br>Y                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | KR 10-0767336 B1 (SEO, Pyeong Won et al.) 18 October 2007. See paragraphs [0012], [0037] and [0043]; and claims 1, 3-7 and 11.                                                                                                                   | 1-3,9,10<br>4-8,11                                                                 |                       |        |                                                                                                                                |                    |   |                                                                                |     |   |                                                                    |     |   |                                                                                           |    |  |
| Y                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | KR 10-0144507 B1 (CHON, Dong Won et al.) 15 July 1998. See page 4, lines 6-10.                                                                                                                                                                   | 4-6                                                                                |                       |        |                                                                                                                                |                    |   |                                                                                |     |   |                                                                    |     |   |                                                                                           |    |  |
| Y                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | JP 2012-072539 A (LION CORP.) 12 April 2012. See paragraph [0066].                                                                                                                                                                               | 7,8                                                                                |                       |        |                                                                                                                                |                    |   |                                                                                |     |   |                                                                    |     |   |                                                                                           |    |  |
| Y                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | JP 2001-081027 A (ICHIMARU PHARCOS CO., LTD. et al.) 27 March 2001. See paragraph [0045].                                                                                                                                                        | 11                                                                                 |                       |        |                                                                                                                                |                    |   |                                                                                |     |   |                                                                    |     |   |                                                                                           |    |  |
| <input checked="" type="checkbox"/> Further documents are listed in the continuation of Box C.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | <input checked="" type="checkbox"/> See patent family annex.                                                                                                                                                                                     |                                                                                    |                       |        |                                                                                                                                |                    |   |                                                                                |     |   |                                                                    |     |   |                                                                                           |    |  |
| * Special categories of cited documents:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                  |                                                                                    |                       |        |                                                                                                                                |                    |   |                                                                                |     |   |                                                                    |     |   |                                                                                           |    |  |
| "A" document defining the general state of the art which is not considered to be of particular relevance                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention                                              |                                                                                    |                       |        |                                                                                                                                |                    |   |                                                                                |     |   |                                                                    |     |   |                                                                                           |    |  |
| "D" document cited by the applicant in the international application                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone                                                                     |                                                                                    |                       |        |                                                                                                                                |                    |   |                                                                                |     |   |                                                                    |     |   |                                                                                           |    |  |
| "E" earlier application or patent but published on or after the international filing date                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art |                                                                                    |                       |        |                                                                                                                                |                    |   |                                                                                |     |   |                                                                    |     |   |                                                                                           |    |  |
| "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | "&" document member of the same patent family                                                                                                                                                                                                    |                                                                                    |                       |        |                                                                                                                                |                    |   |                                                                                |     |   |                                                                    |     |   |                                                                                           |    |  |
| "O" document referring to an oral disclosure, use, exhibition or other means                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                  |                                                                                    |                       |        |                                                                                                                                |                    |   |                                                                                |     |   |                                                                    |     |   |                                                                                           |    |  |
| "P" document published prior to the international filing date but later than the priority date claimed                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                  |                                                                                    |                       |        |                                                                                                                                |                    |   |                                                                                |     |   |                                                                    |     |   |                                                                                           |    |  |
| Date of the actual completion of the international search<br><b>21 January 2021</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Date of mailing of the international search report<br><b>22 January 2021</b>                                                                                                                                                                     |                                                                                    |                       |        |                                                                                                                                |                    |   |                                                                                |     |   |                                                                    |     |   |                                                                                           |    |  |
| Name and mailing address of the ISA/KR<br><b>Korean Intellectual Property Office<br/>Government Complex-Daejeon Building 4, 189 Cheongsaro, Seo-gu, Daejeon 35208</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Authorized officer                                                                                                                                                                                                                               |                                                                                    |                       |        |                                                                                                                                |                    |   |                                                                                |     |   |                                                                    |     |   |                                                                                           |    |  |
| Facsimile No. <b>+82-42-481-8578</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Telephone No.                                                                                                                                                                                                                                    |                                                                                    |                       |        |                                                                                                                                |                    |   |                                                                                |     |   |                                                                    |     |   |                                                                                           |    |  |

Form PCT/ISA/210 (second sheet) (July 2019)

INTERNATIONAL SEARCH REPORT

International application No.  
**PCT/KR2020/005690**

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| C. DOCUMENTS CONSIDERED TO BE RELEVANT |                                                                                         |                       |
|----------------------------------------|-----------------------------------------------------------------------------------------|-----------------------|
| Category*                              | Citation of document, with indication, where appropriate, of the relevant passages      | Relevant to claim No. |
| A                                      | KR 10-2009-0063337 A (DAE EUN EMBI CO., LTD. et al.) 18 June 2009. See entire document. | 1-11                  |
| <div></div>                            |                                                                                         |                       |

INTERNATIONAL SEARCH REPORT  
Information on patent family members

International application No.

PCT/KR2020/005690

| Patent document<br>cited in search report | Publication date<br>(day/month/year) | Patent family member(s) | Publication date<br>(day/month/year) |
|-------------------------------------------|--------------------------------------|-------------------------|--------------------------------------|
| KR 10-0767336 B1                          | 18 October 2007                      | None                    |                                      |
| KR 10-0144507 B1                          | 15 July 1998                         | KR 01-44507 B1          | 15 July 1998                         |
|                                           |                                      | KR 10-1997-0015909 A    | 28 April 1997                        |
| JP 2012-072539 A                          | 12 April 2012                        | JP 5726682 B2           | 03 June 2015                         |
| JP 2001-081027 A                          | 27 March 2001                        | None                    |                                      |
| KR 10-2009-0063337 A                      | 18 June 2009                         | KR 10-1006699 B1        | 12 January 2011                      |

Form PCT/ISA/210 (patent family annex) (July 2019)