US 20250256081A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2025/0256081 A1**

KIM et al. (43) **Pub. Date: Aug. 14, 2025**

(54) **MICRONEEDLE PARTICLES AND METHOD FOR PREPARING MICRONEEDLE PARTICLES**

(71) Applicant: **RAPHAS CO., LTD.**, Seoul (KR)

(72) Inventors: **Seong-Jun KIM**, Gimpo-si, Gyeonggi-do (KR); **Sung-Su KIM**, Anyang-si, Gyeonggi-do (KR); **Sookie LA**, Seoul (KR); **Na-Young YOO**, Incheon (KR); **Do-Hyeon JEONG**, Seoul (KR)

(73) Assignee: **RAPHAS CO., LTD.**, Seoul (KR)

(21) Appl. No.: **18/850,065**

(22) PCT Filed: **Mar. 27, 2023**

(86) PCT No.: **PCT/KR2023/004055**

§ 371 (c)(1),
(2) Date: **Sep. 24, 2024**

(30) **Foreign Application Priority Data**

Mar. 28, 2022 (KR) 10-2022-0037940
Nov. 29, 2022 (KR) 10-2022-0162324

Publication Classification

(51) **Int. Cl.**
A61M 37/00 (2006.01)
A61K 8/02 (2006.01)

(52) **U.S. Cl.**
CPC ***A61M 37/0015*** (2013.01); ***A61K 8/02*** (2013.01); *A61K 2800/87* (2013.01); *A61M 2037/0053* (2013.01); *A61M 2037/0061* (2013.01)

(57) **ABSTRACT**

The present disclosure relates to microneedle particles and a method for preparing microneedle particles.

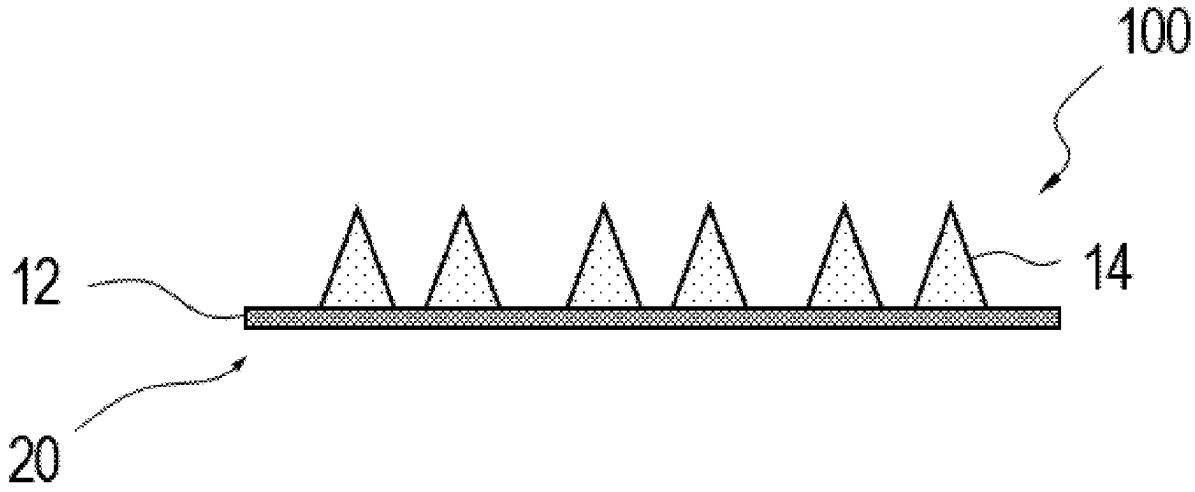


FIG. 1

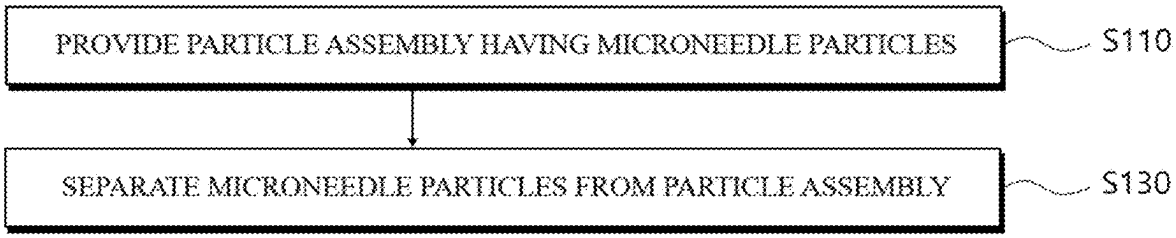

PROVIDE PARTICLE ASSEMBLY HAVING MICRONEEDLE PARTICLES
S110
SEPARATE MICRONEEDLE PARTICLES FROM PARTICLE ASSEMBLY
S130

FIG. 2

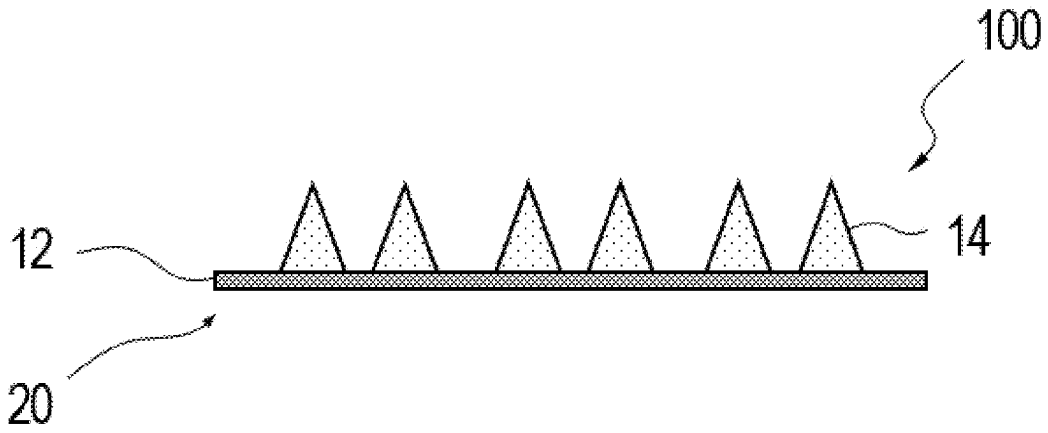


FIG. 3

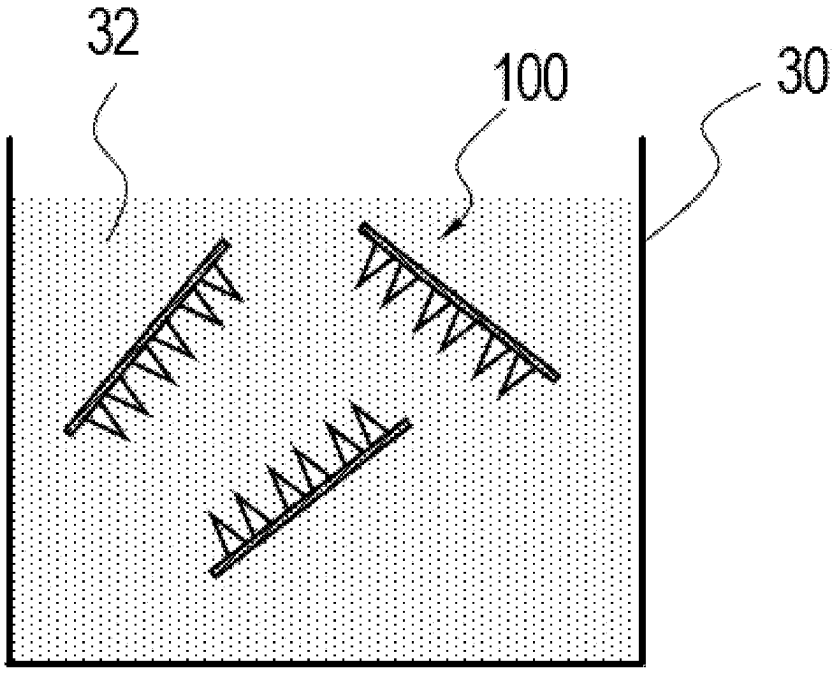


FIG. 4

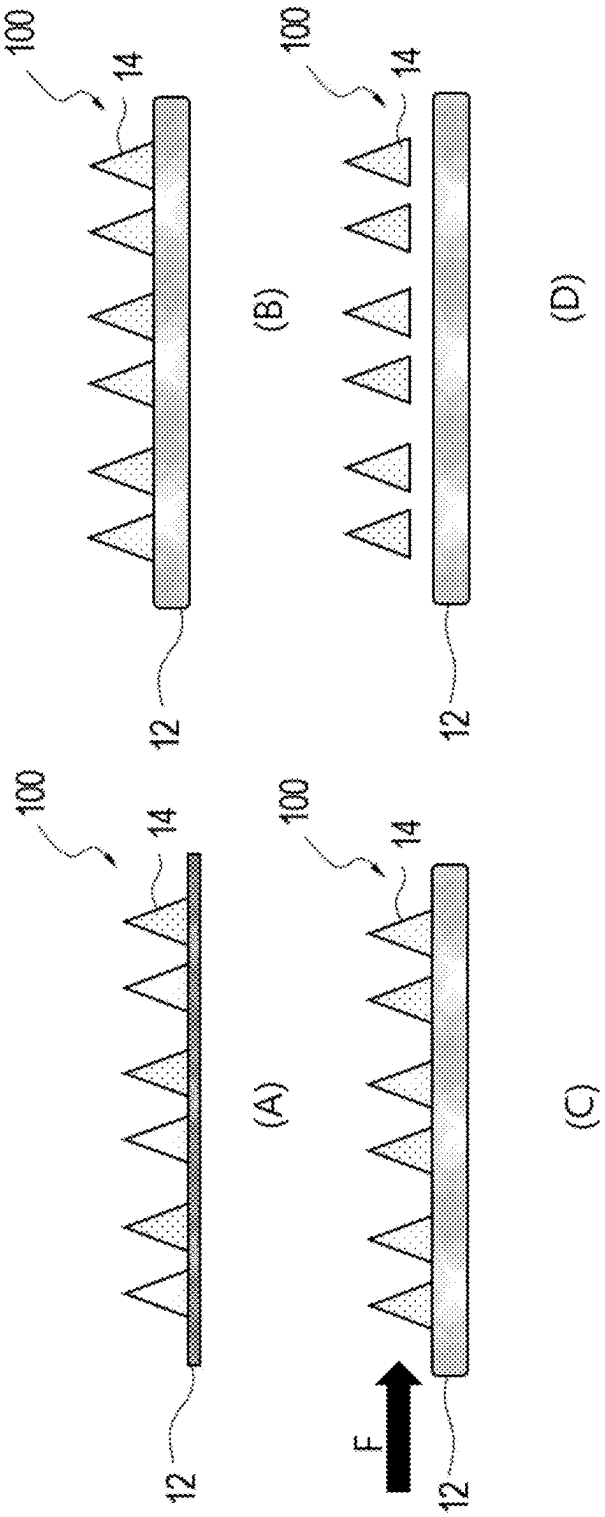


FIG. 5

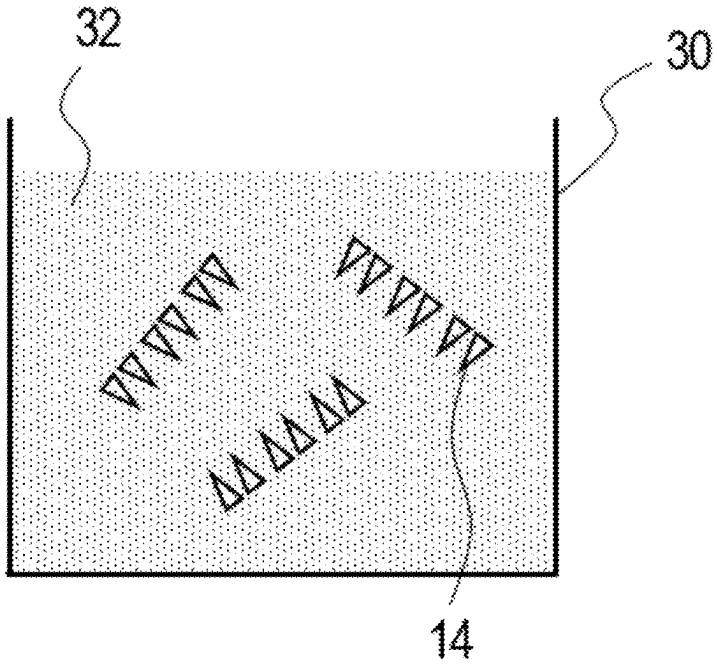


FIG. 6

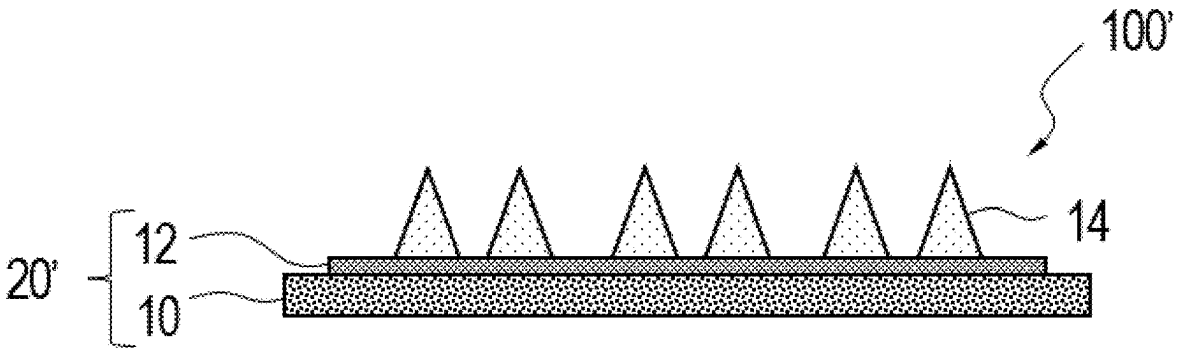


FIG. 7

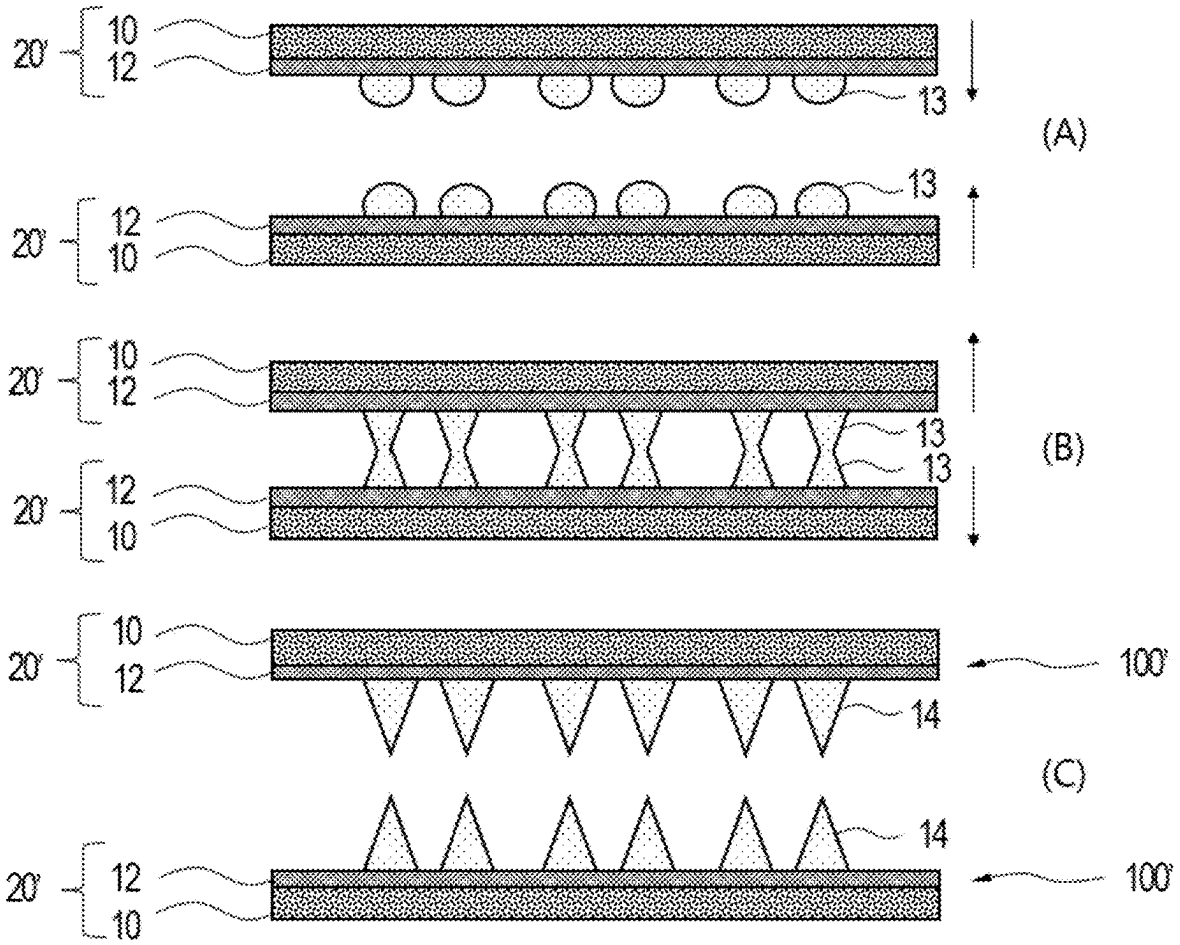

20'
10
12
13
(A)
20'
12
10
13
20'
10
12
13
13
(B)
20'
12
10
20'
10
12
100'
14
(C)
14
20'
12
10
100'

FIG. 8

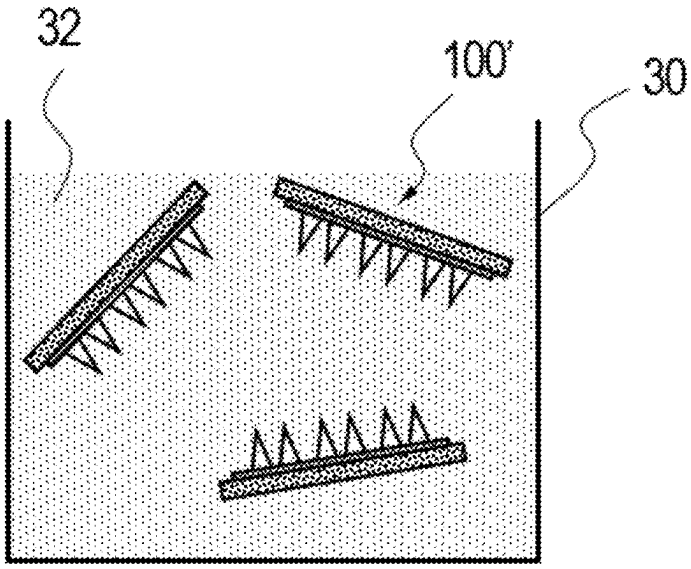


FIG. 9

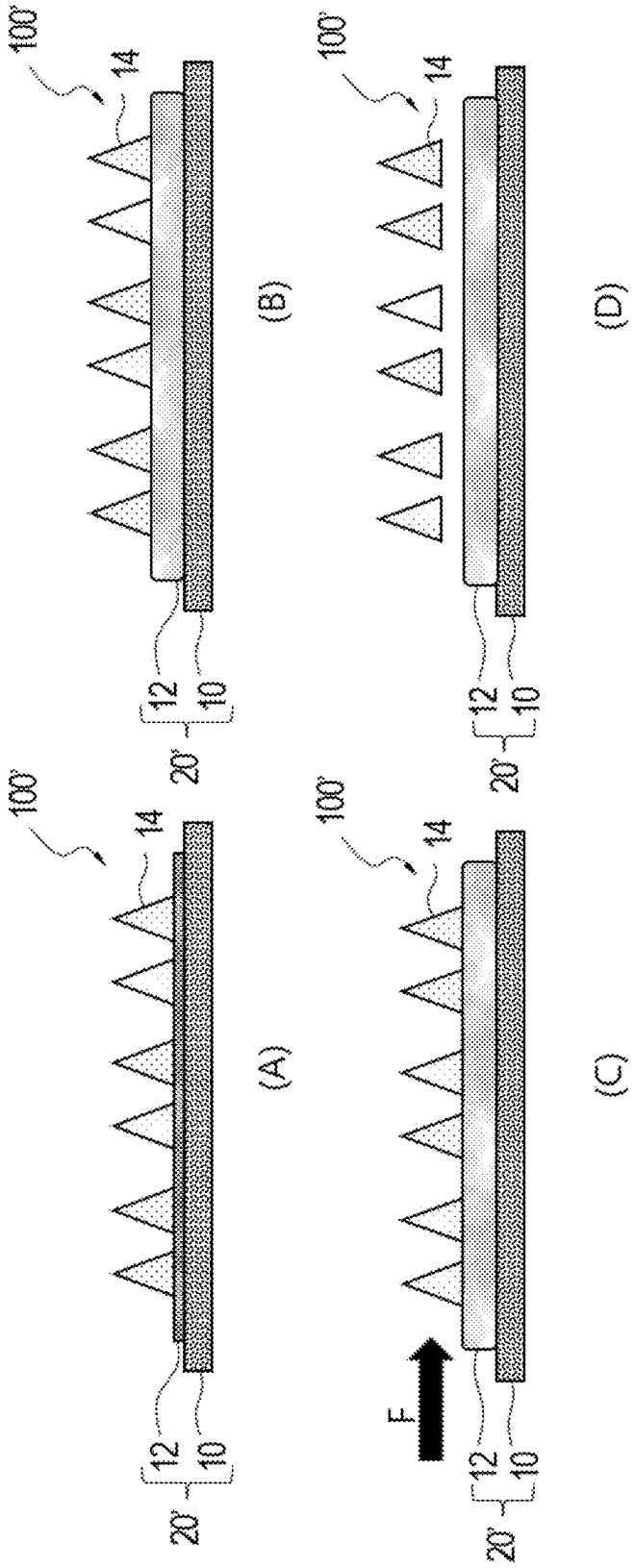


FIG. 10

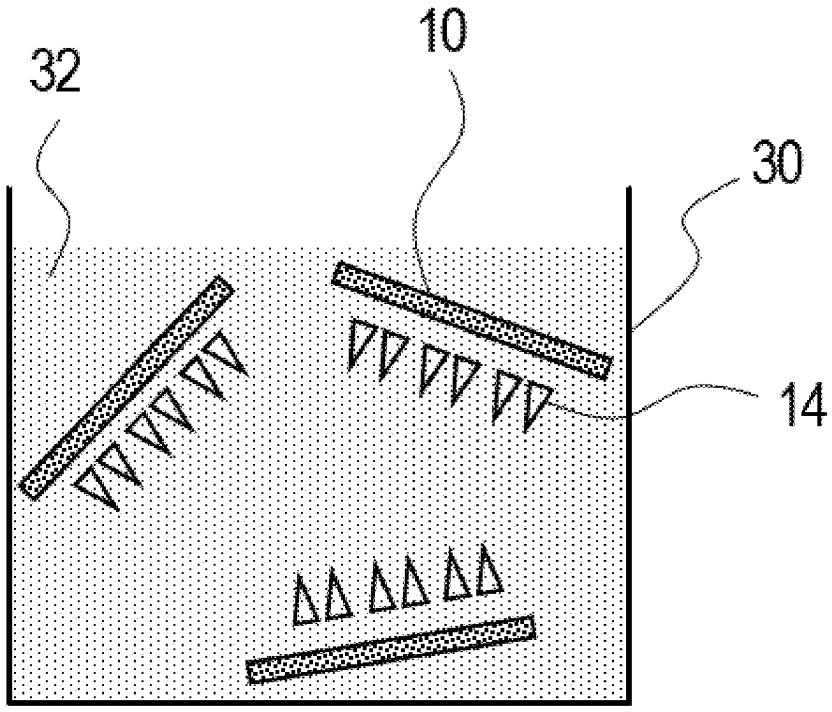


FIG. 11

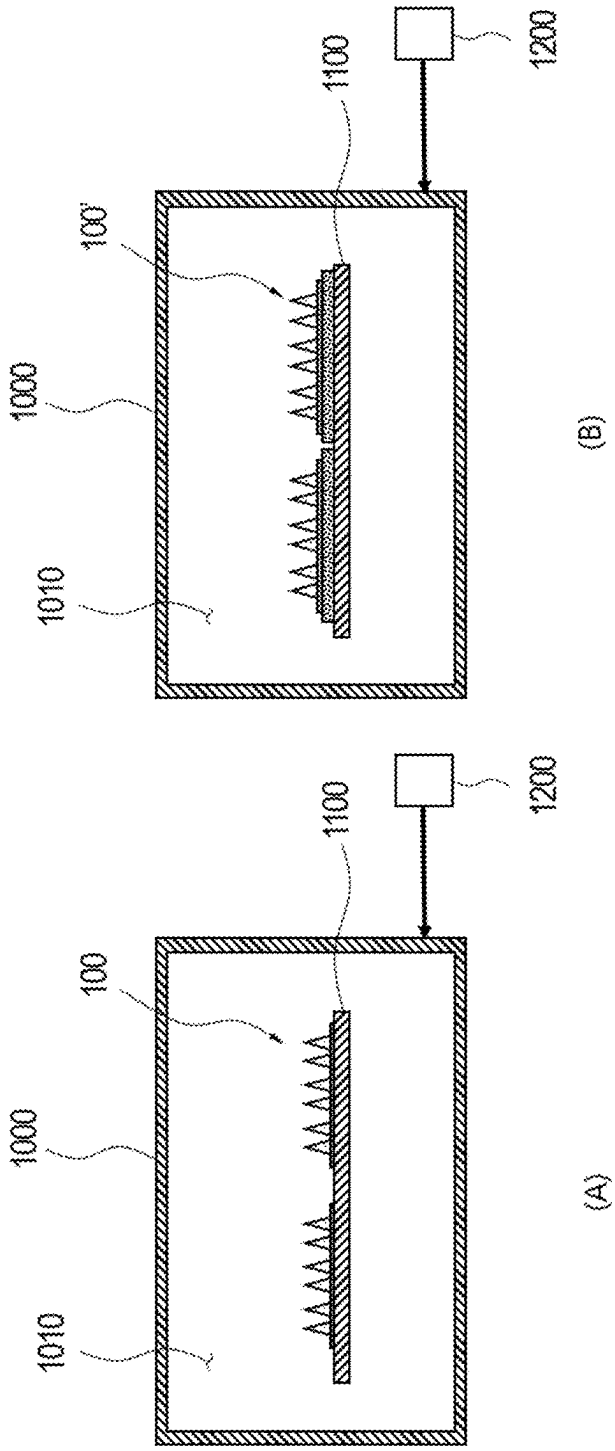
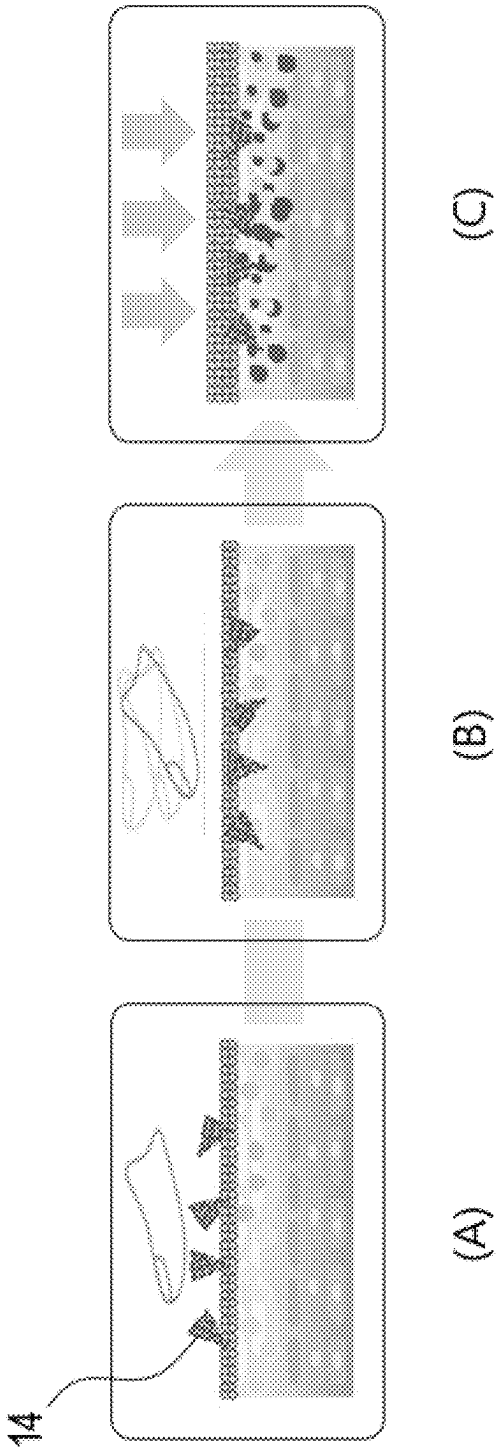


FIG. 12



MICRONEEDLE PARTICLES AND METHOD FOR PREPARING MICRONEEDLE PARTICLES

TECHNICAL FIELD

[0001] The present disclosure relates to microneedle particles and a method of preparing microneedle particles.

BACKGROUND ART

[0002] Drugs and bioactive substances are generally administered orally in tablet or capsule form, but many drugs may not be effectively delivered using this administration method alone for reasons such as digestion or absorption in the gastrointestinal tract or loss through liver mechanisms. Some drugs may not diffuse effectively across the intestinal mucosa. Patient compliance is also an issue.

[0003] Another common technique for delivering drugs and bioactive substances is to use a conventional needle. Although this method is more effective than oral administration, it has disadvantages of causing pain at the injection site, local damage to the skin, bleeding, and disease infection at the injection site.

[0004] To resolve the problems of the oral administration and subcutaneous injection, a transdermal administration method using a patch is used. Transdermal administration using patches has fewer side effects and higher patient compliance, and makes it easy to maintain a constant blood drug concentration.

[0005] As one of the transdermal administration methods described above, various microstructures including microneedles have been developed. Metals and various polymer materials have been used as materials for microneedles. Recently, biodegradable polymer materials have attracted attention as materials for microneedles.

[0006] These microneedles are manufactured in the form of patches including adhesive sheets and are used by attaching the microneedles to a desired area of the body by using the adhesive sheet.

[0007] However, these microneedle products are manufactured in the form of patches and may only be used in limited areas of the human body. Furthermore, when the adhesion of the adhesive sheet is weak, the effectiveness is very low.

DISCLOSURE

Technical Problem

[0008] The present disclosure is to provide microneedle particles that may be used over a wide area of the human body and may be used regardless of adhesion when used with cosmetics and the like.

Technical Solution

[0009] An object of the present disclosure is achieved by a method of preparing microneedle particles, the method including providing a particle assembly having a plurality of microneedle particles on an upper surface of a first film, and separating the microneedle particles from the particle assembly, wherein the separating of the microneedle particles from the particle assembly includes weakening adhesion between the first film and the microneedle particles.

[0010] Here, the first film may include a water-soluble film. The first film may include one or a mixture of two or more selected from polyvinylpyrrolidone, polyvinyl alcohol, cellulose polymer, dextran, gelatin, glycerin, polyethylene glycol, polysorbate, propylene glycol, povidone, carbomer, gum ghatti, guar gum, glucomannan, glucosamine, dammer resin, rennet casein, locust bean gum, microfibrillatedcellulose, psyllium seed gum, xanthan gum, arabino galactan, gum arabic, alginic acid, gelatin, gellan gum, carrageenan, karaya gum, curdlan, chitosan, chitin, tara gum, tamarind gum, tragacanth gum, furcelleran, pectin or pullulan, hydroxypropyl methylcellulose (HPMC), hydroxyalkyl cellulose, ethyl hydroxyethyl cellulose, alkyl cellulose, gluten, soy polysaccharides, polacrilin potassium, sodium starch glycolate, crospovidone, croscarmellose sodium, bentonite, hydroxypropyl starch, sodium carboxymethyl cellulose, sodium alginate, sodium lauryl sulfate, silicic anhydride, hydroxypropyl cellulose, polyvinyl acetate, amylose, sodium hydrogen carbonate, amylopectin, sodium polyphosphate, and aluminium magnesium silicate.

[0011] The particle assembly may further include a second film attached to a lower surface of the first film.

[0012] The second film may include a hydrophobic film or a hydrophilic film. For example, the second film may include one or a mixture of two or more selected from high density polyethylene (HDPE), polystyrene (PS), polypropylene (PP), polyethylene terephthalate (PET), and polyethylene naphthalate (PEN).

[0013] Adhesion between the first film and the microneedle particles may be higher than adhesion between the second film and the microneedle particles.

[0014] The weakening of the adhesion between the first film and the microneedle particles may include treating the particle assembly with a solvent to dissolve or swell the first film.

[0015] In this case, the solvent may not dissolve the microneedle particles.

[0016] For example, the solvent may include one or more substances selected from distilled water, ethanol, acetone, oleyl alcohol, isoparaffin, and dipropylene glycol.

[0017] The method may further include, when the first film is swelled with the solvent, applying a transverse force to the microneedle particles to separate the microneedle particles from the first film.

[0018] The method may further include, when the first film is dissolved with the solvent, filtering and extracting the microneedle particles from the solvent, and drying the microneedle particles.

[0019] When the particle assembly is treated with the solvent, the particle assembly may be treated using the solvent in a liquid state or the solvent may be vaporized to treat the particle assembly with the solvent in a gaseous state.

[0020] An object of the present disclosure is achieved by microneedle particles prepared using the method of preparing microneedle particles described above.

Advantageous Effects

[0021] According to the present disclosure having the above-described configuration, when the microneedle particles are used together with cosmetics and the like, the microneedle particles may be used over a wide area of the human body, and furthermore, may be used regardless of adhesion.

DESCRIPTION OF DRAWINGS

[0022] FIG. **1** is a flowchart illustrating a method of preparing microneedle particles according to an embodiment of the present disclosure.

[0023] FIG. **2** is a diagram illustrating a particle assembly according to an embodiment of the present disclosure.

[0024] FIG. **3** is a conceptual diagram illustrating a process of treating a particle assembly with a solvent, according to another embodiment.

[0025] FIG. **4** is a diagram illustrating a process of separating microneedle particles from a particle assembly after solvent treatment.

[0026] FIG. **5** is a diagram illustrating a state in which microneedle particles are separated from a particle assembly by dissolving a first film after solvent treatment.

[0027] FIG. **6** is a diagram illustrating a particle assembly according to another embodiment of the present disclosure.

[0028] FIG. **7** is a diagram an operation of preparing a particle assembly according to another embodiment.

[0029] FIG. **8** is a conceptual diagram illustrating a process of treating a particle assembly with a solvent, according to another embodiment.

[0030] FIG. **9** is a diagram illustrating a process in which microneedle particles are separated from a particle assembly by swelling a first film after the particle assembly is treated with a solvent, according to another embodiment.

[0031] FIG. **10** is a conceptual diagram illustrating a process of separating microneedle particles from a particle assembly by dissolving a first film in the particle assembly, according to another embodiment.

[0032] FIG. **11** is a schematic diagram illustrating a device for treating a particle assembly by vaporizing and providing a solvent.

[0033] FIG. **12** is a conceptual diagram illustrating a process of using cosmetics containing microneedle particles according to the present disclosure.

BEST MODE

[0034] Hereinafter, a method of preparing microneedle particles according to an embodiment of the present disclosure will be described in detail with reference to the drawings.

[0035] FIG. **1** is a flowchart illustrating a method of preparing microneedle particles according to an embodiment of the present disclosure. FIG. **2** is a diagram illustrating a particle assembly **100** according to an embodiment of the present disclosure.

[0036] Referring to FIGS. **1** and **2**, the method of preparing microneedle particles may include providing the particle assembly **100** in which a plurality of microneedle particles **14** are formed on an upper surface of a first film **12** (S**110**) and separating the microneedle particles **14** from the particle assembly **100** (S**130**).

[0037] Here, the particle assembly **100** may be defined as a structure in which the microneedle particles **14** to be prepared according to the present disclosure are attached on a film support layer **20** including the first film **12**.

[0038] For example, the particle assembly **100** may include the film support layer **20** including the first film **12** including a water-soluble film and a plurality of biodegradable microneedle particles **14** formed on the film support layer **20**.

[0039] As described below, the first film **12** may include a material that is dissolved or swelled by a predetermined solvent when the microneedle particles **14** are separated from the particle assembly **100**.

[0040] The first film **12** described above may include one or a mixture of two or more selected from polyvinylpyrrolidone, polyvinyl alcohol, cellulose polymer, dextran, gelatin, glycerin, polyethylene glycol, polysorbate, propylene glycol, povidone, carbomer, gum ghatti, guar gum, glucomannan, glucosamine, dammer resin, rennet casein, locust bean gum, microfibrillatedcellulose, psyllium seed gum, xanthan gum, arabino galactan, gum arabic, alginic acid, gelatin, gellan gum, carrageenan, karaya gum, curdlan, chitosan, chitin, tara gum, tamarind gum, tragacanth gum, furcelleran, pectin or pullulan, hydroxypropyl methylcellulose (HPMC), hydroxyalkyl cellulose, ethyl hydroxyethyl cellulose, alkyl cellulose, gluten, soy polysaccharides, polacrilin potassium, sodium starch glycolate, crospovidone, croscarmellose sodium, bentonite, hydroxypropyl starch, sodium carboxymethyl cellulose, sodium alginate, sodium lauryl sulfate, silicic anhydride, hydroxypropyl cellulose, polyvinyl acetate, amylose, sodium hydrogen carbonate, amylopectin, sodium polyphosphate, and aluminium magnesium silicate.

[0041] The microneedle particles **14** may have a shape in which a diameter or area of a lower portion is wider than a diameter or area of an upper portion. That is, the microneedle particles **14** may be prepared in a shape of a cone or pyramid with a pointed upper end, or in a shape of having a tip at the top. As such, when the microneedle particles **14** are prepared in a form having a tip at the top, the microneedle particles **14** may penetrate the human skin more effectively when mixed with cosmetics or the like as described below.

[0042] For example, the microneedle particles **14** may be inserted into the skin and may dissolve, and may include a material that is biocompatible and biodegradable.

[0043] As examples thereof, hyaluronic acid and salts thereof, polyvinylpyrrolidone, polyvinyl alcohol, cellulose polymer, dextran, gelatin, glycerin, polyethylene glycol, polysorbate, propylene glycol, povidone, carbomer, gum ghatti, guar gum, glucomannan, glucosamine, dammer resin, rennet casein, locust bean gum, microfibrillatedcellulose, psyllium seed gum, xanthan gum, arabino galactan, gum arabic, alginic acid, gelatin, gellan gum, carrageenan, karaya gum, curdlan, chitosan, chitin, tara gum, tamarind gum, tragacanth gum, furcelleran, pectin or pullulan, hydroxypropyl methylcellulose, hydroxyalkyl cellulose, ethyl hydroxyethyl cellulose, alkyl cellulose, and carboxymethyl cellulose may be used.

[0044] The particle assembly **100** described above may be prepared using various known methods including a mold method. Therefore, the method of preparing the particle assembly **100** is not particularly limited.

[0045] FIG. **3** is a conceptual diagram illustrating a process of treating the particle assembly **100** described above with a solvent **32**. For example, FIG. **3** illustrates a process of treating the particle assembly **100** by using the liquid solvent **32**.

[0046] Referring to FIGS. **2** and **3**, the separating of the microneedle particles **14** may include weakening the adhesion between the first film **12** and the microneedle particles **14**.

[0047] For example, the weakening of the adhesion between the first film **12** and the microneedle particles **14**

may include dissolving the first film **12** or swelling the first film **12**. First, a method of swelling the first film **12** is described below.

[0048] In the present embodiment, the particle assembly **100** described above may be treated with a predetermined solvent **32** such that the first film **12** of the particle assembly **100** swells with the solvent **32**, thereby weakening the adhesion between the first film **12** and the microneedle particles **14**.

[0049] In this case, the solvent **32** may be selected as a material that swells the first film **12** and does not dissolve the microneedle particles **14**.

[0050] For example, the solvent **32** may include one or more substances selected from distilled water, ethanol, acetone, oleyl alcohol, isoparaffin, and dipropylene glycol. The solvent described above has a property by which the first film **12** swells well but the microneedle particles **14** including the component or material described above are not dissolved.

[0051] However, when the solvent **32** includes an ethanol aqueous solution and a concentration of ethanol in the ethanol aqueous solution is less than about 70% (i.e., a concentration of water is greater than about 30%), the microneedle particles **14** may be dissolved in the solvent **32**. Therefore, a concentration of ethanol in the ethanol aqueous solution may be greater than or equal to 70%.

[0052] Accordingly, as shown in FIG. **3**, the particle assembly **100** may be supplied to a housing **30** or tank containing a predetermined liquid solvent **32** and immersed in the liquid solvent **32**. The particle assembly **100** is immersed in the solvent **32** and treated by the solvent **32**.

[0053] In this case, as described above, the first film **12** of the particle assembly **100** may be swollen by the solvent **32**.

[0054] FIG. **4** is a diagram illustrating a process of separating microneedle particles **14** from the particle assembly **100** after solvent treatment.

[0055] (A) of FIG. **4** illustrates the particle assembly **100** before solvent treatment, and (B) of FIG. **4** illustrates the particle assembly **100** after solvent treatment.

[0056] The particle assembly **100** before solvent treatment as shown in (A) of FIG. **4** becomes swollen and inflated as shown in (B) of FIG. **4** after solvent treatment. When the first film **12** swells, a surface area of the first film **12** increases, and the adhesion between the microneedle particles **14** and the first film **12** becomes weaker than before the first film **12** swells.

[0057] As described above, the method may further include applying a transverse force to the microneedle particles **14** to separate the microneedle particles **14** from the first film **12** subsequently to the weakening of the adhesion between the first film **12** and the microneedle particles **14**.

[0058] When a transverse force F is applied to the microneedle particles **14** as shown in (C) of FIG. **4**, the microneedle particles **14** may be easily separated from the first film **12**, and the microneedle particles **14** may be separated and extracted from the first film **12** as shown in (D) of FIG. **4**.

[0059] The transverse force F applied to the microneedle particles **14** may be applied manually by a worker or automatically by a mechanical device.

[0060] After extracting microneedle particles by the method described above, the extracted microneedle particles are dried.

[0061] In the end, the microneedle particles **14**, which is prepared by the method described above, may be provided in cosmetics including lotion and cream.

[0062] FIG. **5** is a conceptual diagram illustrating a process of separating microneedle particles **14** from the particle assembly **100** by dissolving the first film **12** in the weakening of the adhesion between the first film **12** and the microneedle particles **14**.

[0063] Referring to FIG. **5**, the separating of the microneedle particles includes separating the microneedle particles **14** from the film support layer **20** by treating the particle assembly **100** with the solvent **32** that dissolves the first film **12** but does not dissolve the microneedle particles **14**.

[0064] That is, in the present embodiment, the first film **12** is dissolved by a predetermined solvent **32** to separate the microneedle particles **14** from the film support layer **20**. In this case, the solvent **32** may be selected as a material that dissolves only the first film **12** and does not dissolve the microneedle particles **14**.

[0065] In this case, the first film **12** of the particle assembly **100** is dissolved by the solvent **32**, and thus the microneedle particles **14** remain in the solvent **32** as shown in FIG. **5**.

[0066] Then, the microneedle particles **14** are filtered and extracted from the solvent **32**, and the microneedle particles **14** are dried.

[0067] FIG. **6** is a diagram illustrating a particle assembly **100'** according to another embodiment of the present disclosure.

[0068] Referring to FIG. **6**, the particle assembly **100'** according to the present embodiment may further include a second film **10** in a film support layer **20'** described above.

[0069] In this case, the second film **10** may be provided on a lower surface of the first film **12** described above. That is, the first film **12** may be formed on an upper surface of the second film **10** by using a coating method or the like.

[0070] The second film **10** may serve a support sheet or support film of the particle assembly **100**.

[0071] The second film **10** may include a hydrophobic film, but is not limited thereto, and may also include a hydrophilic film.

[0072] For example, the second film **10** may include one or a mixture of two or more selected from high density polyethylene (HDPE), polystyrene (PS), polypropylene (PP), polyethylene terephthalate (PET), and polyethylene naphthalate (PEN).

[0073] The first film **12** may be selected such that the adhesion between the first film **12** and the microneedle particles **14** is higher than the adhesion between the second film **10** and the microneedle particles **14**. The adhesion between the first film **12** and the microneedle particles **14** is described in detail in the preparing of the microneedle particles **14**.

[0074] FIG. **7** is a diagram an operation of preparing the particle assembly **100'** according to another embodiment described above.

[0075] Referring to FIG. **7**, the providing of the particle assembly **100'** may include providing a pair of the second films **10**, providing the first film **12** formed on each of the pair of second films **10** to increase adhesion with the microneedle particles **14** and forming a pair of film support

layers **20'**, and spotting a biodegradable viscous material **13** on at least one of the first films **12** of the pair of film support layers **20'**.

[0076] The pair of second films **10** may serve a support film of the film support layer **20'** of the particle assembly **100'**.

[0077] The second films **10** may be provided, for example, on a pair of substrates (not shown). In this case, the second film **10** may be provided by being applied and dried on the substrate or may be provided in a sheet state.

[0078] The first film **12** may be provided on top of each of the pair of second films **10**. The first film **12** may be applied onto the second film **10**, thereby forming a film layer.

[0079] When the first film **12** is omitted, a viscous material **13** forming the microneedle particles **14** is spotted directly onto the second film **10**. In this case, the adhesion between the viscous material **13** and the second film **10** is weak, and thus the viscous material **13** may not form a tip portion in a tensioning operation described below. That is, the viscous material **13** may be separated from the second film **10** during the tensioning operation, and thus the film support layer **20'** may not be sufficiently separated, and upper and lower viscous materials **13** are attached to each other to form microneedle particles. These microneedle particles have a so-called hourglass shape, which reduces their skin penetration effect.

[0080] Therefore, in the case of the present embodiment, the first film **12** is provided to the second film **10**. In this case, the first film **12** may be selected such that the adhesion between the first film **12** and the microneedle particles **14** is higher than the adhesion between the second film **10** and the microneedle particles **14**.

[0081] The adhesion between the first film **12** and the microneedle particles **14** may be determined to a level or higher that enables the viscous material **13** to form a tip portion when the viscous material **13** is tensioned by separating the pair of film support layers **20'** from each other in the tensioning operation described below.

[0082] (A) of FIG. **7** illustrates that the viscous material **13** is spotted on both the first films **12** of the pair of film support layers **20'** but the present disclosure is not limited thereto. For example, the viscous material **13** may be spotted on only one of the first films **12** of the pair of film support layers **20'**.

[0083] Then, the pair of film support layers **20'** are moved relative to each other ((A) of FIG. **7**) to come closer to each other, and thus the viscous material **13** and the first film **12** come into contact with each other between the first films **12** of the pair of film support layers **20'**, and the pair of film support layers **20'** are separated from each other such that the viscous material **13** is tensioned ((B) of FIG. **7**).

[0084] In this case, as described above, the adhesion between the viscous material **13** and the first film **12** may be determined to a level or higher that enables the viscous material **13** to form a tip portion.

[0085] Then, the viscous material **13** is solidified and the pair of film support layers **20'** are separated to form microneedle particles **14** on each of the first films **12** of the pair of film support layers **20'**.

[0086] In this case, the viscous material **13** described above may be solidified using a method of blowing air or the like. When the viscous material **13** is sufficiently solidified and then the film support layers **20'** are further separated from each other, the microneedle particles **14** having a tip while the viscous materials **13** that are connected to each other are separated from each other ((C) of FIG. **7**).

[0087] Then, the particle assembly **100'** is treated with the liquid solvent **32** as shown in FIG. **8**, and then the microneedle particles **14** are separated from the particle assembly **100'** as shown in FIG. **9**.

[0088] The particle assembly **100'** before solvent treatment as shown in (A) of FIG. **9** becomes swollen and inflated as shown in (B) of FIG. **9** after solvent treatment. When the first film **12** swells, a surface area of the first film **12** increases, and the adhesion between the microneedle particles **14** and the first film **12** becomes weaker than before the first film **12** swells.

[0089] Then, when a transverse force F is applied to the microneedle particles **14** as shown in (C) of FIG. **9**, the microneedle particles **14** may be easily separated from the first film **12**, and the microneedle particles **14** may be separated and extracted from the first film **12** as shown in (D) of FIG. **9**.

[0090] The transverse force F applied to the microneedle particles **14** may be applied manually by a worker or automatically by a mechanical device.

[0091] After extracting microneedle particles by the method described above, the extracted microneedle particles are dried.

[0092] FIG. **10** is a conceptual diagram illustrating a process of separating microneedle particles **14** from the particle assembly **100'** by dissolving the first film **12** in the particle assembly **100'**, according to another embodiment.

[0093] That is, the particle assembly **100'** is treated with the solvent **32** that dissolves the first film **12** but does not dissolve the microneedle particles **14**. Accordingly, the microneedle particles **14** may be separated from the film support layer **20**.

[0094] In this case, the first film **12** of the particle assembly **100'** is dissolved by the solvent **32**, and thus the microneedle particles **14** are separated from the second film **10** and remain in the solvent **32** as shown in FIG. **10**.

[0095] After the microneedle particles **14** and the second film **10** are separated from each other, the second film **10** is removed from the solvent **32** and the microneedle particles **14** are filtered and extracted. The second film **10** may remain in the solvent **32**, and thus may be easily taken out and removed.

[0096] The microneedle particles **14** remain in the solvent **32**, and thus the solvent **32** is filtered to extract the microneedle particles **14**. Then, the microneedle particles are dried.

[0097] FIG. **11** is a schematic diagram illustrating a device for treating a particle assembly by vaporizing and providing a solvent. (A) of FIG. **11** illustrates a device for treating the particle assembly **100** with a gaseous solvent, according to an embodiment, and (B) of FIG. **11** illustrates a device for treating the particle assembly **100'** with a gaseous solvent, according to another embodiment.

[0098] Referring to FIG. **11**, to treat the particle assemblies **100** and **100'** by using a vaporized solvent or a gaseous solvent, a sealed space for accommodating the particle assemblies **100** and **100'** is required.

[0099] In FIG. **11**, a chamber **1000** is used to provide an accommodation space **1010** for accommodating the particle assemblies **100** and **100'** inside the chamber **1000**. Although illustrated in the drawing as the chamber **1000**, the present disclosure is not limited thereto and any sealed structure for

accommodating the vaporized solvent and the particle assemblies **100** and **100'** may be used.

[0100] Although not shown in the drawing, the chamber **1000** may include an opening (not shown) through which the particle assemblies **100** and **100'** are to be placed into the accommodation space **1010** and a door (not shown) that opens or closes the opening.

[0101] A support plate **1100** on which the particle assemblies **100** and **100'** are mounted may be provided in the accommodation space **1010** of the chamber **1000**. The support plate **1100** may be implemented with various structures on which the particle assemblies **100** and **100'** are accommodated or which supports the particle assemblies **100** and **100'**.

[0102] A solvent supply unit **1200** for supplying vaporized solvent or a gaseous solvent into the chamber **1000** may be provided at one side of the chamber **1000**.

[0103] For example, the solvent supply unit **1200** may vaporize ethanol and supply the same into the chamber **1000**. The supply amount, supply time, and the like of the vaporized solvent by the solvent supply unit **1200** may be appropriately adjusted.

[0104] When the particle assemblies **100** and **100'** are treated with a vaporized solvent as illustrated in FIG. **11**, the first film **12** described above in the particle assemblies **100** and **100'** is dissolved or swelled, thereby weakening the adhesion between the first film **12** and the microneedle particles **140** and separating the first film **12** and the microneedle particles **140**, which is described above, and thus a repeated explanation is omitted.

[0105] FIG. **12** is a conceptual diagram illustrating a process of using cosmetics containing microneedle particles **14**.

[0106] When a user rubs the cosmetic against the skin as shown in (A) of FIG. **12**, the microneedle particles **14** contained in the cosmetic may penetrate the skin as shown in (B) of FIG. **12**.

[0107] In particular, the microneedle particles **14** according to the present embodiment are prepared in a form having a tip, and thus the skin penetration effect is excellent. The microneedle particles **14** include a material that is biocompatible and biodegradable, and thus are not harmful to the human body even when the microneedle particles **14** penetrate the skin.

[0108] As such, when microneedle particles **14** penetrate the skin, cosmetic ingredients may also penetrate the skin together with or along with the microneedle particles **14**, as shown in (C) of FIG. **12**.

[0109] The microneedle particles **14** may also include a functional material. For example, in the preparing of the particle assembly **100** described above, a functional material may be provided together with the viscous material forming the microneedle particles **14**.

[0110] The functional material may include, for example, a wrinkle-improving material, a moisture-providing material, or the like and are not limited to a specific material in the present disclosure.

[0111] Although the present disclosure has been described above with reference to exemplary embodiments, those skilled in the art may modify and change the present disclosure in various ways without departing from the spirit and scope of the present disclosure as set forth in the claims described below. Therefore, when the modified implementation basically includes the elements of the claims of the present disclosure, it should be considered to be included in the technical scope of the present disclosure.

1. A method of preparing microneedle particles, the method comprising:

providing a particle assembly having a plurality of microneedle particles on an upper surface of a first film; and

separating the microneedle particles from the particle assembly,

wherein the separating of the microneedle particles from the particle assembly includes weakening adhesion between the first film and the microneedle particles.

2. The method of claim **1**, wherein the first film includes a water-soluble film.

3. The method of claim **2**, wherein the first film includes one or a mixture of two or more selected from polyvinylpyrrolidone, polyvinyl alcohol, cellulose polymer, dextran, gelatin, glycerin, polyethylene glycol, polysorbate, propylene glycol, povidone, carbomer, gum ghatti, guar gum, glucomannan, glucosamine, dammer resin, rennet casein, locust bean gum, microfibrillatedcellulose, psyllium seed gum, xanthan gum, arabino galactan, gum arabic, alginic acid, gelatin, gellan gum, carrageenan, karaya gum, curdlan, chitosan, chitin, tara gum, tamarind gum, tragacanth gum, furcelleran, pectin or pullulan, hydroxypropyl methylcellulose (HPMC), hydroxyalkyl cellulose, ethyl hydroxyethyl cellulose, alkyl cellulose, gluten, soy polysaccharides, polacrilin potassium, sodium starch glycolate, crospovidone, croscarmellose sodium, bentonite, hydroxypropyl starch, sodium carboxymethyl cellulose, sodium alginate, sodium lauryl sulfate, silicic anhydride, hydroxypropyl cellulose, polyvinyl acetate, amylose, sodium hydrogen carbonate, amylopectin, sodium polyphosphate, and aluminium magnesium silicate.

4. The method of claim **1**, wherein the particle assembly further includes a second film attached to a lower surface of the first film.

5. The method of claim **4**, wherein the second film includes a hydrophobic film or a hydrophilic film.

6. The method of claim **4**, wherein the second film includes one or a mixture of two or more selected from high density polyethylene (HDPE), polystyrene (PS), polypropylene (PP), polyethylene terephthalate (PET), and polyethylene naphthalate (PEN).

7. The method of claim **4**, wherein adhesion between the first film and the microneedle particles is higher than adhesion between the second film and the microneedle particles.

8. The method of claim **1**, wherein the weakening of the adhesion between the first film and the microneedle particles includes treating the particle assembly with a solvent to dissolve or swell the first film.

9. The method of claim **8**, wherein the solvent does not dissolve the microneedle particles.

10. The method of claim **8**, wherein the solvent includes one or more selected from distilled water, ethanol, acetone, oleyl alcohol, isoparaffin, and dipropylene glycol.

11. The method of claim **8**, further comprising, when the first film is swelled with the solvent, applying a transverse force to the microneedle particles to separate the microneedle particles from the first film.

12. The method of claim **8**, further comprising:

when the first film is dissolved with the solvent, filtering and extracting the microneedle particles from the solvent; and

drying the microneedle particles.

13. The method of claim **8**, wherein, when the particle assembly is treated with the solvent, the particle assembly is treated using the solvent in a liquid state or the solvent is vaporized to treat the particle assembly with the solvent in a gaseous state.

14. Microneedle particles prepared using the method of preparing microneedle particles of claim **1**.

15. The method of claim **4**, wherein the weakening of the adhesion between the first film and the microneedle particles includes treating the particle assembly with a solvent to dissolve or swell the first film.

* * * * *