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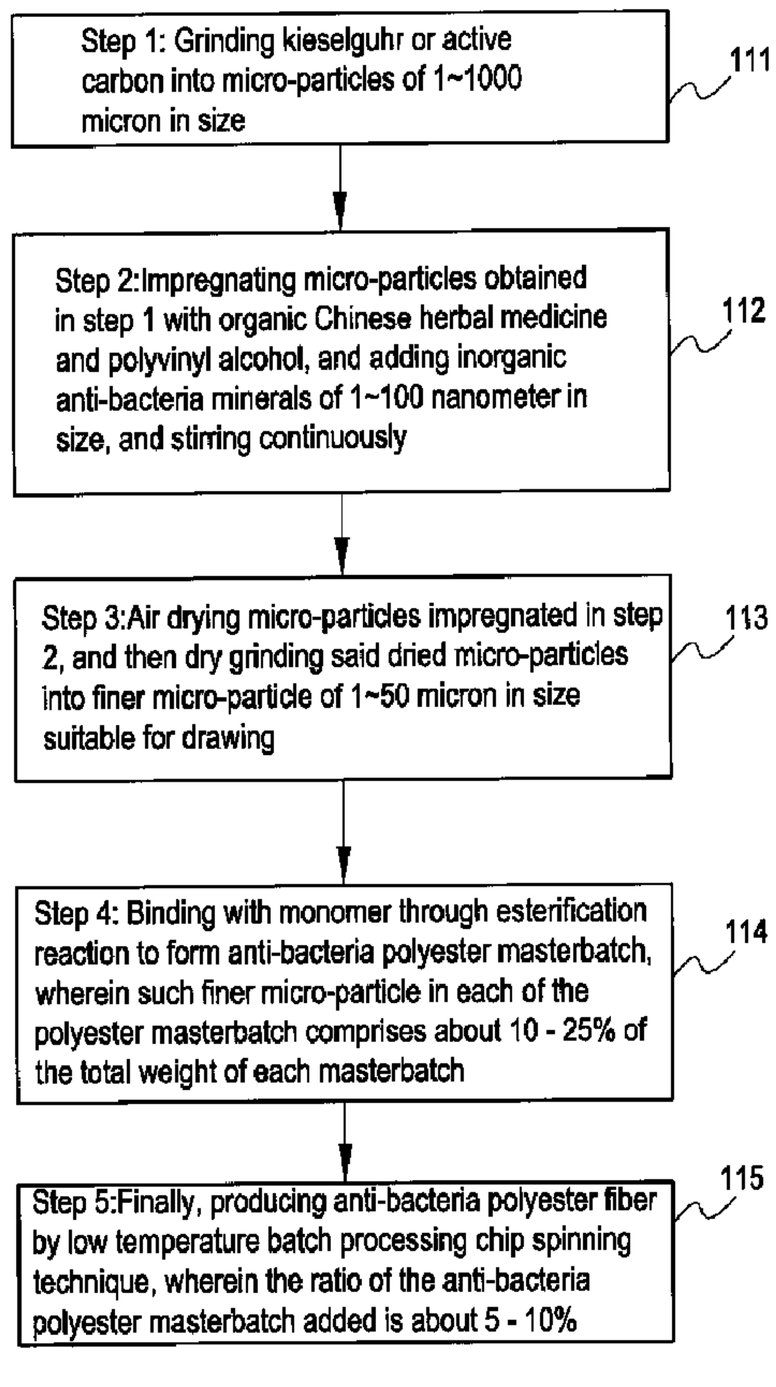
(54) Titre : METHODE DE PRODUCTION D'UN MELANGE MAITRE DE POLYMERE POREUX ET DE FIBRES CONNEXES PRESENTANT DES PROPRIETES ANTIBACTERIENNES ET LA CAPACITE D'ELIMINER LES ODEURS

(54) Title: A PROCESS FOR PRODUCING POROUS POLYMER MASTERBATCH AND FIBER THEREOF HAVING ANTI-BACTERIA AND ODOR ELIMINATING FUNCTIONS



(57) Abrégé/Abstract:
A process for producing porous polymer masterbatch having anti-bacteria and odor eliminating functions, wherein said fiber contains materials such as porous natural mineral kieselguhr or active carbon, can adsorb and eliminate odor such as stink of

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(57) Abrégé(suite)/Abstract(continued):
sweat and the like discharged from human body, has functions of sterilization, anti-bacteria, anti-mould, odor eliminating and the like. Pores of the natural mineral kieselguhr or active carbon contain organic Chinese herbal medicine and inorganic anti-bacteria minerals, wherein all of such organic Chinese herbal medicine and inorganic anti-bacteria minerals have functions of anti-bacteria, anti-fungus and the like, can eliminate effectively odor or reduce substantially stink, and can be applied extensively on various fabrics, clothes and ornaments or other goods.

ABSTRACT OF THE DISCLOSURE

A process for producing porous polymer masterbatch having anti-bacteria and odor eliminating functions, wherein said fiber contains materials such as porous natural mineral kieselguhr or active carbon, can adsorb and eliminate odor such as stink of sweat and the like discharged from human body, has functions of sterilization, anti-bacteria, anti-mould, odor eliminating and the like. Pores of the natural mineral kieselguhr or active carbon contain organic Chinese herbal medicine and inorganic anti-bacteria minerals, wherein all of such organic Chinese herbal medicine and inorganic anti-bacteria minerals have functions of anti-bacteria, anti-fungus and the like, can eliminate effectively odor or reduce substantially stink, and can be applied extensively on various fabrics, clothes and ornaments or other goods.

A Process for Producing Porous Polymer Masterbatch and Fiber thereof Having Anti-bacteria and Odor Eliminating Functions

BACKGROUND OF THE INVENTION

1. Field of the invention

The invention relates to a process for producing porous polymer masterbatch and fiber thereof that have anti-bacteria and odor eliminating functions, and in particular, to a process for producing anti-bacteria and odor eliminating polymer masterbatch and fiber thereof containing organic or inorganic materials.

2. Description of the prior art

As the demand of a modern life for hygienic request is increasing, anti-bacteria products receive gradually consumer's welcome. This trend extends to textile industry and results into considerable progress on the production of anti-bacteria fibers and clothing and other articles of daily use.

Anti-bacteria agent used in the anti-bacteria fiber can be divided generally into two types, namely, an organic anti-bacteria agent, and an inorganic anti-bacteria agent. One of the organic anti-bacteria agent is quaternary ammonium salt. Unfortunately, quaternary ammonium salt has poor heat resistance and can not used on the processed products of plastics or fiber spinning.

On the other hand, an inorganic anti-bacteria agent is a carrier (for example zeolite) containing metal ions (for example Ag^{+}, Zn^{2+}, Cu^{2+}), or certain types of

nano-scale metal particles (for example nano-scale silver particles), and both are considered as effective particles in the following description.

Silver has a well-accepted anti-bacteria effect. In general, an antibiotic can kill approximately six different types of anti-living body, while silver can kill about 600 types of bacteria. In addition, silver is a non-toxic substance, and therefore, utilization of silver is extensive and has a long history. Furthermore, through high nanotechnology way, silver particle becomes more active, its anti-bacteria function is enhanced, and these promote in turn the quality of home environment and personal hygiene. Aqueous solution containing silver ions released from both of nano-scale fine silver granules and nanometer silver has remarkable anti-bacteria effect. Under the circumstance of multiple dilutions, nanometer silver has still an inhibition efficiency of 99.99% against *Escherichia coli*, *Staphylococcus aureus*, *Sarmonella*, *Pseudomonas aeruginosa* and the like. The principal cause of this resides in the biological action that silver has itself. Active silver ion can attract the sulfhydryl group on the enzymatic protein in the bacteria and causes these groups binding fast with each other, thereby render enzymes containing sulfhydryl groups to lose activity and hence kill the bacteria.

Traditional process for using silver ion to produce fiber comprises immersing fiber in an organic anti-bacteria agent so as to adhere a carrier or nanometer silver particle on the surface of the fiber. In such traditional process, effective particles in the anti-bacteria inorganic solvent may be washed off easily, and at the same time, may induce easily the user an allergic response. Another process for producing anti-bacteria fiber comprises of mixing previously an inorganic anti-bacteria agent and polyester, and then drawing the mixture thus-obtained into fibers containing effective particles. In such process for making

anti-bacteria fiber, most of the anti-bacteria materials are embedded within the fiber, and hence the anti-bacteria and odor eliminating functions are unable to display. Further, part of the anti-bacteria material exposed on the outside of the fiber might lose its anti-bacteria and odor eliminating functions after washing or dying and finishing due to bind with chlorine, sulfur and the like.

In view of the foregoing, conventional techniques mentioned above have still many disadvantages, are not good designed and needs to be improved urgently.

In view of the foregoing, conventional techniques mentioned above have still many disadvantages, are not good designed and needs to be improved urgently.

The inventor had learned the various disadvantages and shortcomings derived from such conventional techniques described above, and had thought to improve and innovate, and finally, after studying intensively for many years, has developed a process for producing porous polymer masterbatch and fiber thereof that have anti-bacteria and odor eliminating functions according to the invention.

SUMMARY OF THE INVENTION

The invention relates to a process for producing porous polymer masterbatch and fiber thereof that have anti-bacteria and odor eliminating functions, for the purpose of reducing lost particles in the anti-bacteria inorganic solvent, which tend to be washed off easily, and hence tend to lower the anti-bacteria effect as well as may lead to an unknown effect on the environmental ecological equilibrium.

The invention also relates to a process for producing porous polymer masterbatch and fiber thereof that have anti-bacteria and odor eliminating functions, characterized in that the inventive process can improve the previous conventional process for making anti-bacteria fiber; where in the conventional process, an inorganic anti-bacteria agent is mixed in a polymer and then the resulted mixture is drawn to form fiber containing fine nanometer particles, and in such conventional process for making anti-bacteria fiber, the nanometer particles are difficult to be dispersed homogeneously in the fiber, and further, most of the nanometer particles are embedded within the fiber, so that its anti-bacteria effect can not function effectively.

The invention also relates to provide a process for producing porous polymer masterbatch and fiber thereof that have anti-bacteria and odor eliminating functions, characterized in that wide and diverse materials can be used, and has a wide spectrum of anti-bacteria and anti-fungus effects.

The process for producing porous polymer masterbatch and fiber thereof that have anti-bacteria and odor eliminating functions comprises: step 1, grinding kieselguhr or active carbon into micro-particles; step 2, immersing said micro-particles obtained in step 1 in an organic Chinese herbal medicine and inorganic anti-bacteria minerals and polyvinyl alcohol with constant stirring; step 3, air-drying micro-particles thus-obtained in step 2, and dry-grinding further the dried micro-particles into finer particles suitable for drawing and to be dispersed homogeneously in a solution; step 4, carrying out a esterification reaction for binding monomer to form an anti-bacteria polyester masterbatch; and/or step 5, producing the polyester masterbatch formed in step 4 into anti-bacteria polyester fiber by cold grain spin-drawing technique.

BRIEF DESCRIPTION OF THE DRAWINGS

These features and advantages of the present invention will be fully understood and appreciated from the following detailed description of the accompanying drawings, wherein:

Figure 1 shows the flow chart for carrying out the process according to the invention;

Figure 2 is a schematic view of porous micro-particles according to the invention;

Figure 3 is a schematic view of finer micro-particles obtained after dry-grinding according to the invention; and

Figure 4 is a schematic view of anti-bacteria polyester fibers according to the invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

For understanding further the objects, characteristics and effects of the invention, following non-limiting examples will be illustrated in conjunction with the accompanied drawings below.

Referring to Fig. 1, the process for producing porous polymer masterbatch and fiber thereof having anti-bacteria and odor eliminating functions provided according to the invention comprises following steps:

step 1: grinding kieselguhr or active carbon into micro-particles of 1~1000 micron (111);

- Referring to Fig. 2, a schematic view of kieselguhr or active carbon micro-particles. In the step 1, kieselguhr or active carbon is ground at first into micro-particles 1. In the case of active carbon, the principal component of active carbon is carbon, combined with minor amount of hydrogen, oxygen, nitrogen, sulfur and the like, and is a black porous material 2 with complex surface. It has a six ring structure formed from carbon and its shape may be from a cylindrical coarse granule to a fine powder particle, and hence it has two type of morphology of granule and powder. The granule has generally a diameter of 1~6 mm, and its length is 0.7~4 times of its diameter. Alternatively, it may be present as a granule of irregular shape with a size of 6~120 meshes. The active carbon is odorless, and tasteless, and is insoluble in water and organic solvent. Active carbon has a packing density of about 0.3~0.6 g/ml, a volume of the very large micro-pore of about 0.6~0.8 ml/g, and a specific surface of about 500~1,500 m^2/g, and therefore, exhibits a very strong adhesive force to an organic macromolecular material;
- In addition, kieselguhr can be used in the process of the invention. Kieselguhr is mined from fossil lake bed. Such kieselguhr is formed from the deposition of tremendous dead micro-diatoms in the ancient lake or sea on lake or sea beds. Diatom is classified into two morphologies of salty water diatom and fresh water diatom. Accordingly, the thus-mined kieselguhr is classified also into two types of salty water kieselguhr and fresh water kieselguhr. After mined, it can be washed, processed and ground into micro-powder of various

specific sizes;

step 2: impregnating micro-particles obtained in step 1 in an organic Chinese herbal medicine and a water-soluble cementing agent, adding inorganic anti-bacteria minerals of 1~100 nm in size, and then stirring continuously for more than 24 hours, thereby enabling the organic Chinese herbal medicine and inorganic anti-bacteria minerals being impregnated, bound and adhered sufficiently in pores of the micro-particle (112);

- Referring to Table 1, each of inorganic anti-bacteria minerals mentioned above has its own special effect. Inorganic anti-bacteria minerals used in the process of the invention may be selected from the group consisting of realgar, calamine, melanterite, talc, alum, sulfur, borax, nanometer silver (Ag), nanometer zinc (Zn), nanometer copper (Cu), titanium dioxide (TiO_2) and any combination thereof;

Table 1: The pharmacological effect, function and chemical component of inorganic anti-bacteria minerals.

Item	Name	Pharmacological effect
1.	Realgar	De-toxicating, removing moist, killing insect, anti-bacteria
2.	Calamine	Absorbing moist, stopping itch, controlling sore, antiseptic, anti-bacteria
3.	Melanterite	Treating eczema, killing insect, anti-bacteria
4.	Talc	Treating eczema, wet sore, scarbies, anti-bacteria
5.	Alum	Detoxicating, killing insect, drying moist, stopping itch, wide spectrum anti-bacteria

6.	Sulfur	Killing insect, stopping itch, scabies , eczema, itching, killing insect, anti-bacteria
7.	Borax	Detumescence, antiseptic, anti-bacteria, treating scarbies and itch
8.	Nanometer silver (Ag)	Anti-bacteria, anti-fungus
9.	Nanometer zinc (Zn)	Anti-bacteria, anti-fungus
10.	Nanometer copper (Cu)	Anti-bacteria, anti-fungus
11.	titanium dioxide (TiO_2)	Anti-bacteria, anti-fungus

- The water-soluble cementing agent 3 may be selected from polyvinyl alcohol (PVA) or the like. PVA is an extensively used water-soluble macromolecular polymer, with a property between those of plastic and rubber. Since PVA possesses strong bonding property, skin flexibility, smoothness, oil resistance, solvent resistance, protective gel property, gas insulating property, wear resistance and after special treatment, water resistance, it is used very often in raw materials for fiber;
- The binding property of PVA is utilized to adhere the extract essence fluid of herbal plant on the surface of the outer and inner holes of micro-particles so as to increase the amount and surface area of the organic Chinese herbal medicine and inorganic anti-bacteria minerals thus-adhered. The herbal plants useful in the process according to the invention may be selected from the group consisting of Radix et RhizomanNotopterygii, Black false hellebore, Hibiscus syriacus skin, Cinnamomum cassia Presl, camphor, Cnidium monnieri (L) Cuss), Hydnocarpus anthelmintica Pier., rosin and any combination thereof.

Each of herbal plants mentioned above has its own specific effect as shown in Table 2;

Table 2: Pharmacological effect, functions and chemical components of Chinese herbs

Item	Name	Pharmacological effect	Function	Chemical components
1.	Radix et Rhizoma notopterygii	Anti-bacteria , anti-fungus		
2.	Black false hellebore	Anti-bacteria , anti-fungus, killing insect		
3.	Hibiscus syriacus skin	Killing insect, stopping itch, anti-bacteria		
4	Cinnamomum cassia Presl	Anti-bacteria, anti-bacteria anti-tinea, anti-fungus	Sedation, Analgesia, Allaying fever	Cinnamic aldehyde, Cinnamic acid, Cinnamyl acetate, Phenylpropyl acetate
5.	Camphor	Removing moist, killing insect, anti-bacteria , anti-fungus		

6	Cnidium monnieri (L) Cuss	Anti-fungus, anti-Gram negative bacteria, anti-mould Anti-Ringworm fungus	Removing rheumatic, drying moist, killing insect, stopping itch	L-Piuene, L-Camphene, Bornyl isovalerate, Isoborneol, Edultim, Cnidimine, Xanthotoxin
7	Hydnocarpus anthelmintica Pier.	Anti-bacteria, treating tinea manus and tinea pedis	Detoxication, killing insect, removing tinea cruris	Chaulmoogric Acid, Hydnocarpic Acid, Gorlic Acid
8.	Rosin	Anti-bacteria, anti-mould, treating scarbies, wet itch		

- The organic Chinese herbal medicine and inorganic anti-bacteria minerals mentioned in step 2 may be used in combination with one another to achieve the desired pharmacological effect and function;

step 3: air drying the micro-particle impregnated in step 2, and dry grinding them further into finer micro-particle of 1~50 micron in size suitable for drawing, and dispersing them homogeneously in a solution (113);

- Referring to Fig. 2, the surface and the outside and inside of holes in the thus-impregnated micro-particles had been adhered with extract essence fluid of the herbal plants. Thereafter, the impregnated micro-particles thus air dried were dry ground further into finer micro-particles. The surface 6 and the outside and inside of holes 4 in

the thus-obtained finer micro-particles 7 had been adhered with the organic Chinese herbal medicine and inorganic anti-bacteria minerals 5. The air-dried finer micro-particle 7 had a size of 1~50 micron and became a finer micro-particle suitable for drawing as well as could be dispersed homogeneously in a solution.

- The solution mentioned in the step 3 of the inventive process may be ethylene glycol solution. Ethylene glycol is a catalyst used in the condensation polymerization of polyester, and has following advantages: 1. It has greater solubility and better dispersability in ethylene glycol solution; 2. It has good activity, and can enhance productivity of the apparatus; 3. This catalyst itself will not introduce new contaminant, can increase the intrinsic mass of the slice, and improve post-procession spinning ability; 4. It can improve hues and heat stability of the slice.

step 4: binding the finer micro-particle dispersed homogeneously in the solution to a monomer through esterification reaction to form anti-bacteria polyester masterbatch, wherein such finer micro-particle in each of the polyester masterbatch comprises about 10 – 25% of the total weight of each masterbatch (114);

step 5: Using low temperature batch processing chip spinning technique to produce the anti-bacteria polyester masterbatch to produce anti-bacteria polyester fiber 8, wherein the ratio of the anti-bacteria polyester masterbatch added is about 5 – 10% (115).

In summary, the process for producing porous polymer masterbatch and fiber thereof having anti-bacteria and odor eliminating functions provided by the

invention comprises following steps:

step 1: grinding kieselguhr or active carbon into micro-particles of 1~1000 micron in size (111);

step 2: impregnating micro-particles obtained in step 1 with organic Chinese herbal medicine and water-soluble cementing agent and inorganic anti-bacteria minerals of 1~100 micron in size, and stirring continuously for more than 24 hours, thereby enabling sufficient penetration, binding and adsorption of the organic Chinese herbal medicine and inorganic anti-bacteria minerals in pores of micro-particles (112);

step 3: air drying micro-particles impregnated in step 2, and then dry grinding said dried micro-particles into finer micro-particle of 1~50 micron in size suitable for drawing and dispersing homogeneously in a solution (113);

step 4: binding said finer micro-particles dispersed homogeneously in a solution with monomer through esterification reaction to form said anti-bacteria polyester masterbatch, wherein such finer micro-particle in each of the polyester masterbatch comprises about 10 – 25% of the total weight of each masterbatch (114);

step 5: producing anti-bacteria polyester fiber from said anti-bacteria polyester masterbatch by low temperature batch processing chip spinning technique, wherein the ratio of the anti-bacteria polyester masterbatch added is about 5 – 10% (115).

Accordingly, the process for producing porous polymer masterbatch and fiber thereof having anti-bacteria and odor eliminating functions provided by the invention has following advantages over other conventional techniques:

1. The inventive process for producing porous polymer masterbatch and

fiber thereof having anti-bacteria and odor eliminating functions can reduce the lost amount of particles originally present in the anti-bacteria inorganic solvent, wherein said particles is susceptible to be washed off, and thus, may lower its anti-bacteria effect as well as may cause an unexpected influence on the environmental ecological equilibrium.

2. The inventive process for producing porous polymer masterbatch and fiber thereof having anti-bacteria and odor eliminating functions can enable these odor eliminating anti-bacteria materials to penetrate and adhere into tremendous micro-pores of these porous particles, and further, since they can bind in these micro-pores by means of water-soluble cementing agent, thereby these materials tend not to lose and hence can achieve the purpose of increasing its anti-bacteria and odor eliminating functions.

3. The inventive process for producing porous polymer masterbatch and fiber thereof having anti-bacteria and odor eliminating functions can be extended to make various related products having anti-bacteria and odor eliminating functions, such as shoes, bags, socks, clothes.

4. The inventive process for producing porous polymer masterbatch and fiber thereof having anti-bacteria and odor eliminating functions can adopt wide and diverse materials, and hence can retain wide spectrum anti-bacteria and anti-fungus effects, without loses its anti-bacteria function during dying and finishing process due to bind with chlorine and sulfur like, for example, using nanometer silver alone.

Many changes and modifications in the above-described embodiment of the invention can, of course, be carried out without departing from the scope thereof. Accordingly, to promote the progress in science and useful arts, the invention is

disclosed and is intended to be limited only by the scope of the appended claims.

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What is claimed is:

1. A process for producing a porous polymer masterbatch having anti-bacteria and odor eliminating properties, said process comprising the following steps:

step 1: grinding kieselguhr or active carbon into micro-particles of 1~1000 micron in size;

step 2: impregnating the micro-particles obtained in step 1 with a Chinese herbal medicine and a water-soluble cementing agent, adding anti-bacteria minerals of 1~100 nanometer in size thereto, and stirring continuously for more than 24 hours, thereby enabling the Chinese herbal medicine and the anti-bacteria minerals to penetrate into pores of, bind to and adsorb on the micro-particles; and

step 3: air drying the micro-particles impregnated in step 2, and then dry grinding the dried micro-particles into finer micro-particle of 1~50 micron in size suitable for drawing and dispersing homogeneously in a solution,

wherein said Chinese herbal medicine is Radix et Rhizoma notopterygii, Black false hellebore, Hibiscus syriacus skin, Cinnamomum cassia Presl, camphor, Cnidium monnieri (L) Cuss, Hydnocarpus anthelmintica Pier., rosin or any combination thereof, and

wherein said anti-bacteria minerals is realgar, calamine, melanterite, talc, alum, sulfur, borax, nanometer silver (Ag), nanometer zinc (Zn), nanometer copper (Cu), titanium dioxide (TiO_2) or any combination thereof.

2. The process of claim 1, wherein said water-soluble cementing agent is polyvinyl alcohol.

3. The process of claim 1, wherein said solution is an ethylene glycol solution.

4. The process of claim 1, wherein said Chinese herbal medicine and said anti-bacteria minerals are used in step 2 in the form of an admixture with one another.

5. A process for producing a porous polymer masterbatch having anti-bacteria and odor eliminating properties, said process comprising the following steps:

step 1: grinding kieselguhr or active carbon into micro-particles of 1~1000 micron in size;

step 2: impregnating the micro-particles obtained in step 1 with a Chinese herbal medicine and a water-soluble cementing agent, adding anti-bacteria minerals of 1~100 nanometer in size thereto, and stirring continuously for more than 24 hours, thereby enabling the Chinese herbal medicine and the anti-bacteria minerals to penetrate into pores of, bind to and adsorb on the micro-particles;

step 3: air drying the micro-particles impregnated in step 2, and then dry grinding said dried micro-particles into finer micro-particle of 1~50 micron in size suitable for drawing and dispersing homogeneously in a solution; and

step 4: binding said finer micro-particles dispersed homogeneously in a solution with a monomer through an esterification reaction to form a polyester masterbatch,

wherein said Chinese herbal medicine is Radix et Rhizoma notopterygii, Black false hellebore, Hibiscus syriacus skin, Cinnamomum cassia Presl, camphor, Cnidium monnieri (L) Cuss, Hydnocarpus anthelmintica Pier., rosin or any combination thereof, and

wherein said anti-bacteria minerals is realgar, calamine, melanterite, talc, alum, sulfur, borax, nanometer silver (Ag), nanometer zinc (Zn), nanometer copper (Cu), titanium dioxide (TiO_2) or any combination thereof.

6. The process of claim 5, wherein said water-soluble cementing agent is polyvinyl alcohol.

7. The process of claim 5, wherein said solution is an ethylene glycol solution.

8. The process of claim 5, wherein said Chinese herbal medicine and said anti-bacteria minerals are used in step 2 in the form of an admixture with one another.

9. The of claim 5, wherein, in step 4, said finer microparticles make about 10 to about 25% of the total weight of said polyester masterbatch.

10. A process for producing fibers of a porous polymer masterbatch having anti-bacteria and odor eliminating properties. said process comprising the following steps:

step 1: grinding kieselguhr or active carbon into micro-particles of 1~1000 micron in size;

step 2: impregnating the micro-particles obtained in step 1 with a Chinese herbal medicine and a water-soluble cementing agent, adding anti-bacteria minerals of 1~100 nanometer in size thereto, and stirring continuously for more than 24 hours. thereby enabling the Chinese herbal medicine and the anti-bacteria minerals to penetrate into pores of, bind to and adsorb on the micro-particles;

step 3: air drying thte micro-particles impregnated in step 2, and then dry grinding said dried micro-particles into finer micro-particle of 1~50 micron in size suitable for drawing and dispersing homogeneously in a solution;

step 4: binding said finer micro-particles dispersed homogeneously in a

solution with a monomer through an esterification reaction to form a polyester masterbatch; and

step 5: producing fibers from said polyester masterbatch by low temperature batch processing chip spinning technique,

wherein said Chinese herbal medicine is Radix et Rhizoma notopterygii, Black false hellebore, Hibiscus syriacus skin, Cinnamomum cassia Presl, camphor, Cnidium monnieri (L) Cuss, Hydnocarpus anthelmintica Pier., rosin or any combination thereof. and

wherein said anti-bacteria minerals is realgar, calamine, melanterite, talc, alum, sulfur, borax, nanometer silver (Ag), nanometer zinc (Zn), nanometer copper (Cu), titanium dioxide (TiO_2) or any combination thereof.

11. The process of claim 10, wherein said water-soluble cementing agent is polyvinyl alcohol.

12. The process of claim 10, wherein said solution is an ethylene glycol solution.

13. The process of claim 10, wherein said Chinese herbal medicine and said anti-bacteria minerals are used in step 2 in the form of an admixture with one another.

14. The process of claim 10, wherein, in step 4, said finer microparticles make about 10 to about 25% of the total weight of said polyester masterbatch.

15. The process of claim 10, wherein in step 5, the ratio of the polyester masterbatch is about 5 to about 10%.

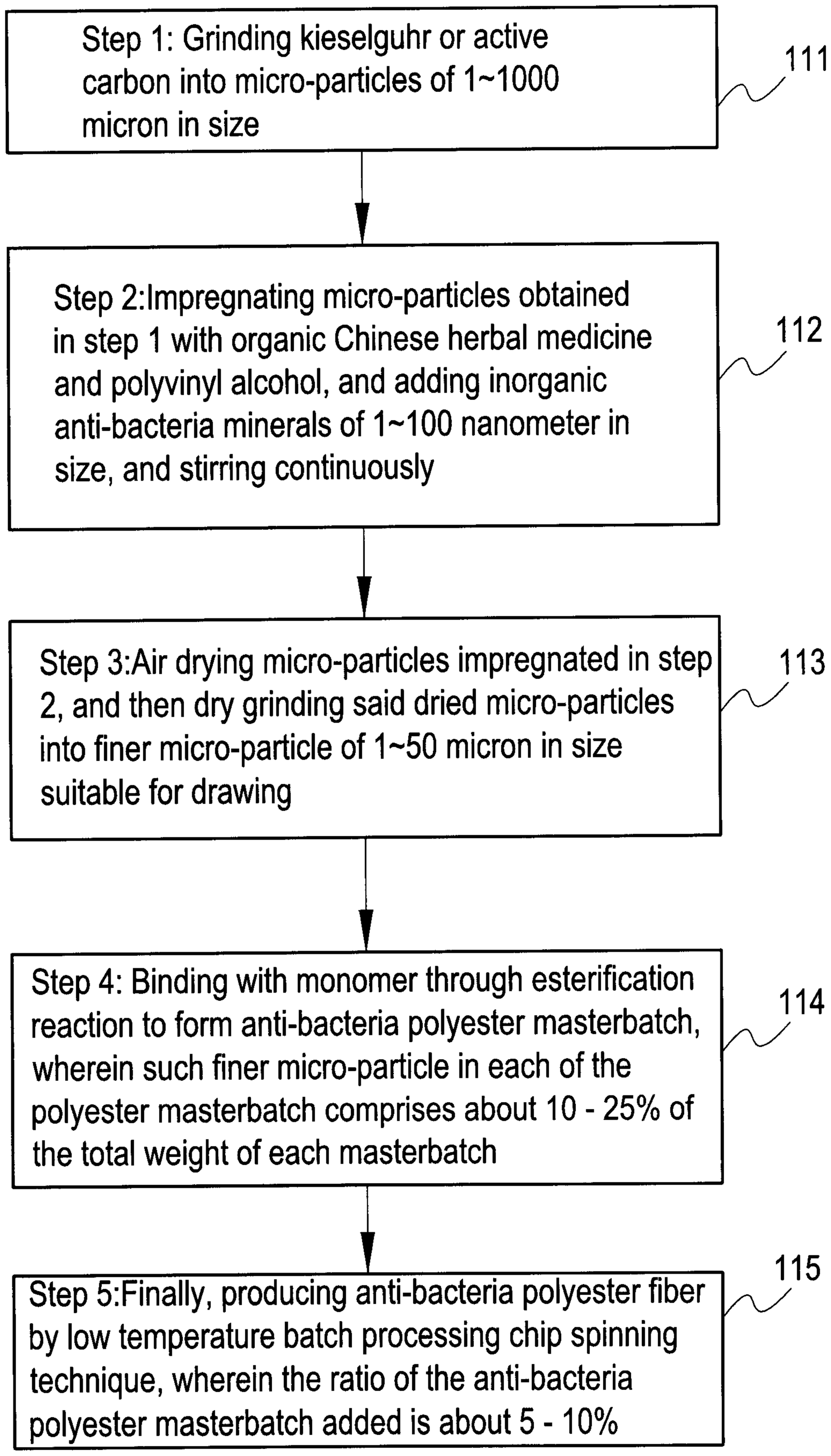
Step 1: Grinding kieselguhr or active carbon into micro-particles of 1~1000 micron in size
111
Step 2:Impregnating micro-particles obtained in step 1 with organic Chinese herbal medicine and polyvinyl alcohol, and adding inorganic anti-bacteria minerals of 1~100 nanometer in size, and stirring continuously
112
Step 3:Air drying micro-particles impregnated in step 2, and then dry grinding said dried micro-particles into finer micro-particle of 1~50 micron in size suitable for drawing
113
Step 4: Binding with monomer through esterification reaction to form anti-bacteria polyester masterbatch, wherein such finer micro-particle in each of the polyester masterbatch comprises about 10 - 25% of the total weight of each masterbatch
114
Step 5:Finally, producing anti-bacteria polyester fiber by low temperature batch processing chip spinning technique, wherein the ratio of the anti-bacteria polyester masterbatch added is about 5 - 10%
115

Figure 1

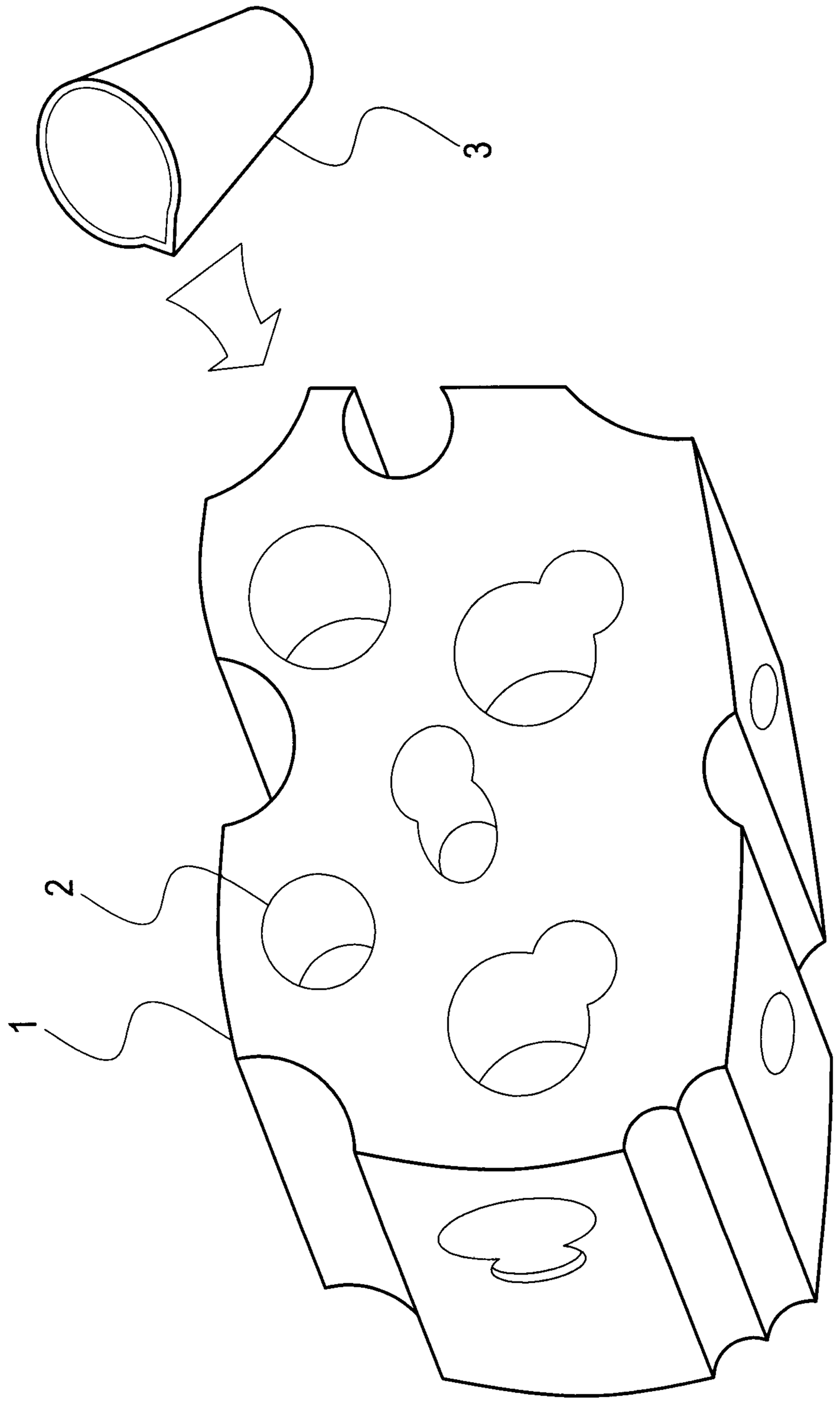

Figure 2

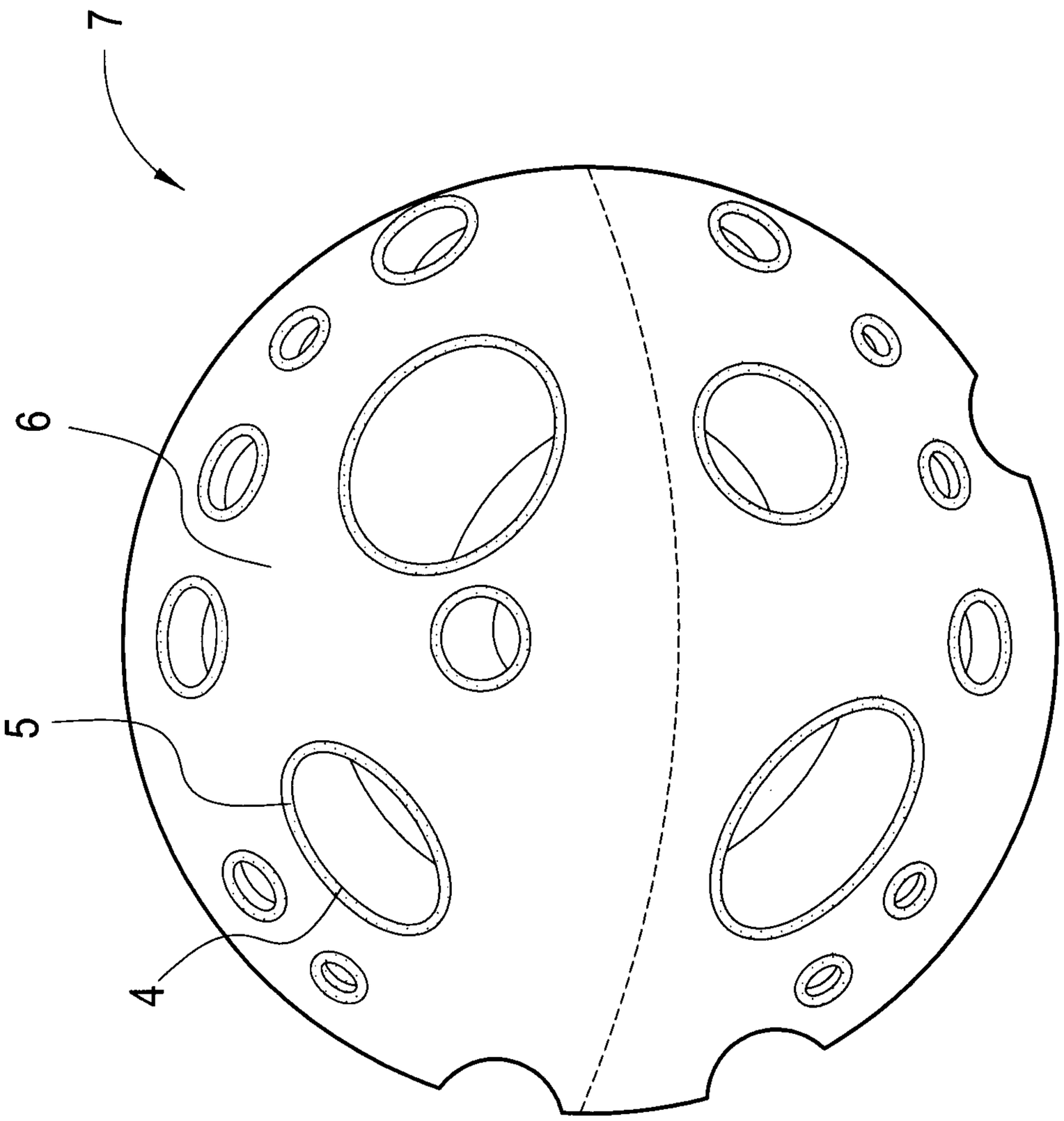

Figure 3

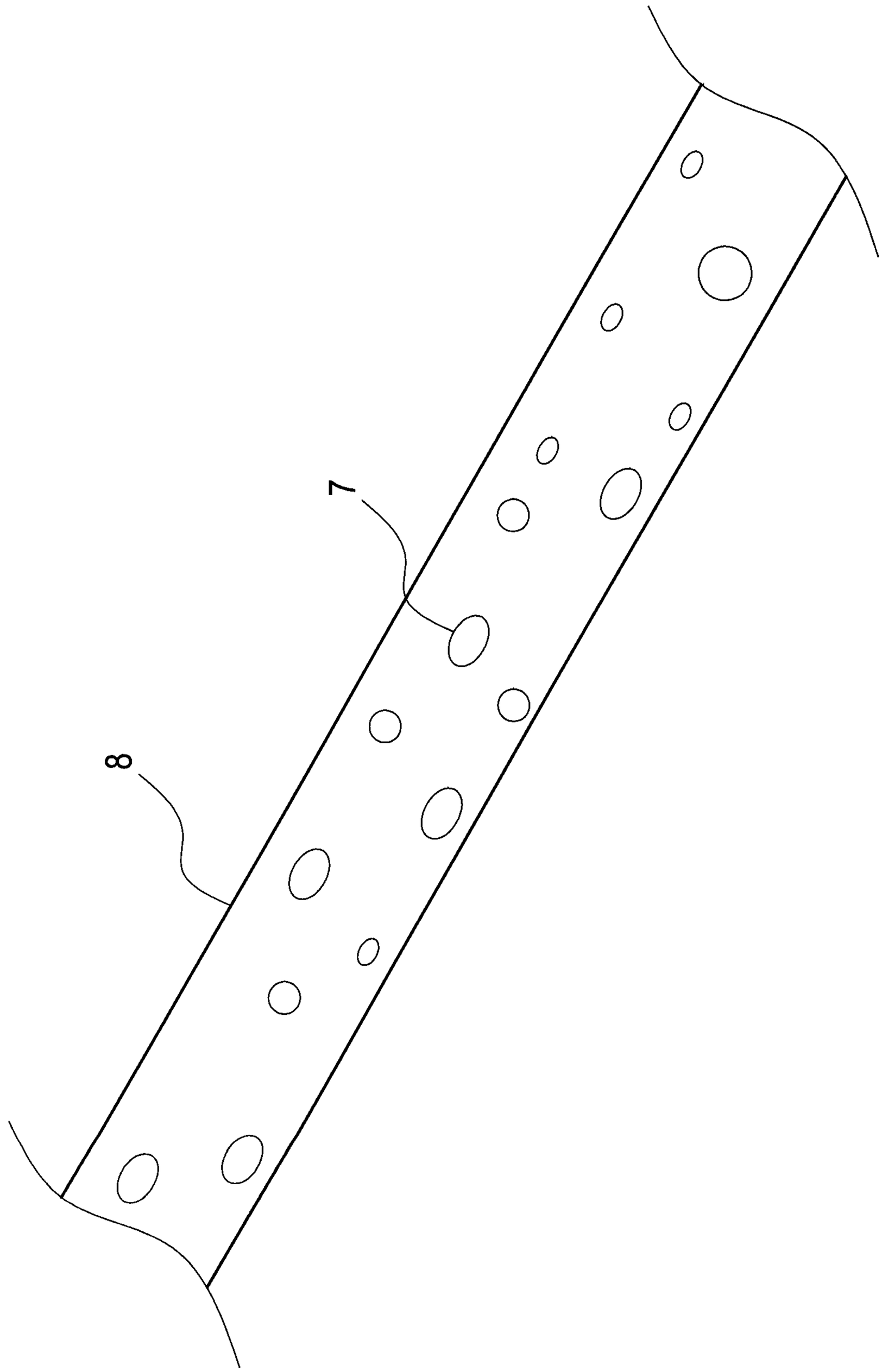

Figure 4

Step 1: Grinding kieselguhr or active carbon into micro-particles of 1~1000 micron in size

111

Step 2:Impregnating micro-particles obtained in step 1 with organic Chinese herbal medicine and polyvinyl alcohol, and adding inorganic anti-bacteria minerals of 1~100 nanometer in size, and stirring continuously

112

Step 3:Air drying micro-particles impregnated in step 2, and then dry grinding said dried micro-particles into finer micro-particle of 1~50 micron in size suitable for drawing

113

Step 4: Binding with monomer through esterification reaction to form anti-bacteria polyester masterbatch, wherein such finer micro-particle in each of the polyester masterbatch comprises about 10 - 25% of the total weight of each masterbatch

114

Step 5:Finally, producing anti-bacteria polyester fiber by low temperature batch processing chip spinning technique, wherein the ratio of the anti-bacteria polyester masterbatch added is about 5 - 10%

115