THREE-DIMENSIONAL ABSORBER FOR DISPOSABLE SANITARY PRODUCT AND PREPARATION METHOD THEREOF

TECHNICAL FIELD

The present disclosure relates to the field of disposable sanitary products, and in particular to a three-dimensional absorber for a disposable sanitary product and a preparation method thereof.

BACKGROUND

At present, the absorber of the disposable sanitary product is mainly improved in terms of the non-woven fabric and the absorbent core body. The improvement of the non-woven fabric is mainly reflected in softness and bulkiness. As the surface layer of the absorber article, the non-woven fabric needs to be in close contact with the human body, so it must be soft, permeable, and skin-friendly. The existing non-woven fabrics mainly include hot-air non-woven fabrics, hot-rolled non-woven fabrics, spun-bond non-woven fabrics, and spunlace non-woven fabrics. The spunlace non-woven fabric is softer and more skin-friendly, with the touch of cotton. However, to serve as the surface layer of the absorber article, it must also satisfy the requirements for air permeability and anti-reverse penetration properties in addition to good touch. Different products have different requirements for the thickness of the non-woven fabric. If the non-woven fabric is too thin, it may cause reverse penetration, and if the non-woven fabric is too thick, it may cause the liquid to penetrate slowly. It has become the pursuit of those skilled in the art to prepare an outperforming non-woven fabric as the surface layer material for the disposable sanitary product.

Chinese patent application CN201310301601.1 discloses a hot-air non-woven fabric and a fabrication method thereof. The hot-air non-woven fabric includes a first fiber layer and a second fiber layer that are fixed together up and down. The first fiber layer has a water contact angle of greater than 70° and a thickness of 0.2-2.0 mm. The first fiber layer has a perforated structure that accounts for 10-80% of a total area of the first fiber layer. The second fiber layer has a water contact angle of less than 70°. The first fiber layer is configured to guide a liquid thereon to the second fiber layer, and the second fiber layer is configured to absorb the liquid flowing from the first fiber layer. The hot-air non-woven fabric can be used for an absorber article in contact with the skin and can bring the user a dry and comfortable feeling. The hot-air non-woven fabric adopts a double-layer structure. The first fiber layer has a lower surface energy level, so when the liquid reaches the first fiber layer, the liquid will flow to the second fiber layer along the perforated structure of the first fiber layer. The first fiber layer plays a flow guiding role and

increases the penetration area, thereby increasing the effective use area of the absorber article and promoting rapid absorption of the liquid. The second fiber layer has a higher surface energy level, so the liquid reaching the second fiber layer can be quickly absorbed into the second fiber layer. After the liquid is absorbed, since the water contact angle of the first fiber layer is greater than 70°, the first fiber layer prevents the liquid from returning to the surface of the absorber article through capillary action, thereby achieving a dry and comfortable effect. Even if some liquid reversely penetrates from the second fiber layer, since the first fiber layer in contact with the user's skin has a thickness of greater than 0.2 mm, it is sufficient to protect the user from feeling wet. However, although the hot-air non-woven fabric performs well for the first absorption, it is hard to withstand multiple absorptions. The hot-air non-woven fabric retains a certain absorption state in the first absorption, which will destroy the three-dimensional (3D) structure of the hot-air non-woven fabric. As a result, in the next absorption, the first fiber layer will appear wet and cannot continue to maintain a dry touch. This problem cannot be solved by the thickness setting of the hot-air non-woven fabric.

SUMMARY

In view of this, the present disclosure proposes a three-dimensional absorber for a disposable sanitary product, which solves the technical problems of poor softness and poor dryness retention of existing non-woven fabrics. Based on this, the present disclosure further provides a preparation method of the three-dimensional absorber.

To achieve the above objectives, the present disclosure adopts the following technical solutions. A three-dimensional absorber includes a non-woven fabric surface layer, an absorbent core body, and a liquid impermeable bottom layer, where the non-woven fabric surface layer includes an upper layer non-woven fabric and a lower layer non-woven fabric; the upper layer non-woven fabric is formed by first three-dimensional (3D) crimped fibers and second 3D crimped fibers by hot air; the first 3D crimped fibers and the second 3D crimped fibers have a crimp count of 19-21 per inch; the first 3D crimped fibers have a denier count of 2.0-2.4 dtex; the second 3D crimped fibers have a denier count of 3.1-3.5 dtex; the lower layer non-woven fabric is formed by first two-dimensional (2D) crimped fibers and second 2D crimped fibers by hot air; the first 2D crimped fibers and the second 2D crimped fibers have a crimp count of 15-17 per inch and a crimp angle of 95-135°; the first 2D crimped fibers have a denier count of 3.1-3.5 dtex; the second 2D crimped fibers have a denier count of 4.8-5.2 dtex; the upper layer non-woven fabric has an air permeability of not less than 4,500 $m^3/m^2/s$; the lower layer non-woven fabric has an air permeability of not greater than 2,500 $m^3/m^2/s$; the upper layer non-woven fabric is provided

with multiple upper layer air-permeable holes; the upper layer non-woven fabric and the lower layer non-woven fabric form multiple embossed lines by ultrasonic hot pressing; the multiple embossed lines form multiple enclosing regions; the enclosing regions each are composed of multiple enclosing sides; any two adjacent enclosing sides are not connected; and the upper layer air-permeable holes are located in the enclosing regions, respectively.

Further, the enclosing regions each may be composed of six enclosing sides to form a regular hexagon; the enclosing regions may be continuously distributed; and the enclosing sides each may have a length greater than 1/2 and less than 4/5 of a side length of the regular hexagon.

Further, the enclosing sides each may have a width of greater than 0.1 mm and less than 1 mm.

A preparation method of the three-dimensional absorber includes the following steps:

step 1: combing the first 3D crimped fibers and the second 3D crimped fibers into a web, and reinforcing the web by hot air to form the upper layer non-woven fabric, where the first 3D crimped fibers and the second 3D crimped fibers have a weight ratio of (3-5):6;

step 2: combing the first 2D crimped fibers and the second 2D crimped fibers into a web, and reinforcing the web with hot air to form the lower layer non-woven fabric, where the first 2D crimped fibers and the second 2D crimped fibers have a weight ratio of (3-5):6;

step 3: arranging a porcupine roller and a bottom roller, where the porcupine roller includes a roller body and pins arranged on the roller body; the bottom roller is provided with multiple avoidance holes for avoiding the pins; the porcupine roller cooperates with the bottom roller to heat the pins at 70-150°C for rolling; and the upper layer non-woven fabric is rolled by the porcupine roller and the bottom roller to form the multiple upper layer air-permeable holes and the downward extension tubes with a height not less than 2 mm at the upper layer air-permeable holes;

step 4: bonding and feeding the upper layer non-woven fabric and the lower layer non-woven fabric into an ultrasonic welding device for hot pressing to form the multiple embossed lines, thereby obtaining a composite non-woven fabric, where the multiple embossed lines form multiple enclosing regions; the enclosing regions each are composed of multiple

enclosing sides; any two adjacent enclosing sides are not connected; the upper layer air-permeable holes are located in the enclosing regions, respectively; and free ends of the extension tubes abut against an upper surface of the lower layer non-woven fabric;

step 5: cutting the composite non-woven fabric to form the non-woven fabric surface layer; and

step 6: combining the non-woven fabric surface layer with the absorbent core body and the liquid impermeable bottom layer to form the absorber.

Further, in step 1, the first 3D crimped fibers and the second 3D crimped fibers may form the web by intersecting with each other longitudinally and transversely.

Further, the first 3D crimped fibers may be arranged longitudinally, and may be spaced transversely to form a fiber-dense portion and a fiber-loose portion; and the fiber-dense portion and the fiber-loose portion may have a width ratio of 1:(3-5) and a weight ratio of 1:(1-2).

Further, the first 3D crimped fibers and the second 3D crimped fibers may form the web by interlacing with each other.

Further, the first 2D crimped fibers and the second 2D crimped fibers may form the web by intersecting with each other longitudinally and transversely.

Further, in step 3, the bottom roller may be a heating roller, which may heat at 150-200°C.

Further, the enclosing regions may have an area not less than 30% of an area of the non-woven fabric surface layer.

With the above technical solutions, the present disclosure achieves the following beneficial effects:

1. The present disclosure obtains a soft and fluffy upper layer non-woven fabric by setting the crimp counts and denier counts of the first 3D crimped fibers and the second 3D crimped fibers. The present disclosure does not strictly limit the materials of the first 3D crimped fibers and the second 3D crimped fibers, such as polypropylene fibers and polyester fibers, as long as

they satisfy the parameters. In the present disclosure, by setting the crimp counts and denier counts of the first 2D crimped fibers and the second 2D crimped fibers, the lower layer non-woven fabric with desired stiffness and support performance is obtained. In the present disclosure, the first 3D crimped fibers and the second 3D crimped fibers are combed into a web, and fixed by hot air. In this way, the upper layer non-woven fabric is relatively fluffy, and has higher softness, higher air permeability, and higher compression resilience. In the present disclosure, the first 2D crimped fibers and the second 2D crimped fibers are combed into a web, and fixed by hot air. In this way, compared with the upper layer non-woven fabric, the lower layer non-woven fabric has higher density, smaller air permeability, higher stiffness, and lower compression resilience. After the upper layer non-woven fabric and the lower layer non-woven fabric are combined, the lower layer non-woven fabric plays a good supporting role, and the upper layer non-woven fabric plays a good role in contact, diversion, and ventilation. In this way, the 3D structure is well maintained. Even after repeated absorption, the 3D structure will not be greatly deformed, thereby ensuring dryness and air permeability.

2. Through the setting of the upper layer air-permeable holes, the ventilation effect of the upper layer non-woven fabric is improved. When forming the upper layer air-permeable holes, the upper layer non-woven fabric forms downward extension tubes at the upper layer air-permeable holes. The height of the extension tube is not less than 2 mm, and the extension tube ensures the flexibility of the upper layer non-woven fabric. The lower end of the extension tube abuts against the lower layer non-woven fabric to support the 3D structure and retain the shape after repeated absorption, thereby ensuring dryness and air permeability.

3. Through the setting of the enclosing regions, the upper layer non-woven fabric and the lower layer non-woven fabric is effectively bonded. Since any two adjacent enclosing sides are not connected, continuous embossed lines are avoided, thereby maximizing the softness. Through the discontinuous embossed lines, every two adjacent enclosing regions communicate with each other, such that the space between the upper layer non-woven fabric and the lower layer non-woven fabric is connected at the adjacent enclosing regions, which facilitates the diffusion and penetration of the liquid. The upper layer air-permeable holes are located in the enclosing regions, respectively, and cooperate with the embossed lines to present a wavy 3D form, so as to achieve a dry, permeable and soft contact effect.

4. The enclosing region is configured in a regular hexagon to achieve an excellent connection and layout effect, and the length of the enclosing side can be set to achieve a desired

3D molding effect.

5. The preparation method of the three-dimensional absorber adopts a porcupine roller and a bottom roller, which heats the pins of the porcupine roller to shape the extension tubes, thereby realizing a stable 3D shape.

6. The first 3D crimped fibers and the second 3D crimped fibers form the web by intersecting with each other longitudinally and transversely, which improves the 3D state of the upper layer non-woven fabric.

7. The fiber-dense portion extends along the length direction, and the fiber-dense portion and the fiber-loose portion has a width ratio of 1:(3-5) and a weight ratio of 1:(1-2). In this way, the fiber-loose portion of the upper layer non-woven fabric forms a depression after hot air molding, and the fiber-dense portion forms a protrusion after hot air molding, thereby presenting a wavy effect. The fiber-dense portion will not form a hard state.

8. The bottom roller is a heating roller, which heats at 150-200°C in cooperation with the pins to achieve effective forming of the extension tube and improve the supporting effect of the extension tube.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a structural view of enclosing regions formed by embossed lines of an upper layer non-woven fabric and a lower layer non-woven fabric according to the present disclosure.

FIG. 2 is a structural view of the upper layer non-woven fabric according to the present disclosure.

FIG. 3 is a structural view of the lower layer non-woven fabric according to the present disclosure.

FIG. 4 is a sectional view taken along A-A shown in FIG. 1.

FIG. 5 is a structural view of a three-dimensional absorber for a disposable sanitary product according to the present disclosure.

FIG. 6 is a schematic view showing that the upper layer non-woven fabric and the lower layer non-woven fabric pass through a porcupine roller, a bottom roller, and an ultrasonic welding device according to the present disclosure.

DETAILED DESCRIPTION OF THE EMBODIMENTS

The present disclosure is described in further detail below with reference to the drawing and specific implementations.

Referring to FIGS. 1 to 5, this embodiment provides a three-dimensional absorber for a disposable sanitary product. The three-dimensional absorber includes a non-woven fabric surface layer 1, an absorbent core body 2, and a liquid impermeable bottom layer 3. The non-woven fabric surface layer includes an upper layer non-woven fabric 4 and a lower layer non-woven fabric 5. The upper layer non-woven fabric 4 is formed by the first 3D crimped fibers 41 and second 3D crimped fibers 42 by hot air. The first 3D crimped fibers 41 and the second 3D crimped fibers 42 have a crimp count of 19-21 per inch, which is 20 per inch in this embodiment. The first 3D crimped fibers 41 have a denier count of 2.0-2.4 dtex, which is 2.2 dtex in this embodiment. The second 3D crimped fibers 42 have a denier count of 3.1-3.5 dtex, which is 3.3 dtex in this embodiment. The lower layer non-woven fabric 5 is formed by first two-dimensional (2D) crimped fibers 51 and second 2D crimped fibers 52 by hot air. The first 2D crimped fibers 51 and the second 2D crimped fibers 52 have a crimp count of 15-17 per inch, which is 16 per inch in this embodiment. The first 2D crimped fibers 51 and the second 2D crimped fibers 52 have a crimp angle of 95-135°, which is not required to be the same. The first 2D crimped fibers 51 have a denier count of 3.1-3.5 dtex, which is 3.3 dtex in this embodiment. The second 2D crimped fibers 52 have a denier count of 4.8-5.2 dtex, which is 5 dtex in this embodiment. The upper layer non-woven fabric 4 has an air permeability of not less than 4,500 $m^3/m^2/s$, which is 4,800 $m^3/m^2/s$ in this embodiment. The lower layer non-woven fabric 5 has an air permeability of not greater than 2,500 $m^3/m^2/s$, which is 2,200 $m^3/m^2/s$ in this embodiment. The upper layer non-woven fabric 4 is provided with multiple upper layer air-permeable holes 43. The upper layer non-woven fabric 4 and the lower layer non-woven fabric 5 form multiple embossed lines 6 by ultrasonic hot pressing. The multiple embossed lines 6 form multiple enclosing regions. The enclosing regions each are composed of six enclosing sides to form a regular hexagon. The enclosing sides are the embossed lines 6. The enclosing regions are continuously distributed, and the enclosing sides each have a length greater than 1/2 and less than 4/5 of a side length of the regular hexagon. In this embodiment, the length of the surrounding side is 2/3 of the side length of the regular hexagon. Any two adjacent enclosing

sides are not connected. The enclosing sides each have a

width of greater than 0.1 mm and less than 1 mm. The width of the enclosing side is 0.5 mm in this embodiment. The first 3D crimped fibers 41 are arranged longitudinally, and the first 3D crimped fibers 41 are spaced transversely to form a fiber-dense portion 411 and a fiber-loose portion 412. The fiber-dense portion 411 and the fiber-loose portion 412 have a width ratio of 1:(3-5), which is 1:4 in this embodiment. The enclosing regions have an area not less than 30% of an area of the non-woven fabric surface layer. In this embodiment, the enclosing regions are continuously distributed, as shown in FIG. 1. The upper layer air-permeable holes 43 are located in the enclosing regions, respectively. The upper layer non-woven fabric 4 forms downward extension tubes 44 at the upper layer air-permeable holes 43. The extension tubes 44 each have a height of not less than 2 mm. In this embodiment, the extension tubes each have a height of 1.5 mm. The extension tubes each have a lower end abutting against an upper surface of the lower layer non-woven fabric 5.

The enclosing regions may have other shapes, such as regular octagons, or irregular shapes. The extension tube may also be omitted. In this case, the 3D effect achieved by the upper layer non-woven fabric and the lower layer non-woven fabric still exists, but it is weakened. The first 3D crimped fibers may not be provided with the fiber-dense portion or the fiber-loose portion. In this case, the upper layer non-woven fabric does not have a wavy shape in the width direction, but this does not affect the softness, air permeability and dry performance of the upper layer non-woven fabric. The width and shape of the fiber-dense portion and the fiber-loose portion are not limited to the S shape, as long as they extend longitudinally. The value range of these parameters is adjustable according to actual needs.

A preparation method of the three-dimensional absorber includes the following steps:

In a first step, the first 3D crimped fibers and the second 3D crimped fibers are combed into a web and are reinforced by hot air to form the upper layer non-woven fabric. The first 3D crimped fibers and the second 3D crimped fibers have a weight ratio of 4:6, which is 4:6 in this solution. The first 3D crimped fibers and the second 3D crimped fibers form the web by intersecting with each other longitudinally and transversely. The first 3D crimped fibers and the second 3D crimped fibers form the web by interlacing with each other. The first 3D crimped fibers are arranged longitudinally, and are spaced transversely to form the fiber-dense portion and the fiber-loose portion. The fiber-dense portion and the fiber-loose portion have a width ratio of 1:4 and a weight ratio of 1:1.5.

In a second step, the first 2D crimped fibers and the second 2D crimped fibers are combed into a web and reinforced with hot air to form the lower layer non-woven fabric. The first 2D crimped fibers and the second 2D crimped fibers have a weight ratio of 4:6, which is 4:6 in this solution. The first 2D crimped fibers and the second 2D crimped fibers form the web by intersecting with each other longitudinally and transversely.

In a third step, referring to FIG. 6, a porcupine roller 7 and a bottom roller 8 are arranged. The porcupine roller 7 includes a roller body 71 and pins 72 arranged on the roller body. The bottom roller 8 is provided with multiple avoidance holes 81 for avoiding the pins. The porcupine roller 7 cooperates with the bottom roller 8 to heat the pins at 70-150°C (100°C in this solution) for rolling. The bottom roller is a heating roller, which heats at 150-200°C (180°C in this solution). The upper layer non-woven fabric is rolled by the porcupine roller and the bottom roller to form the multiple upper layer air-permeable holes, and the upper layer non-woven fabric forms the downward extension tubes at the upper layer air-permeable holes.

In a fourth step, the upper layer non-woven fabric 4 and the lower layer non-woven fabric 5 are bonded and fed into an ultrasonic welding device 9 for hot pressing to form the multiple embossed lines. The multiple embossed lines form multiple enclosing regions. The enclosing regions each are composed of multiple enclosing sides. Any two adjacent enclosing sides are not connected. The upper layer air-permeable holes are located in the enclosing regions, respectively. The free ends of the extension tubes abut against the upper surface of the lower layer non-woven fabric. In this way, a composite non-woven fabric is formed.

In a fifth step, the composite non-woven fabric is cut to form the non-woven fabric surface layer.

In a sixth step, the non-woven fabric surface layer is combined with the absorbent core body and the liquid impermeable bottom layer to form the absorber.

Moreover, the terms such as "first" and "second" are used only for the purpose of description and should not be construed as indicating or implying a relative importance, or implicitly indicating a quantity of indicated technical features. Thus, features defined with "first" and "second" may explicitly or implicitly include one or more of the features. In the description of the present disclosure, "multiple" means two or more, unless otherwise specifically defined.

In the present disclosure, unless otherwise clearly specified, the terms such as "connected to", "connected with" and "fixed" should be comprehended in a broad sense. For example, these terms may be comprehended as being fixedly connected, removably connected, or integrally connected; may be comprehended as being directly connected, or indirectly connected through an intermediate medium; and may be comprehended as being in an internal communication between two elements or an interactive relationship between two elements. Those of ordinary skill in the art may understand specific meanings of the above terms in the present disclosure based on a specific situation.

In the present disclosure, unless otherwise clearly specified, when it is described that a first feature is "above" or "below" a second feature, it indicates that the first and second features are in direct contact or the first and second features are in indirect contact through a medium. In addition, when it is described that the first feature is "over", "above" and "on" the second feature, it indicates that the first feature is directly or obliquely above the second feature, or simply indicates that an altitude of the first feature is higher than that of the second feature. When it is described that a first feature is "under", "below" or "beneath" a second feature, it indicates that the first feature is directly or obliquely under the second feature or simply indicates that the first feature is lower than the second feature.

In this specification, descriptions of reference terms such as "one embodiment", "some embodiments", "an example", "a specific example" and "some examples" indicate that specific features, structures, materials or characteristics described in combination with the embodiment(s) or example(s) are included in at least one embodiment or example of the present disclosure. In this specification, schematic representation of the above terms is not necessarily directed to the same embodiment or example. Moreover, the specific features, structures, materials or characteristics described may be combined in a suitable manner in any one or more embodiments or examples. In addition, those skilled in the art may combine different embodiments or examples described in this specification and characteristics of the different embodiments or examples without mutual contradiction.

Although the present disclosure is specifically illustrated in combination with preferred implementation solutions, those skilled in the art should understand that various changes may be made to the present disclosure in terms of forms and details without departing from the spirit and scope of the present disclosure defined in the appended claims, but these changes should fall within the protection scope of the present disclosure.

CLAIMS

WHAT IS CLAIMED IS:

1. A three-dimensional absorber for a disposable sanitary product, comprising a non-woven fabric surface layer, an absorbent core body, and a liquid impermeable bottom layer, wherein the non-woven fabric surface layer comprises an upper layer non-woven fabric and a lower layer non-woven fabric; the upper layer non-woven fabric is formed by first three-dimensional (3D) crimped fibers and second 3D crimped fibers by hot air; the first 3D crimped fibers and the second 3D crimped fibers have a crimp count of 19-21 per inch; the first 3D crimped fibers have a denier count of 2.0-2.4 dtex; the second 3D crimped fibers have a denier count of 3.1-3.5 dtex; the lower layer non-woven fabric is formed by first two-dimensional (2D) crimped fibers and second 2D crimped fibers by hot air; the first 2D crimped fibers and the second 2D crimped fibers have a crimp count of 15-17 per inch and a crimp angle of 95-135°; the first 2D crimped fibers have a denier count of 3.1-3.5 dtex; the second 2D crimped fibers have a denier count of 4.8-5.2 dtex; the upper layer non-woven fabric has an air permeability of not less than 4,500 $m^3/m^2/s$; the lower layer non-woven fabric has an air permeability of not greater than 2,500 $m^3/m^2/s$; the upper layer non-woven fabric is provided with multiple upper layer air-permeable holes; the upper layer non-woven fabric and the lower layer non-woven fabric form multiple embossed lines by ultrasonic hot pressing; the multiple embossed lines form multiple enclosing regions; the enclosing regions each are composed of multiple enclosing sides; any two adjacent enclosing sides are not connected; and the upper layer air-permeable holes are located in the enclosing regions, respectively.

2. The three-dimensional absorber according to claim 1, wherein the enclosing regions each are composed of six enclosing sides to form a regular hexagon; the enclosing regions are continuously distributed; and the enclosing sides each have a length greater than 1/2 and less than 4/5 of a side length of the regular hexagon.

3. The three-dimensional absorber according to claim 2, wherein the enclosing sides each have a width of greater than 0.1 mm and less than 1 mm.

4. A preparation method of the three-dimensional absorber according to claim 1, 2 or 3, comprising the following steps:

step 1: combing the first 3D crimped fibers and the second 3D crimped fibers into a web,

and reinforcing the web by hot air to form the upper layer non-woven fabric, wherein the first 3D crimped fibers and the second 3D crimped fibers have a weight ratio of (3-5):6;

step 2: combing the first 2D crimped fibers and the second 2D crimped fibers into a web, and reinforcing the web with hot air to form the lower layer non-woven fabric, wherein the first 2D crimped fibers and the second 2D crimped fibers have a weight ratio of (3-5):6;

step 3: arranging a porcupine roller and a bottom roller, wherein the porcupine roller comprises a roller body and pins arranged on the roller body; the bottom roller is provided with multiple avoidance holes for avoiding the pins; the porcupine roller cooperates with the bottom roller to heat the pins at 70-150°C for rolling; and the upper layer non-woven fabric is rolled by the porcupine roller and the bottom roller to form the multiple upper layer air-permeable holes and downward extension tubes with a height of not less than 2 mm at the upper layer air-permeable holes;

step 4: bonding and feeding the upper layer non-woven fabric and the lower layer non-woven fabric into an ultrasonic welding device for hot pressing to form the multiple embossed lines, thereby obtaining a composite non-woven fabric, wherein the multiple embossed lines form multiple enclosing regions; the enclosing regions each are composed of multiple enclosing sides; any two adjacent enclosing sides are not connected; the upper layer air-permeable holes are located in the enclosing regions, respectively; and free ends of the downward extension tubes abut against an upper surface of the lower layer non-woven fabric;

step 5: cutting the composite non-woven fabric to form the non-woven fabric surface layer; and

step 6: combining the non-woven fabric surface layer with the absorbent core body and the liquid impermeable bottom layer to form the absorber.

5. The preparation method of the three-dimensional absorber according to claim 4, wherein in step 1, the first 3D crimped fibers and the second 3D crimped fibers form the web by intersecting with each other longitudinally and transversely.

6. The preparation method of the three-dimensional absorber according to claim 5, wherein the first 3D crimped fibers are arranged longitudinally, and are spaced transversely to form a

fiber-dense portion and a fiber-loose portion; and the fiber-dense portion and the fiber-loose portion have a width ratio of 1:(3-5) and a weight ratio of 1:(1-2).

7. The preparation method of the three-dimensional absorber according to claim 4, wherein the first 3D crimped fibers and the second 3D crimped fibers form the web by interlacing with each other.

8. The preparation method of the three-dimensional absorber according to claim 4, wherein the first 2D crimped fibers and the second 2D crimped fibers form the web by intersecting with each other longitudinally and transversely.

9. The preparation method of the three-dimensional absorber according to claim 4, wherein in step 3, the bottom roller is a heating roller working at 150-200°C.

10. The preparation method of the three-dimensional absorber according to claim 4, wherein the enclosing regions have an area not less than 30% of an area of the non-woven fabric surface layer.