

SPECIFICATION

Non-woven fabric for sanitary towels

5 The present invention relates to a non-woven fabric for sanitary towels. More particularly, the present invention relates to a non-woven fabric which has a three-layer structure composed of a mixture of rayon fibers and thermoplastic fibers, in which the density, the fiber fineness and the mixing ratio of these fibers varies between the different layers.

10 Sanitary towels now available on the market have a structure in which the back face and side face of an absorbent material such as absorbent paper or pulp are covered with an impervious layer and the assembly is entirely covered with a non-woven fabric. Sanitary towels of this type have a shape convenient for handling but are nevertheless unsatisfactory in certain ways. One problem, known as "wet back" arises when an external pressure is applied. The menstrual blood that has already been absorbed is returned to the skin through the surface non-woven fabric. Furthermore, in some fibers, there is observed the phenomenon of separation of fibers from the non-woven fabric, and furthermore it often happens that the menstrual blood is not absorbed but rather runs along the surface of the non-woven fabric. Moreover, in order to prevent leakage in the longitudinal direction, both ends of the non-woven fabric covering must be heat-sealed.

20 Research has been carried out with a view to eliminating these defects. For example, the specification of U.S. Patent No. 3,420,235 discloses an envelope of non-woven fabric comprising 25 to 75% of rayon and 75 to 25% of polypropylene, and it is this envelope which is said to have excellent feel to the skin and good heat-sealability. Furthermore, Japanese Utility Model Publication No. 35353/72 discloses that if a rayon paper or thermoplastic fiber non-woven fabric having a thin layer of rayon staple cotton bonded to the inner face thereof is used, the spot absorption characteristics and the cushioning property at the time of application are improved, and shedding of fibers is prevented. However, the first-mentioned envelope still suffers from lateral leakage of menstrual blood running along the surface of the non-woven fabric.

30 The present invention seeks to reduce or eliminate the above-mentioned defects by adopting a specific three-layer structure for the envelope.

More specifically, in accordance with the present invention, there is provided a non-woven fabric suitable for use as an envelope or covering in a feminine sanitary towel which has an integrated three-layer structure including a first layer for forming a skin-contacting surface, a third layer for forming the back face and a second layer between the first and third layers wherein the first layer is composed of rayon fibers having a fineness of 1.5 to 3 deniers and thermoplastic fibers, the weight ratio of the rayon fibers to the thermoplastic fibers being from 40/60 to 70/30 and the rayon fibers and thermoplastic fibers being densely compacted to a paper-like form, the second layer is composed of rayon fibers having a fineness of 3 to 7 deniers and thermoplastic fibers, the weight ratio of the rayon fibers to the thermoplastic fibers being from 60/40 to 90/10 and the rayon fibers and thermoplastic fibers being loosely compacted, the third layer is composed of rayon fibers having a fineness of 1.5 to 3 deniers and thermoplastic fibers and the weight ratio of the rayon fibers to the thermoplastic fibers being from 40/60 to 90/10, and the density of the three layer structure is from 15 to 30 g/m².

45 The present invention will now be described by way of example and with reference to the accompanying drawings, in which:

Figure 1 is an enlarged sectional view illustrating one embodiment of the non-woven-fabric of the present invention.

Figure 2 is a sectional view showing the sanitary napkin used at the experiment of Example 2.

50 Fig. 1 shows the structure of the non-woven fabric according to the present invention. It has an integrated three-layer structure including a first layer 1 for forming the skin-contacting surface, a third layer 3 for forming the back face, and a second intermediate, layer 2. Each of these layers is composed of a mixture of rayon fibers and thermoplastic fibers, but the fineness of the rayon fibers, the mixing ratios and the densities differ between the respective layers. More specifically, in the first layer 1, the weight ratio of the rayon fibers to the thermoplastic fibers is in the range of from 40/60 to 70/30 and the fineness of the rayon fibers is 1.5 to 3 deniers. The mixed fibers are densely compacted to a paper-like form, but the density need not be uniform but is generally reduced in the direction of the second layer 2. In the second layer 2, the weight ratio of the rayon fibers to the thermoplastic fibers is in the range of from 60/40 to 90/10, and the fineness of the rayon fibers is 3 to 7 deniers. In the mixed fibers of the second layer 2, the rayon fibers are finer than in the first layer 1 and the proportion of rayon fibers is preferably higher than in the first layer 1. Since the conduction of heat is small at the forming step, the density is low and the fibers are loosely compacted. In the third layer, the weight ratio of the rayon fibers to the thermoplastic fibers is in the range of from 40/60 to 90/10 and the fineness of the rayon fibers is 1.5 to 3 deniers. The density of the three layer structure as a

whole is 15 to 30 g/m². The relative proportion of the three layers are not particularly critical, but from the viewpoint of the bulkiness of the second layer, it is preferred that the proportion of the second layer be larger than the other two. It also is preferred that the proportions of the the three layers be adjusted so that the ratio of finer rayon fibers having a fineness of 1.5 to 3 deniers to thicker rayon fibers having a fineness of 3 to 7 deniers is in the range of 10/90 to 70/30 in the centre structure. Furthermore, it is preferred that the mixing weight ratio of the rayon fibers to the thermoplastic fiber in the entire three-layer structure be from 50/50 to 80/20.

Various advantages described below are attained by the non-woven fabric of the present invention having the above-mentioned structure.

Rayon has excellent touch to the skin and good moisture-absorbing properties but since it has no self-adhesiveness, a binder must be used when forming a non-woven fabric from rayon. In such a non-woven fabric formed by using a binder, however, the desirable natural properties of the rayon are degraded, and the non-woven fabric becomes hard and unpleasant to the touch.

Accordingly, an envelope suitable for a sanitary napkin cannot be obtained from such a rayon non-woven fabric. Thermoplastic fibers exhibit self-adhesiveness when heated, and the degree of adhesion can be controlled by varying the heating temperature and time. However, thermoplastic fibers have no moisture-absorbing property, and if a non-woven fabric envelope of thermoplastic fibers were used in a sanitary towel, the menstrual blood would run along the surface of the envelope, causing lateral leakage.

In the non-woven fabric of the present invention, by mixing both the rayon fibers and thermoplastic fibers appropriately, the desirable properties of both types of fibers can be effectively utilized, and excellent properties can be obtained by varying the fineness and the mixing ratio.

Since the rayon fibers used for the first layer 1 have a fineness of 1.5 to 3 deniers, the first layer 1 has a good touch to the skin, and since the mixing ratio of the thermoplastic fibers is relatively high and 30 to 60% by weight and the first layer 1 is densely compacted in the paper-like form, shedding of fibers does not occur and repelling of the menstrual blood or re-appearance of previously absorbed blood on the surface can be prevented. Furthermore, since rayon fibers absorb blood but thermoplastic fibers do not, the menstrual blood is immediately spot-absorbed by the absorbing layer.

In the second layer 2, since the proportion of thermoplastic fibers is relatively low (10 to 40% by weight) and the conduction of heat is small during the forming step, the fibers are loosely compacted as in cotton, and since the rayon fibers used have a fineness of 3 to 7 deniers, the second layer has high bulk and resilience, and therefore, the cushioning property is very good. Furthermore, this high bulk helps to prevent the squeezing-out of previously-absorbed blood.

In the third layer 3, since the rayon fibers used have a fineness of 1.5 to 3 deniers, the feel is improved. If the proportion of the rayon fibers is 40 to 70% by weight, the strength of the entire structure is improved. If the proportion of the rayon fibers is 70 to 90%, a good cushioning property is obtained. An optimum mixing ratio can be chosen depending on the feel or mechanical properties required.

If the ratio of the rayon fibers to the thermoplastic fibers in the entire structure is chosen within the range 50/50 to 80/20 both good feel and sufficient strength are generally obtained.

Since the density of the entire structure is adjusted to 15 to 30 g/m², the necessary strength can be obtained while maintaining adequate softness.

The non-woven fabric having the above-mentioned three-layer structure according to the present invention can easily be obtained by performing a carding operation with respect to each of the three layers, assembling the layers together and passing the assembly between heating rollers. The densities of the three layers can be varied by appropriately varying the heating temperature or the roll speed.

Any thermoplastic fibers satisfying the above-mentioned requirements can be used in the present invention. For example, fibers of polyolefins such as polyethylene and polypropylene, polyesters, polyamides and acrylonitrile polymers are preferred, and polyolefin fibers are especially preferred because the manufacturing cost is low and they have good properties. The fineness of the thermoplastic fibers is not particularly critical and attainment of the above-mentioned effects is not influenced by the fineness of the thermoplastic fibers. However, it is generally preferred that the fineness of the thermoplastic fibers used be 1.5 to 5 deniers.

The effects attained according to the present invention are summarised below:

- (1) The liquid-absorbing property on the surface of the non-woven fabric is good (good spot absorbing property)
- (2) Shedding of fibers is not caused.
- (3) Return of previously-absorbed liquid is prevented.
- (4) High bulk and good cushioning properties can be obtained.

From the Examples given hereafter, it will readily be understood that the non-woven fabric according to the present invention has the above-mentioned excellent effects.

In carrying out the present invention, a thin layer of rayon cotton or the like may be bonded to the inner face of the non-woven fabric according to the present invention, whereby the cushioning property can be further improved.

5 Example 1

Non-woven fabrics with different proportions of their constituent fibers were tested with respect to the softness and shedding of fibers (the surface portion). The softness was evaluated based on the touch and shedding of fibers was evaluated based on the number of fibers separated when the surface of the non-woven fabric was rubbed. The results obtained are shown in Table 1, where ○ is good, △ is poor, and X is bad.

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Table 1

Run No.	Layer Number	Mixing Ratio (% by Weight) of Rayon Fibers					Thermoplastic Fibers Kind*	Mixing Ratio (% by weight)	Base Weight** (g/m)	Softness Shedding of Fibers	
		Denier Number									
		1.5	2	3	5	7					
1 (product of present invention)	1	70					ES	30			
	2				80		ES	20	18	○	○
	3	70					ES	30			
2 (product of present invention)	1		60				ES	40			
	2					80	ES	20	19	○	○
	3		80				ES	20			
3 (comparative product)	1		80				ES	20			
	2				60		ES	40	20	○	○
	3		70				ES	30			
4 (ditto)	-		60				ES	40	23	△	○
	-	80					ES	20	20	○	○
5 (ditto)	-						ES	40			
	-					60	ES	20	19	x	○
7 (ditto)	1				60		ES	40			
	2		70				ES	30	19	△	○
	3		70				ES	30			

Note

*: ES indicates polyethylene-polypropylene composite fibers.

**: The base weight is the weight per unit area.

Example 2

An inner layer comprising an absorbent tissue 5 having a weight of 0.6 g, a fluffed pulp 6 having a weight of 4.0 g and a polyethylene-laminated water-proof paper 7 having a weight of 0.6 g was wrapped with a non-woven fabric as shown in Fig. 2, thus forming a sanitary towel.

- 5 The flow of the liquid on the surface, the amount of previously-absorbed liquid returned, and dryness were tested. 5

The flow of the liquid on the surface was tested in the following manner.

- 10 The sanitary towel was placed at an angle of 45° from the horizontal plane so that the skin-contacting face was facing outwards. A blood-like liquid (1 ml) was dropped on to the top end portion, and the distance along which the liquid flowed before it was absorbed was measured. 10

The amount of the liquid returned was determined in the following manner:

After the liquid has been absorbed in the above-mentioned manner, a filter paper was placed on the top face and the assembly was subjected to a pressure of 50 g/cm² for 3 minutes, and the amount of the liquid absorbed by the filter paper was measured.

- 15 The dryness was evaluated subjectively based on the feel of the surface of the non-woven fabric after absorption of the liquid. 15

The results obtained are shown in Table 2.

Table 2

Run No.	Layer Number	Mixing Ratio (% by weight) of Rayon Fibers					Kind	Thermoplastic Fibers	Base Weight (g/m ²)	Surface Flow (mm)	Amount (g) of Return under Pressure	Dry-ness
		Denier Number)										
		1.5	2	3	5	7						
8 (product of present invention)	1			55			ES	45				
	2				70		ES	30	18	30	3.0	○
	3			70			ES	30				
9 (product of present invention)	1	65					ES	35				
	2			75			ES	25	20	25	3.4	○
	3		70				ES	30				
10 (product of present invention)	1	60					ES	40				
	2			70			ES	30	20	30	3.5	○
	3	70					ES	30				
11 (comparative product)	-	65					ES	35	18	35	4.2	x
12 (comparative product)	-			50			ES	50	20	130	3.9	△
13 (comparative product)	1		30				ES	70				
	2			70			ES	30	22	190	3.8	△
	3		70				ES	30				

Table 3

<u>Run No.</u>	<u>Non-Woven Fabric</u>	<u>Base Weight (g/m²)</u>	<u>Surface Flow (mm)</u>	<u>Amount (g) of Return Under pressure</u>	<u>Dryness</u>
19 (product of present invention)	as described above	19	25	2.9	○
20 (commercial product A)	composed mainly of rayon (wet type), binder used	20	150	4.4	x
21 (commercial product B)	composed mainly of rayon (dry type), binder used	18	90	3.9	x
22 (commercial product C)	PP-rayon (dry type), binder used	20	65	3.6	△

Example 3

Comparative tests were carried out on a sanitary towel wrapped with the non-woven fabric according to the present invention and a commercially available sanitary towel. The inner layer used for the sanitary towel according to the present invention had the same structure as that of the inner layer used in Example 2. The structure of the non-woven fabric was as follows.

	Rayon Fibers		ES Fibers	
	3 deniers	5 deniers	3 deniers	
First layer	55% by weight		45% by weight	
Second layer		70% by weight	30% by weight	
Third layer	70% by weight		30% by weight	

The results obtained are shown in Table 3.

Table 2 (continued)

Run No.	Layer Number	Mixing Ratio (% by weight) of Rayon Fibers	Thermoplastic Fibers	Base Weight (g/m ²)	Surface Flow (mm)	Amount (g) of Return * Under Pressure	Dry-ness
		Denier Number	Kind	Mixing Ratio (% by weight)			
14(product of present invention)	1	1.5 2 3 5 7 60	PP*	40			
	2		PP	30	18	35	3.2
	3		PP	30			○
15(product of present invention)	1		ES	45			
	2		PET*	20	21	30	3.0
	3		PET	30			○
16(comparative product)	-		ES	20	20	30	4.1
	-		PET	20			△
17(comparative product)	-		ES	40	18	130	3.5
	-		PET	60			○
18(comparative product)	-		ES	100	19	150	4.2
							△

* PP = polypropylene
PET = polyethylene

The "amount of return under pressure" ("wet-back") figures were obtained after 10 ml of liquid had been brought into contact with the sample.

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CLAIMS

1. A non-woven fabric suitable for use as an envelope or covering in a feminine sanitary towel which has an integrated three-layer structure including a first layer for forming a skin-contacting surface, a third layer for forming the back face and a second layer between the first and third layers, wherein the first layer is composed of rayon fibers having a fineness of 1.5 to 3 deniers and thermoplastic fibers, the weight ratio of the rayon fibers to the thermoplastic fibers being from 40/60 to 70/30 and the rayon fibers and thermoplastic fibers being densely compacted to a paper-like form, the second layer is composed of rayon fibers having a fineness of 3 to 7 deniers and thermoplastic fibers, the weight ratio of the rayon fibers to the thermoplastic fibers being from 60/40 to 90/10 and the rayon fibers and thermoplastic fibers being loosely compacted, the third layer is composed of rayon fibers having a fineness of 1.5 to 3 deniers and thermoplastic fibers and the weight ratio of the rayon fibers to the thermoplastic fibers being from 40/60 to 90/10, and the density of the three layer structure is from 15 to 30 g/m².
2. A non-woven fabric according to Claim 1 wherein the thermoplastic fibers are polyolefin fibers.
3. A feminine sanitary towel including an envelope according to either preceding claim.

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