

- 1 -



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DISPOSABLE BODY FLUIDS ABSORBENT ARTICLE

The present invention relates to body fluids absorbent articles such as disposable diapers, sanitary napkins and the like.

In such body fluids absorbent articles, it is well known to use discrete particles of a superabsorptive polymer as a component of the liquid-absorbent core. It is also well known that the discrete particles gelate and aggregate to form blocks.

The presence of the blocks prevent body fluids from transmitting and spreading within the absorbent core, resulting in deterioration of a body fluid absorbing capacity of the core, in spite of using the discrete particles. This tendency becomes more and more significant as a content of the discrete particles increases and/or an absorption rate



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-2-

increases.

In view of the above problem, it is an object of the invention to provide a body fluids absorbent article improved so that, even when the content of discrete particles of superabsorptive polymer in the core is relatively high and/or the absorption rate of the discrete particles is relatively high, the discrete particles can be utilized as efficiently as possible.

According to the present invention, there is provided a body fluids absorbent article including a liquid-pervious topsheet, a liquid-impervious backsheet and a liquid-absorbent core having a body-facing side and a garment-facing side and disposed therebetween and said core including fluff pulp and discrete particles of superabsorptive polymer having different initial water

- 3 -

absorption rates.

In the body fluids absorbent article, the core comprises 100 ~ 200 g/m² of fluff pulp, 20 ~ 45 g/m² of thermoplastic synthetic fibers and 120 ~ 400 g/m² of discrete particles of superabsorptive polymer; the fluff pulp and the synthetic fibers are present in an intermixed state so that their contents in the core gradually decrease from the body-facing side towards the garment-facing side in a thickness direction of the core; the discrete particles consists of essentially 20 ~ 100 g/m² of first polymer particles presenting an initial water absorption rate $V = 40$ or higher and 100 ~ 300 g/m² of second polymer particles presenting an initial water absorption rate $V = 5 \sim 20$ wherein the initial water absorption rates are measured according to a measuring method as described in the following (a), (b) and (c); and a total amount of the first polymer particles is

- 4 -

distributed in a lower zone adjacent the garment-facing side of the core thickness while $100 \sim 200 \text{ g/m}^2$ of the second polymer particles is distributed in an upper zone adjacent the body-facing side of the core and $0 \sim 100 \text{ g/m}^2$ of the second polymer particles is distributed in the lower zone of the core.

(a) About 1 g of each polymer particles sample is put in a 250 mesh nylon cloth bag of 10 mm X 200 mm and weighed. Thus a weight W_0 is obtained. This bag is immersed in an amount of 0.9 % physiological saline solution poured into a 1 litre beaker;

(b) Bags taken out from the beaker in 10 seconds and 10 minutes of immersion, respectively, are suspended in midair for 10 minutes to drain. Thereafter these bags together with the contents are weighed and their weights W_1 , W_2 are obtained; and

- 5 -

(c) The initial water absorption rate V is calculated on the basis of an equation

$$V = \{(W_1 - W_0) / (W_2 - W_0)\} \times 100$$

Preferably, the first polymer particles are concentrated on a bottom of the core and in vicinity thereof so that the first polymer particles may swell and aggregate after water absorption to form gel blocks spreading over the bottom of the core.

Preferably, the core has a thickness of 0.7 ~ 7 mm.

Fig. 1 is a perspective view of a diaper as a body fluids absorbent article constructed according to one embodiment of the present invention as partially broken away; and

Fig. 2 is a fragmentary sectional view taken along line II-II in Fig. 1.

-6-

Details of a body fluids absorbent article according to the present invention will be more fully understood from the description given hereunder with reference to the accompanying drawings.

Disposable diaper 1 shown by Fig. 1 in a perspective view as partially broken away is an example of a body fluids absorbent article according to the present invention. The diaper 1 comprises a liquid-pervious topsheet 2, a liquid-impervious backsheet 3 and a liquid-absorbent core 4 disposed between these two sheets 2, 3. The topsheet 2 and the backsheet 3 are placed upon each other and joined together along their portions extending laterally beyond peripheral edges of the core 4. Elastic members 15 to surround a wearer's legs extend along transversely opposite side edges of the diaper 1 and are secured under appropriate tension to an inner surface of at least one of the topsheet 2 and the backsheet

3.

Fig. 2 is a fragmentary sectional view taken along line II-II in Fig. 1. As shown, the core has a body-facing side 4a and a garment-facing side 4b and is formed by covering a body fluids absorbent material 5 with tissue paper 6. The absorbent material 5 includes fluff pulp 11, thermoplastic synthetic fibers 12 and discrete particles 13 of superabsorptive polymer. A thickness of the core 4 except the tissue paper 6 is in a range of 0.7 ~ 7 mm, preferably in a range of 1 ~ 5 mm.

The fluff pulp 11 has a basis weight of 100 ~ 200 g/m² and its content distribution (% by weight) in a thickness direction of the core 4 progressively decreases from the body-facing side 4a towards the garment-facing side 4b.

Individual fibers of the thermoplastic synthetic fibers 12 are fused not only among themselves but also with

the fluff pulp 11 and the discrete particles superabsorptive polymer 13 to maintain a shape of the core 4. To provide a desired effect, the thermoplastic synthetic fibers 12 having a relatively low melting point is mixed with the fluff pulp 11 and the discrete particles of superabsorptive polymer 13 preferably so that the thermoplastic synthetic fibers 12 may present its basis weight of $20 \sim 45 \text{ g/m}^2$. An example of such fibers 12 is split yarns obtained by splitting a three-layered laminate sheet of polyethylene/polypropylene/polyethylene.

The discrete particles of superabsorptive polymer 13 is composed of first polymer particles 13A presenting a relatively high absorption rate and second polymer particles 13B presenting a relatively low absorption rate for body fluids or water. The first polymer particles 13A presents an initial water absorption rate V higher than 40, preferably higher than 50 as measured according to a measuring method

- 9 -

of absorbed water as will be described in detail. The first polymer particle 13A is distributed at a ratio of 20 ~ 100 g/m² in a zone defined by lower 1/2 of a thickness of the core and more preferably concentrated in proximity of a bottom of the absorbent material 5 constituting the core 4. Such concentrated distribution allows the first polymer particles 13A to be gelated, aggregated and thereby to form a block(s) spreading like a layer over a bottom surface of the core 4 after the first polymer particles 13A has absorbed body fluids. The second polymer particles 13B presenting an initial water absorption rate of 5 ~ 20 is distributed at a ratio of 100 ~ 200 g/m² in a zone defined by upper 1/2 and at a ratio of 0 ~ 100 g/m² in a zone defined by the lower 1/2 of a thickness of the core 4, respectively. In the lower 1/2 zone, the second polymer particles 13B presenting the lower absorption rate is mixed with the first polymer particles 13A presenting the

- 10 -

higher absorption rate, thereby inhibiting the formation of gel blocks due to gelation of the first polymer particles 13A alone and facilitating body fluids to get mixed into interfaces between the first polymer particles 13A and the second polymer particles 13B.

Measurement of initial water absorption rate

Initial water absorption rates V of the first and second polymer particles 13A, 13B are measured as follows:

(a) Polymer particles sample of about 1 g is put in a 250 mesh nylon cloth bag of 100 mm X 200 mm and weighed. Thus a weight W_0 is obtained. After sealing, this bag is immersed in a sufficient amount of 0.9 % physiological saline solution poured into a 1 litre beaker.

(b) Bags taken out from the beaker after immersion for 10 seconds and 10 minutes, respectively, are suspended in midair for 10 minutes to drain. Thereafter these bags

- 11 -

together with the contents are weighed and their weights W_1 , W_2 are obtained.

(c) The initial water absorption rate V is calculated on the basis of an equation as follows:

$$V = \{(W_1 - W_0)/(W_2 - W_0)\} \times 100$$

Calculated V represents a water absorption ratio in 10 seconds of immersion based on 100 representing the amount of absorbed water in 10 minutes of immersion. The present invention uses discrete particles of superabsorptive polymer of the type which can absorb an amount of water 40 or more times of the particles' own weight in 10 minutes of immersion and 70 % or higher than the amount of absorbed water in saturated state. If a V -value of the particles is relatively high, it is indicated that the amount of absorbed water in 10 seconds of immersion is correspondingly high.

With the diaper 1 constructed as described above, a

- 12 -

certain amount of body fluids are absorbed and held by the first polymer particles 13A as soon as the amount of body fluids arrive at the lower 1/2 zone of the core thickness.

If the arrangement is adapted, in which the first polymer particles 13A are concentrated over the bottom of the absorbent material 5 constituting the core 4, the first polymer particles 13A aggregate together as they absorb the certain amount of body fluids and, in consequence, they form the layer-like gel block(s) spreading over the bottom. An additional amount of body fluids having transferred down and arrived later at the gel block(s) is prevented by it from further transferring down. Therefore, this additional amount of body fluids stays above the gel block(s) for a relatively long period. The amount of body fluids thus staying for a long period can be maintained in contact with the second polymer particles 13B presenting the relatively low

- 13 -

absorption rate for a sufficiently long period to be absorbed by the polymer particles 13B. Accordingly, even when the total content of the polymer particles 13 is as high as 35 ~ 75 % by weight, it is possible to achieve rapid absorption of body fluids as well as absorption of a large amount of water by efficiently utilizing the total content of the discrete particles superabsorptive polymer 13. The disposable diaper 1 adopting such core 4 can effectively alleviate leakage of body fluids.

Embodiment and controls

1. Polymer particles of first and second types having characteristics indicated in Table 1 were used to make a disposable diaper.

[Table 1]

- 14 -

	Absorption in 10 sec $(W_1 - W_2) / P_0$	Absorption in 10 min $(W_2 - W_0) / P_0$	Initial absorption rate V $\{ (W_1 - W_2) / (W_2 - W_0) \} \times 100$
1 st polymer particles	41.6	61.4	67.7
2 nd polymer particles	7.7	65.9	11.6

wherein P_0 : Weight of polymer particles before immersion

W_0 : Weight of a bag before immersion

W_1 : Weight of a bag in 10 sec. of immersion

W_2 : Weight of a bag in 10 min. of immersion

2. Absorbent material contained in the core was composed as indicated in Table 2.

- 15 -

[Table 2]

	Embodiment	Control 1	Control 2
Fluff pulp (g/m ²)	150	150	150
Split yarns (g/m ²)	23	23	23
1 st polymer particles (g/m ²)	-	50	50
2 nd polymer particles (g/m ²)	250	200	200
Distribution of 1 st Polymer particles	-	uniform	concentrated in lower 1/2 zone
Distribution of 2 nd Polymer particles		uniform	
Core thickness (mm)	2.5		
Core size (mm)	100 x 400		

- 16 -

3. Result of test

The respective cores were used to make the diapers as shown by Fig. 1 and 80 ml of artificial urine was poured twice onto each diaper at the interval of 10 minutes to measure times taken for absorption of artificial urine. Result of measurement is shown in Table 3.

[Table 3]

	Embodiment	Control 1	Control 2
Absorption rate (sec) for 1 st pouring	16	24	18
Absorption rate (sec) for 2 nd pouring	15	20	29

As will be apparent from Table 3, the embodiment of the

- 17 -

invention efficiently utilizes the polymer particles so that a high absorption rate can be maintained even when absorption of body fluids is repeated.

The disposable body fluids absorbent article according to the invention is characterized by the unique arrangement of the liquid-absorbent core, more particularly by composition of the discrete particles of superabsorptive polymer contained therein. Specifically, the polymer particles consisting of the polymer particles of first and second types presenting their initial absorption rates different from each other. The polymer particles of first type presenting a relatively high absorption rate is distributed in a lower 1/2 zone, preferably concentrated on a bottom of the core thickness. Most of the polymer particles of second type presenting a relatively low absorption rate is distributed in an upper 1/2 zone and mixed with the polymer

- 18 -

particles of first type in said lower 1/2 zone. With a consequence, the polymer particles of both types can not readily form gel block except the bottom of the core. The core of such arrangement can achieve a high absorption rate as well as a large amount of absorption and the body fluids absorbent article adopting such core can effectively alleviate apprehensive leakage of body fluids.

- 19 -

WHAT IS CLAIMED IS:

1. In a body fluids absorbent article including a liquid-pervious topsheet (2), a liquid-impervious backsheet (3) and a liquid-absorbent core (4) having a body-facing side (4a) and a garment-facing side (4b) and disposed therebetween and said core (4) including fluff pulp (11) and discrete particles of superabsorptive polymer (13) having different initial water absorption rates characterized in that:

said core (4) includes 100 ~ 200 g/m² of fluff pulp (11), 20 ~ 45 g/m² of thermoplastic synthetic fibers (12) and 120 ~ 400 g/m² of discrete particles of superabsorptive polymer (13);

said fluff pulp (11) and said synthetic fibers (12) are present in a intermixed state so that contents of said fluff pulp (11) and said synthetic fibers (12) in said core (4)

- 20 -

gradually decrease from said body-facing side (4a) towards said garment-facing side (4b) in a thickness direction of the core (4);

said polymer particles (13A, 13B) consist essentially of 20 ~ 100 g/m² of first polymer particles (13A) presenting an initial water absorption rate $V = 40$ or higher and 100 ~ 300 g/m² of second polymer particles (13B) presenting an initial water absorption rate $V = 5 \sim 20$ wherein these initial water absorption rates are measured according to a measuring method as described in the following (a), (b) and (c); and

a total amount of said first polymer particles (13A) is distributed in a lower zone adjacent said garment-facing side (4b) of said core (4) while 100 ~ 200 g/m² of said second polymer particles (13b) is in an upper zone adjacent said body-facing side (4a) of said core (4) and 0 ~ 100 g/m² of said second polymer particles (13B) is distributed in said

lower zone.

(a) About 1 g of each polymer particles (13A, 13B) sample is put in a 250 mesh nylon cloth bag of 10 mm X 200 mm and weighed. Thus a weight W_0 is obtained. After sealing, this bag is immersed in an amount of 0.9 % physiological saline solution poured into a 1 litre beaker;

(b) Bags taken out from the beaker in 10 seconds and 10 minutes of immersion, respectively, are suspended in midair for 10 minutes to drain. Thereafter these bags together with their contents are weighed and their weights W_1 , W_2 are obtained; and

(c) The initial water absorption rate V is calculated on the basis of an equation

$$V = \{(W_1 - W_0) / (W_2 - W_0)\} \times 100.$$

2. The article according to Claim 1, wherein said first

polymer particles (13A) in concentration on a bottom of said core (4) and in vicinity thereof so that said first polymer particles (13A) may swell and aggregate after water absorption to form a gel block spreading over said bottom of said core (4).

3. The article according to Claim 1, wherein said core (4) has a thickness of 0.7 ~ 7 mm.

4. The article according to Claim 1, wherein individual fibers of said thermoplastic synthetic fibers (12) are fused not only among themselves but also with said fluff pulp (11) and said discrete particles (13A, 13B) of superabsorptive polymer (13) to maintain shape of said core (4).