



G00002

- 1 -



166166

VARIABLE DENSITY TOPSHEET FOR DISPOSABLE ABSORBENT
ARTICLE

This invention relates to a disposable body fluids absorbent article such as a sanitary napkin or a disposable diaper and more particularly to such an article including a liquid-pervious topsheet formed with a plurality of pleats.

Japanese Patent Application Disclosure Gazette (Kokai) No. Hei7-328061 discloses a sanitary napkin in which a liquid-pervious topsheet made of a nonwoven fabric formed with a plurality of high density zones and low density zones alternately arranged in a stripe-pattern. The high density zones have their upper surface covered with plastic film. The low density zones are protuberant relatively to the upper surface of the high density zones.

The topsheet of the napkin allows menstrual fluid to spread rapidly toward longitudinally opposite ends of the napkin along the high density zones extending in the stripe-pattern after menstrual fluid has transferred from the low density zones to the high density zones. Accordingly, the napkin allows an absorption capacity of a body fluids absorbent core to be efficiently utilized not only in a

- 2 -

central region of the napkin on which menstrual fluid is discharged but also in the longitudinally opposite ends of the napkin.

With the known napkin, the presence of the high density zones enables the absorption capacity of the napkin to be efficiently utilized also in the longitudinally opposite ends thereof. However, the high density zones covered with the plastic film cannot directly absorb menstrual fluid and, as a result, a rate of menstrual fluid absorption cannot be improved as much as expected from a large surface area of the topsheet.

It is an object of the present invention to utilize an absorption capacity of a disposable body fluids absorbent article such as a sanitary napkin as efficiently as possible without deteriorating a rate of body fluids absorption.

According to the present invention, there is provided a disposable body fluids absorbent article including a body fluids absorbent core having a surface thereof at least partially covered with a liquid-pervious sheet of nonwoven fabric, the nonwoven fabric being partially formed with a plurality of alternately arranged high density zones and low

- 3 -

density zones extending substantially in one direction. The topsheet is formed by thermoplastic synthetic fibers having a basis weight of $20 \sim 80 \text{ g/m}^2$ and formed with a plurality of pleats extending in the one direction, the pleats repeating undulation transversely of the one direction, the high density zones being defined by crests and troughs of the pleats and the low density zones being defined between the crests and troughs, and the troughs being in contact with a surface of the absorbent core.

According to one embodiment of the present invention, a depth from the crest to the trough of the pleat is $1 \sim 10 \text{ mm}$ and a distance between each pair of adjacent crests is $1 \sim 15 \text{ mm}$.

According to another embodiment of the present invention, a density of the high density zone is $0.08 \sim 0.25 \text{ g/cm}^3$.

According to still another embodiment of the present invention, a width of the high density zone is $0.5 \sim 3 \text{ mm}$.

According to further another embodiment of the present invention, the high density zones continuously extend in the one direction.

According to an additional embodiment of the present

- 4 -

invention, the high density zones intermittently extend in the one direction.

Fig.1 is a perspective view showing a sanitary napkin according to a specific embodiment of the present invention as partially broken away;

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

Fig. 3 is a plan view a sanitary napkin according to one preferred embodiment of the present invention;

Fig. 4 is a view similar to Fig. 3, showing a sanitary napkin according to still another preferred embodiment of the present invention; and

Fig. 5 is a view similar to Fig. 3, showing a sanitary napkin according to further another preferred embodiment of the present invention.

Details of a disposable 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.

A napkin 1 shown by Fig. 1 in a perspective view as partially broken away is larger in its longitudinal direction

- 5 -

and includes a liquid-pervious topsheet 2, a liquid-impervious backsheet 3 and a liquid-absorbent core 4 having its upper and lower surfaces 6A, 6B covered with these two sheets 2, 3, respectively. The topsheet 2 and the backsheet 3 are placed upon and bonded to each other along their portions extending outward beyond a peripheral edge of the core 4.

The topsheet 2 is formed by a nonwoven fabric made of thermoplastic synthetic fibers and provided with a plurality of pleats 5 arranged symmetrically with respect to a center line C-C dividing a width of the napkin 1 in two. The pleats 5 extend substantially in the longitudinal direction of the napkin 1. More exactly, of crests 7 of these pleats 5, a crest 7A extending just above the center line C-C is rectilinear and crests 7B, 7C, ... and crests 7b, 7c, ... extending symmetrically with respect to the center line C-C are gently curved. These curved crests 7B, 7C, ... and 7b, 7c, ... are formed so that they progressively become shorter as they go far off from the center line C-C.

Fig. 2 is a fragmentary sectional view taken along a line II-II in Fig. 1. The pleats 5 of the topsheet 2 have, in addition to the crests 7 (7A, 7B, 7C, ..., 7b, 7c, ...),

-6-

troughs 8 (8A, 8B, ..., 8b, 8c, ...) and side walls 9 (9A, 9B, ..., 9a, 9b, ...) extending between the crests 7 and the troughs 8, respectively. The nonwoven fabric forming the topsheet 2 have been firmly compressed at the crests 7 and troughs 8 under heating or not under heating. Consequently, the nonwoven fabric is relatively thin and has a relatively low density at these crests 7 and troughs 8. The side walls 9 have been substantially not compressed or slightly compressed. Therefore, the nonwoven fabric is relatively thick and has a relatively low density at these side walls 9. A distance between each pair of adjacent crests 7 in the pleats 7 is herein represented by P and a depth from the crests 7 to the troughs 8 is herein represented by D.

The nonwoven fabric as stock material for the topsheet 2 may be selected from a group consisting of, in addition to a spun bond nonwoven fabric or a melt bond nonwoven fabric or the like made of suitable synthetic fibers such as of polyethylene, polypropylene, nylon or polyester. However, a nonwoven fabric made of conjugated fibers, particularly of crimped conjugated fibers is more preferable as the stock material for the topsheet 2. Preferably, such nonwoven fabric has a fineness of 1 ~ 6 deniers, a basis weight of 20 ~ 80

- 7 -

g/m² and a density of 0.025 ~ 0.05 g/cm³. The pleats 5 formed by the nonwoven fabric is defined by the distance P between each pair of adjacent crests 7 preferably of 1 ~ 15 mm, more preferably of 2 ~ 10 mm and the depth D from the crests 7 to the troughs 8 preferably of 1 ~ 10 mm, more preferably of 1 ~ 6 mm. The density at the crests 7 as well as at the troughs 8 is preferably as high as 0.08 ~ 0.25 g/cm³ particularly along a width of 0.5 ~ 3 mm.

The core having its upper surface 6A covered with the topsheet 2 comprises fluff pulp or a mixture of fluff pulp and superabsorptive polymer particles. The core 4 is in contact with the pleats 5 defined by the crests 7, the troughs 8 and the side walls 9 at least the troughs 8, preferably in contact also with the inner surfaces of the respective side walls 9 as shown, more preferably in contact also with the inner surfaces of the respective crests 7. Along a peripheral region of the napkin 1 surrounding the pleats 5, the core 4 is in contact also with the inner surface of the topsheet 2. The core 4 and the topsheet 2 may be locally bonded to each other by means of suitable adhesive agent such as hot melt adhesive or heat-sealing technique in order to ensure that the core 4 is kept in contact with the topsheet 2.

- 8 -

The backsheet 3 covering the lower surface 6B of the core 4 is formed by a plastic film and bonded to the topsheet 2 along its peripheral edge by means of suitable adhesive agent or sealing technique. The backsheet 3 is applied on its lower surface with suitable adhesive agent 16 by which the napkin 1 is separably fastened to the shorts worn by a napkin wearer and the adhesive agent 16 is covered with a release paper sheet 17.

With the napkin 1 put on the wearer's body, a portion of menstrual fluid discharged on a central zone of the napkin 1 is absorbed by the crests 7 of higher density, then spreaded along the crests 7 toward longitudinally opposite ends of the napkin 1 and from there absorbed into the core 4. The remainder of menstrual fluid flowing down along the side walls 9 toward the troughs 8 of the pleats 5 is rapidly absorbed by the troughs 8 of higher density and then immediately transferred to the core 4, or spreaded along the troughs 8 toward the opposite ends of the napkin 1 before absorbed into the core 4. Menstrual fluid can relatively freely flow along the troughs 8 of the pleats 5 toward the longitudinally opposite ends of the napkin 1. In this manner, the napkin 1 allows menstrual fluid to flow rapidly from its central zone toward

- 9 -

the longitudinally opposite ends and thereby allows an absorption capacity of the longitudinally larger core 4 to be utilized as efficiently as possible. On the other hand, a transverse flow of menstrual fluid is obstructed by the side walls 9 of the pleats 5 and therefore it is not apprehended that a portion of menstrual fluid might leak sideways. For the napkin generally configured to be larger in its longitudinal direction, it is the important feature of the napkin 1 according to the present invention, from the viewpoint of preventing menstrual fluid from leaking sideways, that the napkin 1 can facilitate menstrual fluid to transfer in the longitudinal direction but restrain menstrual fluid from transferring in the transverse direction.

Figs. 3, 4 and 5 are plan views showing preferred embodiments of the napkin 1 according to the present invention. In the case of the napkin 1 shown in Fig. 3, symmetrically with respect to the center line C-C the topsheet 2 is formed with a plurality of pleats 5 having the crests 7B, 7C, ..., 7b, 7c, ... and the troughs 8B, 8C, ..., 8b, 8c, ... extending in parallel to the troughs substantially in the longitudinal direction of the napkin 1. More exactly, these pleats 5 are gently curved toward the center line C-C and progressively

- 10 -

become longer as they go far off from the center line C-C. In the case of the napkin 1 shown in Fig. 4, the crests 7B, 7C, ..., 7b, 7c, ... and the troughs 8B, 8C, ..., 8b, 8c, ... defining the respective pleats 5 extend in parallel one to another as well as to said center line C-C and longitudinal dimensions of the respective crests are uniform. The napkin 1 shown in Fig. 5 is similar to the napkin 1 shown in Fig. 4 except that the crests 7B, 7C, ..., 7b, 7c, ... and the troughs 8B, 8C, ... 8b, 8c, ... continuously extending between the longitudinal opposite ends of the napkin 1 shown in Fig. 4 are respectively divided into short sections in the case of the napkin 1 shown in Fig. 5. For example, the crest 7B extending in parallel to the center line C-C comprises a plurality of relatively short crests 31, 32, 33, ... intermittently arranged in the longitudinal direction. Each of these short crests 31, 32, 33, ... preferably has a length of 1 ~ 10 mm and a distance between each pair of adjacent crests 31, 32, 33, ... is preferably 0.3 ~ 1 mm. By dividing the crests as well as the troughs in this manner, the napkin 1 can be flexibly curved along a crotch region of the shorts worn by the napkin wearer. The distance between each pair of adjacent crests of each pleat 5 is sufficiently small to

- 11 -

ensure that menstrual fluid can rapidly spread in the longitudinal direction.

To realize the present invention, the topsheet 2 may be formed by a hydrophilic nonwoven fabric or a hydrophobic nonwoven fabric. When a hydrophobic nonwoven fabric is used, the crests 7 and the troughs 8 may be locally treated to become hydrophilic. The topsheet 2 as has been described above in the connection with the sanitary napkin 1 as a specific embodiment of the present invention can be used also as the topsheet for the other various disposable body fluids absorbent articles such as disposable diaper and shorts for incontinent patient.

The disposable body fluids absorbent article according to the present invention allows body fluids to spread along the pleats formed on the topsheet, particularly along the crests and the troughs thereof both having relatively high densities to the longitudinally opposite ends of the napkin. Accordingly, the absorption capacity of the core can be utilized as efficiently as possible so that much amount of body fluids may be absorbed and undesirable leakage of body fluids may be effectively avoided. The pleats function to prevent body fluids from flowing transversely thereof and

- 12 -

improves an effect of preventing body fluids from leaking sideways. The troughs having a relatively high density promote body fluids to transfer from the crests toward the troughs. Furthermore, the pleats characterizing the article according to the present invention provide a surface area of the garment serving to absorb body fluids larger than such surface area provided by the flat topsheet and thereby improve a rate of body fluids absorption. The pleats not only contribute to improvement in body fluids absorbing ability of the napkin but also make the topsheet cushiony and provide the article according to the present invention with a soft touch.

- 13 -

WHAT IS CLAIMED IS:

1. A disposable body fluids absorbent article (1) including a body fluids absorbent core (4) having a surface (6A) thereof at least partially covered with a liquid-pervious sheet (2) of nonwoven fabric, said nonwoven fabric being partially formed with a plurality of alternately arranged high density zones and low density zones extending substantially in one direction, wherein:

said nonwoven fabric is formed by thermoplastic synthetic fibers having a basis weight of $20 \sim 80 \text{ g/m}^2$ and formed with a plurality of pleats (5) extending in said one direction, said pleats (5) repeating undulation transversely of said one direction, said high density zones being defined by crests (7) and troughs (8) of said pleats (5) and said low density zones defined between said crests (7) and troughs (8), and said troughs (8) being in contact with the surface (6A) of said core (4).

2. The article (1) according to Claim 1, wherein a depth from said crest (7) to said trough (8) of the pleat (5) is $1 \sim 10 \text{ mm}$ and a distance between each pair of adjacent crests

- 14 -

(7) is 1 ~ 15 mm.

3. The article (1) according to Claim 1, wherein a density of said high density zone is $0.08 \sim 0.25 \text{ g/cm}^3$.

4. The article (1) according to Claim 1, wherein a width of said high density zone is 0.5 ~ 3 mm.

5. The article (1) according to Claim 1, wherein said high density zones continuously extend in said one direction.

6. The article (1) according to Claim 1, wherein said high density zones intermittently extend in said one direction.