The present invention relates to cellulose fibrous diapers and diaper pads, sanitary napkins and like products that may be safely and reliably disposed of simply by flushing in an ordinary water closet.

The disposable products of the present invention are characterized by having the necessary dry strength, high water absorbency and other physical properties when in use, and yet will disintegrate when agitated in a container of water, such as a water closet, and may be easily flushed away without danger of clogging the drain.

Prior paper products of the above type have been made from wood pulp, cotton, or similar natural cellulose materials. Those products may be thrown away after use but are not reliably and safely "flushable" in the ordinary water closet without clogging the fixture. A functionally satisfactory and truly flushable diaper pad, sanitary napkin, and like products have been produced by the present invention, for the first time, through use of a special type of rayon, regenerated cellulose, fiber. This fiber is prepared by a process that imparts new and unique properties not heretofore possessed by the conventional cellulose or regenerated cellulose fibers. In this process, the cellulose spinning solution is aerated before extrusion through the spinnerettes, and this imparts a multicellular structure to the spun fibers and produces them in ribbon like form having large smooth flat surfaces.

Conventional regenerated cellulose fibers do not have the above mentioned ribbon shape and multi-cellular form, and a sheeted product consisting solely of conventional rayon fibers without binder, would not have sufficient dry strength to make the sheet practically usable. The above mentioned specially prepared regenerated cellulose fibers have made possible for the first time a sheeted product having relatively good dry strength, good "wet hang" and dispersibility properties. The flat shape, extremely wide width dimension, and hydrophilic nature of these special fibers provide strong interbonding between the fibers. Those fibers have a width to thickness ratio of about 10 to 1 to 40 to 1, and their wide, smooth, flat surfaces afford large surface area contact between fibers when formed in a sheet.

A fiber that has been used successfully in the present invention, is "Fiber RD-100," manufactured by American Viscose Corp., Marcus Hook, Pa. This fiber is an aerated regenerated cellulose rayon fiber of multi-cellular configuration. The cells have very thin walls, in the range of 1 to 3 microns in one embodiment, and are generally collapsed, providing substantially flat fibers. In one actual embodiment the fibers were 1.5 denier and 1/2" long. These fibers were roughly 0.012 mm. thick and 0.120 mm. wide.

It is to be understood that the present invention is not intended to be limited to the above specific dimensions as suitable results could be obtained with fibers of other dimensions. It is also to be understood that the present invention is not intended to be limited to the above described "RD-100" fiber. Other ribbon like fibers that provide strong interfiber bonding when dry and will retain such interbonding upon absorption of water by the fiber mass up to about 40 times its weight will lose their interbonding and disperse easily upon immersion and agitation in large excesses of water, may be used. Such fibers might be produced for example by ball milling of regenerated cellulose fibers to provide a relatively wide flat surface on these fibers.

The unique and novel flushable diaper or similar product of the present invention is produced from these specially prepared regenerated cellulose fibers in a manner to provide the required combination of high dry strength, high wet "hang" when soaked with water, and dispersibility when agitated in a large excess of water. The flushable diaper or the like of the present invention is produced from these specially prepared regenerated cellulose fibers that have strong interbonding properties when formed into a sheet. The fibers are readily disassociated when the fibrous product is immersed in water, and agitated e.g. when dropped in a water closet; and the product thus becomes readily flushable.

Other features and advantages of the present invention will be apparent from the following description taken in conjunction with the accompanying drawings in which:

FIG. 1 is a perspective view of a flushable diaper pad of the present invention;
FIG. 2 is a perspective view of a diaper holder in which a diaper pad of the type illustrated in FIG. 1, is used;
FIG. 3 is a magnified plan view of a number of the specially prepared regenerated cellulose fibers of the type used to make the diaper pad of FIG. 1; and
FIG. 4 is an enlarged vertical sectional view taken along line 4--4 of FIG. 3.

The embodiment of the present invention illustrated in FIG. 1 of the drawings is in the form of a fibrous mat 10, cut to a rectangular shape for use as a diaper pad in a diaper holder 12 of the type illustrated in FIG. 2, the pad being held in the pocket 14. The diaper holder 12 may be held around the body of the baby, by the snap fasteners 16.

The diaper pad 10 is produced from a wet non woven mass of the special regenerated cellulose fibers, which have strong interbonding characteristics, that provide strength when the diaper is dry or wet. The interbonding holds the fibers together when the pad is dry and even when it is soaked with water or thoroughly wet by a baby. When the pad is immersed in a water closet and agitated, the liquid breaks the bond so that the fibers easily disperse and render the pad flushable.

FIGS. 3 and 4 illustrate a number of the above described special fibers 20 and 20', which have extensive contact area between the smooth surface 22 of one fiber 20 and the smooth surface 22' of an adjacent fiber 20'. A sheet made from these fibers is found to absorb as much as six times its weight of water while still retaining its desirable "wet hang" characteristic and yet is readily flushable when immersed in a water closet.

To produce the type of diaper pad illustrated in FIGS. 1 and 2, the fibers are processed into sheet form using a wet paper process, on a Fourdriner or modified Fourdriner machine such as disclosed in G. L. Bedwell Patent No. 2,488,700, issued November 22, 1949. The sheet formed by this process upon drying is normally hard and substantially infusible, having a typical density of 0.4 gram per cubic centimeter. The thickness of the sheet may be for example, 0.04 inch. To prepare this boardy sheet for use as a diaper pad it is treated to give it softness and flexibility. This can be accomplished by passing the sheet through a creping machine such as a Bird Walton Creping Machine of the type disclosed in R. R. Walton Patent No. 2,915,109, issued December 1, 1959.

A similar flexible fluffed condition may be obtained initially by processing the fibers into sheet form in a dry forming process such as, for example, the Rando-Web process, using a Rando-Web machine manufactured by the Curlator Rubber Machine of East Rochester, New York. Following formation of the sheet in this dry
forming process, it should be moistened sufficiently to cause interbonding of the ribbon like fibers, and then dried. The softness and flexibility properties of this product may be improved, if desired, by subjecting the dry formed sheet to creping or a suitable similar process.

Also, the fibers, before or after forming of the sheet, may be treated with various chemicals as desired to increase interbonding, improve wetting, or to impart desired surface characteristics to the product.

Whether formed by the above mentioned wet or dry processes, the characteristics of the product may be varied by blending the special regenerated cellulose fibers with other different fibers to provide flexibility or other characteristics, or simply to reduce the cost of the product. Excellent results have been obtained by mixing the above mentioned "Fiber RD–101" with cotton linters of relatively short fiber length, e.g. 1.5 mm. A blend that has been found of practical value consists of a mixture of equal amounts of "Fiber RD–101" and the short cotton linters. This blend has excellent absorptive, cohesive and flushability characteristics and is significantly less expensive than "RD–101" by itself.

A sanitary napkin made in accordance with this invention, may consist solely of the special regenerated cellulose fibers described above or mixtures with other fibers. It may be made in conventional shapes and sizes and may be used in conjunction with protective devices and garments in the regular way, and disposed of by flushing in a water closet.

The above described end products are illustrative of certain important practical adaptations of the present invention but are not intended to limit the scope of the invention to these particular products. Other end products which require sufficiently high dry strength for handling and wear for a short time, and also require high water absorbency and easy disposability when agitated in a large excess of water, such as in a water closet, are contemplated by the present invention and are intended to be covered in the appended claim.

We claim:

A disposable pad, as described herein, adapted to be placed in position on the wearer for use in the conventional manner to absorb body fluids of the wearer and adapted to be disposable by flushing in an ordinary water closet, said pad comprising a shaped mass of interbonded, hydrophilic, flat, ribbon-like, aerated, regenerated cellulose fibers of the generally collapsed multi-cellular form having relatively large flat contacting surfaces overlying and contacting each other throughout said mass, said fibers providing strong bonds therebetween at the places where they contact each other to give said pad a relatively high dry strength sufficient to permit handling of the pad without destroying said bonds between said fibers and to give said pad a high wet hang sufficient to permit said pad to absorb the body fluids of the wearer without destroying said bonds between said fibers, said bonds between said fibers being adapted to weaken when immersed in a large excess of water to permit said fibers to easily disperse upon agitation and thereby allow said pad to be flushable in an ordinary water closet.

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