THE FIBERIZATION PROCESS IN MEANTIME PRODUCTION

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Abstract

Today, more then 17 million American's suffer from incontinence. The market is in two major segments, the institutional market place valued at $1.2 billion and the retail market valued at $600 million in 1997. The market place is made up of 4 major categories in terms of products, Briefs 38%, Undergarments 27%, Underpads 18% and Liners 17%. The average nursing home resident is White (89.5%), Female (75%), greater than 75 years old (75%), needs a hospital bed (78%), 65% need wheelchairs and 50% are incontinent. The number of American's 65 and older will double in the next 30 years which will potentially make this market larger than the baby diaper market by the year 2010.

Most of the products today are manufactured using rolled pulp and super absorbent polymers as the absorbing platforms. This presentation will describe the general process used in making the absorbing cores (platforms) and what things effect product performance now and it will take a short look at the future trends. Treated cotton offers some unique properties that may fit in with the future needs and designs.

The processes described here are very similar to those used in the baby diaper production process but the core structure in baby diapers is nearly 60% super absorbent polymers (SAP) and only 40% pulp versus adult briefs 90% pulp and 10% SAP. Adult briefs use between 60 and 90 grams of pulp per product while baby diapers use between 10 and 25 grams of pulp. Both products use primarily rolled pulp and SAP particles about the size of sugar particles. They are combined together in a forming chamber and formed on vacuum table or drum. They can be formed as discrete pads or continuous mats that are cut into individual pads. This paper will talk in detail on the core formation process and what characteristics are most important.

The Fiberization Process in Meantime Production

Today, more then17 million American's suffer with incontinence. The market to service these needs is divided into two major segments, the institutional market place valued at in excess of $1.2 billion and the retail market valued at in excess of $600 million in 1997. The market in these segments is made up of 4 major product categories, Briefs or adult diapers which is 38% of the market, Undergarments at 27%, Underpads at 18% and Liners at 17% of the market. These products serve the heavy, moderate, moderate light and light incontinent user needs.

Where are these users cared for? They are cared for in Acute Care or hospitals, long term care (nursing homes) and the at home provider which can include family and/or assisted living care. The majority is in nursing homes. The average nursing home resident is White (89.5%), Female (75%), greater than 75 years old (75%), 78% need a hospital bed, 65% need wheelchairs and 50% are incontinent. The number of American's 65 and older will double in the next 30 years. Since this market is somewhat age dependent, this potentially makes this consumer need larger than the baby diaper market by the year 2010 and it is growing at a faster rate.

Most of the products today are manufactured using rolled pulp and super absorbent polymers as the absorbing platforms. There are some airlaid and or composite cores but mostly in the light market segment. This presentation will describe the general process used in making the absorbing cores (platforms) in the heavy and moderate care protection products and what things effect product performance now and it will briefly address some potential future trends. Treated cotton potentially offers some unique properties that appear to fit in with the future needs and designs.

The processes described here are very similar to those used in the baby diaper production process. The core structure in adult incontinent products is typically 15% super absorbent polymers (SAP) and 85% wood fibers. The core structure in baby diapers is nearly 60% super absorbent polymers (SAP) and only 40% pulp or wood fibers. Adult briefs use between 60 and 90 grams of wood fibers per product while baby diapers use between 10 and 25 grams of wood fibers. Because of the higher content of wood fibers in adult products and the higher level of knots in cotton fibers, cotton appears to be a better direct substitute in adult products. SAP particles about the size of sugar particles and can vary greatly in performance characteristics. Different types are used by manufactures depending the core structure and fluid movement scheme developed by the product designer. In nearly every case they are combined together in a forming chamber and formed on vacuum table or rotating drum.

When formed on a vacuum table, the wood fiber structure, generally appears to be uniform in shape throughout the length of the product. The wood fiber core shape depends upon the design parameters that are being met. Two general shapes are in the market today, a “trim line” which is primarily rectangle in appearance and an “hour glass” that has wings or ears on each end. Either shape can produce an effective product and has advantages depending the end design requirements. To get the core shapes on vacuum table formed product, a water cutter or die cutter is used and the

Reprinted from the *Proceedings of the Beltwide Cotton Conference*
Volume 1:763-764 (2000)
National Cotton Council, Memphis TN

excess wood pulp / SAP is generally recycled back into the hammermill during this "trimming" process. Vacuum formed products can also have a z direction profile or can be flat in shape. Most cores have a two or three to one profile ratio to provide more wood fibers and SAP in the product target zone. This helps in getting both fluid movement and "trapping or locking" the fluid into the core structure. After the forming process and sometimes before the trimming process, the core is run through a calendering or debulking roll and/or embossing roll. The process of this is to set a density into the core. Higher density helps lock in fluid (rewet testing) and a lower density helps fluid acquisition into the core. Wood fibers can effectively retain 4 to 6 grams of fluid where SAP can effectively retain between 10 and 30 grams of fluid. Getting the right SAP, the right density, the right core profile and the right distribution of SAP particles determines the effectiveness of the fluid movement properties a core has. Fluid acquisition rate is influenced by the type of acquisition layer employed. Two companies today employee the use of "curly" fibers, Proctor & Gamble in Pampers and Paper Pak in Attends. Other companies use nonwovens ranging in weight from 15 gsm to 60 gsm. Notable users of nonwovens are Kimberly Clark, Paragon Trade Brands, First Quality, and Paper Pak. Either method can be used effectively but have patent limitations. The purpose of the acquisition layer is to assist getting the fluid off the topsheet and into the product core.

Drum formed cores have several advantages over vacuum formed products. First the shape of the core is designed into the pocket and thus does not require a "trimming" section to remove unneeded fiber/SAP blend. Second the profile can be varied throughout the shape of the core providing varying core densities. Varying core densities help in fluid movement and locking fluid into the core. Drum formers can have either continuous fiber/SAP cores like vacuum table formed cores or they can be formed in discrete individual cores. If discrete individual pockets/cores are formed, no initial knife is needed to separate the cores into separate pieces before they are combined with the rest of the product. Almost all forming sections made in the last ten years are all the drum form variety.

The SAP placement can and does very greatly. SAP placement is varied in several methods. The SAP can be setup to provide uniform distribution through the entire fiber – SAP core in both the length and width and the depth within the core. This is often referred to as a homogenous core design. Homogenous designs generally have the highest core capacities because there is good separation between SAP particles. This permits holding the greatest amount of fluid around the SAP particle. This SAP distribution scheme generally producers high rewet values because the fluid is not moved away from the core surface as effectively. Earlier core designs were primarily constructed in this manner. SAP can be targeted to apply all of the SAP particles in only a portion of the core x and y dimensions. They can be done in both in discrete pads or continuous mats designs. Depending upon the type of SAP used and the depth or z direction placement of the SAP, the designer can attempt to get better surface dryness or fluid acquisition. The placement of the SAP and the density of the core are the determining factors in achieving the core performance. A third concept has been used by Pope & Talbot in baby diapers which was a combination core using both a homogenous mix or SAP blend and a targeted application in the performance zone. In their design, two different types of SAP's were used to maximize core performance and reduce cost. A low cost, quick absorbing SAP was used in the homogenous blend and a slower, higher absorbency underload SAP was used in the target - performance zone. This design provided excellent core performance and used the entire core to absorb fluid at a very low overall cost. This concept also appears to be a good fit for smaller, cotton treated fibers that can be used within a core.

Today nearly all manufactures use a hammermill system to convert wood fibers from a rolled form into a "cotton-like" mat. Some older designs used fiberizers which requires the use of a treated pulp. Hammermills have two general designs. Fixed hammers that rotate around a pivot point and always strike the fiber at the same angle. The shape of these can be in fixed rows or in a "V" or chevron shape. They could also be in a wave or multiple chevron shape. These are generally only used in underpads which are very wide require a very uniform shape and do not have a target or special target zone. Another style is "swinging" hammers. These are offered as an advantage because they are generally mounted on a bar via a hole. By "flipping" the hammer and changing it from end to end, you can get four times the life from a single set of hammers.

Another key factor in the hammermill is the "breaker bar" or anvil gap. The length of this gap determines how much fiber is pushed into the mill before the hammer hits it and defiberizes it. Too much or little depending on the rotor speed can too many knots or turn the fibers into dust or fines. The objective of the hammermill is to convert as many fibers into individual strands of the proper length for the product design without creating too many knots or fines. Good setups will result in 95 to 98% good fibers and less then 2% knots or fines. The screen at the bottom of the hammermill is also a key factor in product design. The bigger the screen opening, the longer the individual fiber length. Longer fibers help move fluid within the core structure. Studies indicate that acceptable fiber lengths can be achieved with cotton fibers converted into a rolled form and inserted into a conventional hammermill.

I have attempted to explain the potential opportunity in the adult incontinent market that treated cotton fibers can be used within the current converting equipment designs and the types of core structures being used by various manufactures. There are two additional concepts the cotton industry should consider.

First the use of baled cotton versus rolled cotton fibers. Most manufactures have reclaim systems for recovering fiber/SAP blends. Inserting cotton fibers in this method may reduce the energy required to get the fiber into the system It may also provide a method of inserting cotton fibers without having to subject them directly to the hammers and anvil system. This in turn gives the cotton fiber supplier the control over the percent of good fibers available and the excessive knots currently generated when going through a conventional hammermill setup.

Within the next ten years, the adult incontinent market will most likely change from thick product forms to much thinner product designs. Designing fibers and fibers systems that result in thin cotton cores may provide the best method of converting a very large segment of the industry to your fiber. All manufactures are going to have to change their base designs and equipment, the cotton industry could be the leader and winner in this change if thoughts, energy, and dollars are spent today in research.

Thank you and I hope I have given you some insights on how you will have to compete to get this market place as one of yours.