

Recouping The Costs Of Disposable Diaper Improvements

manufacturers all know that diaper innovations cost money and affect productivity; savings in construction adhesives, polyethylene backsheet, superabsorbent polymers, diaper elastics and elastic adhesives can potentially reach \$657,000 a year

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It all began innocently enough . . . a simple blue piece of polyethylene in the waist area of the diaper. But this proved to be only the first of many such technical volleys that have strained the engineering and investment resources of private label diaper manufacturers around the world.

The blue barrier was followed by elastic waists, the incorporation of superabsorbents, sophisticated leg elastic systems, frontal tapes, breathable films and, lately, the gender specific diaper. During this ruthless battle for valuable market share in the disposable diaper market, plant managers have despaired as product costs have risen, line productivity has dropped and funds available for capital investment have been exhausted. Features were often added to diapers to maintain market share at seemingly any cost, as many manufacturers found themselves with excess capacity and shrinking gross margins on their products.

In the midst of these assaults on profitability, several new product features and technologies have been developed that have increased the quality of the diaper and simultaneously reduced the cost per product by 6-8%. The following is a look at each of these savings individually, and also the disposable diaper as a system and how these programs are often interrelated.

To define the savings of feature changes within a diaper, many assumptions are required. Below are the assumptions on which these cost savings are based.

*Annual Diaper Production Per Line	90,000,000 diapers/year
*High Density Polyethylene 1.25 mil (31 micron)	\$.0098/product
*Hot Melt Adhesive For Elastic Attachment	\$1.40/pound

*Hot Melt Adhesive For Diaper Construction	\$1.25/pound
*Superabsorbent Powders	\$1.20/pound

Using these assumptions, we can now begin to evaluate the latest in material-saving technologies.

Diaper Construction Hot Melt Adhesives

In the "typical" American disposable baby diaper, specifications call for .8-1.2 grams of multi-line construction adhesive per product. Actual consumption typically ranges from 1.0-1.5 grams per product. With an average estimated to be 1.1 grams per diaper, a reasonably efficient diaper line would consume approximately 220,000 pounds of hot melt adhesive annually. At a cost of \$1.25 a pound, this translates to an annual adhesive cost of \$275,000 per line.

While most European-style diapers use less adhesive for the multi-line construction, a slot coating in the waist area provides an end seal to prevent fluff and superabsorbent powder migration. The net result is comparable adhesive consumption per product in most geographic zones.

A fairly recent technological innovation has been the use of a spiral gluing process known as "controlled fiberization" to provide a fully laminated polyethylene sheet at adhesive weights as low as three milligrams sq. inch. Assuming a coated area of approximately 215 sq. inches per product (13 in. wide X 18 in. long minus the elastic channels), this deposition weight translates to approximately .65 grams per product.

With a current average of 1.1 grams per diaper, this new technology can save up to .45 grams of hot melt adhesive per product while providing the end seal lacking in most American diapers. At 90 million diapers a year, this controlled fi-

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berization process can save manufacturers up to \$110,000 per line in adhesive consumption.

Potential Savings = \$110,000/year

The Polyethylene Savings

Many manufacturers have incorporated the frontal tape or landing zone for refastenable tapes into their products for defensive purposes. To many, this was just another costly feature that compressed the gross margins of their products while decreasing the line productivity.

Several industry leaders, though, saw that by combining this frontal tape with a more precise management of their adhesive deposition they had a golden opportunity to dramatically reduce the thickness of their polyethylene. A controlled fiberization of adhesive was found to cool the adhesive sufficiently to allow the use of lower gauge polyethylene without unsightly distortion or burnthrough.

One leading manufacturer reduced polyethylene weights by more than 0.25 mil (7 micron) in thickness. It should be noted that the cross web strength of the polyethylene must be sufficient to withstand the stress associated with tape fastening by the consumer. Given that this problem can be solved with proper material specification, this reduction in polyethylene accounted for an estimated \$176,000 savings a year per line.

As marketing dictates the use of microporous, breathable films, a cooler method of hot melt deposition such as controlled fiberization may become critical. These films will require a significant reduction in adhesive temperature. This can be achieved either through the use of lower temperature adhesives or by conversion to methods of applying existing adhesives at lower temperatures.

Potential Savings = \$176,000/year

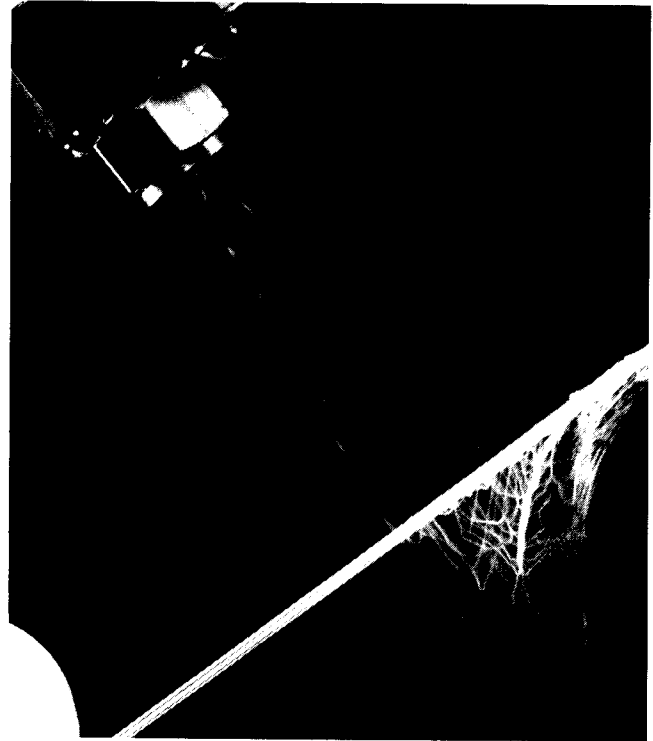
Superabsorbent Polymers

It is estimated that the current U.S. diaper utilizing a homogeneous blend of fluff pulp and superabsorbent powder typically consumes from 6-8 grams of the polymer per pad. This process has proven to be relatively simple, but expensive from a material point of view.

An alternative is the intermittent dosing of powder within the pad, thereby eliminating unwanted powder from the leg gathers and waist areas. As the application systems have continued to evolve, many of the concerns regarding these systems have been eliminated. Flow monitoring devices have been developed to verify powder flow into the pad. Pneumatic powder delivery has been refined to improve consistency of deposition.

With current equipment, manufacturers are now able to consistently deposit accurate amounts of powder in the optimal location within the pad. By eliminating unneeded powder from the pad, one to two grams of polymer can be saved. If a net savings of one gram per pad can be realized, a diaper manufacturer can save up to \$238,000 per line annually.

As mentioned previously, the diaper must be looked at as a system. For example, a manufacturer who reduces polyethylene thickness as suggested previously may find that the particular grind of superabsorbent powder used may be more evident with the thinner back sheet. By dosing the powder into the pad, the unwanted sand-like texture can be



Controlled Fiberization: A way to recoup costs of disposable diaper improvements.

removed from the back of the product, thereby maintaining the desired esthetic features.

Potential Savings = \$238,000/year

Threaded Elastics

The use of threaded (or stranded) elastics in the disposable diaper was featured at several locations at the recent IDEA '88 Show. It is estimated that conventional strip rubber materials (0.25 in. by 7 mil) can cost up to \$3.12 per thousand diapers. The incorporation of threaded elastic materials can save up to 50% of this cost. By conservatively estimating a 35% material savings, threaded elastics can provide manufacturers an additional \$100,000 a year in savings.

It is becoming quite clear that the battle in the U.S. will not be whether to use strip rubber or threaded elastic, but whether to use threaded natural rubber, such as that supplied by Fulflex or JPS Elastomerics, or a synthetic threaded product such as DuPont's "Lycra" XA Spandex. With significant differences in cost per pound but more comparable costs per manufactured product, the battle for market dominance continues.

The ultimate winner will be the threaded elastic material supplier with reliable product availability, dependent product quality and maximum process compatibility. As this competitive struggle continues, the primary beneficiary seems to be the diaper manufacturer.

Potential Savings = \$100,000/year

Elastic Attachment Adhesives

One of the major hot melt adhesive companies was also instrumental in revolutionizing the attachment of stranded

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elastics with hot melt adhesives. The high frequency spiraling characterization of the controlled fiberization process (up to 1500 spirals a second) was discovered to allow coating the stranded elastic without contacting the application head. This eliminated breakage of the thin strands that was caused by friction with the coating nozzle.

It also minimized the reduction in elasticity caused by subjecting some of the synthetic elastics to heated slot coaters. But the most rewarding feature of this new elastic method was the ability to reduce hot melt consumption without sacrificing creep resistance.

With conventional elastic attachment methods, .35 grams of hot melt per product is typical. The controlled fiberization process allows equal creep results with as little as one half of the adhesive. Using a conservative figure of .12 grams per product in adhesive reduction, annual savings of \$33,000 can be realized. In addition to adhesive savings, this process has provided a more uniform gathering of the polyethylene and nonwoven materials.

$$\text{Potential Savings} = \$33,000/\text{year}$$

Summing Up The Savings

What follows is a summary of the estimated savings cur-

rently available to disposable diaper manufacturers.

<u>Material</u>	<u>Potential Savings/Year</u>
Construction Adhesive	\$110,000
Polyethylene Backsheet	\$176,000
Superabsorbent Polymer	\$238,000
Diaper Elastics	\$100,000
Elastic Adhesives	\$33,000
Total Potential Savings	\$657,000

Product changes no longer translate automatically into higher costs and lower line productivity. Significant savings are being realized while improving the performance of the finished product. It is quite feasible that these savings can be realized without prohibitive changes to diaper machines and plant layouts.

Hundreds of thousands of dollars in savings are now realistic with modest changes to materials and application systems. As they improve their product performance while reducing its cost, diaper manufacturers are finally able to improve value to both their customers and their stockholders. Hopefully this trend can continue for years to come. □

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