Disposable Diaper Absorbency: Improvements via Advanced Designs

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Abstract
Absorbency effectiveness in diapers has improved significantly in recent years with the advent of new ingredient combinations and advanced design features. With these features, many leading products maintain their dryness performance overnight. Considering the importance of holding liquid away from the skin, ongoing research in diaper construction focuses on strategies to increase the effectiveness to capture liquid and help avoid rewetting of infant skin. The layout and design of a disposable diaper allows for distribution of absorbency features where they can provide the optimal benefit. Clinical evidence indicates materials can keep moisture away from the skin in the diapered area, helping maintain proper skin hydration, minimizing irritation, and contributing to reduced rates of diaper rash.

Keywords
disposable diaper absorbency, diaper leaks, dryness performance, skin rewetting, acquisition layer, topsheet, superabsorbent polymers, diaper rash, diaper dermatitis

Prevention of diaper leaks is a priority for both parents and pediatricians to help avoid irritation and minimize liquid exposure on the skin.

Absorbency effectiveness in diapers has improved significantly in recent years with the advent of new ingredient combinations and advanced design features. With these features, leading products today have an extended duration of activity, in many cases maintaining dryness performance overnight.

A 22- to 37-pound baby produces an average urine load of roughly 180 mL (about three fourths of a cup) over an average of 4 hours per diaper.¹

Considering the importance of holding liquid away from the skin, ongoing research in diaper construction focuses on strategies to capture increasing quantities of liquid and help avoid rewetting of infant skin.

Quickly Pull Liquid Away From the Skin
Clinical evidence indicates that use of materials that can keep moisture away from the skin in the diapered area, thereby helping maintain proper skin hydration and minimizing irritation, may help contribute to reduced rates of diaper rash.²

Research in Western Europe has documented statistically significant reductions in frequency and severity of diaper dermatitis in users of disposable absorbent diapers compared with either cloth or cellulose-only disposable diapers (see Figure 1).³

With a focus on reducing skin wetness and helping minimize the effects of irritation, leading diaper manufacturers have introduced topsheets that quickly absorb the urine and spread it across the core of the diaper. This topsheet feature helps speed the absorption process, and the thick materials under this layer help prevent liquid from leaking back out of the diaper and onto the baby’s skin.

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Capture Liquids to Help Avoid Rewetting From the Diaper Core

A valuable element of modern designs is the acquisition layer, a layer containing specially designed fibers embedded beneath the diaper’s topsheet that absorbs the liquid once it has been pulled away from the skin and retains it while it is being absorbed into the diaper’s deep storage core. The materials in this layer also help prevent the urine from rewetting the baby’s skin.2

As the acquisition layer distributes the liquid, the urine is gradually absorbed into a highly dense layer containing super absorbent polymers (SAPs), which has been commonly used in disposable diapers since the 1980s because of its powerful absorbency features. When dry, SAPs look like small, transparent crystals, but when wet, the structure is unraveled and the crystals swell, transforming into a gel-like substance that can absorb up to 30 times its weight in liquid. Despite the high absorbency, SAPs are not water soluble and will not fully break up when wet. As a gel, SAPs are particularly durable and can withstand high pressure to avoid rewetting even when babies are active (see Figure 2).2,4

Maximize Durability and Extend Duration

While the SAPs and cellulose pulp are the primary absorbency features in diapers, leading disposable diapers have been designed with a range of layers and features that contribute to improved durability and absorption. These components help prevent rewetting of the sensitive skin in the diaper region and help maintain proper skin health.2,3

The layout and design of each of the layers allows for distribution of absorbency features where they can provide the optimal benefit. For example, the fasteners, outer backsheets, and stretch features of the diaper are designed to optimize the fit to the infant’s torso and legs and can withstand active moments, such as crawling or walking, to help prevent leaks. The less bulky designs provide flexibility for even the most active babies, while minimizing leaks and irritation.

Each of these important features contributes to better overall skin performance and dryness protection, as well as an improved diaper experience for parents and their babies.

Declaration of Conflicting Interests

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The development of new ingredients and materials is leading to great strategies that improve the absorbency and durability of diapers, with the goal of eliminating the burden of leakages. While there is a clear emphasis on maintaining skin health, the designs are also increasingly better fitted and less bulky, allowing for more activity without compromising dryness.

**References**

1. P&G Data on File.