Xennovate Medical

Innovation to Reality™

TECHNOLOGY BRIEF

A PRIMER ON HYDROCOLLOID ADHESIVES —

Nearly all you ever wanted to know about their unique properties...

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Question

How can Hydrocolloids be gentle to the skin while being formulated to be so aggressive in tack?

All rubber adhesives, including hydrocolloids, typically can be found to demonstrate the following attributes:

- ☑ Chemically and thermally stable
- ☑ Resistant to moisture and weathering
- ☑ Suitable tack for quick bonding
- ☑ Ability to conform to skin; acceptable adhesion to skin (even variegated surfaces such as the peri-stoma skin surfaces) for extended periods of time; easily removed from skin; able to deliver active ingredients to the skin.

Note: stretch-ability can be customized and hydrocolloids do not need to "set or harden" into one configuration that becomes immobile, and, therefore, damaging, when inadvertently moved

- ☑ Easily customized and formulated
- ☑ Can be formulated to adhere well to a wide range of surfaces
- ☑ Can be designed to withstand highly acidic or highly basic chemicals, and organic solvents
- ☑ Biocompatible

The "hydro" portion of the name characterizes hydrocolloid's unique ability to absorb moisture, while maintaining its tack, such as sweat, normal transudation from skin surface, or wound fluids (exudates) which, in effect, keeps the "gravel off the parking lot" to allow better traction, while moisture totally inactivates most adhesives.

Just as importantly, prolonged occlusive water contact on the skin macerates cells (cell death) in as little as 30 minutes. Hydrocolloids provide an optimal moist environment, not a macerating wet one | They keep the skin moist, but not wet, for the best wound and skin compatibility for healing and sustaining surrounding skin.

The typical Hydrocolloid carries a slightly acidic pH which retards bacterial growth in its own right without further additives (antimicrobials can be added too).

Definitions

Adhesion and Cohesion represent forces of attraction between material bodies. A distinction is generally made between an adhesive force, which acts to hold two separate like-bodies together (or to stick one body to another) and a cohesive force, which acts to hold together the like or unlike atoms, ions, or molecules of a single body; both are important in high stress environments, and adhering to skin, for a prolonged period of time, represents a conspicuous example of a ***high stress*** situation. A diamond represents an excellent example of ***high cohesion*** with low or no adhesion – it does not stick to any other substance, however, ***its hardness comes from its own molecules aggressively sticking to each other***.

Increased adhesion does not guarantee increased cohesion (and under continuous high stress the adhesive can literally break apart).

Peel and Shear

The classic example employed to demonstrate the difference an everyday activity of "placing tape on a postal package." One doesn't readily place tape only on the top flaps you are bringing together (peel); rather one usually takes the tape down the sides of the package to utilize the adhesive's (shear) force. **SHEAR** forces typically represent as much as100 times more strength than **PEEL** forces.

Xennovate has formulated new products to ***maximize shear without over-developing peel strength***, which methodology allows the device to stay adhered in shear for a prolonged length of time, yet to be "peeled" off when needed, and with little or no cell damage and with minimal skin stripping (see below).

If you engineer a device to attach to the skin in shear—but the adhesive doesn't have shear strength—then you will have a cohesion failure (adhesive breaks apart and bond is broken).

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Skin stripping

This process comes about when the top layer of skin cells (epithelial cells) are able to be stripped away from the surface through either aggressive peel or shear forces, or by the alteration of the dermal surface from maceration (see below), which can then lead to skin stripping with even normal adhesive forces applied. Hydrocolloids are uniquely positioned to prevent moisture maceration.

Moisture Maceration

Prolonged exposure to moisture can cause skin to soften and break down. This condition, called maceration, can be particularly troublesome when healing wounds. Dr. Maibach (UCSF School of Dermatology) observes that moisture maceration and cell death can occur in as little as 30 minutes under occlusive environments.

Evaporative losses

Depending on the skin location on the body, normal evaporative losses are on the order of 1-mg H_2O / cm^2 / hr. Naturally, other variables can affect this number such as...

- ☑ Degree of intact skin
- ☑ Degree of maceration of skin
- ☑ Thickness of skin (say over an elbow)
- ☑ Number of sweat glands in location
- ☑ Body temperatur-
- ☑ Ambient temperature
- ☑ Ambient humidity