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Next Generation Human Interface Adhesives Selection

Human interface adhesives address all areas of the body, but cannot serve those areas with equal efficacy due to a variety of differing factors. A new testing system addresses this by more accurately evaluating adhesives for the specific part of the body upon which they are to be used. This article provides the benefits of this system while also looking at applications where it can best be implemented.

By Peter C. Johnson, MD

A new process for selecting human interface adhesives used in temporary adherent medical devices (TAMD) is presenting manufacturers with additional opportunities for product design, innovation, and development.

The selection process, called the Comprehensive Skin Adhesion Testing System, has evolved the approach to choosing adhesives. Developed by Avery Dennison Medical Solutions in response to marketplace needs for human interface adhesives that satisfy highly specialized application requirements, the system incorporates traditional testing, such as tack and shear testing, with novel methods for evaluating virtually any site on the human body, including skin thickness and type. The informa-

tion gathered can then be deployed into product design in collaboration with TAMD manufacturers whose applications have been accepted for the adhesives selection service. Production of finished adhesive products can then be completed quickly, cost effectively, and according to precise specifications.

Until now, TAMD manufacturers could choose from one basic family of human interface adhesives, a product category that had a bias toward being stronger than potentially necessary. The one-size-fits-all approach often employed inner forearm testing as a surrogate for testing adhesives on both thick and thin skin. However, the inner forearm, which tends to be hairless and of average thickness, typically yields only a small fraction of the information gained by comprehensive testing of specific body locations. As such, it does little to provide an optimal



adhesive solution for widely differing skin types.

Skin tolerance for adhesives also needs to be considered. The elderly, as well as infants and persons taking steroids for transplants or rheumatic diseases, have thinner and more sensitive skin than that of a typical healthy young person. When compounding these differences with other variants, it becomes apparent that a broad range of specialized adhesives is needed.

Diverse Applications

TAMD applications range from simple bandages and medical tapes to monitors and complex multilaminar drug delivery systems. Solutions call for creativity, deep technical resources, and a commitment to problem solving.

Consider the expertise and specialized adhesive characteristics needed to satisfy specific adhesion demands. In negative pressure wound therapy, a plastic drape connected to a vacuum device is held in place with adhesive



edges. This application requires a specific level of securement to maintain the proper amount of pressure during treatment, while also necessitating adhesion and removal that will not damage the periwound skin.

Multilaminate membranes for diagnostic products are another example. Properly designed membranes provide a barrier that will not impact the oxygen rich environment that is needed for cell growth. Adhesives that support vapor permeability and porosity specifications are required to produce the most appropriate membrane for any given application.

Beyond that, adhesive-based therapeutics, such as antimicrobial adhesive technology, can also be incorporated into TAMDs.

(See sidebar: A Look at Adhesive-Based Therapeutics.)

Driving Innovation

Pressure-sensitive medical adhesives act as an intimate interface with the human body. That proximity, coupled with adhesive and materials technologies, can produce new knowledge and new products. Ultimately, creating systems of adhesives that can be customized to meet the needs of diverse individuals is an application of personalized medicine. With the Comprehensive Skin Adhesion Testing System, TAMD manufacturers now have a platform for innovation through broad, design-oriented testing, precise adhesive synthesis, and efficient poly laminate manufacturing.

A Look at Adhesive-Based Therapeutics

Adhesive-based therapeutics offer great potential for use with temporary adherent medical devices (TAMD). In particular, antimicrobial adhesive technology can offer TAMD manufacturers effective and affordable opportunities for barrier protection products that could reduce incidences of infection. Adhesive-based transdermal drug delivery systems are candidates for the controlled release of therapeutic agents, and adhesive-based active ingredients are being formulated to offer moisturizing, therapeutic, and cosmetic benefits.

Antimicrobial Adhesive Technology

Antimicrobial agents control the growth of microorganisms, provide a reduction in the amount of bacterial flora present in a device, and reduce infections associated with the presence of the microorganisms that they kill. The use of antimicrobial agents as medical device components, in the form of coatings, impregnated foams, and formulation ingredients, is already widespread in the medical marketplace.

The benefits of antimicrobial adhesives are that various antimicrobial agents can be incorporated into them to form integrated systems that guard against infection and reduce bacterial bioburden. Antimicrobial agents formulated into adhesives that are coated onto films and then converted into medical dressings can reduce bioburdens on the dressing.

Transdermal Drug Delivery

Transdermal drug delivery systems, such as an adhesive-based patch, convey a specific dose of medicine through the skin and into the bloodstream. Benefits of transdermal drug delivery include controlled release of the therapeutic agent and the elimination of hypodermic medicine delivery. It also reduces medical waste and costs associated with syringe disposal.

Adhesives can be engineered to tailor the rate of delivery as well as the volume of medicine transferred from the adhesive to the skin. Adjustments in adhesive formulations can also be made to increase or decrease the wear time of an adhesive-based patch depending on the required time of therapy.

Release kinetics and solubility profiles can be specifically designed to accommodate the target molecule. They can also be compatible with the adhesive chemistry formulation so the resulting formulation does not induce a cytotoxic or irritative event.

Active Ingredients

Restorative active ingredient agents, such as moisturizers, collagen, proteins, and essential oils, all can be formulated into adhesives that are applied to heal skin, restore skin properties, and minimize tissue damage.

For cosmetic purposes, active ingredient-based adhesives can be manufactured into discreet patches that smooth lines and wrinkles and restore skin elasticity.

For therapeutic purposes, active ingredient-based adhesives can promote tissue regeneration, reducing the presence of scars and other skin damage.

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