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*Blending the science of polymers, molecular cosmetics and botanicals for*

**complete advanced skin care**



## INNOVATIVE SOLUTIONS FOR THE FORMULATION OF LOW pH SKIN CARE SYSTEMS

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Creating effective low pH skin care products that are not disruptive to the skin's natural defence and rejuvenation processes can present many challenges to formulators. **Lubrizol, Lipotec and Active Organics**, three industry leaders providing specialty ingredients for personal care products, have collaborated to provide this informative guide with innovative solutions for the formulation of low pH skin care systems.

The surface of the skin is covered by a mildly acidic thin shielding mantle made up of sebum (free fatty acids) and sweat excreted from the sebaceous glands. This acidic mantle is an integral part of the barrier function of the stratum corneum. It helps defend the skin from external environmental aggressions such as wind and pollution. It also inhibits the growth of harmful microorganisms to further protect the skin from infection while at the same time reducing the risk of acne, allergies,

blemishes and other skin disorders. It is critical to maintain a slightly acidic skin pH to ensure the integrity of this natural barrier.

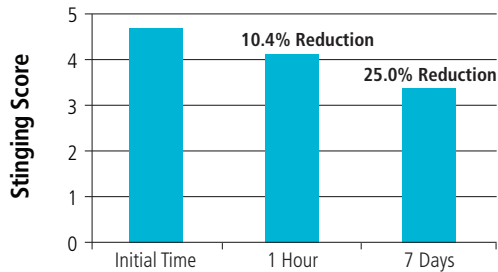
Normal healthy skin is characterized by a pH ranging from 4.5 to 6.0 depending on gender, body zone, and further external factors. Daily hygienic habits, such as washing skin with soaps, can alter the stratum corneum and barrier functions resulting in skin pH increases. When the acidic mantle is disrupted or loses its acidity, the skin becomes more prone to damage and bacterial infection. Skin disorders, such as eczema, contact dermatitis, atopic dermatitis and dry skin can also cause an increase in skin pH.

The use of formulations containing active ingredients which enhance the skin's natural defense system and help preserve its barrier function integrity have become crucial for maintaining healthy looking skin.

**Bodyfensine® peptide ingredient** from Lipotec is a tripeptide that reinforces the skin's defense mechanisms by inducing endogenous defensins production. These antimicrobial peptides constitutively produced by human skin are one of the key components of the skin's innate immune system. This peptide protects skin from external microbial invasions, thereby lowering the risk of infections.

Additionally, **Delisens™ peptide ingredient**, also from Lipotec, is a new hexapeptide especially designed for sensitive skin. It helps recover the skin barrier function while improving scaling, smoothness and suppleness, and significantly ameliorates skin hydration. When its effectiveness was tested on a panel of volunteers pre-selected for their sensitivity to lactic acid, the participants experienced an exceptional reduction in the stinging feeling within one hour after the first application of a cream containing 2% Delisens peptide ingredient solution.

**FIGURE 1: Delisens™ peptide ingredient efficacy to reduce the stinging induced by lactic acid (reduction % indicated on the chart)**



Effective low-pH skin care formulations must work in harmony with the skin's natural processes. Beautiful skin requires a balance between natural desquamation, the flaking of dead surface epidermal cells, and the synthesis of new skin cells. When this coordinated process occurs optimally, not only are the appearance and health of the epidermis enhanced, but measurable benefits can be demonstrated more deeply into the dermis as well.

Skin cells at the outermost layer of the epidermis are held firmly to their neighboring cells by strong protein links called desmosomes. An enzyme called Cathepsin-D helps to naturally exfoliate skin cells by breaking these desmosomal links, thus allowing the cells to flake off, cell-by-cell. For mature skin, the ability to maintain this efficient cell turnover decreases, resulting in signs of aging including the appearance of fine lines, uneven skin tone and sagging.

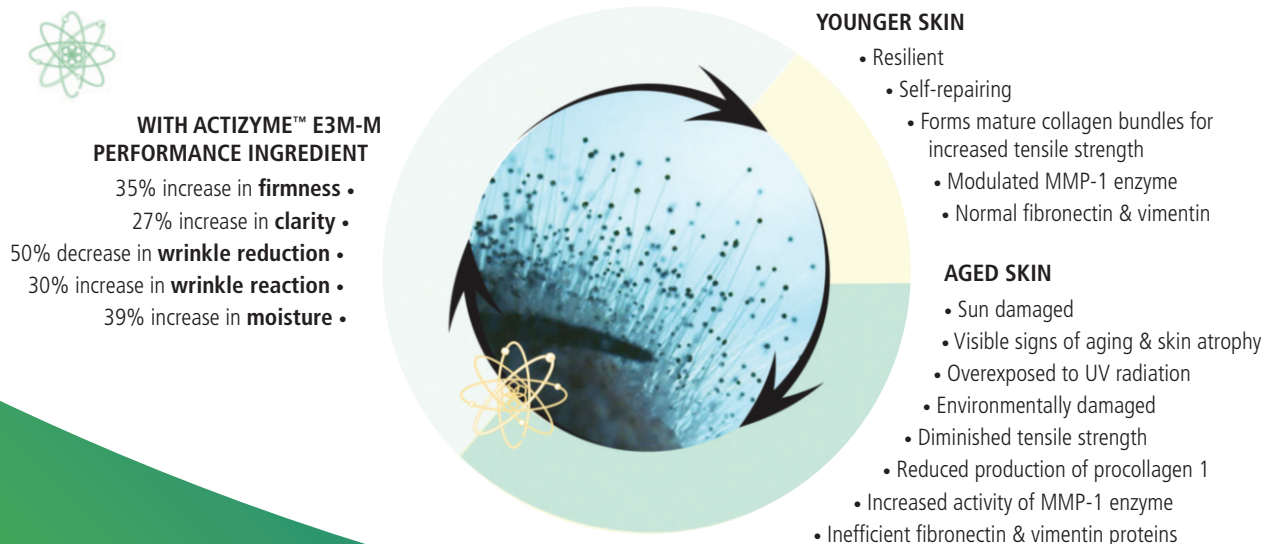
Normal, healthy skin undergoes a balanced remodeling at a rate of approximately one turnover per month. It has become apparent that endogenous proteolytic enzymes are one of the major tools by which this process is accomplished. The body produces various proteolytic enzymes, including Cathepsin-D, that help ensure this desquamation is accomplished in an orderly, non-irritating and imperceptible fashion. However, it is widely accepted that under abnormal conditions, cytokines can induce changes in the rate of desquamation.

Harsh scrubs, keratolytic acids or any agent that disrupts desmosomal cohesive forces in a non-specific manner, can also cause scaling and irritation. One goal of effective skin care formulations is to help induce the shedding of squames at the outer layers of a healthy epidermis at a rate that is balanced by the mitotic development of new cells at the basal layer.

**Actizyme™ E3M-M performance ingredient** from Active Organics, is a mushroom derived, water-soluble enzyme of the aspartyl dependent, or acid protease class. When topically applied in the presence of an acidic buffer, Actizyme E3M-M performance ingredient has proved to be an effective method for skin cell exfoliation. Over a period of time, the skin neutralizes the acidic buffering agent and the pH of the skin returns to normal. At this point the enzyme activity and exfoliation cease to occur. Thus the amount of exfoliation, and the time frame that is to occur as a result of topical application of Actizyme E3M-M performance ingredient, can be controlled by the amount of active material added.

Since the epidermis exhibits a pH gradient from pH 4.5 - 6.0 at the stratum corneum to about pH 7.4 at the basal layer, the proteolytic activities of these pH-dependent enzymes may vary significantly with the pH values found within the epidermal pH gradient. Some examples of well-known, effective actives, such as alpha or beta hydroxy acids (BHAs or AHAs), require a pH below 5 for better stability and efficiency. Actizyme E3M-M performance ingredient is recommended to be used at 0.5% - 5% in leave-on products formulated at pH ~4 and should be added to the final stage of production at less than 40°C, under low shear conditions.

**FIGURE 2: Actizyme™ E3M-M performance ingredient In Vivo test results**



Also from Active Organics is **Actisea™ H<sub>2</sub>O performance ingredient**, a unique mixture of concentrated extracts of Japanese Green Tea polyphenols, the inner gel of Aloe Barbadensis, and Sea Kelp. The selected kelp extract contains low molecular weight humectants and hydrating peptides, and the green tea polyphenols act as protective agents, specifically designed to provide intense hydration while being light-weight and cost effective.

Prepared via a proprietary process to yield the maximum concentration of ingredients, the unique water binding properties of Active Organic's Actisea H<sub>2</sub>O performance ingredient protects, enriches, moisturizes and provides soothing hydration and wrinkle smoothing activities, while protecting the skin from the harsh effects of the environment.

Actisea H<sub>2</sub>O performance ingredient is ideal for use in creams, lotions, face-masks, body washes and soaps where moisturizing, conditioning, purifying and protective properties are needed. The recommended usage level is 2%, and should be added to the final stage of production at 45°C or less.

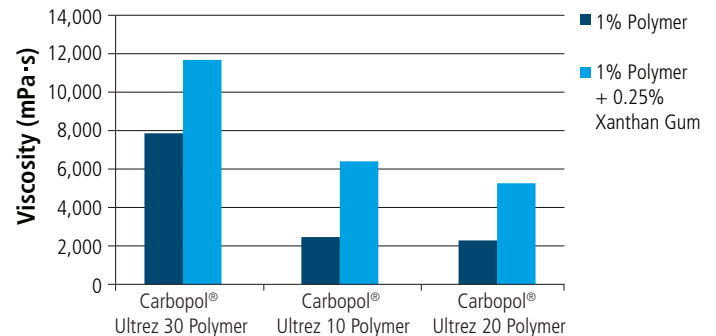
The increasing use of milder organic acid preservatives has also impacted formulation habits. Indeed, microorganisms such as fungi, mold, gram-positive and gram-negative bacteria, with such intimidating species names as Staphylococcus aureus and Escherichia coli are everywhere: on our skin, in our homes, schools, and cosmetic manufacturing facilities. The role of preservatives is to ensure the safety of the finished product not only during manufacturing but also over the period of consumer use.

Using organic acids as preservative systems for skin care applications is one of the key formulation solutions to evolve away from the traditional preservative systems based on formaldehyde, paraben, or isothiazolinone that are sometimes perceived negatively by consumers. When free acid forms are utilized as the only active ingredient to inhibit microorganisms, the use of organic acids limits the pH of skin care formulations to levels below 5.5. As a result, an increasing number of skin care products today are formulated at a pH of 5.5 and below.

However, the formulation of stable and aesthetically pleasant emulsions at low pH can be very challenging. Anionic thickeners traditionally used in mildly acidic skin care formulations are sensitive to electrolytes thereby limiting their efficiency. Nonionic thickeners are effective but often lead to undesired texture and sensory aesthetics.

Lubrizol's **Carbopol® Ultrez 30 polymer** is a new crosslinked acrylic acid homopolymer that provides a solution for formulating products having lotion-like viscosities and good aesthetic properties at acceptable use levels. It can be used with efficacious levels of acidic actives at a pH range as low as 4.0 - 4.5, either as a sole thickener or in combination with co-thickeners such as xanthan gum. The additional benefits of Carbopol Ultrez 30 polymer are improved electrolyte resistance compared to traditional homopolymers, and a rich initial feel upon application.

**FIGURE 3: Viscosity performance of 1 wt% Carbopol® Ultrez 30 polymer in aqueous dispersion with 1% glycolic acid at pH 4.5, with and without xanthan gum (Brookfield, RV, 20 rpm)**



Developing efficient and effective skin care products with pleasant aesthetics can present many challenges. It requires advanced science expertise and a deep understanding of skin biology. At Lubrizol, Lipotec and Active Organics, we are a group of companies working together to build on our collective strengths, polymer technologies, molecular science and botanical extracts to help you deliver unique, innovative and more natural solutions to the market.

*For more information, starting formulations and detailed technical specifications, contact [personalcare@lubrizol.com](mailto:personalcare@lubrizol.com) or visit our websites:*



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Lipotec, SAU.



[www.lipotec.com](http://www.lipotec.com)

Active Organics, Inc.



[www.activeorganics.com](http://www.activeorganics.com)



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Actiphyl™, Actiplax™, and Aromaphyte™ botanical extracts, Actiscrub™ exfoliants, Activera™ aloe products; and a line of Performance Ingredients

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