Active combinations

Ursula Maczkiewitz, Petra Biehl and Jennifer Schild look at the challenges of body care and how using combinations of actives can improve products' effectiveness.

Modern concepts for body care products not only address moisturisation, they also target other signs of body imperfections like reduced skin elasticity, decreased firmness of the skin or cellulite. Lifestyle habits such as frequent showering or working in climatised rooms stress the skin and often lead to a dry, rough and scaly appearance. With increasing age, skin elasticity and firmness is reduced and women especially complain about the appearance of cellulite. So to maintain healthy looking skin the use of body care products is an essential step in the daily routine – Mintel analysis of body care products launched during the last 12 months showed that more than three-quarters of products fulfill customer demand for better moisturised and better protected skin.

To cover the different needs of modern body care products, innovative actives are a good choice; combinations of active ingredients with different working mechanisms and targets can play a part in the development of successful cosmetic products providing perceivable effects for the consumer.

MOISTURISATION

The skin needs an optimal proportion of water to retain optimal moisturisation. During ageing and under dry skin conditions, especially during winter, the epidermal barrier becomes less effective and transepidermal moisture loss increases. With inadequate moisture content, the skin gets dry and tight with a rough wrinkled texture, and can appear dull and less radiant – a concern for both young and old, independent of gender.

The natural skin moisture level depends on a balance of different factors within the stratum corneum, the outermost skin layer. Intercellular lipids and cornocytes containing proteins and natural moisturising factors (NMF) work together to maintain the hydration of the skin. NMF substances like urea, lactic acid, pyrrolidone carboxylic acid (PCA) and amino acids contribute to skin moisturisation by attracting and retaining water. The proteolytic breakdown of filaggrin (structural epidermal protein) provides the NMF with amino acids. Thus, it is important under dry skin conditions to control the osmotic pressure of the skin and the amount of water in the stratum corneum.

The last factor necessary to keep the skin moisture level constant is the integrity of intercellular lamellar lipid structures. These lipids (eg ceramides) form multilamellar bilayers surrounding the cornocytes in the stratum corneum. This provides an efficient barrier against water loss (figure 1).

To help users obtain an appropriate level of skin moisturisation, Evonik developed Tego Smooth as a moisturiser with skin smoothing properties. The active has a...
patent protected composition of low and high molecular weight active ingredients and is based on a three in one concept. Firstly, it contains biopolymers to enable physical skin moisturisation from the outside – the polyglutamic acid shows strong water binding capacity and helps to retain water in the stratum corneum. Secondly, key NMF components like potassium lactate and urea replenish skin moisture from within. Finally, cellular osmoprotectors like trimethylglycine shield skin cells from drying out.

In addition, low molecular weight scleroglucan adds skin soothing and anti-inflammatory functions, enabling the product to be used not only for body care formulations targeting dry skin but also for skin soothing and sensitive skin products.

A study of Tego Smooth showed that it effectively increased skin moisturisation. Figure 2 shows the increase in moisturisation two hours after the application of a test formulation containing 1–5% Tego Smooth. Even with 1% Tego Smooth, immediate moisturisation was obtained.

Besides immediate moisturisation, Tego Smooth also provided longer term, 48 hour moisturisation (figure 3) and skin moisture content continued to improve with a ‘depot effect’ showing after two weeks of application. After a four week application period, skin hydration increased by approximately 80% compared to the vehicle. The effect stayed for a minimum of four days after the end of the treatment in the regression phase without any further application of the tested formulation.

Body care products should not only increase moisture in the skin but should also be able to fight against visible signs of dry skin, such as scaleiness which occurs most strongly and visibly on the skin, especially during winter. Representative photos of tapes with adhered skin scales obtained before and after the application period and four days after the end of treatment show how Tego Smooth reduced the scaly look of the skin and improved smoothness by promoting desquamation and minimising the occurrence of flakes.

**FIRMING/BODY SHAPING**

Besides moisturisation, another target for body care products is the improvement of skin firmness for body shaping benefits. To achieve this effect it is of relevance which skin layers are reached by an active. An effective active ingredient would ideally stimulate crosstalk between the different layers of the skin.

To achieve this, Ewonik developed the short chain ceramide Sphingokine NP which aims to improve the state of the various skin layers by functioning as a signalling sphingolipid. Because of its deep penetration properties, the molecule can reach all of the layers of the skin, from the epidermis and dermis to the subcutaneous tissue (figure 4). A patented biotechnological production process provides the phytosphingosine backbone of the short chain ceramide with skin identical stereochemistry and it is based on fermentative production from biorenewables.

In the epidermis Sphingokine NP functions as a signalling molecule for keratinocyte differentiation, helping to strengthen, densify and smooth the stratum corneum, the protective barrier of the human skin.

In addition, the factors that stimulate dermal cells (fibroblasts) are induced, resulting in improved communication between keratinocytes and fibroblasts as well as stimulation of the dermal matrix by keratinocyte derived signals.

In the dermal areas of the skin, Sphingokine NP supports the dermal scaffold function by inducing fibroblast derived signals for improved extracellular matrix (ECM) organisation, while keratinocyte and adipocyte derived signals stimulate dermal matrix formation.

In the deepest layer of the skin, the adipose tissue, stimulation of adipocytes by Sphingokine NP leads to induced crosstalk between adipocytes and fibroblasts, which ultimately results in additional support of dermal ECM. In addition, adipose matrix formation and modulation of lipogenesis is stimulated by Sphingokine NP resulting in denser subcutaneous fat tissue. As a result, Sphingokine NP can help body care products to reduce skin sagging and reshafe the dermal scaffold, plumping and densifying the skin, tightening the skin structure and toning skin tissue.

A cosmetic study showed that Sphingokine NP markedly improved skin density (echogenicity) after eight weeks of

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**FIGURE 2**
Skin hydration two hours after application of Tego Smooth; increase of corneometer units relative to start value

**FIGURE 3**
Skin hydration after application of Tego Smooth
Long-term skin hydration

**FIGURE 4**
Working mechanism of Sphingokine NP, supporting crosstalk between the different skin cell types and multitier activity
application compared to the vehicle (figure 5). This effect became stronger after 12 weeks.

This can also be observed in the ultrasound images of the skin at defined points of time. The lighter the structures appear, the denser the skin tissue. The application of Sphingokine NP led to structural improvement of all skin layers, strengthening the epidermis, reshaping the dermal scaffold and densifying and plumping the subcutis.

**CELLULITE REDUCTION**

Another important topic for body care is the reduction of cellulite. Western women particularly demand products which lead to a visible reduction of the orange peel effect on the upper legs. The appearance of cellulite is the consequence of different interacting impacts: increased fat accumulation in the adipocytes, reduced dermal strength and reduced microcirculation. In addition to this, cellulite is usually accompanied by constant inflammation.

To fight against the different signs of cellulite, Evonik developed a new natural ingredient, Tego Xymenynic, a solution of 20% xymenynic acid in a cosmetic emollient. Xymenynic acid is a highly purified, phytochemical compound extracted from the seeds of the sandalwood tree, Santalum album, which grows in the mountainous regions of south India. All trees are owned by the government and the harvest of the trees is strictly controlled.

The seeds are collected by the Indian government’s Forest Department in order to maintain the sustainability of the species. Traditionally, the plant is used in Ayurvedic treatments to make the skin smoother, tauter and more velvety.

*In vivo* tests with keratinocytes demonstrated that Tego Xymenynic increased all key components of the glutathione metabolism. Glutathione is known to be responsible for protecting cells against oxidative stress to prevent inflammation and dermal structure alterations. In addition, Tego Xymenynic showed a strong hyaluronidase and

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**FIGURE 5** Ultrasound images of two representative volunteers: (a) before, (b) after four weeks, (c) after eight weeks and (d) after 12 weeks of application of 0.2% Sphingokine NP
collagenase inhibitory activity which is crucial for the strengthening of the ECM.

One important factor in reducing the appearance of cellulite is the improvement of skin elasticity and dermal strength. Figure 6 shows the improvement of skin elasticity by Tego Xymenynic compared to a control formulation after four and eight weeks of application. The different skin elasticity parameters measured with a cutometer demonstrated that already after four weeks skin elasticity was improved. This effect could be further increased by extending the application to eight weeks.

Usually, to fight against the different signs of cellulite a combination of different actives is used in cosmetic anti-cellulite formulations. Caffeine is a commonly used active with a known lipolytic activity. In the following in vivo study, it was combined with xymenynic acid. Caffeine alone (the vehicle) reduced the appearance of cellulite slightly but with the addition of xymenynic acid, an improvement of nearly 10% was achieved. The combination of the two actives also resulted in the improvement of skin elasticity.

Ultrasound pictures illustrate how the combination of xymenynic acid and caffeine led to a significantly improved, better structured dermis. The invasion of fat cells of the subcutis into the connective tissue was diminished. This led to a visible reduction in bumps and a reduced appearance of orange peel skin. Therefore body imperfections due to cellulite were minimised.

Today, body care products are designed to fight against numerous signs of skin imperfections and with the formulations and ingredients available it is possible to meet the demands of the modern consumer. Combinations of innovative active ingredients can help users achieve better moisturised, tighter skin, a reshaped body and reduced cellulite.

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