A new way to meet complex consumer demands:
How to combine mildness, high performance and environmental benefits

KEYWORDS: emollient, enzymatic process, sensitive skin, mildness, renewable raw materials

Abstract

Skin care remains the largest personal care category around the world. However, the increasing diversity of consumer needs and attitudes has resulted in greater segmentation of the skin care market. Some of the major market trends are now being driven by consumers’ growing awareness of their health, safety and environment. These consumer preferences are reflected in the demand for customized solutions for sensitive skin and products that are based on renewable raw materials. In this study, a new light emollient derived from renewable feedstock and manufactured through an enzymatic process is presented. This new product can help manufacturers meet the current demand for sensitive skin care products with an improved environmental profile.

INTRODUCTION

Skin care remains the largest personal care category around the world (Euromonitor, 2011) (1). Identifying major shifts in consumers’ values and perceptions at an early stage is key to developing valuable solutions that are both useful and relevant for them. The growing awareness of health, safety and environmental issues has sparked greater demand for products with reduced ecological footprints and ingredients based on renewable raw materials – a trend that shapes consumers’ expectations of even complex skin care products. The growing number of consumers perceiving themselves to have sensitive skin is another factor that is increasingly influencing the skin care market: More and more consumers are looking for skin care products that improve the condition of their sensitive skin. This has resulted in numerous launches of products for sensitive skin in the last few years (Figure 1).

SENSITIVE SKIN

The condition of a person’s skin plays an integral role in their well-being. The skin is the largest organ of the body and has important functions, such as protection against external factors and as a mediator of sensation. Of all the body’s organs, the skin is the most exposed to external stress factors, such as UV irradiation, extreme temperatures, dry air and xenobiotics, and it reacts in its own way to these factors. People suffering from sensitive skin often react more strongly to external factors. A look at recent scientific studies reveals a number of different characteristics and descriptions of sensitive skin but no single definition is available. The common understanding now emerging is that it can be defined as a skin type with heightened sensitivity to topically applied substances and environmental factors. Results of studies conducted in the last few years indicate a high prevalence, with more than half the population in the Western world having self-assessed sensitive skin and numbers are still on the rise. Ethnic differences have also been described. Fair skinned Caucasians respond more strongly to environmental insults such as wind or sun, and Asians report sensory irritation more often. Women suffer from sensitive skin more often, although the number of men affected is growing and numbers in some recent studies were similar (2, 3).

Although predominantly viewed as a facial problem, sensitive skin can occur all over the body (4). Sensitive skin can react more intensely to irritants. Subclinical irritation thresholds may play a role, as sensitive skin can react more intensely to irritants.
Increased skin neurosensory responses, reduced lipid content, insufficient hydration and/or deficiencies in the skin barrier function have also been reported to be underlying causes (3). Deficiencies in skin barrier function are often inversely correlated to an increase in transepidermal water loss (TEWL). A high baseline TEWL has also been observed in volunteers with sensitive skin, which can increase even more when the skin is exposed to external factors such as detergents, indicative of a compromised skin barrier function. Due to the wide variety of possible causes and the subjective nature of the associated symptoms, sensitive skin is extremely difficult to measure or quantify – and yet it is a common condition, and one that is now accepted as a genuine dermatological problem of physiological origin. Ideally, skin care products for sensitive skin counteract problems associated with sensitive skin while giving the skin a healthier appearance. However, developing effective yet environmentally friendly solutions for sensitive skin presents significant challenges. Wide-ranging expertise is therefore needed to develop new products that meet this increasing demand. Cetiol RLF, a new, fast-spreading emollient derived from 100% renewable feedstock, was developed in response to this growing need.

**CONFIRMED MILDNESS FOR SENSITIVE SKIN APPLICATIONS**

Mildness is generally characterized by the lack of a substantial potential of a substance or formulation to cause irritation following topical application to the skin. Sensitive skin is often characterized by a hypersensitivity to irritants and mildness of products is therefore indispensable. Prior to any testing on humans, toxicological clearance is essential, and the tests themselves should be conducted using the main principles of good clinical practice as guidance. Among the most commonly used test methods to evaluate the primary irritation potential of a substance is the epicutaneous patch test. Occlusive application and the long contact times give rise to exaggerated exposure conditions, thereby providing a type of “worst case scenario” in which skin irritation should occur. In an initial test to assess the skin compatibility, a patch test was conducted by applying the undiluted product onto the skin of the back of 21 (16 with self-assessed sensitive skin) volunteers under occlusive conditions for 24 hours using large Finn chambers backed with ScanPor®. The intensity and duration of erythema, edema, fissure and squamation were used to calculate the total irritation score (TIS). Based on the TIS, undiluted Cetiol RLF caused only 7.2% of the reactions relative to the positive control (0.5% sodium lauryl sulfate; TIS=100%) and was dermatologically assessed as having a good skin compatibility with respect to irritation (internal report, C110032). Due to the ethnic differences reported, the susceptibility to irritation was also assessed on Asian skin using a number of skin care formulations containing Cetiol RLF. These included gels, creams and sun care formulations containing up to 20% Cetiol RLF. Once again, good skin compatibility was confirmed.

Occasionally, clinical or subclinical irritation only starts to develop following repeated application of a substance to the skin. In some cases, this can be attributed to multiple insults to the skin barrier which diminishes its integrity over time; reservoir effects have also been discussed. Tests in which the product is applied under use conditions help to provide a more realistic assessment of the cosmetic product’s characteristics. In addition, the sensory responses associated with sensitive skin, which also need to be taken into consideration when developing suitable personal care products, can be evaluated by including specifically developed questionnaires.

An independent institute conducted a home-use test among males and females aged between 30 and 61 who had a disturbed skin barrier function evidenced by a high baseline TEWL (< 10 g/(m²h)). SC-DE/10/127/16 was once again used. Twenty subjects, 18 of which had self-assessed sensitive skin, were asked to apply the Cetiol RLF-based gel formulation containing 10% Cetiol RLF twice daily for 28 days. Skin surface hydration and skin barrier function were assessed on defined areas of the forearm skin prior to treatment and after 4 weeks of use via corneometry and TEWL measurements, respectively. The volunteers were asked to complete a questionnaire to document their subjective evaluations at the end of the study period. After 4 weeks of use, a significant increase in skin surface hydration was observed as was a decrease in TEWL indicating a better skin surface moisturization and an improved skin barrier function. All subjects found the formulation to have a good spreadability and to be absorbed quickly. 95% of the volunteers agreed that the product gave their skin a pleasant feeling directly after application and 90% confirmed this to still be the case after 15 minutes. 85% perceived their skin to be softer. 85% felt their skin looked more vital and fresh, 70% felt the formulation calmed their

<table>
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*Table 1. Composition of the formulation used in the sensitive skin study.*
skin (Figure 2B). 55% perceived their skin to be firmer and 50% noticed a reduction in wrinkles. All of the panelists said that the product had left their skin feeling more moisturized which confirms that the effects were not only measurable but also perceivable. None of the volunteers reported any adverse effects such as burning, stinging or redness. In total, the formulation was well accepted among the volunteers and the test results confirmed the formulation to be suitable for use on sensitive skin.

ENZYMATIC ESTERIFICATION AT LOW TEMPERATURES

The consistently positive assessment of Cetiol RLF, its good skin compatibility and crystal-clear appearance as well as its light natural odor and medium polarity make it an ideal component in leading-edge skin care products. Besides its strong performance and the fact that it is 100% derived from renewable natural feedstock, Cetiol RLF features another essential property that expands the value it can add to personal care formulations: Cetiol RLF is produced using an enzymatic process – an alternative to conventional manufacturing methods.

Conventional chemical ester synthesis is performed at high temperatures using an acid or a metal catalyst. For chemical synthesis steps, temperatures of over 200° C are often needed. Depending on the product quality, some by-products must be removed from the raw product. To this end, further purification steps, such as treatment with bleaching earth and/or activated charcoal, or the removal of by-products via steam deodorization treatments are essential. Downstream processing steps are generally performed at temperatures ranging from 80 to 200° C which make chemical emollient production and purification energy-intensive processes. A number of these energy-intensive processes can be circumvented by the use of natural enzymes. In contrast to chemical catalysts such as acid or metal catalysts, enzymes perform more defined reactions and with a higher substrate specificity. New avenues to explore the use of biocatalysts in manufacturing processes are currently being explored to increase their use [5].

Esterases or lipases are well known enzymes often used in the field of lipid biotechnology, to catalyze the conversion of fatty acids and fatty alcohols into emollient esters. The enzymatic esterification is performed at temperatures ranging from 30° C to 60° C, which are much lower than those usually required for chemical catalysis. For ester synthesis, the enzyme is usually attached to a solid support and can be recovered and recycled. Due to the lower reaction temperatures and the specificity of the enzymatic process, less by-products are formed which would otherwise have to be removed by energy-intensive downstream processing steps. Next to a potential decrease in energy consumption, the advantages of the process include improved color and smell compared to chemically synthesized products. The multitude of advantages biocatalysis entails, along with the use of a 100% renewable feedstock makes enzymatic esterification an eco-efficient process and a versatile tool for the production of high quality emollient esters such as Cetiol RLF.

MEETING COMPLEX CONSUMER DEMANDS

In an increasingly diverse world, people’s needs and demands are becoming more and more varied. If manufacturers want to serve the market successfully, it is essential they consider the specific needs and desires of different consumers. To this end, observation of market trends is crucial to sufficiently support customers and their needs. Cetiol RLF was developed in response to the growing need for skin care products for sensitive skin with improved environmental footprints. It combines good sensorial properties with good skin compatibility. Cetiol RLF is also suitable for concepts in line with Ecocert, NaTrue, the National Products Association (NPA), BDIH, and COSMOS.

REFERENCES AND NOTES

Ecocert disclaimer: raw material certified by Ecocert Greenlife according to the Ecocert Standard for Natural and Organic Cosmetics is available at http://cosmetics.ecocert.com: 100% of total ingredients are from Organic Farming.

1. New Value Perceptions in Skin Care, Euromonitor, March 2011.
Skin Fairness products form a major segment of cosmetic products worldwide and carry with them the promise of flawless skin free from age spots, blemishes and scars. Whatever the color of the skin, it is susceptible to damage due to environmental agents, physiological changes and psychological factors. The demand for “skin fairness products” is rooted in the need to eliminate localized hyperpigmentation as well as to lighten the general skin tone. Visit, www.sabinsa.com to learn more.

Contact Sabinsa for further information on innovative skin tone lightening natural actives, such as the ones listed below.

SabiWhite® (95% Tetrahydrocurcumin) INCI: Tetrahydrodiferuloylmethane
Tetrahydrocurcuminoids CG (95% Tetrahydrocurcuminoids) INCI: Tetrahydrodiferuloylmethane, Tetrahydrodihydroxydiferuloylmethane, Tetrahydrodibisdihydroxydiferuloylmethane
Saberry® (10% Beta-glucogallin) INCI: Emblica Officinalis Fruit Extract
Licorice 4% & 40% (Glabridin) INCI: Glycyrrhiza glabra (Licorice) Root Extract
pTeroWhite® (90% Pterostilbene) INCI: Pterocarpus Marsupium Bark Extract
Artonox® (95% Oxyresveratrol) INCI: Artocarpus Lakoocha Wood Extract