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Abstracts

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Review Article: Nanostructure of the stratum corneum extracellular lipid matrix as observed by cryo-electron microscopy of vitreous skin sections

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In recent years, high-resolution cryo-electron microscopy of vitreous skin sections has been used to visualize the formation and structure of the human stratum corneum extracellular lipid matrix. The aim of the present work was to summarize these findings. It is proposed that skin barrier formation does not take place as a 'lamellar body' fusion process, but as a lamellar 'unfolding' of a small lattice parameter lipid 'phase' with cubic-like symmetry with subsequent 'crystallization' and concomitant lamellar re-organization of the extracellular lipid matrix.

In vitro stability of triclosan in dentifrice under simulated use condition

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Triclosan has been formulated into a dentifrice at a 0.3% level to enhance the antibacterial function of the dentifrice, to improve oral health and to decrease the daily malodor inside the mouth cavity. The hypothesis that chloroform may be generated from triclosan when contacted with chlorinated drinking water has challenged our guarantee of safe use of triclosan in oral care products, especially in Colgate Total® toothpaste. Currently, there was no available analytical method to detect chloroform levels under the use conditions expected during daily tooth brushing. To fill this gap and to continue guaranteeing that our customers can safely use Colgate Total® toothpaste products, a gas chromatography–single ion monitoring–mass spectrometry method for detecting chloroform in artificial saliva media has been developed. The limit of detection (LOD) and limit of quantitation are about 41 and 130 ppb, respectively. This LOD level is lower than the current Environmental Protection Agency trihalomethanes contamination limit, which is required for our daily drink water. Our in vitro study indicated that Colgate Total® does not form detectable chloroform levels (41 ppb) over the range of expected consumer-brushing times while using normal chlorinated drinking water.

In vitro skin permeation and retention of parabens from cosmetic formulations

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Parabens are antimicrobial agents widely used in foods, cosmetics and pharmaceutical products. Although non-mutagenic, non-teratogenic and non-carcinogenic, parabens

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can induce allergic contact dermatitis and posses estrogenic activity. The aim of this work was to assess the skin permeation and retention of methyl- (MP), ethyl- (EP) and propyl- (PP) paraben from three commercial cosmetic creams. The results obtained indicate that parabens are capable of permeating through and accumulating in the skin. The extent of penetration depends more on paraben characteristics (solubility, lipophilicity) than on the composition of the formulation. In particular, the percentage permeated across the skin was independent of the composition of the cream used and decreased in the order MP, EP and PP, in accordance with decreasing solubility. After 8 h of contact with the skin, 60% of MP, 40% of EP and 20% of PP were found across the skin. Concerning skin retention, the percentage remaining in the skin after 8 h depends on both paraben characteristics and on the composition of the formulation used. In conclusion, it appears that only the type of paraben, in particular its water solubility, affects skin penetration whereas the composition of the emulsion, which influences skin retention, plays a secondary role. Finally, excised rabbit ear skin can be considered as a good model for human skin for in vitro experiments.

Fragrance raw materials and essential oils can reduce prostaglandin E_2 formation in keratinocytes and reconstituted human epidermis

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Essential oils and certain perfumery raw materials exhibit a wide range of beneficial biological activities. Besides the antimicrobial and antioxidant activity, the anti-inflammatory and anti-irritant effects are most often cited. One specific mode of action is the reduction of the formation of the key mediator prostaglandin E_2 (PGE_2). To study this activity in detail and to create cosmetically useful fragrances with the potential to reduce a key marker of skin irritancy in keratinocytes, an initial screening with pig blood platelets was conducted on 900 perfumery raw materials. Active compounds were then validated in a human keratinocyte cell line. Compounds which successfully reduced PGE_2 formation in this assay were used for the creation of active fragrances. These final fragrances reduced PGE_2 formation by >80% when dosed at 0.8 $\mu g\ mL^{-1}$ to keratinocytes. Application of such a fragrance in a hydrogel allowed reduction of UVB-induced PGE_2 formation in reconstituted epidermis (MatTec EpiDerm™). Similarly, antiperspirant-induced formation of PGE_2 in reconstituted epidermis was reduced to background levels if these novel fragrances were used in the antiperspirant formulation. In conclusion, fragrances with this added cosmetic benefit can be created based on a database from a comprehensive screening. These fragrances may find use as a part of a formulation strategy optimizing each part of a cosmetic formulation for optimal product mildness.

Emulsifying power of mannan and glucomannan produced by yeasts

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Subject of study was the colloid chemical properties of the biopolymers mannan, synthesized from strain Rhodotorula acheniorum MC, and glucomannan, synthesized from strain Sporobolomyces salmonicolor AL_1. Their emulsifying capacity was studied in model systems of aqueous solutions in concentrations from 0.5% to 2.5% with regard to the aqueous phase. Emulsions of the direct type (oil/water) with 50% oil content were obtained. A disperse system with 2.5% glucomannan had 100% intact emulsion in the centrifugation test, while for the system with mannan, this indicator was 72%. Lab cream emulsions were obtained with glucomannan and with the emulsifiers Rofetan N/NS and Arlacel 165 used in the cosmetics industry. It has been established that under standard testing conditions, cream-like emulsions with 2.0% glucomannan have stability indicators comparable to these of 5.0% rofetan N/NS and 5.0% Arlacel 165. The samples with different concentrations of glucomannan showed a pseudo-plastic behaviour, as the highest viscosity was shown by the emulsion with 2.0% stored at 45°C. The newly synthesized exopolysaccharides had a distinct emulsifying power and can be applied in the cosmetic and food industries.

A double-blind and controlled study on the influence of the vehicle on the skin susceptibility to stinging from lactic acid

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For patients with skin diseases, the process of treating the skin with topical medications adds to the burden of having the disease. Inconvenient skin reactions can make the treatment troublesome and lower the compliance. Moreover, epidemiological surveys indicate that 50% or more of female consumers believe they have sensitive skin. In the present study, the influence of the vehicle on the adverse skin reaction to lactic acid was judged by the test subjects after application of the test formulations to the facial skin. The results showed a water-in-oil (w/o) emulsion to induce less stinging than an ordinary oil-in-water (o/w) emulsion. Increasing the mineral oil content in the o/w emulsion from 10% to 50% tended ($P = 0.077$) to decrease the stinging potential of the formulation. An o/w

emulsion free from lactic acid but with pH adjusted to 3 using hydrochloric acid induced significantly less stinging than the corresponding lactic acid formulation at pH 3. In conclusion, the present study gives new insights into the influence of vehicle on the stinging capacity of lactic acid, which may be related to its possible penetration via appendages. Hence, encapsulation of the stinging substances in the inner water phase of an emulsion may be a possible option to reduce adverse skin reactions and to increase compliance to water-soluble substances.

Perfluoropolyether phosphate: skin exfoliation after a topical pre-treatment, TEWL and skin elasticity, by in-vivo non-invasive methods

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Glycolic acid (GA) and other alpha-hydroxyacids (AHAs) are common ingredients of products designed to accelerate exfoliation of the skin. It is known that acidic pHs are essential in order to increase the efficacy of AHA-based products. The formulator is, therefore, obliged to achieve a difficult balance between performance (skin exfoliation) and risks (skin irritation). In order to overcome this problem, many common organic acids, and combinations of them, have been proposed, with marginal improvements. The need for a new chemistry, in order to achieve better results, was evident, particularly from the point of view of safety. We decided, therefore, to investigate the efficacy of perfluoropolyether (PFPE) phosphate, a new acidic material, already proposed for lowering the pH without increasing skin irritation. Two gels containing PFPE phosphate at different pH values (3 and 7), an acidic gel containing GA at pH 3, and a neutral gel, without an active compound, were applied on 20 healthy volunteers and evaluated with regard to effects on the skin:

- Exfolidation after a topical pre-treatment with these gels
- Transepidermal water loss (TEWL) and elasticity

The main conclusion of the investigation was that PFPE phosphate has effects, particularly skin exfoliation rate, quite independent of the pH, and comparable to the gel containing GA at pH 3, apparently without the typical drawbacks of AHAs.

Psychological and physiological evaluation of emotional effects of a perfume in menopausal women

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In the present study, we familiarized menopausal women with a pleasant smell in the skin care products, they used for 1 week and assessed whether their mood and emotions improved using behavioural and physiological tools. Eventually, we studied the effects of inhaling the familiar fragrance on physiological response of the subjects. An anhedonia questionnaire was used to distinguish the effects of the test products according to low vs. high score of anhedonia. Familiarization with the fragrance induced a modification of some physiological parameters, reflecting a relaxing effect, and these unconscious effects paralleled the conscious positive effects on mood recorded during the familiarization phase; it appeared that the effects were more prominent in subjects with higher scores of anhedonia. These results suggest that the pleasant smell of a skin care product contributes to the quality of life in a population of menopausal women with low easiness to experience pleasure.