

Abstracts

Journal of the Society of Cosmetic Chemists Japan (as published in Vol. 33, No. 2, 1999)

The Mechanism of Desquamation in the Stratum Corneum and Its Relevance to Skin Care

Junichi Koyama**, Jotaro Nakanishi**, Junko Sato**, Junko Nomura***, Yumiko Suzuki**, Yoshiko Masuda**, Yasuhisa Nakayama**

Life Science Research Center**, Basic Research Center***, Shiseido Co., Ltd.

For healthy people, the most common skin problem is the occurrence of visible scales on the skin surface. This phenomenon is commonly seen on dry skin. Many morphological and biochemical studies on the stratum corneum have revealed the aspects of skin. However, we still do not know why and how scales appear on the skin surface, except that a defect of the desquamation process in the stratum corneum must be involved. In this study, we examined the mechanism of desquamation, to establish what factors influence the mechanism and what treatments might be effective for skin care. We found two types of proteases, trypsin type (30 kDa) and chymotrypsin type (25 kDa), in stratum corneum (SC). cDNA cloning followed by nucleotide sequence analysis revealed that the chymotrypsin-like protease corresponded to the reported chymotrypsin-like enzyme in stratum corneum (SCCE). Trypsin-like protease corresponded to trypsinogen IV and we found new type of trypsinogen. Desmosomes in SC sheets were digested and SC sheets were dissociated into individual intact cells in buffer solution, whereas heat-treatment or addition of inhibitors of these proteases to the buffer solution prevented the degradation of desmosomes and the cell dissociation. Leupeptin or chymostatin retarded the cell dissociation only about half as effectively as aprotinin, but a mixture of the two inhibited stratum corneum sheet degradation as potently as aprotinin. These results support the hypothesis that desmosomes play a key role in the adhesion of SC cells, and the digestion of

desmosomes by these two types of serine proteases leads to SC desquamation. An age-related decrease in the activity of the trypsin-type protease was observed in normal subjects. Digestion of desmosomes in SC by the proteases was influenced by the water content in SC. Lower humidity (lower water content in stratum corneum) resulted in a decrease of desmosomal degradation. Our studies demonstrated that desquamation was influenced by two factors. One is water content in the stratum corneum. Under the low water condition enzymes cannot work well, even if the contents of the enzymes are normal. In this case, humectant treatment was effective by supplying water to the stratum corneum. The other factor is a decline in the activity of the proteases themselves. This can be seen in diseased or aged skin. Humectant treatment is not sufficient in this case; compounds that accelerate desmosomal digestion independently of the water content in the stratum corneum are required. Derivatives of dicarboxylic acid are thought to be the candidate for such ingredients.

Key words: stratum corneum, desquamation, protease, dry skin, desmosome, α -hydroxy acid

Evaluation of Pigmentation by Multispectral Image Analysis (Second Report): Reconstruction of Pigmented Images Based Only on the Melanin Component in the Skin

Yukiko Kawaguchi, Osamu Kaneko, Institute of Beauty Sciences, Shiseido Co., Ltd.

Conventional digitized images of pigmented skin include both coloring caused by melanin and coloring contributed by other skin factors. To accurately quantify the darkness of pigmented skin, only melanin should be considered. Coefficients for weighting M_1 and M_2 for the reflected light constituent factors

V_1 and V_2 derived from the spectral reflectance data of the skin indicate the amount of melanin in the stratum basale and that above the stratum basale, respectively. The authors have devised a method for separating coloring caused by melanin at different depths from the skin surface and for displaying the degree of coloration at each depth as a separate image. The average brightness of a pigmented region was calculated based only on the melanin component and defined as the average pigmentation density. To represent the brightness-related frequency distribution of pixels in a digitized image, a new method employing two parameters was developed. Using this method to display the melanin profile in skin, it is possible to represent the pigmentation condition in images having equal average pigmentation densities but different frequency distributions of brightness.

Key words: spectral reflectance, melanin, pigmented skin, evaluation, principal component analysis

The Effects of Oligosaccharide-Carrying Polymers to Skin Cell and Its Cosmetic Applications

Hideo Kuroda, Ai Oba, Michio Ochiai, Masao Shaku, POLA R&D Institute of Fundamental Technology, POLA Corporation

We examined the biological properties of oligosaccharide-carrying styrene homopolymers. In cell cultures, of four oligosaccharide species, only lactose-carrying polymer (PVLA) increased fibroblast cell attachment. And PVLA showed biological activities as substratum like an extracellular matrix, that promoted cell proliferation, collagen and glycosaminoglycan (GAG) synthesis. In animal skin, PVLA not only increased epidermal cell mitotic activity, but also improved recovery of UVB induced photoaged skin surface textures. Moreover, after 1 month usage of 1% PVLA contained cream on faces of middle-aged women, their skin elasticity was increased significantly. Therefore, we considered PVLA was an effective ingredient for anti-aging cosmetics.

Key words: lactose-carrying styrene homopolymer, PVLA, extracellular matrix, collagen, glycosaminoglycan, keratinocyte, fibroblast cell, cell proliferation, skin elasticity, anti-aging

A New Method for Direct and Instantaneous Measurement of Skin Texture

Koichi Shimoto**, Tsunenori Honda***

Fundamental Research Laboratories, Research & Development Division, KOSE Corporation**, Faculty of Engineering, Tokyo University of Agriculture and Technology***

Objective measurement and evaluation of skin surface conditions is important in developing effective cosmetics. Three-dimensional (3D) depiction of skin characteristics such as wrinkles and skin texture is crucial to this evaluation. In recent years, many methods based on image processing for measuring skin surface characteristics have been proposed. However, conventional methods have many problems. Some measure only skin replicas and some require keeping test subjects for long periods of time. There is clearly a lack of quick and accurate means of measuring important skin surface characteristics. A new and unique method for accurately measuring the 3D characteristics of human skin directly and instantaneously is proposed here. This method involves direct measurement of the skin. From multiple monocular gray images recorded under various optical conditions, 3D shapes of the skin texture are reconstructed through image processing that is derived from integration of normals over the entire surface. With conventional methods, it is impossible to accurately reconstruct the complex shapes and varying complexions of human skin. However, our proposed method enables reconstruction of the complex 3D shapes from theoretical solutions based on vector equation. When the object is multi-colored, this method permits reconstruction of the shape from estimation of reflectance using new restricting conditions based on surface free energy. To increase the speed of measurements, a new method was devised to simultaneously process multiple images recorded in color, categorizing them by wavelength, using our new equation to avoid the problems in color of objects. A new measurement system has been constructed from our theory and tested on different specimens. The new device required only 0.03 s for each image recording and the average square error of reconstruction was only 0.0026. Clearly, this method offers significant advantages over conventional methods.

Key words: direct measurement, human skin, texture, 3D shape, color image

Preparation of Ultra Fine Emulsion by Phase Inversion Temperature (PIT) Emulsification

Yoshikazu Konno, Yoshio Sugaya, Midori Hirobe, Emi Hokao, Product Research Laboratory, KOSE Corporation

Phase inversion temperature (PIT) emulsification is the method which use the change of the balance for hydrophilic-hydrophobic of nonionic surface active agent. In this study emulsions were assembled according to PIT emulsification with POE (n) sorbitol tetraoleate (n: 30, 60) and POE (20) hydrogenated castor oil as emulsifier, and were subjected to evaluation of particle size and storage stability. Thus in order to obtain ultra fine emulsion with less than 200 nm in diameter, the combination of emulsifier and oil is important. Stability of ultra fine emulsion

prepared with POE (20) hydrogenated castor oil was good; on the other hand prepared with POE (n) sorbitol tetraoleate (n: 30, 60) depended on oils. We could obtain ultra fine and stable emulsion with mixture of the emulsifiers for various oils.

Key words: phase inversion temperature, emulsification, ultrafine emulsion, POE (30) sorbitol tetraoleate, POE (60) sorbitol tetraoleate, POE (20) hydrogenated castor oil, particle size, storage stability, emulsifier, oil