News Release
Kao Corporation

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14-10, Nihonbashi Kayabacho 1-chome, Chuo-ku, Tokyo 103-8210 Japan www.kao.com/global/en

FOR IMMEDIATE RELEASE

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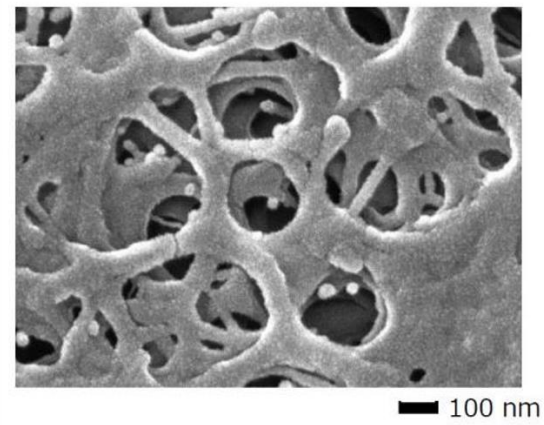
Clarifying Newly Found Causes for Rough Skin
Development of New Technology for Trapping Unsaturated Fatty Acids*1 Contained in Sebum

Kao Corporation's Skin Care Products Research Laboratory, Material Science Research Laboratory, Analytical Science Research Laboratory and Biological Science Research Laboratory have discovered that the unsaturated fatty acids*1 contained in secreted sebum have a negative effect on the skin barrier function that can cause dryness. By successfully developing a new technology that utilizes hydroxypropyl cellulose (HPC) which forms a sponge-like structure (Figure 1) and selectively combines with unsaturated fatty acids to trap them on the skin, Kao expects to be able to suppress contact between unsaturated fatty acids and skin with this technology.



Observed membranes by SEM (Scanning Electron Microscope)
after removal of oleic acid through solvent processing

Figure 1. HPC membranes after HPC actions on oleic acid

These findings were presented at the 48th Convention of the Japanese Cosmetic Science Society (June 23–24, 2023 in Tokyo) and the 74th Divisional Meeting of Division of Colloid and Surface Chemistry (September 12–15, 2023 in Nagano).

*1 A type of free fatty acid that has 18 carbon chains and one double bond (C18:1) such as 8Z-octadecenoic acid and oleic acid

Background

While sebum secreted from our skin works as a moisturizer to protect it from dryness, a survey on skin problems revealed that roughly 40% of people who report having oily skin feel dryness during the winter months immediately after washing their face, the same response as people who report having dry skin*2.

This prompted Kao to examine the correlation between skin surface sebum and skin functions to understand the effects of sebum on skin conditions.

*2 Surveyed by Kao between May and June 2021, targeting 129 Japanese females with different skin types between the ages of 20 and 55

The survey suggested the possibility that the skin barrier function and moisture content were affected not only by the quantity of sebum, but also its quality

In May 2021, Kao collected skin surface sebum from the right cheeks of 125 men and women between the ages of 25 and 45 at 90 minutes after face washing and measured trans-epidermal water loss (TEWL), an indicator of skin barrier function, and water content in the stratum corneum to examine the correlation.

Subjects were divided into two groups according to the amount of sebum secretion*3. Results showed that in the group with 5μg/cm^2 or greater sebum secretion, a lower skin barrier function was clearly associated with lower water content in the stratum corneum (Figure 2). Furthermore, qualitative analysis of sebum components confirmed a correlation between a higher ratio of unsaturated fatty acid rate in sebum and lower skin barrier function (Figure 3).

This suggested that in subjects with 5μg/cm^2 or greater sebum secretion, a high ratio of unsaturated fatty acids may lead to both a lower skin barrier function and less water content in the stratum corneum. The group of subjects with less sebum secretion did not show such a correlation.

The above results suggest that it is not only the quantity of sebum, but also the quality (ratio of unsaturated fatty acids) that influences skin barrier function and can have a negative influence on the skin by lowering the water content in the stratum corneum. These were clarified for the first time through this research.

*3 65 subjects with 5μg/cm^2 or greater sebum secretion 90 minutes after face washing, and 60 subjects with less than 5μg/cm^2 sebum secretion 90 minutes after face washing

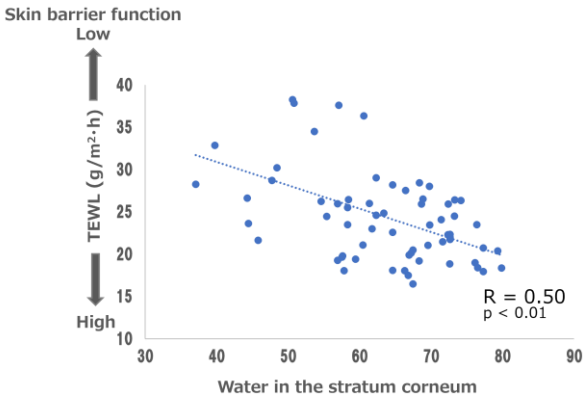


Figure 2. Correlation between the water in the stratum corneum and skin barrier function in the subjects with 5μg/cm^2 or greater sebum secretion

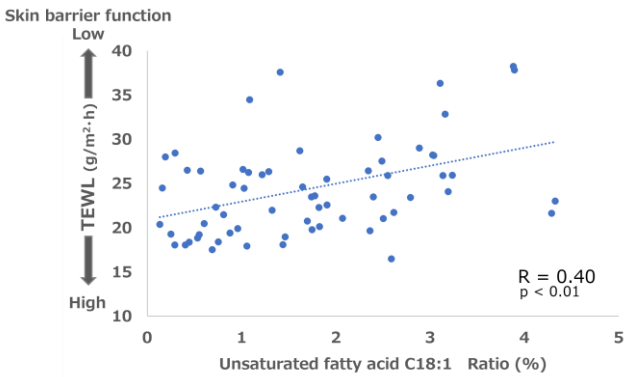


Figure 3. Correlation between unsaturated fatty acid ratio and skin barrier function in the subjects with 5μg/cm^2 or greater sebum secretion

Development of a technology that selectively traps unsaturated fatty acids

These findings prompted Kao to explore ways to reduce unsaturated fatty acids, which can cause negative

effects on the skin, while maintaining the hydrating function of sebum. This led to the development of a technology that selectively gels and traps unsaturated fatty acids. The research involved mixing individual components contained in sebum with a wide range of polymers to see whether they gelled. It was found that a certain type of HPC immediately and selectively gelled oleic acid (OA), an unsaturated fatty acid (Figure 4).

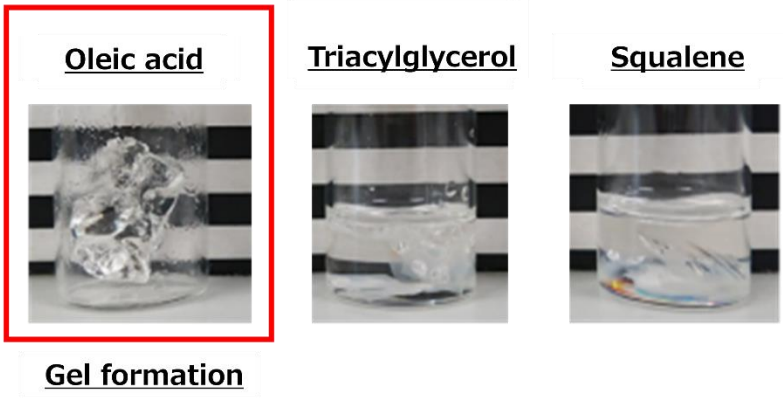


Figure 4. Behaviors of sebum components mixed with HPC at a ratio of 10:1

Furthermore, it was also discovered that when HPC was processed to easily dissolve in water, it was effective in gelling and trapping more OA (Figure 5).

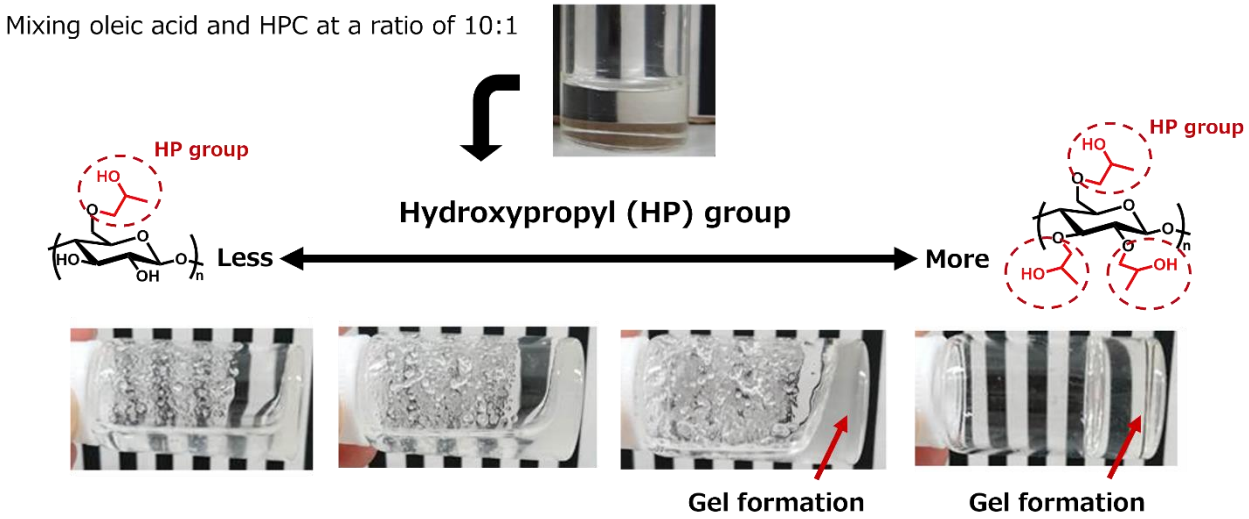


Figure 5. Difference in gelation behaviors by HP group ratio

Further analysis was conducted to clarity the mechanism by which HPC selectively gels OA. The results showed that hydrogen bonding occurs between HPC and OA. Analysis of membranes using a scanning electron microscope showed that membranes formed by HPC and OA had a unique sponge-like structure (Figure 1). Kao also speculates that the gelling may also have occurred because a significant amount of OA was taken into the spaces of the sponge-like structure formed by the bonding of HPC and OA. It is expected that trapping OA on the skin surface may reduce its contact with the skin, thereby reducing its negative effect on the skin.

Conclusion

Kao clarified in this research that the quantity and quality of sebum can affect the skin barrier function and water content. It was found that skin with a certain quantity of sebum and a higher ratio of unsaturated fatty acids has lower skin barrier function and water content. In the process of research, it was also discovered that HPC could be used as an effective means to trap unsaturated fatty acid, a component of sebum that negatively affects the skin. Kao will apply these findings to the development of new skincare products from a new standpoint of solving rough skin and skin dryness caused by sebum.

About Kao

Kao creates high-value-added products and services that provide care and enrichment for the life of all people and the planet. Through its portfolio of over 20 leading brands such as *Attack*, *Bioré*, *Goldwell*, *Jergens*, *John Frieda*, *Kanebo*, *Laurier*, *Merries*, and *Molton Brown*, Kao is part of the everyday lives of people in Asia, Oceania, North America, and Europe. Combined with its chemical business, which contributes to a wide range of industries, Kao generates about 1,550 billion yen in annual sales. Kao employs about 35,400 people worldwide and has 136 years of history in innovation. Please visit the Kao Group website for updated information.