News Release
Kao Corporation

Kao
Kirei–Making Life Beautiful

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

FOR IMMEDIATE RELEASE

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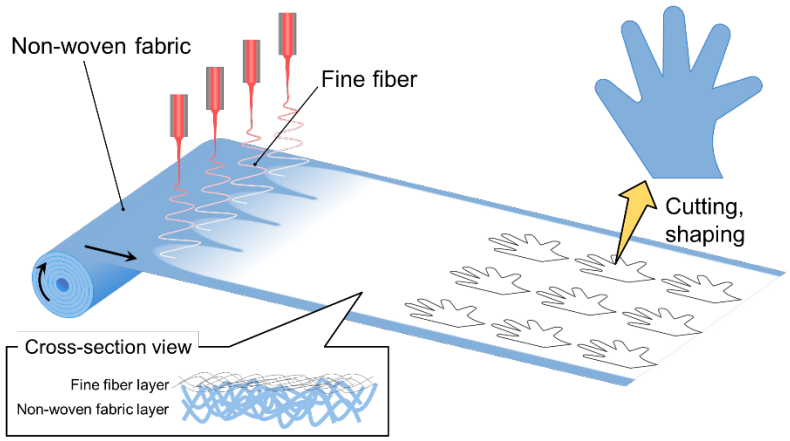
Large Fine Fiber Sheets Integrated with Non-woven Fabric Developed

Applicable to Large Areas or Parts that Move Frequently

This is an English translation of reference material released in Japanese on May 29.

Kao Corporation's Skin Care Research Laboratory and Processing Development Research Laboratory are proud to announce the enhancement of an innovative technique for spinning fine fibers into large sheet forms, resulting in a new fine fiber sheet with a two-layer structure created by spraying fine fibers onto non-woven fabric. This advanced sheet retains the properties of the fine fiber membrane while offering high strength and elasticity. It is capable of covering the skin extensively and accommodating significant movement, opening up new potential applications where previous limitations existed.



Visual representation of fine fiber manufacturing and processing

Part of this study's findings will be presented at the 43rd Annual Meeting of the Japanese Society of Aesthetic Dermatology in Osaka, Japan (August 16–17, 2025).

Background

In 2018, Kao announced the development of Fine Fiber Technology*[1] to create an ultra-thin membrane made from interfolded fine fibers on the surface of the skin by directly spinning super-fine fibers under one micron in diameter. This flexible, ultra-thin film maintains adequate moisture permeability without completely blocking the skin, and thanks to capillary action, can evenly distribute a formula throughout the entire membrane. Kao has reported that combining the fine fiber membrane with a moisturizer formula on the skin can help control moisture evaporation and protect against friction and other physical irritants*[2].

However, spinning the membrane directly onto the skin is unsuitable for areas with uneven surfaces, areas that move frequently, or large surfaces. Kao began developing technology for an industrial process to produce large fine fiber sheets, in order to broaden applications and scope of use.

*1 "Kao Has Developed Fine Fiber Technology," Nov. 27, 2018 Kao news release.

*2 "The Function of Fine Fiber Technology to Protect the Skin Has Been Elucidated," January 29, 2021 Kao news release.

Developing technology for spinning fine fibers into large sheets

Fine fiber technology employs a fiber-spinning method called electrospinning, which utilizes the attraction between positively and negatively charged objects. Initially, Kao dissolved polymer in a solvent to give it a positive charge and spun this solution onto a negatively charged target surface. However, the solvent diluted the polymer, restricting the amount that could be spun at one time and required evaporation, slowing the spinning process.

To spin a large amount of fine fiber, Kao explored methods to avoid using polymers that dissolve in solvents. By selecting polypropylene, a polymer that melts upon heating and solidifies when cooled, and then adding the appropriate charge-regulation agent, along with utilizing the drawing force of airflow, Kao developed a technology for spinning superfine fibers. This technology enabled the production of over 100 times more fine fiber than the previous method. In addition, setting up equipment with multiple fiber outlets made it possible to produce large sheets of fine fiber membrane.

Video showing fine fiber being spun to form a sheet

Developing layered sheets by spinning fine fiber onto non-woven fabric

Due to the fine fiber membrane's thinness, it lacks sufficient strength and other attributes when produced in large sheets. Therefore, Kao considered spinning it onto a non-woven fabric surface to create a layered sheet. To enhance flexibility and stretch, Kao used polypropylene resin with low crystallinity as the fine fiber material and non-woven fabric with good stretching properties. This resulted in fine fiber layered sheets that do not rip easily and that conform closely to the skin. (Figure 1)

Similar to cutting a single piece of fabric to make clothing, these layered sheets can be cut and formed into various shapes. Their strength and elasticity make them well-suited for covering large areas or parts that move frequently.

Figure 1. Visual representation of a fine fiber layered sheet cross-section

Fine fiber layered sheet applications

1. Humidity between skin and sheet when covered by a fine fiber layered sheet

Kao has reported that the fine fiber membrane is permeable and that, when combined with a moisturizer formula, the skin remains appropriately moist*[3]. To test whether the fine fiber layered sheet has the same effect, moisture behavior when the skin was covered was investigated.

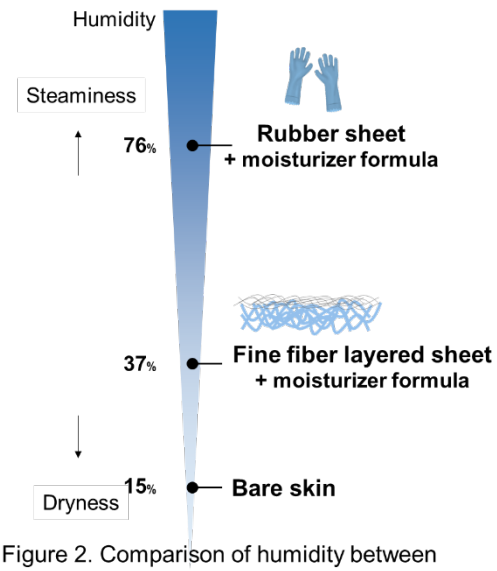


Figure 2. Comparison of humidity between skin and sheet at 20°C and 15% humidity

The skin was covered with both a fine fiber layered sheet and a non-porous rubber sheet spread with a moisturizer formula, and the humidity between the skin and the sheets in a low-humidity environment (20°C, 15% humidity) was measured. The result showed that after 20 minutes, the skin covered with the layered sheet maintained higher humidity than bare skin.

This demonstrates that, similar to the fine fiber membrane, the fine fiber layered sheet, used in combination with a moisturizer formula, can maintain a moist environment that does not dry out and is not steamy by controlling moisture permeability. (Figure 2)

*3 "Membrane formed by use of fine fibers with moisturizer formula has effects on protein expression in stratum corneum and efficacy for improving skin condition" September 4, 2019 Kao news release.

2. Comparison of the amount of moisturizer formula remaining on the skin

Fine fiber layered sheets can be cut and fashioned into any shape. Leveraging this property, and to test their effectiveness, two sheets were cut into the shape of a hand and joined together to create a glove. The glove was then worn on a hand—a part of the body prone to skin trouble—with the fine fiber on the inside to ensure contact with the skin.

A moisturizer formula was spread on the palm and tested under three conditions: wearing the glove fashioned from the layered sheets, wearing a cotton glove, and wearing nothing. Ordinary daily activities were conducted for two hours in each condition, after which the amount of moisturizer formula remaining was visualized. Results showed that compared to wearing a cotton glove or nothing, the moisturizer formula remained spread evenly up to the fingertips when the glove made from layered sheets was worn. (Figure 3)

Similar to the fine fiber membrane, the strong capillary action of the super-fine fibers allowed the layered sheet to evenly distribute and keep the moisturizer formula on the skin surface.

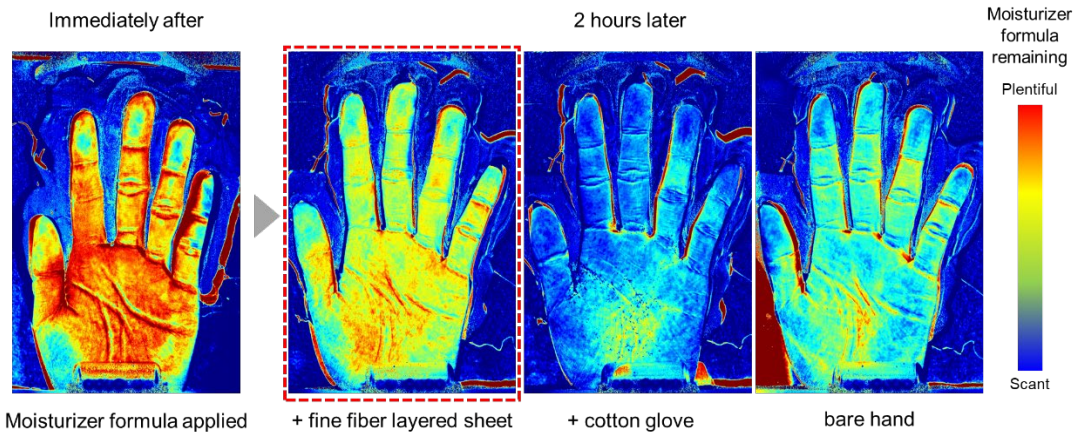


Figure 3. Example of moisturizer formula remaining when applied to palm of hand

3. Dryness-prevention effects

In a study by Kao, 56 women who regularly use hand cream in winter to manage skin issues on hands tested two treatments for two weeks: using a moisturizer formula alone and applying the moisturizer formula followed by wearing a glove made from the advanced, two-layer structured fine fiber sheet. Findings showed that moisture content in the stratum corneum was significantly higher when wearing the glove with the moisturizer formula than when using a moisturizer formula alone, demonstrating that fine fiber was effective in preventing dryness. In subjective evaluations, the women reported a reduction in dryness, hard skin, itchiness, and pain. They also stated improvements surrounding their quality of life (QOL) *4, including matters related to emotional well-being, such as concerns about physical appearance and feelings of depression.

*4 Skindex-16: QOL measure for patients with skin diseases

Summary

Kao has devised technology for spinning fine fiber into large sheets and developed a fine fiber layered sheet by spinning fine fiber onto non-woven fabric. This sheet combines the properties of fine fiber membrane with strength and flexibility. Since it can cover large areas or frequently moving parts, it is expected that it can complement skincare in various uses and conditions.

Kao will continue developing new uses for fine fiber to support consumers with skin problems.

About Kao

Kao, a Japan-based manufacturer of personal care and household products, cosmetics, and specialty chemicals creates high-value-added products and services that provide care and enrichment for the life of all people and the planet. Through its brands such as *Attack* laundry detergent, *Bioré* and *Jergens* skin care products, *Laurier* sanitary products, *Curél*, *SENSAI*, and *MOLTON BROWN* cosmetics, and *Oribe* hair care products, Kao is part of the everyday lives of people across Asia, the Americas, Europe, the Middle East, and Africa. Combined with its chemical business, which contributes to a wide range of industries, Kao generates about 1,630 billion yen in annual sales. Kao employs about 32,600 people worldwide and has more than 130 years of history in

innovation. As an enterprise that provides products people use on a daily basis, the Kao Group takes responsibility to actively reduce the environmental footprint of its products throughout the product lifecycle. This is laid out in Kao's ESG strategy, the Kirei Lifestyle Plan, which launched in 2019.
Please visit the Kao Group website for additional information.

Media inquiries should be directed to:

Public Relations
Kao Corporation
corporate_pr@kao.com