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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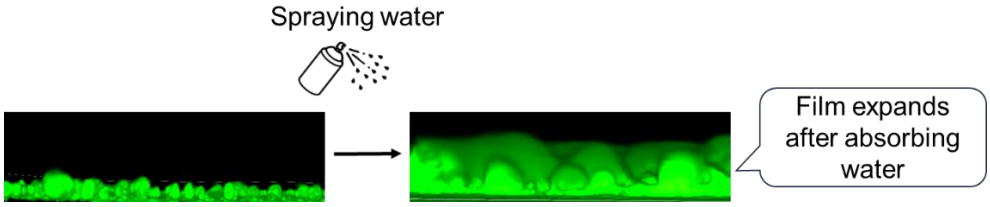
Development of Humidity-Responsive UV Protection Film Technology

Seeking Effective Protection Against Sunburn with a Unique and Comfortable Texture

Kao Corporation's Skin Care Products Research Laboratory and Processing and Development Research Laboratory has developed a new technology capable of combining agar hydrogel capsules containing ultraviolet (UV) absorber and highly water-retaining polymer in the aqueous phase of a water-based (oil-in-water) formulation. This new technology makes it possible to produce a sunscreen with a light and airy texture that spreads easily, absorbs and releases moisture along with changes in humidity, and forms an adaptive film that remains comfortable on the skin throughout the day.



When being applied and dried After being sprayed

Changes in the new UV protection film after spraying water

Background

Surveys conducted by Kao found that while many sunscreens that offer high UV protection are available on the market, more than 90% of sunscreen users reported experiencing sunburn despite use.[*1] Noting that users reported using sunscreen out of a sense of duty, Kao researchers hypothesized that the amount of sunscreen consumers apply when they go out may be insufficient. What's more, many consumers reported finding the uncomfortable feeling of stickiness, which accompanies perspiration following the application of sunscreen, unappealing. This issue has become more prevalent due to increasingly high levels of humidity; which have been exacerbated by recent rises in summer temperatures.[*2]

To address these issues, Kao sought to develop a more comfortable sunscreen formulation that would encourage consumers to use and reapply appropriate amounts while reducing the uncomfortable feeling from humidity and sweat.

*1 Kao survey 2019 targeting 1,241 women aged 10 to 40

*2 Kao survey 2024 targeting 800 women aged 10 to 50

A highly water-retaining polymer that creates a comfortable film

Kao offers a wide variety of sunscreens in different textures. One of Kao's strengths lies in its water-based sunscreen products that have a light texture and high UV protection. This is achieved through Kao's uniquely developed technology that encapsulates UV protection ingredients (UV absorbers and UV scattering agents), which are generally water-insoluble, and disperses them in the aqueous phase of a water-based formulation. In this case, Kao used agar hydrogel capsules, which can be filled with a large amount of UV absorbers and exhibit properties of disintegration and spreadability upon application. Encapsulating all UV absorbers has made it possible to stably combine a wide variety of ingredients in the aqueous phase of formulation, which greatly expanded the potential for adding new textures and functions.

Leveraging these advantages, Kao worked to combine highly water-retaining polymer, which had not previously been used in UV protection formulation, with the concept that if the film itself could control moisture along with changes in humidity, it might be possible to reduce the uncomfortable feeling resulting from humidity and sweat. After experimenting with combinations of a wide variety of materials, Kao researchers found that they could achieve the desired high level of comfort by using this highly water-retaining polymer, which is capable of holding several hundred times its weight in moisture (Figure 1).

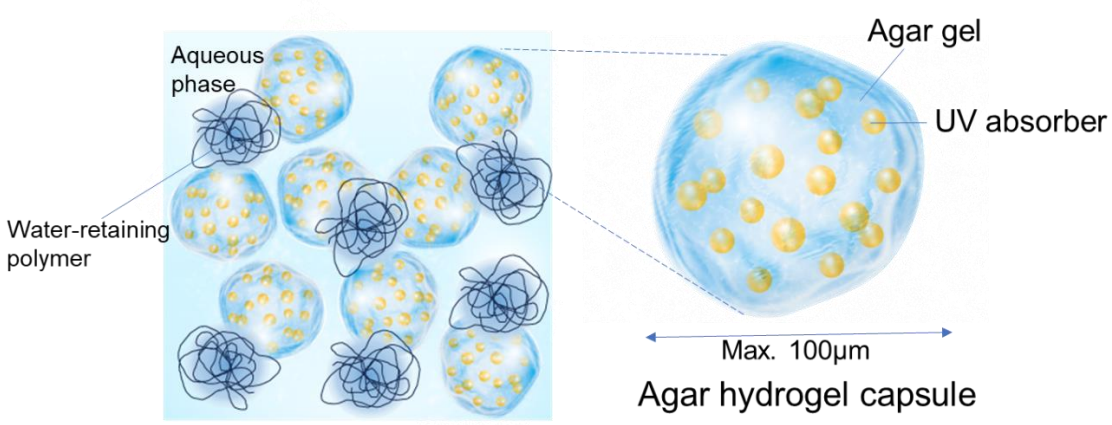


Figure 1. New formulation combining highly water-retaining polymer and agar hydrogel capsule (illustrations)

UV protection film capable of absorbing and releasing moisture along with changes in humidity

Kao researchers examined how this newly developed formulation would respond to changes in humidity. They applied equal amounts of this new formulation and conventional water-based formulation on glass plates to compare their thicknesses under three conditions: (1) after drying for more than 30 minutes at a humidity of 20% or lower, (2) after being sprayed with water to maximize the moisture content, and (3) after redrying for 60 minutes at a humidity of 20% or lower.

While the thickness of the conventional formulation did not change after exposure to water, the thickness of

the new formulation increased, showing the impressively high water retention capability of the new formulation. In addition, the film became thinner after redrying, indicating that this new film could absorb and release moisture in response to the external environment (Figure 2).

Furthermore, measurement of film weight along with the changes in humidity from 21% to 88% in a closed space clarified that at the relative humidity of 88%, the newly developed formulation was capable of absorbing more than twice the amount of moisture that the conventional formulation does (Figure 3).

This indicates that the film could absorb sweat to reduce the uncomfortable feeling even in a hot and humid environment.

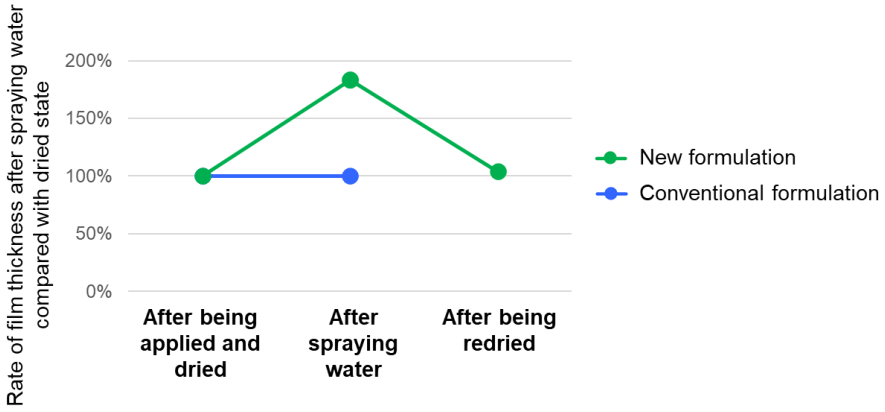


Figure 2. Rate of change in film thickness when being sprayed with water and after drying

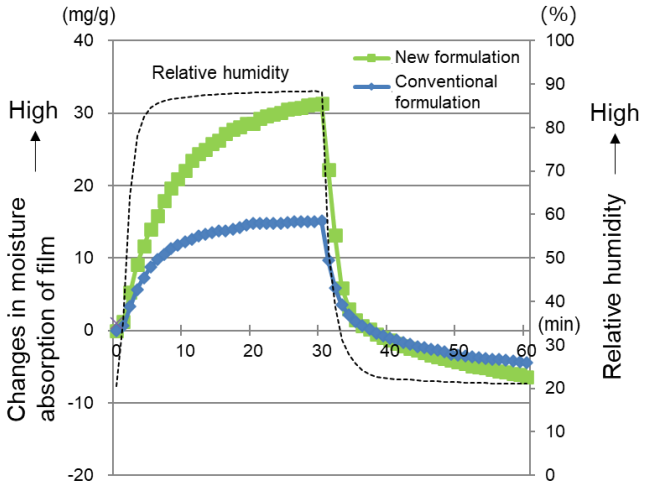


Figure 3. Changes in film weight in response to humidity variations

Kao conducted a survey on 42 women in their 20s to 50s who used the newly developed formulation from May to June of 2024 (mean maximum temperature: 27°C).

More than 70% of respondents reported feeling comfortable during daytime even in a hot and humid environment.

Unique texture encourages consumers to apply the product liberally

Kao developed a sunscreen with a semi-solid, yet light and airy texture, an uncommon quality in sunscreens, by combining the disintegratability of agar hydrogel capsules and the mutual action of highly water-retaining polymer. This semi-solid formulation's ability to release moisture and liquify quickly with light pressure when applied was confirmed by rheology measurement.

Preventing sunburn requires that the appropriate amount of sunscreen be applied and reapplied as necessary throughout the day. This uniquely comfortable texture increases the effectiveness of Kao sunscreen by making it easier and more enjoyable to use.

Summary

Kao has developed a new sunscreen that combines an agar hydrogel capsule containing UV absorber and a highly water-retaining polymer in a water base formulation capable of absorbing and releasing moisture along with changes in external humidity and featuring a unique texture capable of quickly liquifying from a semi-solid state when applied.

Using this knowledge, Kao will continue its research so as to realize a sunscreen that imparts a pleasant texture upon application, thus encouraging consumers to use the product in appropriate amounts leading to increased levels of protection.

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 1,530 billion yen in annual sales. Kao employs about 34,300 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