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Kao's New UV Absorber-free Sunscreen Formulation Reconciles Strong UV Protection and Pleasant Texture

Kao Corporation's Skin Care Products Research Laboratory and Processing and Development Research Laboratory have successfully developed a new formulation technology for sunscreen free of ultraviolet (UV) absorbers that offers strong UV protection, no white cast and a light texture. This technology is based on the novel idea of dispersing a UV scattering agent (titanium oxide, etc.) contained in a specially developed capsule stabilized at the aqueous phase.

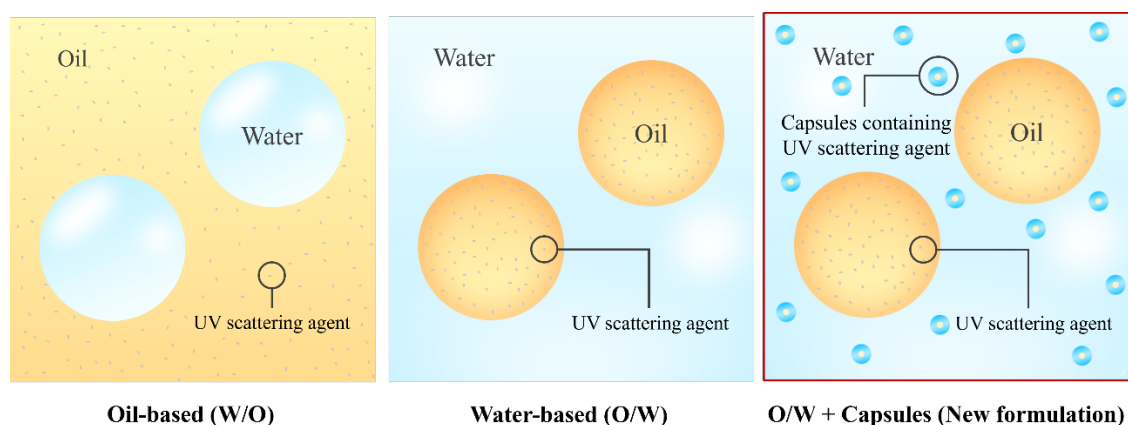


Figure 1. Pictorial representation of the UV absorber-free sunscreen formulation

Background

Recent surveys by Kao have indicated that more than 30% of consumers view gentleness or non-irritating to the skin as important attributes for sunscreen.*¹ UV absorber-free sunscreens are recommended for those who are concerned about burdening their skin, but such products only account for under 10% of sunscreens on the market.*² Users of UV absorber-free sunscreens expect the product to easily blend with their skin color, have a light texture, and provide strong UV protection, so Kao decided to work toward meeting these needs.

UV absorber-free sunscreens need to give UV protection using only UV scattering agents. A UV scattering agent is usually a powder that reflects UV rays to prevent them from reaching the skin, but such an agent is oleophilic and does not disperse in water. Thus, to achieve good UV protection, UV absorber-free sunscreens often use an oil base into which a certain amount of UV scattering agent is

added. (Figure 1 left shows water droplets in the oil). The more oil is used, the more UV scattering agent can be added, but such a product has a heavy texture and is prone to leaving a white cast.

A water-based formulation (Figure 1 center) works well for achieving a light texture, but since the UV scattering agent can only penetrate oil droplets, it had been difficult up to now for UV absorber-free sunscreens to give good UV protection. In addition, Kao observed that when a water-based product was applied to the skin and the water evaporated, it left gaps on the skin that UV rays could easily penetrate resulting in sunburn.

Kao thus began trying to develop a water-based UV absorber-free sunscreen offering good daily UV protection and a light, white cast-free texture.

*1 September 2024 Kao survey targeting women aged 15 to 79, N=995s

*2 Intage SCI® (Nationwide Consumer Panel Survey) market share breakdown by UV sunscreen type from January to October 2024

Developing a capsule for containing a UV scattering agent capable of being added to a water base

Kao studied various approaches to incorporating a UV scattering agent in the water based aqueous phase and came up with the idea of enveloping a UV scattering agent in a capsule with affinity to both water and oil. To achieve the intended effect of UV protection, Kao studied and designed capsule size and material and concentration of the UV scattering agent such as titanium oxide to be enclosed in it and developed the optimum capsule containing a UV scattering agent. (Figure 2) With these capsules added, the new formulation was completed.

When applied, the new formulation forms a seamless layer of UV scattering agents that effectively protects the skin from UV rays. (Video)

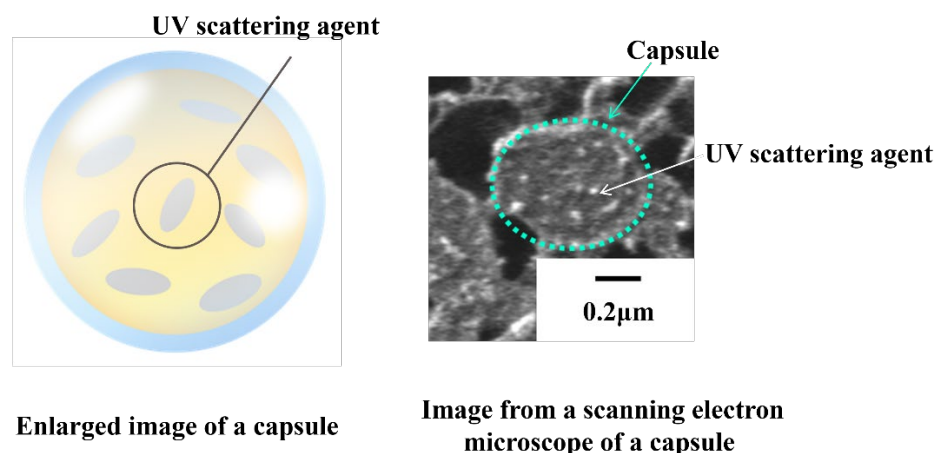
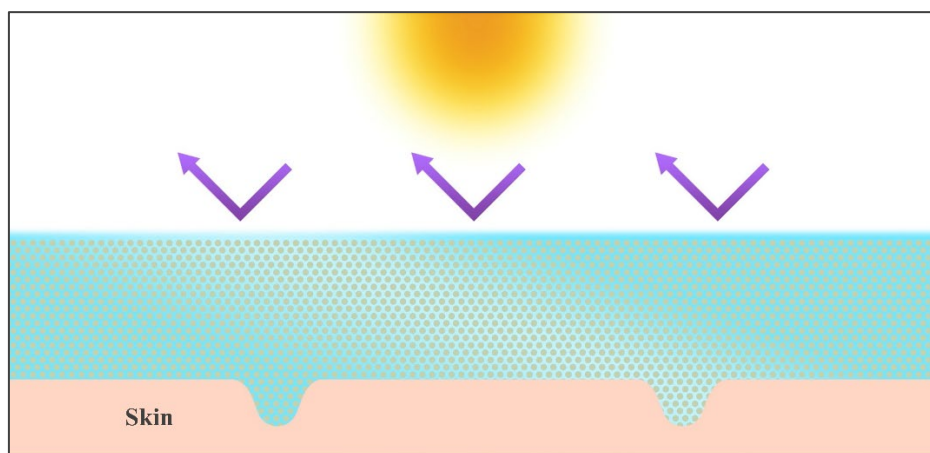


Figure 2. Capsules containing UV scattering agent



Video: [Pictorial representation of UV protective layer after application to the skin](#)

Evaluations of new formulation UV protective effect and white cast

Both the new emulsion containing the capsules and a water-based UV absorber-free sunscreen containing no capsules were applied to a plate with an uneven surface, modeling the skin, which was then exposed to UV rays; the optical density*³ for each was measured using a UV spectral microscope. Results showed that the new emulsion had higher optical density compared to the emulsion containing no capsules. (Figure 3) This indicates that an even protective layer is created, and that the UV scattering agents contained in the capsules and oil droplets are seamlessly dispersed across the skin.

*³ Optical density measures the capacity of an object to reduce the power of the light that is passing through it.

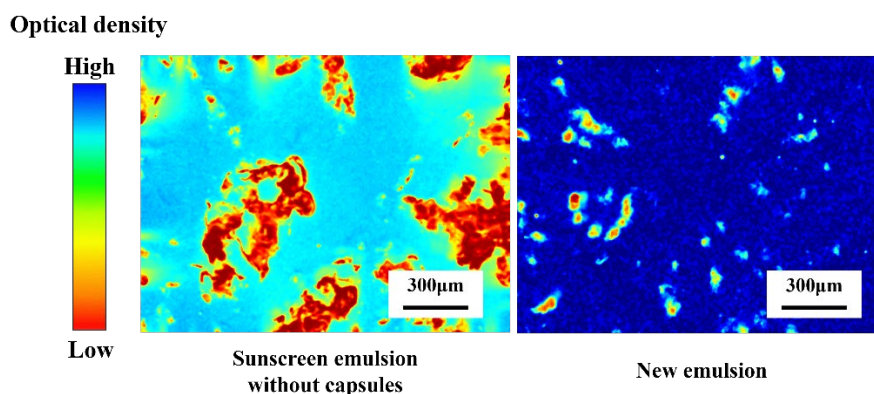


Figure 3. Comparison of the optical density between formulations with/without capsules

Conventional oil-based UV absorber-free sunscreen and the new emulsion were applied to the model skin, and skin color before and after application was compared. The result was that, compared to the portion of skin to which the conventional sunscreen had been applied, there was little change in the skin color and little noticeable white cast to the area of application of the new emulsion with capsules containing UV scattering agent. (Figure 4)

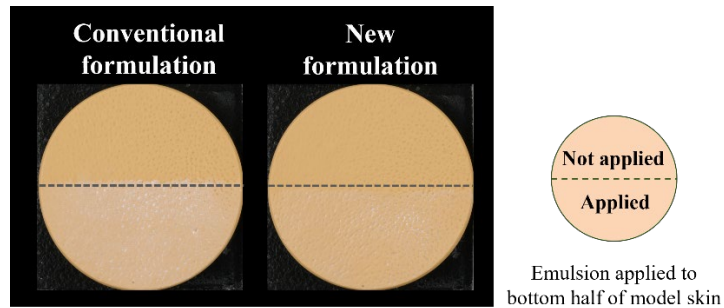


Figure 4. Comparison of white cast

Summary

Developing a new sunscreen formulation with capsules containing a UV scattering agent, a formulation exclusive to Kao, has made it possible to design a new UV absorber-free sunscreen which provides both good protection against UV rays, with no white cast and a light texture. Building on this knowledge, Kao, using ingredients available around the world, will continue developing sunscreen products that consumers everywhere will want to use everyday.

Related Information

Video: [Kao New UV Absorber-free Sunscreen Formulation](#)

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 1,530 billion yen in annual sales. Kao employs about 34,300 people worldwide and has 137 years of history in innovation. Please visit [the Kao Group website](#) for updated information.