News Release
Kao Corporation

Kao
Kirei–Making Life Beautiful

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FOR IMMEDIATE RELEASE

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Keratotic Plug Disintegrating and Cleansing (KPDC) Technology Combined with Hydrophilic Micropowders Enables Removal of Keratotic Plugs Deep Within Pores

Suggesting the Potential for Making Blackheads Less Noticeable

Kao Corporation's Skin Beauty 2 Products Research has developed a new cleansing technology that removes keratotic plugs from deep inside pores by combining hydrophilic micropowders with Kao's unique Keratotic Plug Disintegrating and Cleansing (KPDC) Technology using tromethamine (tris(hydroxymethyl)aminomethane). Tromethamine loosens keratotic plugs, while hydrophilic micropowders promote dispersion, allowing the tromethamine to reach and act on keratotic plugs deeper within the pores.

This new cleansing technology demonstrated a superior cleansing effect inside the pores, indicated by increased depth in pores after washing (Figure 1). The increase can be attributed to the effective removal of keratotic plugs which had been lodged deep within the pores. This suggests that daily face cleansing may reduce the appearance of blackheads.

This research will be presented at the 106th CSJ Annual Meeting (March 17–20, 2026, Chiba, Japan).

* This news release is a translation of a Japanese-language news release dated February 3, 2026.

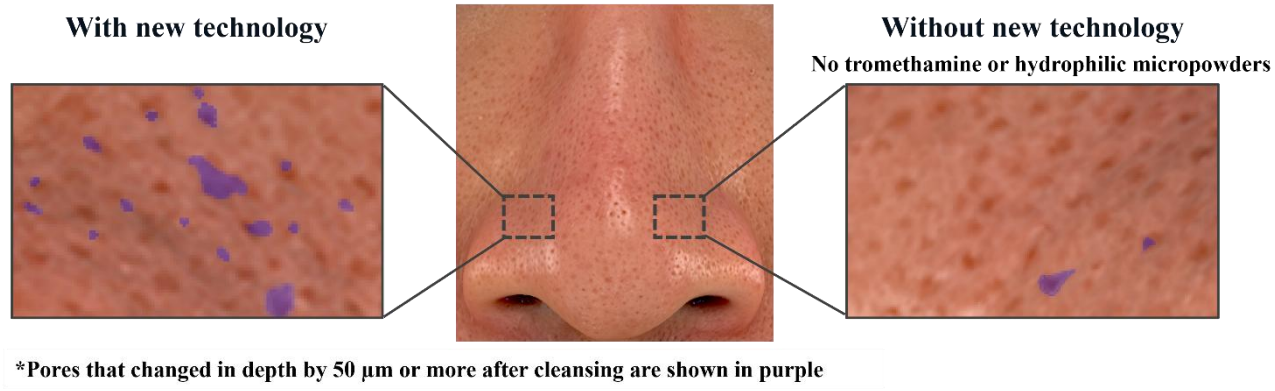


Figure 1. Visualization of morphological changes in the keratotic plugs and pores after cleansing (example of notable effect).

Background

Keratotic plugs are often noticed on the nose where sebum production is higher, but can be found anywhere on the face, including the cheeks and forehead. In a study*[1] of elementary and junior high school students aged

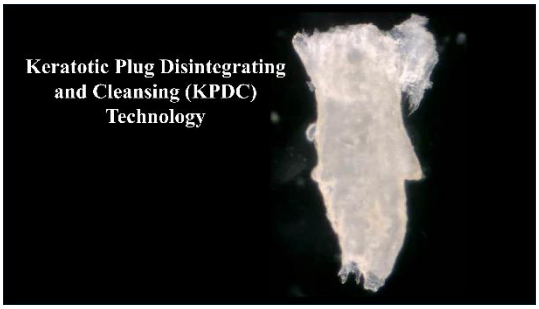
7 to 13, Kao confirmed that the severity of acne increases as the number of keratotic plugs increases. Moreover, it was observed that skin with more keratotic plugs has a higher ratio of *Cutibacterium acnes*—bacteria linked to acne—on the skin surface*[2]. Kao also discovered that people in their 40s and 50s have more keratotic plugs on their cheeks than those in their 20s and 30s. These keratotic plugs are a catalytic source of sebum and stratum corneum oxidation, and may cause the skin to appear dull*[3]. Therefore, skincare that targets keratotic plugs is important for people across a wide range of ages.

Keratotic plugs are comprised of mainly solid fats and exfoliated stratum corneum which are layered within the pore in a compact, onion-like structure. This structure makes them difficult to remove by regular facial cleansing alone. In 2017, Kao developed the KPDC Technology using tromethamine to loosen keratotic plugs and cause them to spontaneously disintegrate (video).

*1 Study conducted in 91 subjects (38 boys, 53 girls) from September to October 2022.

*2 The 48th Annual Meeting of the Japanese Society of Pediatric Dermatology, July 6－7, 2024.

*3 Kao News Release dated October 28, 2021: Dull skin is caused by keratotic plugs in the pores! Suggestions for washing to eliminate dullness. (in Japanese)



Video: Keratotic plugs extracted from pores disintegrate in a tromethamine solution (16× speed)

Hydrophilic micropowders work with tromethamine to help clear keratotic plugs from deep within pores

Kao has focused its research on blackheads, a major pore-related concern for consumers. To make blackheads less noticeable, it is important to remove keratotic plugs from deep within pores. Kao has therefore been striving to establish a new cleansing technology that can remove keratotic plugs more effectively, based on our KPDC Technology using tromethamine.

When tromethamine comes into contact with keratotic plugs and the solidified oils become softer, the layered structure of the keratotic plug loosens. While the plug is loosened, it is not yet dispersed. Consequently, Kao researchers focused on finding a way to scatter the tromethamine-loosened keratotic plugs to promote its removal from the pores.

After evaluating various ingredients, the research team found that when tromethamine is combined with hydrophilic micropowders with an average particle size of several tens of μm, the swollen keratotic plugs adhere to the hydrophilic micropowders, making them easier to disperse. This is thought to enable the tromethamine to reach further into the pores and remove keratotic plugs embedded within the pores (Figure 2).

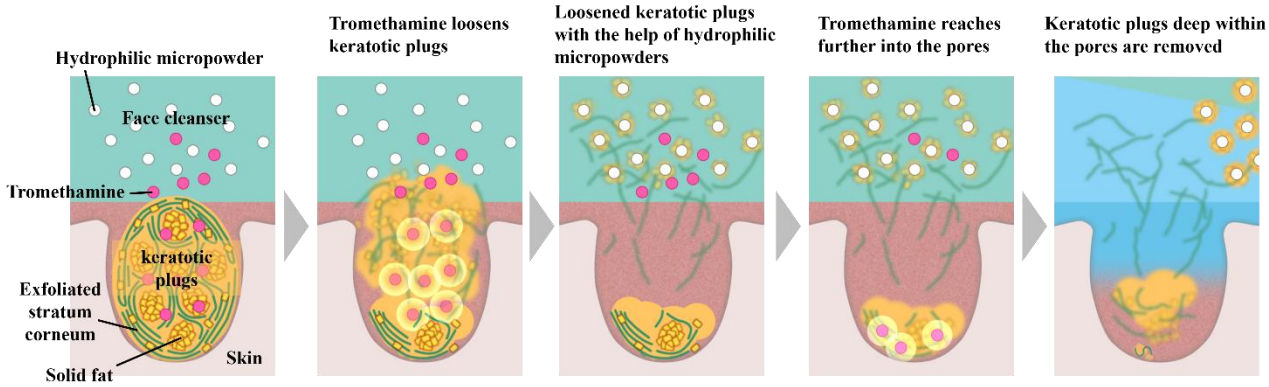


Figure 2. Mechanism of the removal of keratotic plugs from deep within pores by combining tromethamine and hydrophilic micropowders

Verification of cleansing ability using artificial keratotic plugs in model pores

To verify the cleansing effectiveness of this technology on keratotic plugs deep within pores, Kao researchers created model pores of the same diameter as human pores and filled them with artificial keratotic plugs*[4]. The team then performed cleansing using a formulation containing tromethamine and hydrophilic micropowders (with the new technology)*[5]. Approximately 90% of the artificial keratotic plugs were removed, outperforming a formulation that lacked these two components (without the new technology) (Figure 3). This suggests that keratotic plugs lodged deep inside pores can be removed by the combination of tromethamine and hydrophilic micropowders.

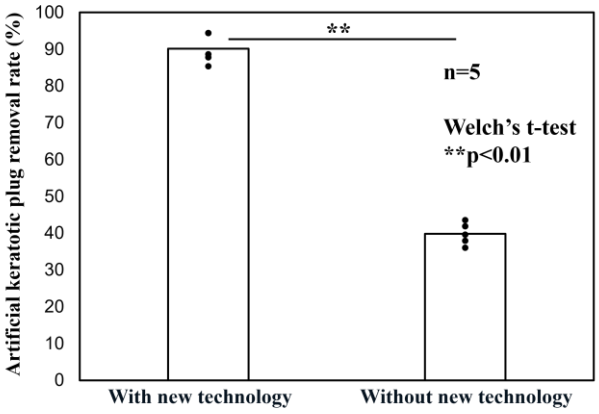


Figure 3. Removal rate of artificial keratotic plugs embedded in model pores

*4 Palmitic acid/oleic acid/triacylglycerol/carbon black = 30/30/40/1

*5 Sixty one model pores on a substrate were filled with artificial keratotic plugs. Formulations with and without the new technology were applied dropwise, followed by a washing process, and the change in weight before and after washing was measured. The test was repeated five times to evaluate the removal of artificial keratotic plugs from deep within the model pores.

Verification of keratotic plug removal from skin

In November 2025, Kao conducted a single-use face-cleansing test on 27 Japanese men and women in their 20s to 40s using a formulation incorporating the new technology. Photographs were taken before and after face cleansing, and the total area of detectable keratotic plugs was analyzed*[6]. After cleansing, the total keratotic plug area was reduced by approximately 20% on average compared to before cleansing (Figure 4).

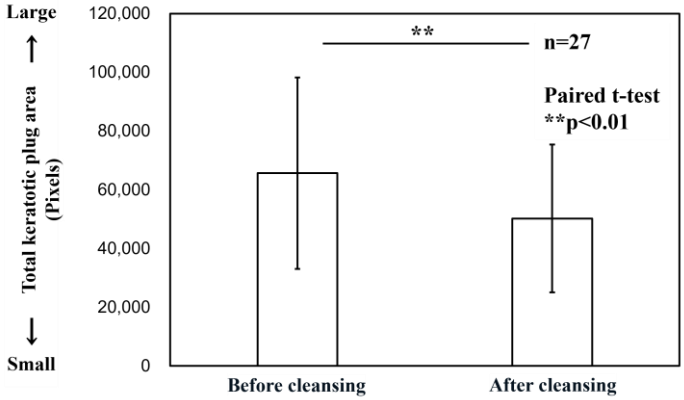


Figure 4. Total keratotic plug area before and after cleansing using a formulation with the new technology

To further investigate the cleansing effect, a single-use half-face-cleansing test on 9 Japanese men and women in their 20s and 30s was conducted. A formulation containing tromethamine and hydrophilic micropowders was applied to one half of the face and a formulation without these components to the other. Using 3D images of the nose constructed from photographs taken before and after cleansing, changes in the depth of the pores were analyzed*[7]. With the new technology, many pores exhibited a depth increase of 50 μm or more after cleansing. This change can be attributed to the removal of keratotic plugs lodged deep within the pores. Little change was observed when the new technology was not used (Figure 1). The evaluation also revealed that with the new technology, the appearance of blackheads was less noticeable after cleansing.

These results suggest that the new technology can remove keratotic plugs from deep within pores, improving the appearance of blackheads.

*6 The total area of keratotic plugs was analyzed by calculating the total area of luminescent spots in the UV image of the nose.
*7 3D images were acquired to analyze the skin-surface morphology, and changes in pore depth (within a 500 μm diameter range) before and after face cleansing were evaluated.

Summary

Kao has developed a new cleansing technology that combines tromethamine with hydrophilic micropowders to remove keratotic plugs located deep inside pores. These findings suggest that for consumers troubled by blackheads, daily facial cleansing with products using this technology may help minimize their appearance. Kao will continue to research cleansing technologies tailored to the needs of consumers.

Related Information

Kao Skincare Special Feature: New Cleansing Technology for Removing Keratotic Plugs (in Japanese)

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.

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