

## Press Release

## Research and Development

## Shiseido Develops Technology that Efficiently Delivers to and Retains Natural Moisturizing Factors at Target Stratum Corneum Site New Approach to Enhance Skin's Moisturizing Function

Shiseido developed "Reservoir in Skin," an innovative technology<sup>\*1</sup> that facilitates efficient delivery and retention of "natural moisturizing factors"<sup>\*2</sup> in the stratum corneum, where they play an important role in moisturizing the skin (Figure 1). Natural moisturizing factors characteristically do not easily permeate through the stratum corneum and are easily washed away by daily soap washing. However, with this technology, the company successfully delivered PCA,<sup>\*3</sup> one of the natural moisturizing factors, to the stratum corneum, where it was retained. It was confirmed that the moisturizing effect enhanced and the smoothness of the skin improved.

This technology was developed using the company's exceptional drug delivery system (DDS) technology, which helps efficiently deliver useful ingredients to the skin. The development also focused on the stratum corneum, the "place" where the moisturizing ingredients exert their effects. By effectively delivering the moisturizing ingredients to the skin, the technology adds new value to skin care. In the future, the findings of this study will be utilized to provide solutions that promote healthy and beautiful skin, for example, by enhancing skin condition through harnessing the natural power of the skin and the components present within it.

The results of this study were partially published in the International Journal of Pharmaceutics.

<sup>\*1</sup> Patent pending: International Publication Number WO 2024/142836

<sup>\*2</sup> Moisturizing components present in the skin that humans naturally have and refer to water-absorbing and water-retaining substances found in the stratum corneum and corneocytes (10%–30%).

<sup>\*3</sup> PCA: pyrrolidone carboxylic acid, a natural moisturizing factor that moisturizes the skin

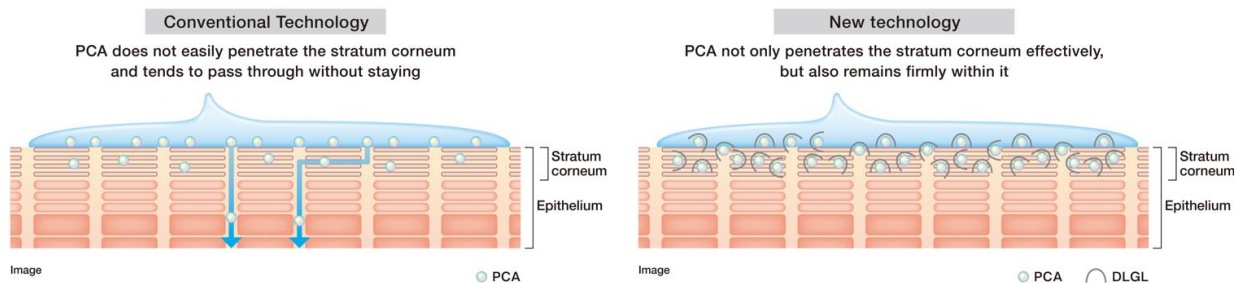


Figure 1: Development of a technology that facilitates proper delivery and retention of natural moisturizing factors in the stratum corneum

### Research background

In addition to developing useful ingredients, Shiseido continues to tackle the challenges of mixing and formulating complex and diverse ingredients as part of its research to maximize their effects. Technologies developed thus far to promote the efficient permeation of useful ingredients include a technology that controls the volume of polymers<sup>\*4</sup> and booster ingredients based on a technology that changes the form of substances from solid to liquid.<sup>\*5</sup> This time, the emphasis was on DDS technology, which not only enhances the permeation of ingredients but also retains them to ensure they stay effective where needed.

Natural moisturizing factors, the focus of this study, are naturally found in the stratum corneum on the surface of the skin and are crucial for maintaining the skin's moisture. These ingredients, however, are not only susceptible to loss from age-related changes but are also easily washed away by facial cleansing and other daily activities. Moreover, it is difficult to maintain their presence in the stratum corneum, where they exert their effects, even if they are supplemented externally with cosmetic products, which has been a significant issue. With the understanding that increasing the amount of useful ingredients in areas where the function is crucial for expressing their effects, a technology was developed that will enable these ingredients to be effectively delivered and retained in the stratum corneum.

<sup>\*4</sup> Shiseido Develops Technology to Control Hyaluronic Acid Volume (2022)

<https://corp.shiseido.com/en/news/detail.html?n=00000000003396>

<sup>\*5</sup> Shiseido Develops New Booster Ingredient That Dramatically Improves Skin Penetration of Pharmaceutical Agents (2022)

<https://corp.shiseido.com/jp/news/detail.html?n=00000000003496> (in Japanese)

## The "Reservoir in Skin" technology - delivering and retaining ingredients in the appropriate place through complex formation

Shiseido tested natural moisturizing factors combined with various ingredients. Test results showed that PCA, a type of natural moisturizing factor, remained in larger amounts within the stratum corneum when combined with certain amphiphilic substance (Figure 2<sup>\*6</sup>). In addition, the amount of PCA permeating through the epidermal layer, including the stratum corneum, increased compared with its use alone.

This study resulted in the development of "Reservoir in Skin," a technology that allows PCA to be delivered and retained in appropriate places by forming a complex.

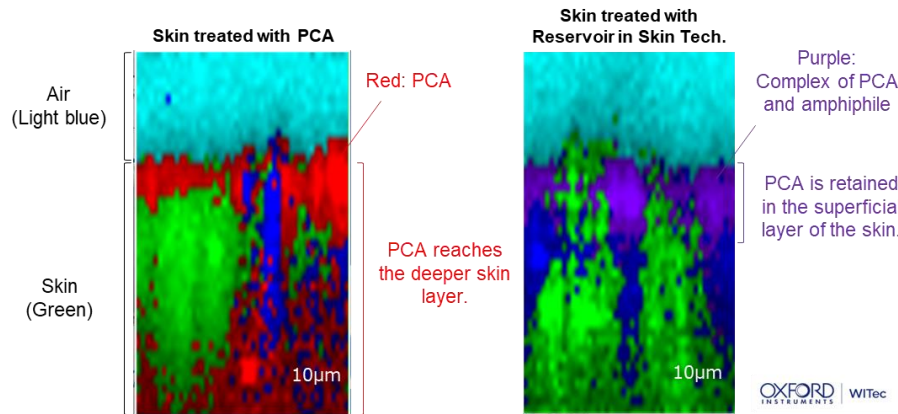


Figure 2: It was confirmed that, when an aqueous solution with the "Reservoir in Skin" technology was applied and measured after 12 hours, a larger amount of the ingredient remained in the stratum corneum of the surface layer because it had difficulty penetrating deeper into the skin layer.

## PCA confirmed to be efficiently delivered to corneocytes where it further exerted its moisturizing effect

The results of verification using the skin component distribution visualization technology revealed that, with the developed technology, the amount of PCA detected in corneocytes was higher when applied as a complex compared to when applied alone (Figure 3). Moreover, it was confirmed that when the complex was applied, the unevenness of the corneocytes reduced, and the smoothness of the skin improved (Figure 4<sup>\*6</sup>).

It is anticipated that developing cosmetic raw materials focusing on PCA and applying them to product development will enhance skin moisturizing function.

<sup>\*6</sup> M. Y. Fujii, *et al.*, *Int. J. Pharm.*, 675, 2025, 125561.

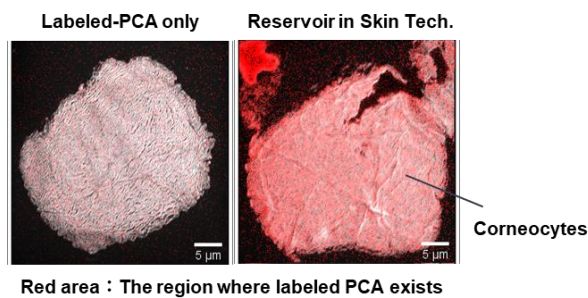


Figure 3: A greater amount of PCA was present in corneocytes after applying an aqueous solution with the Reservoir in Skin technology than without.

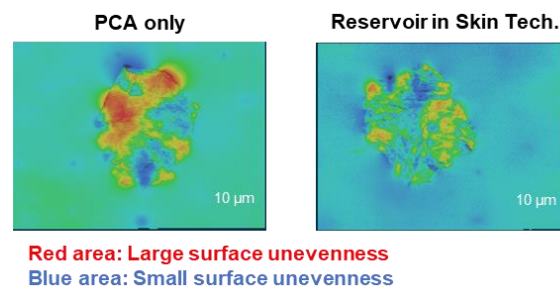


Figure 4: The unevenness of the corneocytes reduced, and the smoothness of the skin improved after applying an aqueous solution with the Reservoir in Skin technology compared to without.

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### R&D Strategy

Shiseido has established three pillars under its R&D philosophy "DYNAMIC HARMONY" to accelerate innovation: "Skin Beauty Innovation: Enhancing brand value," "Sustainability Innovation: Creating circular value," and "Future Beauty Innovation: Challenging new domains." Additionally, Shiseido promotes open innovation and advances new value creation through research alliances with various external organizations. The innovative research outcomes generated from the fusion of Shiseido's advanced science and the knowledge and technology of world-class research institutions are highly regarded academically on a global scale, including at the IFSCC Congress, the world's largest and most prestigious research conference on cosmetic technology.

About R&D Philosophy "DYNAMIC HARMONY"

<https://corp.shiseido.com/en/rd/dynamicharmony/>