

Press Release

Research and Development

**Shiseido develops a new skin lotion formulation technology,
which is expected to bring about higher skin care effects by allowing
active ingredients to penetrate into the skin quickly and thoroughly**

Confirming that the brightening effective ingredient m-tranexamic acid penetrates inside the skin quickly and in higher quantities

Shiseido has developed a new skin lotion formulation technology that is expected to bring about higher skin care effects. This technology allows active ingredients in skin lotion to penetrate inside the skin efficiently and uniformly, and so the ingredients can be delivered to every corner of the skin. Focusing on the fact that the coating film of skin lotion tends to spread unevenly over the skin, which has water-repelling properties, a vesicle structure*¹ with high affinity for the skin was developed using specific naturally derived ingredients, leading to a successful formation of a uniform coating film over a wide area of the skin. In addition, evaluations using the newly established analytical technology*² to determine how the penetration of m-tranexamic acid*³, a brightening* effective ingredient, was promoted, it was confirmed that m-tranexamic acid penetrates inside the skin quickly and in higher quantities when the present technology was applied to the formulation, as compared with the formulation based on the general skin lotion formulation technology.

In the future, this technology will be applied to the development of new skin care formulations that will enable our customers to experience even more powerful effects. The results of the present study were partly presented at the 33rd IFSCC Congress in Barcelona in 2023 (IFSCC*⁴ Conference 2023) (September 4-7, 2023).

* Brightening means suppressing the production of melanin and preventing dark spots and freckles.

*1. Vesicle structure: Vesicles consisting of bimolecular membranes of surfactants or amphiphilic lipids having both hydrophilic and hydrophobic groups within the molecules. Also called lipid vesicles.

*2. Shiseido enhances functionality and safety of cosmetic products by visualizing penetration and distribution of active ingredients in the skin with cell-level resolution (2024) <https://corp.shiseido.com/en/news/detail.html?n=0000000003768>

*3. The brightening effective ingredient uniquely developed by Shiseido, which was approved by the Ministry of Health, Labour and Welfare in 2002 as an active ingredient in quasi-drugs with the effect-efficacy to suppress the production of melanin and prevent dark spots and freckles. The "m" in m-tranexamic acid represents its effect for suppressing the production of melanin.

*4. IFSCC: The International Federation of Societies of Cosmetic Chemists

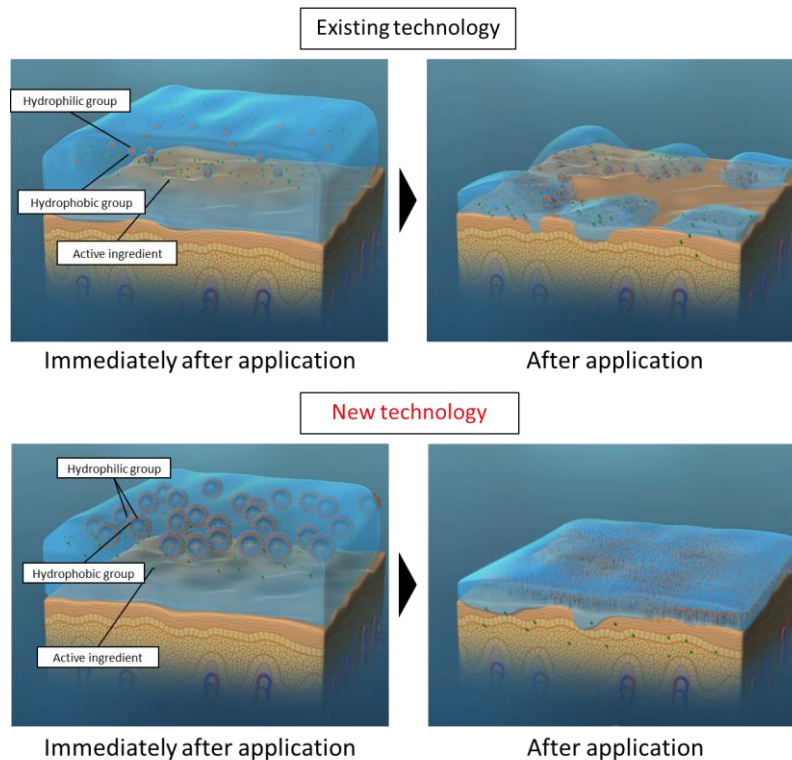


Figure 1. By using the new technology, active ingredients can be delivered to every corner of the skin as they spread evenly and quickly. Hydrophilic groups are shown in blue, hydrophobic groups are shown in red, and active ingredients are shown in green (conceptual diagram)

Research background

Shiseido has produced various formulations (Figures 2) with the continuing advancement of the company's skin lotion formulation technology for skin care preparations. For example, the micellar solubilization technology^{*5} is still used in many skin lotions today, and there are also formulation technologies that provide an additional emollient effect or achieve a smooth, non-sticky feeling after application. Following these developments, this time, we aimed to develop a formulation technology that is expected to deliver higher skin care effects by allowing active ingredients to quickly penetrate into the skin. Because the stratum corneum on the skin surface has a high affinity for oil with the property to repel water, skin lotion containing a high amount of water tends to be distributed unevenly on the skin. For this reason, it has been considered difficult to have active ingredients penetrate into the skin efficiently and uniformly. This led us to focus on "biomimetics"^{*6}, i.e., mimicking the characteristic structures, etc., of living organisms, and the present study was carried out with the idea that having a structure that mimics the skin could enhance the affinity for the skin and thereby increase the penetration of the lotion's active ingredients.

*5. A technology in which multiple molecules of surfactants gather in water and are dispersed as small particles, and oil-based ingredients such as fragrances are incorporated into the particles.

*6. Biomimetics: A scientific technology that seeks to utilize the distinctive structures and functions of living organisms in the development of new technologies and manufacturing.

*7. Poly-gly-vesicle: A structure formed from polyglycerol fatty acid esters, which are naturally derived ingredients.

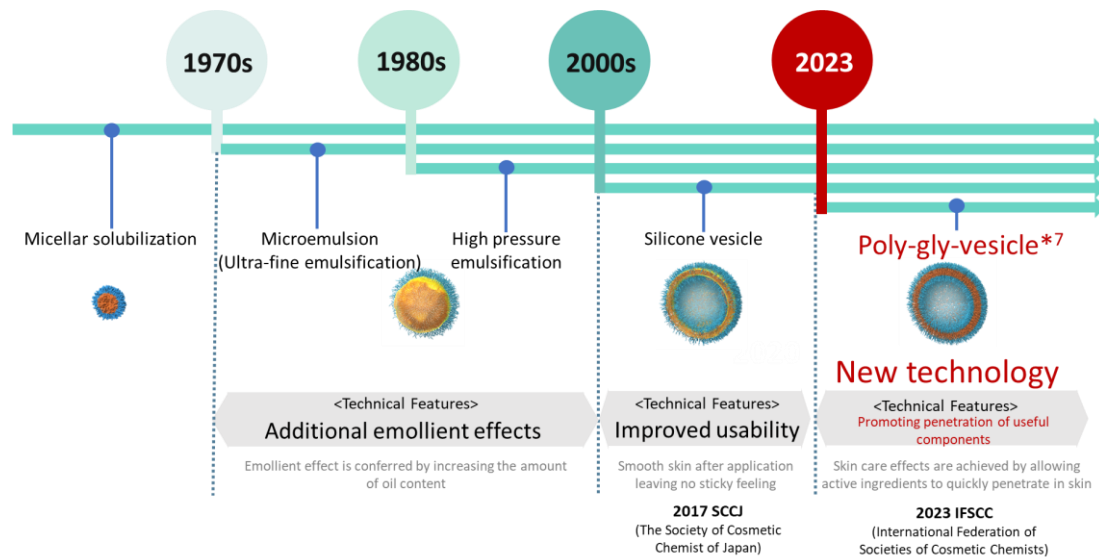


Figure 2. Shiseido's various skin lotion formulation technologies

Development of a vesicle structure that mimics the cell membrane, and features of the skin lotion formulation based on the developed technology

This study was carried out based on our previous research findings on skin lotion. The liquid with low surface tension quickly spreads on the hydrophobic skin surface, and as they are distributed evenly, active ingredients are expected to efficiently penetrate into the skin. In order to create formulations with low surface tension, we focused on the vesicle structure mimicking the cell membrane structure. In addition, to meet the needs of customers who are highly interested in the environment and safety, we screened 200 kinds of polyglycerol fatty acid esters, which are naturally derived ingredients. As a result, we identified ingredients capable of forming a vesicle structure that resembles the cell membrane, which led us to successfully create a vesicle structure in the formulation (Figure 3). When the developed technology was applied, the formulation had a lower surface tension (Figure 4) compared with formulations based on the general skin lotion formulation technology, and so the liquid could quickly spread to every corner of the skin and blended evenly on the skin in a speedy manner, achieving a high penetration (Figure 5).

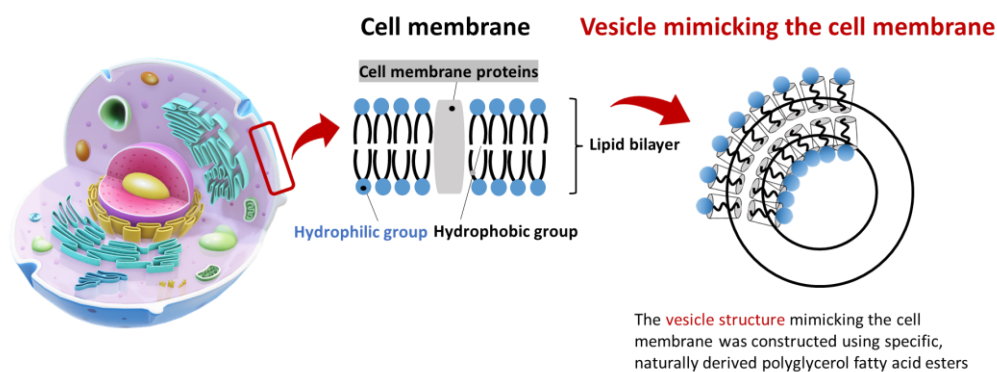


Figure 3. Construction of the vesicle structure mimicking the cell membrane with high affinity for the skin (conceptual diagram)

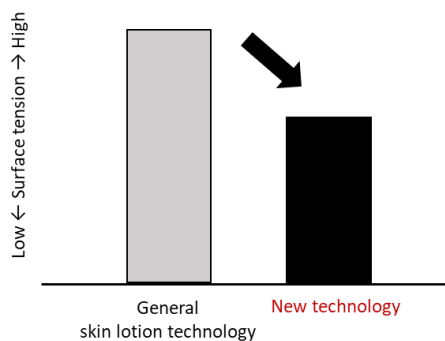


Figure 4. Surface tension of the formulation based on the new technology is lower than that based on the general skin lotion technology

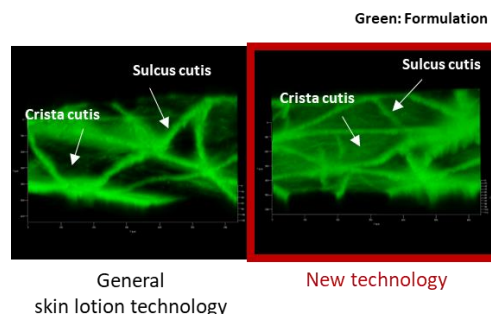


Figure 5. Formulation based on the new technology quickly spreads over the skin and forms a uniform coating film

Formulation's active ingredient penetration effect

When we evaluated the effect to promote the penetration of m-tranexamic acid, which has a melanin production suppressing effect, using human skin, it was confirmed by the newly established analytical technology that the formulation based on the present technology allows m-tranexamic acid to quickly penetrate into the skin in higher quantities compared with the formulation based on the general skin lotion formulation technology (Figures 6 and 7). In the present technology, the vesicle structure changes the shape to form a film that spreads evenly over the skin, thereby significantly lowering the surface tension of the formulation. This ensures that active ingredients are delivered to the skin, as the formulation quickly spreads to every corner of the skin.

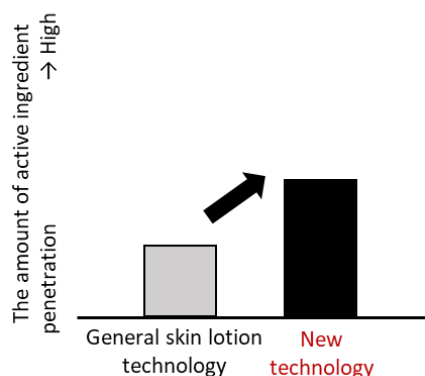


Figure 6. The new technology led to an increase in the penetration of m-tranexamic acid.

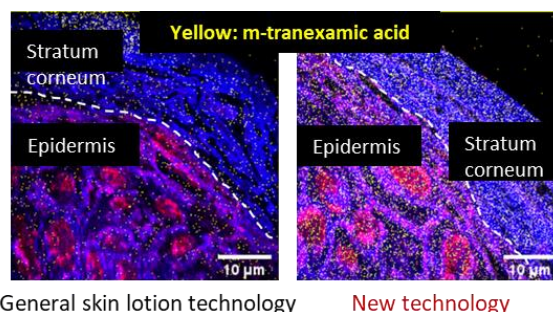


Figure 7. The formulation based on the new technology was confirmed to allow penetration of m-tranexamic acid inside the skin quickly and in

Future prospects

This technology can be potentially applied to various water-soluble active ingredients. Going forward, we will strive to meet the diverse needs of our customers for usability and skin care effects, and provide effective solutions for all skin problems our customers have.

About Our R&D Strategy:

Under "Skin Beauty INNOVATION," one of the three pillars of the company's R&D strategy, the present study was carried out in the field of "cosmetic formulation technology" aimed at pursuing and realizing the value of cosmetic products sought by customers by capitalizing our strength in material sciences.

- Integrated Report 2022 (Beauty Innovation)

https://corp.shiseido.com/report/en/2022/value_creation/innovation/

- Keywords

Skin Beauty INNOVATION, skin care, penetration

<Reference>

Researchers' challenges

■R&D Philosophy "DYNAMIC HARMONY" approach

This research was carried out under the Functionality/Japan Quality approach of Shiseido's R&D philosophy, DYNAMIC HARMONY. In addition to realizing effective skin care products with excellent skin penetration, we advanced the development of our technology using naturally derived ingredients.

■We want our customers to experience more powerful effects

There are many customers around the world who have high hopes for effective cosmetic products to solve their skin problems. To address the concerns of many customers and meet their expectations for cosmetics, we have taken on the challenge of improving skin lotion formulation technology within skincare products to make their effects more noticeable. The results of the present study were partly presented as an oral presentation at the 33rd IFSCC Congress, the world's largest conference to compete on cosmetic technologies, held in Barcelona, Spain. In the future, we will take this technology further to experience more powerful effects of skin care for our customers, continuing to strive to provide effective solutions for all their problems related to the skin.



Researcher Yang

Shiseido's R&D Philosophy "DYNAMIC HARMONY"

Shiseido Formulates Its Unique R&D Philosophy "DYNAMIC HARMONY" (2021)

<https://corp.shiseido.com/en/news/detail.html?n=0000000003252>

DYNAMIC HARMONY website:

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