

**FOR IMMEDIATE RELEASE**

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## **Beneficial Effect of Rosemary Extract Containing Highly Pure Rosmarinic Acid on Healthy Keratinization**

Kao Corporation's Skin Care Products Research Laboratory and Biological/Material Science Research Laboratory have determined that Smart Garden Meguri Rosemary Extract, a rosemary extract containing enhanced-purity rosmarinic acid manufactured according to a proprietary method, promotes healthy keratinization.



Kao's research findings were presented at the 144th Annual Meeting of the Pharmaceutical Society of Japan (March 28–31, 2024, Kanagawa Prefecture) and the second Annual Congress of the Society of Cosmetic Chemists of Japan (November 18–20, 2024, Hyogo Prefecture).

### **Background**

To reduce its environmental impact, Kao has built the proprietary plant factory Smart Garden Meguri, a hydroponic farm for rosemary and Roman chamomile, which uses equipment able to capture and purify carbon dioxide (CO<sub>2</sub>) emitted from an incinerator plant owned by Saga City in Saga Prefecture. At Smart Garden Meguri, advanced control of cultivating conditions and harvest timing can accelerate plant growth and increase the amount of active ingredients the plants contain. Kao has also developed technology for removing impurities during the process of obtaining extracts from the plants, making it possible to produce Smart Garden Meguri Rosemary Extract, a highly pure active ingredient plant extract\*.

Plant extracts, believed to have various effects, are used in a wide range of products; Kao has confirmed the efficacy of the Smart Garden Meguri Rosemary Extract.

\* Kao News Release dated March 14, 2024: [Kao Builds a Plant Factory “Smart Garden Meguri” Using Captured and Purified CO<sub>2</sub>](#)

## Smart Garden Meguri Rosemary Extract's healthy keratinization effect

### Comprehensive gene expression analysis

Smart Garden Meguri Rosemary Extract was added to normal human epidermal keratinocytes to assess gene expression changes in 191 genes related to skin functions. Results revealed higher expression particularly in genes related to keratinization functions.

### Comparison of effects on keratinization-related proteins

Both Smart Garden Meguri Rosemary Extract and conventional rosemary extract were added to normal human epidermal keratinocytes, and the production rates for transglutaminase 1 (TGM1) and involucrin (IVL), proteins involved in keratinization, were compared. Results showed that Smart Garden Meguri Rosemary Extract increased the production of TGM1 and IVL (Figure 1).

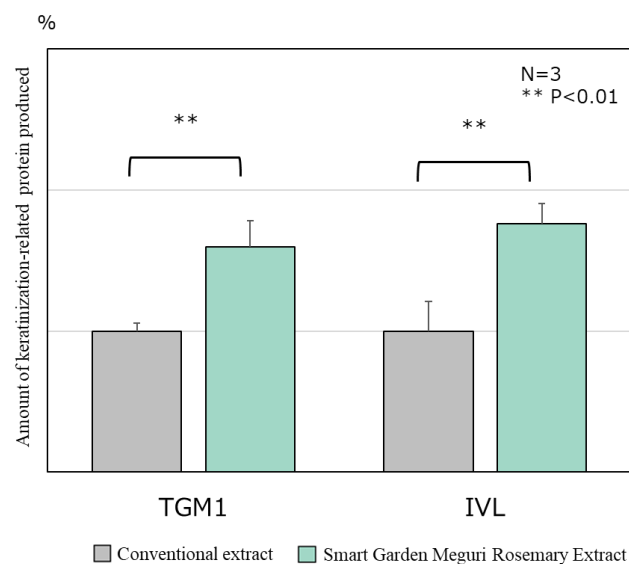


Figure 1. Comparison of keratinization-related protein production

### Effects on the stratum corneum structure

Kao researchers investigated the formation of the cornified envelope (CE), the membrane-like structure of the stratum corneum cells strengthening the stratum corneum. Smart Garden Meguri Rosemary Extract and conventional rosemary extract were added to normal human epidermal keratinocytes. Using fluorescent staining, the CE's degree of maturation was assessed by calculating the generalized polarization (GP) value, the indicator of membrane packing order.

Observation of the fluorescent image showed that the cells to which Smart Garden Meguri Rosemary Extract had been applied were larger than the cells to which conventional rosemary extract had been applied, and that the outer part corresponding to the cell membrane was clear. The GP value was also high, indicating that the CE of the cells treated with Smart Garden Meguri Rosemary Extract were more mature (Figure 2).

The results obtained indicated that Smart Garden Meguri Rosemary Extract had a better healthy keratinization effect than conventional rosemary extract.

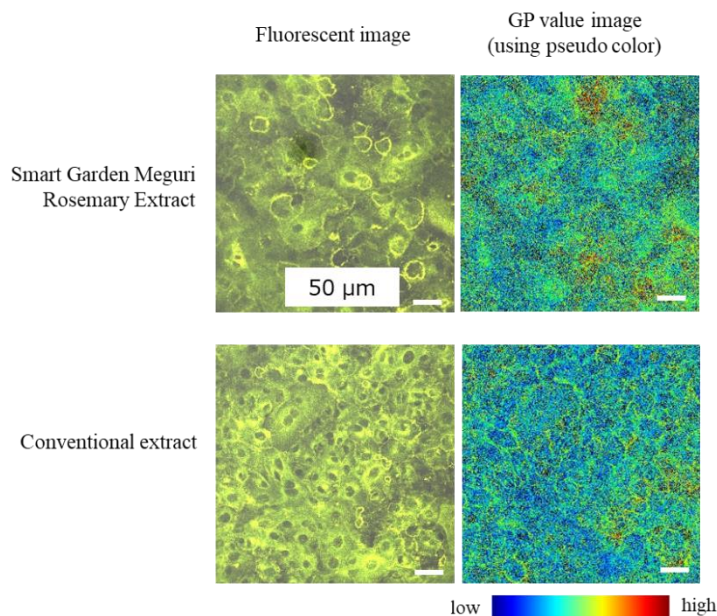


Figure 2. Assessment of membrane packing order

### **Ingredient that inhibits the healthy keratinization effect of rosmarinic acid discovered**

Conventional rosemary extract contains many ingredients besides rosmarinic acid. Focusing on this fact, researchers applied each of those ingredients together with the rosmarinic acid to normal human epidermal keratinocytes to assess their impact on keratinization. Results showed that the combination of betulinic acid and rosmarinic acid inhibited increases in TGM1 expression induced by rosmarinic acid.

This demonstrated that the Smart Garden Meguri Rosemary Extract had a stronger healthy keratinization effect, because the purification process reduced betulinic acid, which inhibits the effect of rosmarinic acid.

### **Summary**

Kao has developed Smart Garden Meguri Rosemary Extract containing highly pure rosmarinic acid and determined that it is more effective for healthy keratinization than conventional rosemary extract, possibly because Smart Garden Meguri Rosemary Extract contains less betulinic acid, one of the extract's ingredients. Employing an end-to-end integrated process from eco-friendly plant cultivation to production of high-performance botanical extracts, Kao will continue developing products to enhance consumer satisfaction.

### **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.

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