

**Mandom Discovers Compounds that Prolong Antimicrobial Activity
Toward the Development of Products that Prolong the Effectiveness of
Deodorants**

Mandom Corporation (Headquarters: Osaka; President Executive Officer & Director: Motonobu Nishimura; hereafter, Mandom) has been involved in the development of products with efficacy, durability, and functionality by quantitatively evaluating the microscopic amounts of compounds that remain on the skin and hair after application.

As a part of this study, we sought to understand how the skin surface concentrations of antimicrobial agents contained in deodorant products decrease after application. We found that these agents (1) flow off of the skin owing to the secretion of sweat and other substances and (2) penetrate into the skin; these are the primary routes by which antimicrobial agents contained in deodorant products are lost from the surface of the skin. After exploring compounds that may control this loss, we found several that prolonged the deodorizing effects of antimicrobial agents by retaining them on the surface of the skin. We presented our findings at the 76th Annual Research Symposium of the Society of Cosmetic Chemists of Japan.

We named these compounds “Deodorant Keeper” and incorporated them into our deodorant product series launched in February 2015.

1. An Increase in the Awareness of Etiquette Standards Has Led to a Need for Long-lasting Deodorants

At present, the word “smell harassment” is commonly used, and the number of consumers seeking odor-blocking products not simply to ease their own discomfort but to avoid making a bad impression on others is increasing. Body odor and the unpleasant smell of sweat arise when bacteria on our body digest dirt in the sweat and sebum on our skin to produce foul-smelling substances. The use of deodorants containing antimicrobial agents has become a standard way of preventing this sort of foul odor, and the usage rates of deodorants increase annually. However, consumers have demanded that deodorants have a “longer period of effectiveness.” Thus, we intended to develop deodorants that maintain their effectiveness over longer periods of time than those currently available.

2. Explanation of the Factors That Cause a Loss in the Efficacy of Deodorants over Time

One factor that contributes to the decline in the deodorizing effects of deodorants over time is the loss of antimicrobial agents from the surface of the skin. At Mandom, we temporally and quantitatively evaluated the changes in the concentrations of microscopic antimicrobial agents in deodorant compounds on the surface of the skin after application by using original technologies for analyzing microscopic amounts of substances. We found that, with time, antimicrobial compounds are remarkably lost from the surface of the skin. To explain the factors contributing to this loss, we investigated the processes by which antimicrobial agents leave the surface of the skin. We found that (1) flowing off of the skin owing to the secretion of sweat and other substances and (2) penetration into the skin are the two main factors that contribute to this loss.

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3. Discovery of Compounds that Control the Loss of Deodorizing Activity

To address and improve these antimicrobial agent loss-causing factors, we used a Mandom-original evaluation method to identify compounds that increase the retention of antimicrobial compounds. We found that oil esters with high molecular weight and high hydrophobicity are effective at preserving antimicrobial agents (Figure 1) and that specific high-molecular-weight compounds can retain antimicrobial agents at the surface of the skin by forming films (Figure 2).

At Mandom, we collectively named these newfound compounds that preserve antimicrobial agents, together with water-repelling compounds—already in use in waterproof products—“Deodorant Keeper,” and separated these compounds into three classes based on their properties: adhesive, film-forming, and water-repelling. By selecting several Deodorant Keepers according to the pharmaceutical type of a product, we confirmed that they enable the deodorizing effects to persist for a longer period of time.

At Mandom, in February 2015, we launched a series of deodorant products that contain a combination of several Deodorant Keepers. We intend to continue to develop this technology further, in order to develop functional products with sufficient efficacy.

<Reference Materials>

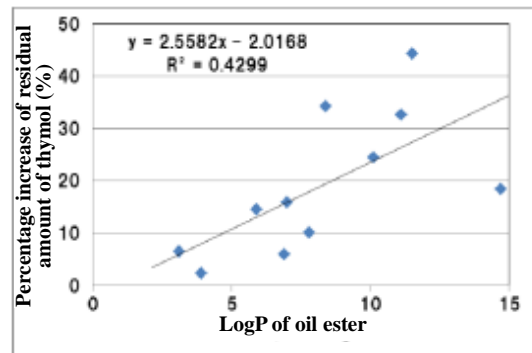
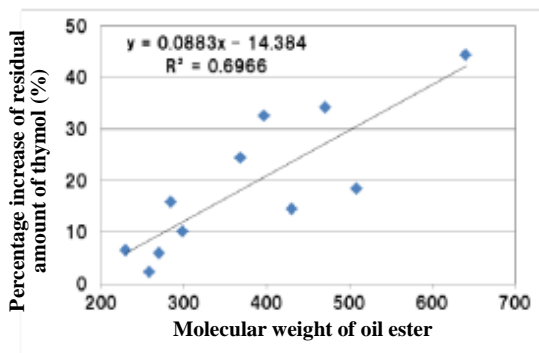


Figure 1: Correlation Analysis Results of Residual Amount of **IPMP** (Isopropyl Methylphenol), an Antimicrobial Agent, and Molecular Weight and LogP of Oil Esters

Note: LogP = octanol/water partition coefficient; value that indicates the difficulty of miscibility (hydrophobicity) of the target compound.

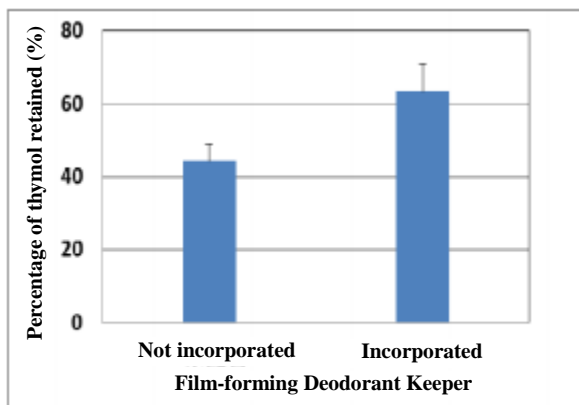


Figure 2: Investigation of the Effectiveness of Film-forming Deodorant Keeper (in vitro)
IPMP 残存率 : Percentage of **IPMP** retained

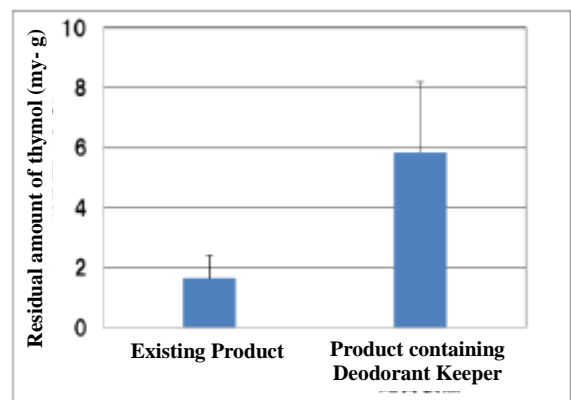


Figure 3: Comparison of Residual Amounts of Antimicrobial Agents **IPMP** between Our Existing Product and One Containing a Deodorant Keeper