# Mandom Develops Deodorant Formulation Containing Two Antimicrobials, Lysozyme Chloride (Enzyme) and Isopropyl Methylphenol, that Maintains Effectiveness Across a Variety of Skin States

Mandom Corporation (Headquarters: Osaka; President Executive Officer & Director: Motonobu Nishimura; hereafter, Mandom) has found that formulations containing the antimicrobial compounds lysozyme chloride (a lytic enzyme) and isopropyl methylphenol (IPMP) possess superior deodorizing effects.

We plan to announce the results of our research at the 2006 Young Researchers' Summit of the Society for Antimicrobial and Antifungal Agents, Japan (Kinki University, Department of Agriculture) to be held October 14, 2006.

<The Mechanism of Odor Generation and Antimicrobial Activity>

Body odor and unpleasant odor associated with sweat arise when microorganisms on the skin surface digest agents in sweat and sebum to produce foul-smelling compounds. Deodorants that contain antimicrobial compounds can suppress or limit the activity of these microorganisms and in turn decrease odor. However, the amount of sweat (water) and sebum (oil) on the skin surface can fluctuate in response to changes in environmental factors such as increases in temperature, physical activity, and humidity.

In 2004, we presented at the Fall Joint Symposium of the Society for Antimicrobial and Antifungal Agents, Japan our demonstration that formulations containing both triclosan and IPMP as antimicrobial compounds maintain high deodorizing effects across a variety of skin states. We were the first in Japan to implement this technology in a deodorant product, the Gatsby Double System Series, which went on sale in February 2005.

We have continued our research and development of deodorant formulations that exhibit enhanced antimicrobial activity and improved odor suppression across changing skin states. We have found that the combination of lysozyme chloride (an enzyme) and IPMP (an antimicrobial) exhibits antimicrobial activity that surpasses the previously described combination of triclosan and IPMP.

<Discovery of the Deodorizing Effects of Combined Use of Lysozyme Chloride and IPMP>

(1) Lysozyme Chloride

Lysozyme chloride is a biological agent produced by multiple organisms that has long been known for its antimicrobial effects. In particular, lysozyme chloride is included in anti-cold medications to kill cold-causing germs. Lysozyme chloride is a lytic enzyme that exhibits antimicrobial activity by destroying the cellular membranes of microorganisms. In contrast to antimicrobials that are more commonly used in deodorants, such as IPMP, lysozyme chloride has high water solubility.

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(2) Combined Use of Lysozyme Chloride and IPMP in Deodorant Formulations

The combination of lysozyme chloride and IPMP had superior antimicrobial effects under both normal skin conditions and when sebaceous secretion levels were high, as measured by minimum bactericidal concentration (MBC) values, which represent the minimum amount of antimicrobial agent required to kill microorganisms (Table 1). Lower MBC values indicate higher effectiveness.

Lysozyme chloride alone has an MBC ≥5,000 µg/mL in the presence and absence of sebum. Meanwhile, in the absence of sebum, IPMP alone has an MBC of 150 µg/mL, but loses half its effectiveness in the presence of sebum, as reflected by the near doubling of the MBC to 270 µg/mL.

However, the MBC values for lysozyme chloride and IPMP in combination are only slightly affected by sebum (70 µg/mL vs. 54 µg/mL). These results show that this combination of antimicrobials exhibits superior effectiveness both in the presence and absence of sebum.

Thus, formulations containing a combination of IPMP and lysozyme chloride exhibit superior deodorizing effects under a variety of skin states, and particularly when the skin is sweaty (moist) or sebaceous (oily).

Mandom has applied for the requisite, related patents and has plans to continue development of deodorant products that make use of this technology.

Table 1: Changes in MBC with Single/Combined Use of Thymol and Lysozyme Chloride

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| | MBC (µg/mL) | |
|---|---|---|
| | Sebum absent | Sebum present |
| Lysozyme chloride alone | > 5,000 | > 5,000 |
| IPMP alone | 150 | 270 |
| Combined use of lysozyme chloride and IPMP | 70 | 54 |

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