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〈シンポジウム〉

第50回日本香粧品学会学術大会（2025）・シンポジウムⅡ「フロンティア研究で彩る香粧品の未来」

先駆的テクノロジーで巨大分子を皮膚内に届ける
～香粧品の未来を変える技術～

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Breakthrough Technology for Delivering Macromolecules into the Skin: A Novel Strategy for Innovation in Cosmetic Science

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Abstract

The stratum corneum functions as a formidable barrier that significantly limits the transdermal penetration of hydrophilic macromolecules such as hyaluronic acid (HA) and collagen. While various chemical and physical methods—such as deep eutectic solvents, microneedles, and nano-carriers—have been developed to enhance skin permeability, challenges remain in safely delivering high molecular weight compounds across the skin. We herein introduce a novel approach using polyion complex (PIC) nanoparticles composed of HA and protamine. Our findings demonstrate that PIC nanoparticles markedly improve the transdermal delivery of fluorescent-labeled HA into deeper skin layers compared to non-particulate formulations. Furthermore, mechanistic analysis revealed that the particles destabilize within the skin environment and release free HA, which may preferentially follow the intercellular lipid pathway. This technology may offer a promising platform for the effective delivery of cosmetic macromolecules. In parallel, the Saga University has established an interdisciplinary academic program, the "Cosmetic Science Program," to address the growing demand for scientifically trained professionals in the cosmetic industry. Scheduled to launch in 2026, this program integrates expertise from pharmaceutical sciences, life sciences, engineering, economics, and design. By combining advanced research in transdermal delivery with interdisciplinary education, we aim to cultivate the next generation of leaders in cosmetic science who can bridge fundamental research and practical applications.

Key words: transdermal delivery, hyaluronic acid, nano particle, cosmetic science program, Saga.