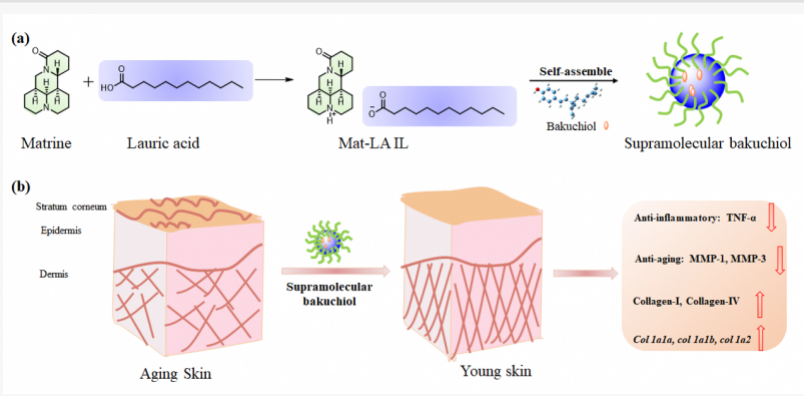
Supramolecular Bakuchiol in Ionic Liquid Boosts Anti-Aging Efficacy with Less Irritation

FAYETTEVILLE, GA, UNITED STATES, April 28, 2025 /EINPresswire.com/ -- A groundbreaking study published in Supramolecular Materials introduces a novel supramolecular solution of bakuchiol, a plant-derived retinol alternative, using an ionic liquid (IL) carrier. This innovation achieves a breakthrough in anti-aging by delivering both high efficacy and skin-friendly gentleness. The bakuchiol-ionic liquid solution eliminates the irritation commonly associated with retinol while dramatically enhancing bakuchiol's transdermal permeability, ensuring its full anti-aging potential is realized.



(a) Schematic diagram illustrating the preparation process of supramolecular bakuchiol. (b) Supramolecular bakuchiol exerts an anti-aging effect, inhibition of inflammatory factors, and promotes collagen production.

Skin aging, driven by collagen degradation and chronic inflammation, remains a prevalent dermatological challenge. In particular, retinol, the gold-standard anti-aging compound, can cause redness, peeling or burning in many users, limiting its utility. Meanwhile, bakuchiol, a plant-based retinol alternative, offers similar collagen-boosting effects but also suffers from similar collagen-boosting effects but faces challenges, including redness and itching in a small subset of users and transdermal permeability that still requires further enhancement to unlock its full anti-aging potential.

To address these challenges, a collaborative effort between Mr. Tao Zhang's team at Better Way (Shanghai) Cosmetics Co., Ltd. and Professor Jiaheng Zhang's group from Harbin Institute of Technology (Shenzhen) led to the development of a supramolecular delivery system. The study integrates bakuchiol with Mat-LA IL— a biocompatible ionic liquid synthesized from matrine, a natural anti-inflammatory agent, and lauric acid, a permeability-enhancing fatty acid.

By leveraging computational chemistry, the team modeled hydrogen bonding and van der Waals interactions to precisely optimize the self-assembly of supramolecular bakuchiol into uniform

18-nm nanoparticles, ensuring targeted delivery into the epidermis and dermis for maximal efficacy.

Notably, the permeability of supramolecular bakuchiol was 4.17 times that of retinol and 3.48 times that of bakuchiol. Compared with bakuchiol and retinol, at 0.01% supramolecular bakuchiol could decrease TNF-α activity (inhibition rate 20.16%), inhibit MMP content in cells (inhibition rate 51.87%), and promote collagen-I production in human skin fibroblasts (promotion rate 75.11%). Moreover, the expression levels of col1a1a, col1a1b, and col1a2 genes were upregulated, which promotes collagen synthesis and exerts anti-aging effects on the skin.

For the US$150 billion skincare market, this breakthrough addresses the surging demand for gentle yet high-performance anti-aging solutions. Supramolecular bakuchiol emerges as a retinol alternative tailored for sensitive skin, positioning it as a transformative innovation with vast commercial potential in anti-aging cosmetics.

References
DOI
10.1016/j.supmat.2025.100093

Original Source URL
https://doi.org/10.1016/j.supmat.2025.100093

Funding Information
This work was supported by the National Natural Science Foundation of China (82073018, 82202851), the Shenzhen Science and Technology Innovation Committee (JCYJ2022053015187038, KQTD20170809110344233), Guangdong Basic and Applied Basic Research Foundation (2023A1515110487), Southern University of Science and Technology-Shinesky Joint Engineering Laboratory (Y01411853) and China Postdoctoral Science Foundation (2023M732379).

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