A Multifunctional Thermoresponsive Micellar Hydrogel System for Targeted Skin Depigmentation, Enhanced Dermal Penetration, and Extracellular Matrix Stimulation

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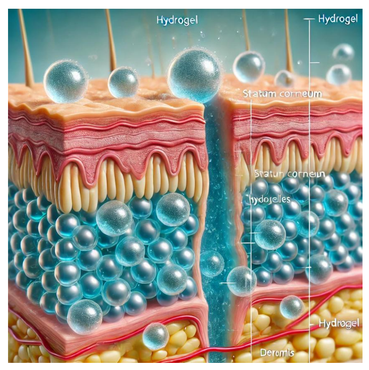
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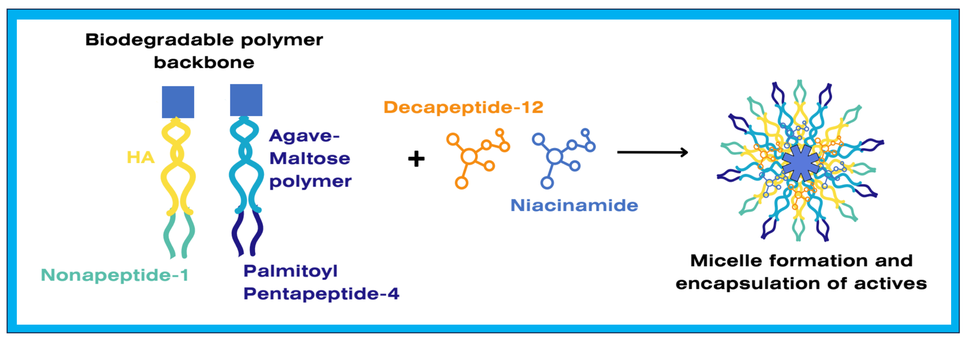
INTRODUCTION

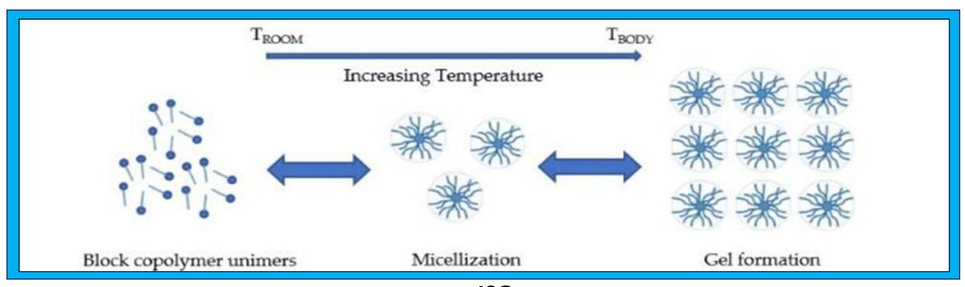
Skin hyperpigmentation and aging are closely associated with increased melanin production and degradation of the extracellular matrix. Advanced delivery systems are required to improve penetration, stability, and sustained release of active compounds.

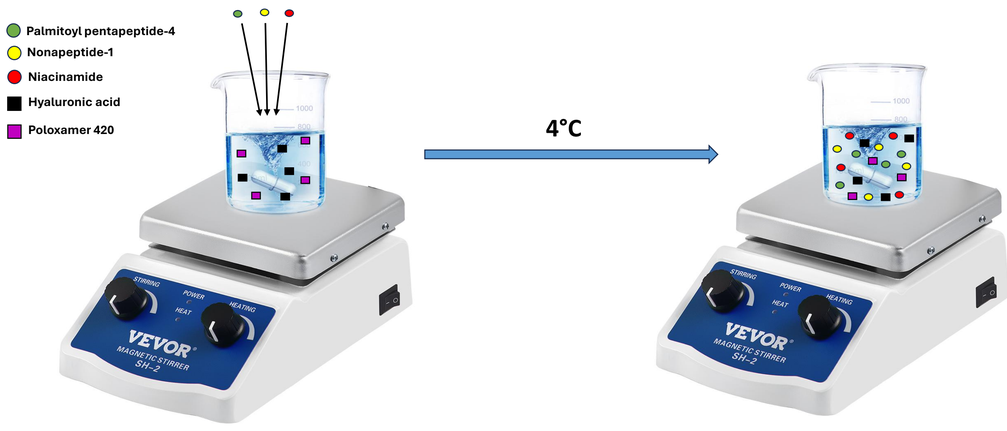
This study describes the development and evaluation of a thermoresponsive micellar hydrogel designed to enhance dermal delivery while providing combined depigmenting and anti-aging effects. The formulation is based on a micelle-forming polymeric system containing hyaluronic acid, niacinamide, and biomimetic peptides.

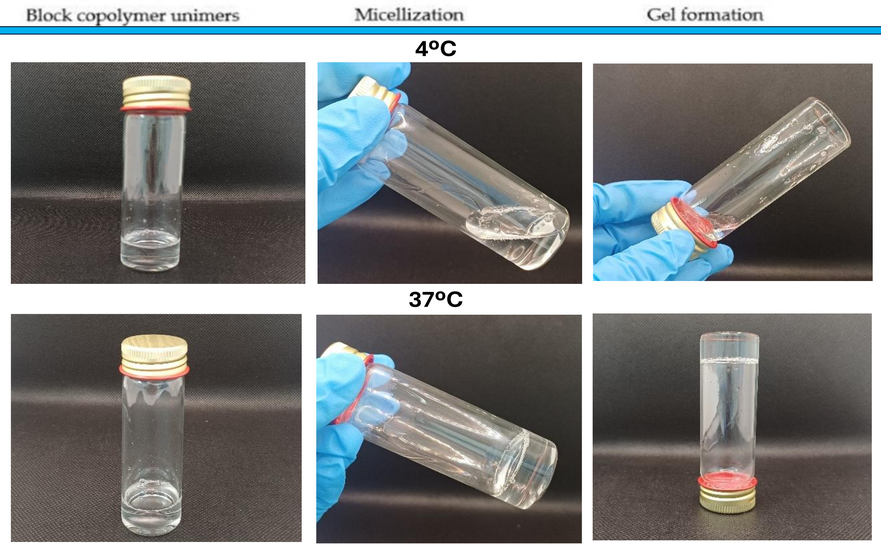


METHODS



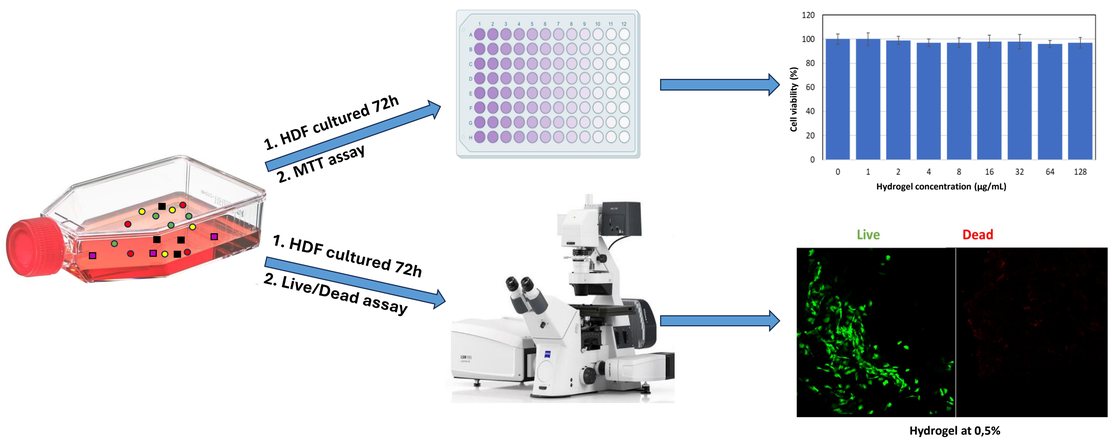




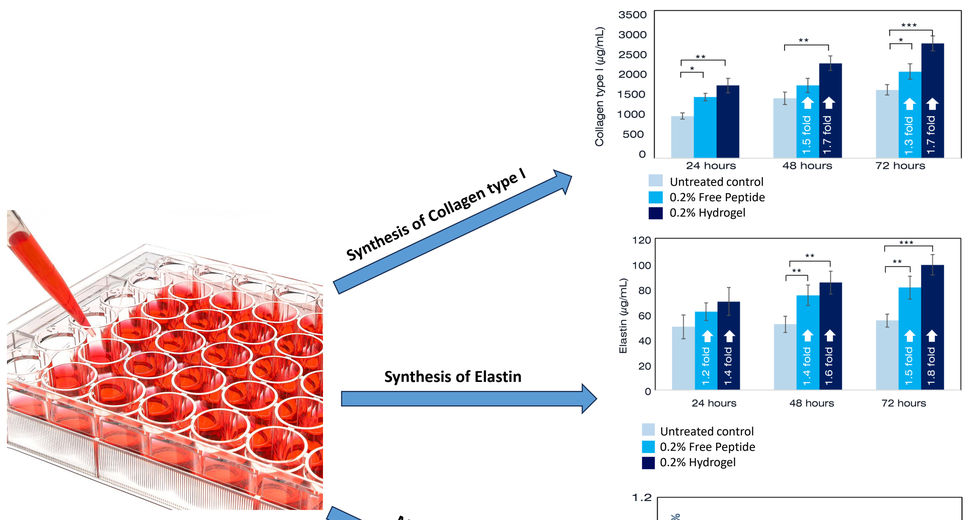


RESULTS

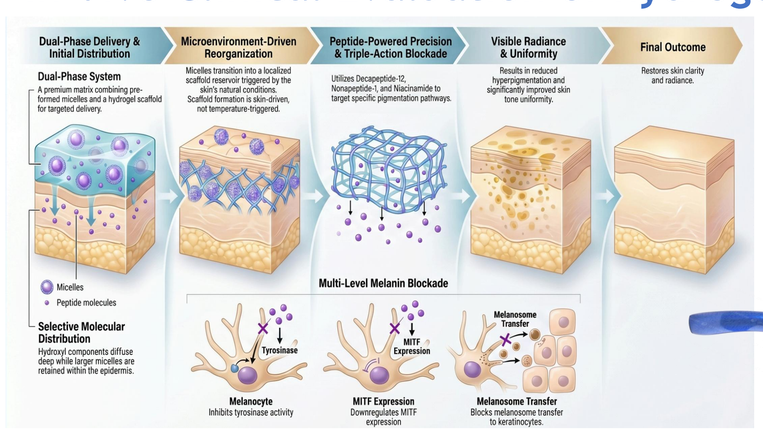
In vitro studies: Cytotoxicity and cell viability

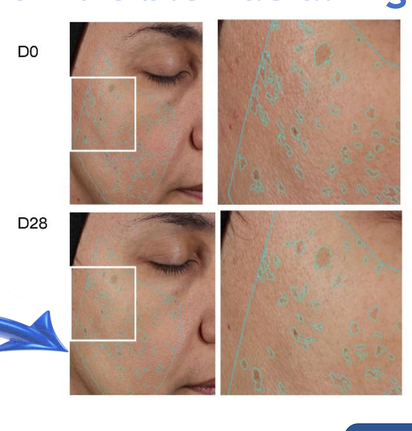


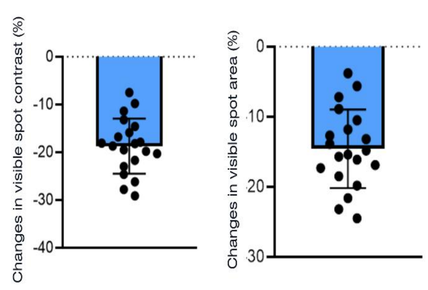
Extracellular matrix production



In Vivo Clinical Evaluation of hydrogel on Visible Facial Pigmentation







CONCLUSION

This thermoresponsive micellar hydrogel represents a promising multifunctional platform for skin depigmentation and anti-aging applications, combining efficient dermal delivery, sustained bioactive release, and clinically validated efficacy.

Acknowledgement

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