WASTE-DERIVED SURROGATE INGREDIENTS:
A NEW SUSTAINABLE WORLD FOR SUNSCREEN FORMULATIONS

Inês Miquelino (1), Margarida Miranda (1,2), Sara Raposo (1,3), Deolinda Auxtero (1)
(1)CiiEM – Centro de investigação interdisciplinar Egas Moniz, Egas Moniz School of Health and Science, Monte de Caparica, Portugal; (2) Coimbra Chemistry Center, Department of Chemistry, University of Coimbra, Portugal; (3) Laboratório Edol, Produtos Farmacêuticos SA.

INTRODUCTION

The cosmetic industry is under increasing pressure to adopt new sustainable practices.

One solution relies in repurposing bio-waste products as cosmetic active ingredients [1].

The **repurpose of biowastes** could be a viable strategy, due to their high content in bioactive compounds, that display antioxidants, anti-inflammatory and photo-protective properties, which **may be beneficial for sunscreens**.

The aim of this work is to present 3 case studies of bio-waste-derived raw materials with potential sunscreen application.

CASE STUDIES

WALNUT AND HAZELNUT SHELLS

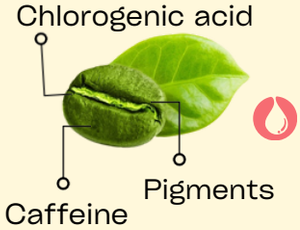
Lignins are capable of:

- absorbing UVA/UVB radiation due to its chromophore groups.
- Enhance photoprotection;
- Provide antioxidant properties;
- Reduce reliance on synthetic filters, which are widespread in aquatic ecosystems due to their bioaccumulation characteristics

APPLICATION CONSTRAINTS

- Intrinsic dark color of industrial lignin;
- Low dispersity in the base creams.

SPENT COFFEE GROUNDS (SCG)

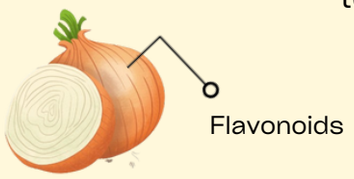


- **SCG** = residue obtained after coffee treatment with hot water or steam;
- SCG displays a **high lipid content**, particularly on fatty acids.

A novel sunscreen formulation combined SCG with UV physical absorbers, showing:

- SPF improvement
- Antiaging and skin lightning effects
- Reduce synthetic filter concentration

ONION PEELS (OP)



Annually, nearly 600 million tons of waste are produced consisting of OP, roots and damaged onions. However, these ingredients are valuable by-products due to their content on flavonoids, as well as other compounds;

A recent study, extracted and microencapsulated OP compounds by molecular inclusion using β-cyclodextrin, as the coating agent. The results showed:

- Stable cream formulations with high photoprotection
- Microencapsulated OP are a natural UV filter, capable of replacing synthetic UV filters or be used to decrease their concentration

CONCLUSIONS

- Addition of waste-derived natural ingredients to sunscreens increases their photoprotective properties and can decrease the concentrations of synthetic filters which are an intrinsic bioaccumulation profile highly detrimental to aquatic ecosystems;
- These case studies represent exciting opportunities in reducing the impact on the environment and contributing towards a circular economy, as well as a circular beauty.

References: [1] Marto, J., et al 2016. Ind. Crops Prod. 80, 93–100. [2] Sasounian, R., et al. 2024. Clean Technol. 6, 176–198; [3] Messias, M.A., et al. Int. J. Mol. Sci. 24.