Extraction of beetroot peels using Natural Deep Eutectic Solvents and incorporation of the extract in cosmetic formulation

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Introduction

Nowadays, **herbal cosmetics** containing plant extracts are gaining popularity since they are characterized by important properties like antioxidant, anti-inflammatory, antiseptic and antibacterial etc. **Beetroot** contains high amounts of bioactive compounds such as ascorbic acid, carotenoids, phenolic acids, flavonoids etc and is regularly consumed as part of the normal diet. Recent studies, have focused on the valorisation of **red beetroot waste**. **Natural Deep Eutectic Solvents (NADES)** are mixtures of two or more naturally occurring components, a hydrogen bond acceptor and a hydrogen bond donor, with a low-temperature eutectic point. NADES display a broad range of advantages, including among others low or negligible volatility, non-flammability, tunability of their physicochemical properties, ability to dissolve a wide variety of compounds while they can be prepared in high purity through straightforward and low-cost procedures without producing waste. Owing to these characteristics, NADES have been extensively used as solvents for the extraction of valuable bioactive compounds from a wide range of natural sources and biomass.

Material & Methods

Results & Discussion

Characterization of Extract

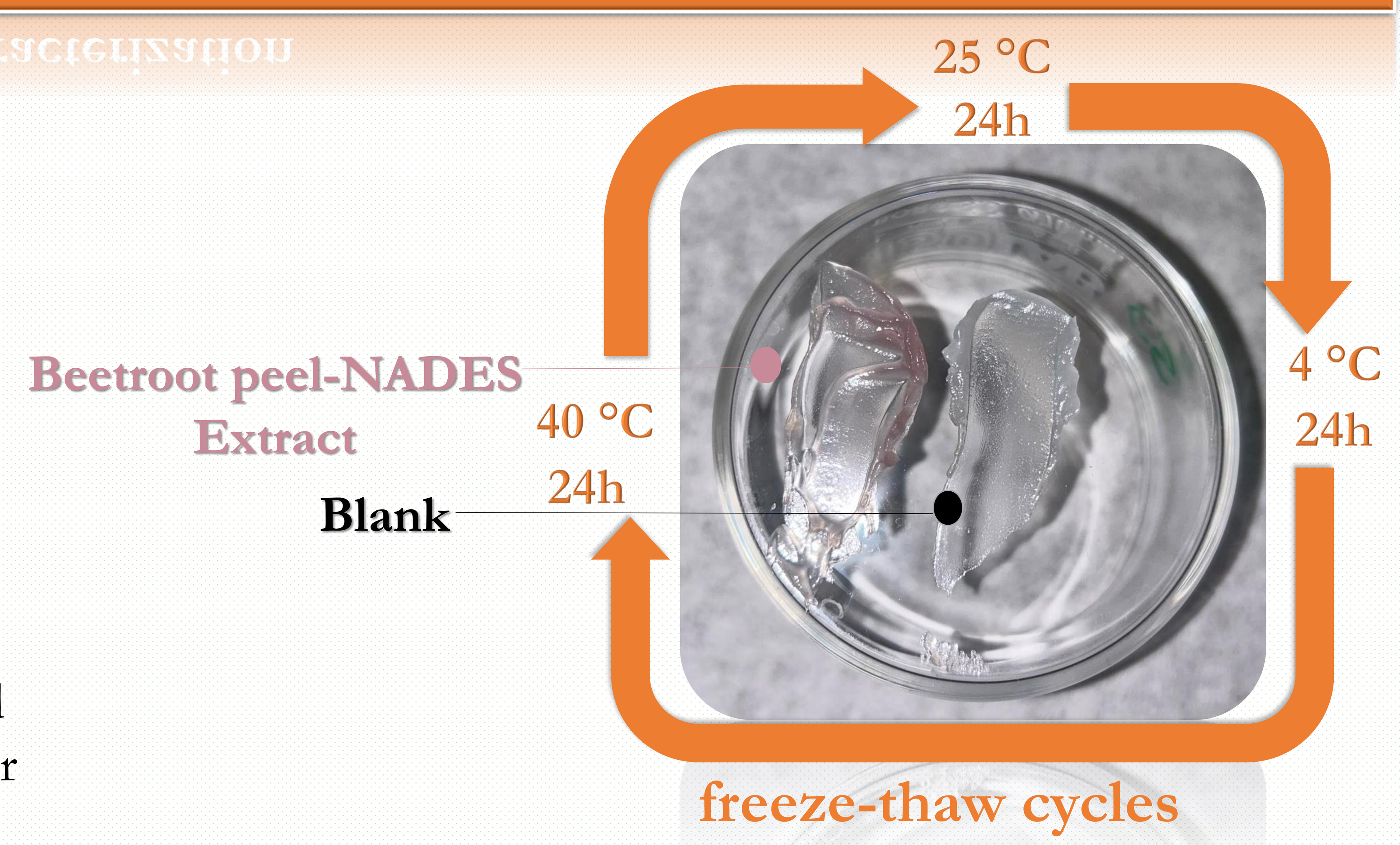
- The **Total Phenolic Content (TPC)** was estimated to be 18.97 ± 0.75 mg GAE/g DW, and the **Total Flavonoid Content (TFC)** was estimated to be 1.42 ± 0.15 mg CE/g DW for the beetroot peel-NADES extract.
- The **extracted natural products are "stored" inside the NADES (lactic acid/glucose/water)** leading to a stable extract which retains its TPC, TFC and antioxidant activity for a long period of time.

Lip Balm Characterization

- The most important **organoleptic characteristics** such as **pH** and **spreadability** of the cosmetic formulation as well as **stability studies** (freeze-thaw cycles) were performed **(Table 2)**.

Table 2 Organoleptic characteristics of the lip balm formulation .

Formulation	Color	Odor	Appearance	Consistency	pH
Beetroot peel-NADES-extract lip balm	pink	Pleasant	Semi-solid	Smooth	6.8
Blank lip balm	transparent	Pleasant	Semi-solid	Smooth	6.9



- The prepared **lip balm exhibited uniformity** and could be applied perfectly **without any deformation** at room temperature and under refrigeration.

Conclusions

- The results demonstrated that the **selected NADES (lactic acid/glucose/water)** was suitable for the **extraction of bioactive compounds from beetroot peels**.
- The **biocompatibility of NADES** enabled their incorporation into **cosmetic formulations**, representing a novel strategy for eco-friendly formulation design.
- The bioactive molecules extracted by the NADES can generate **beneficial effects for facial skin and lips**, leveraging the synergistic effects of the bioactive compounds.

References

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