IMPACT OF EUTECTIC SOLVENTS ON EMULSIONS STRUCTURE

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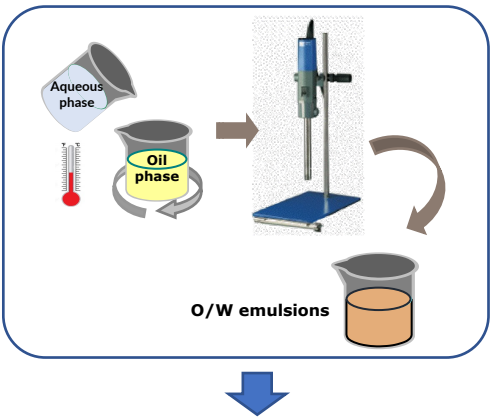
Introduction:

Solvent selection represents an important part of cosmetics development. The reduction of organic solvents use is one of the main solutions to improve sustainability (1), as well as selection of green alternatives. One interesting alternative is the use of natural deep eutectic solvents (NADES), seen as a promising, green alternative to synthetic organic solvents to produce plant extracts (2,3). Contrary to organic solvents, NADES can be designed to be incorporated into the final product, providing additional opportunities to fine tune the desired properties.

AIM: This study is focused on the impact of natural deep eutectic solvents (NADES) used on the extraction of phenolic compounds from the brown seaweed *Sargassum muticum* on an O/W emulsion.

Materials & Methods:

Three emulsions were prepared:



O/W emulsions developed:

- a blank emulsion (**BC**),
- an emulsion with 1% (*w/w*) of SLF3 extract (**EC**);
- an emulsion with 1% (*w/w*) of lactic acid:fructose (7:1) with 50% of water (*v/v*) (**SC**).

Evaluation of their structure and physical stability:

- **centrifugal cycles** (4000 rpm for 5 min in each cycle, Medifuge small benchtop centrifuge),
- pH determination (pH-Meter, SevenEasyTM),
- **microscopy** (optical microscope with polarized light, Nikon eclipse C*i*,)
- **viscosity and oscillation** frequency sweep tests with a controlled stress Kinexus Lab+ Rheometer (Malvern) using a cone and plate geometry (truncated cone angle 4° and radius 40 mm).
- **Droplet size distribution** was also determined using a Malvern Mastersizer (Hydro 2000).

Results & Discussion:

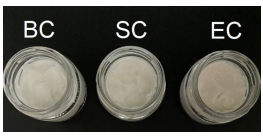


Figure 1. Macroscopic aspect of formulations.

Phase separation confirmed that these formulations are not stable, meaning that the selected NADES has impact formulation stability. This was probably due to the pH values of the formulations SC and EC were very low, around 2, due to the high content of lactic acid in the NADES used.

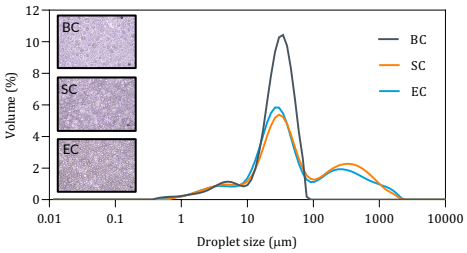


Figure 2. .Droplet size distribution of seaweed formulations (n=6) and optical microscope images of formulations at 20x magnification.

Results of droplet size show a monomodal distribution in the BC emulsion, used as the control, while SC and EC emulsions presented bimodal populations. These results were confirmed by microscopy. (fig 2)

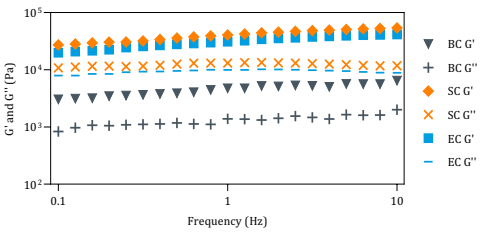


Figure 3 . Oscillation frequency sweep test.

BC, used as control, showed higher viscosities all formulations are shear-thinning fluids resulted in G' > G'' (4). It also suggests the existence of a strong network dominated by cohesive forces that allows good spreadability, adhesion and tackiness of emulsions. Results further indicate that the formulations SC and EC have higher G' and G'' than the control and BC, meaning these formulations are slightly more structured. SC and EC creams differ from the BC (control formulation) since they contain the NADES lactic acid:fructose (7:1, 50% *v/v* H_2O) and the seaweed extract, SLF3, respectively (fig. 3).

Conclusions:

The physical-chemical characterization of the O/W emulsion showed acidic pH value and a shear thinning behavior suggesting its suitability for skin application. However, the extract formulation prepared, EC, revealed stability issues, highlighting the impact of NADES in topical formulations for skin care.

References:

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