ISGC 2022

N°1389 / PC
TOPIC(s) : Alternative solvents / Alternative technologies

Spirulina extraction with non-polar NaDES: impact of component ratio and extraction method

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PURPOSE OF THE ABSTRACT

Microalgae have been the subject of growing interest for several decades, particularly from the cosmetics industry [1]. They constitute a valuable and renewable source of biomolecules of interest such as free fatty acids (FFA), phycobiliproteins, chlorophylls and carotenoids. In particular, FFAs have anti-inflammatory, moisturizing and regulating properties of the skin microbiota, properties with high added value for the cosmetics field [2]. The extraction of FFAs on an industrial scale generally requires the use of organic solvents with a negative environmental impact, such as hexane alone or in mixture with methanol. Recently, natural deep eutectic solvents (NaDES) have been studied in SIMBA laboratory as a sustainable alternative for the valorization of these FFAs.

NaDES are generally made up of 2 or 3 compounds belonging to the primary metabolites of plants, which makes it possible to consider them as biocompatible. They are characterized by a melting temperature lower than that of their components taken separately, due to the formation of a network from intermolecular hydrogen bonds. For a better understanding of these interactions, a tool for predicting thermodynamic properties was used: Conductor-like Screening Model for Real Solvents (COSMO-RS). Studies have been carried out to investigate the interactions between the NaDES components, their physico-chemical properties and to determine their theoretical eutectic point.

First, a NaDES composed of a fatty acid and a polyol will be presented. To highlight the influence or not of the composition of NaDES on the extraction performance, in silico and experimental approaches have been implemented, for the extraction of apolar metabolites from spirulina (FFA, chlorophylls, carotenoids). Three fatty acid/polyol ratios were selected on the solvent formation isotherm, and used in extraction, in comparison with the pure substances. The generated extracts were characterized by LC-MS and UV-visible spectrophotometry. The results showed a significant NaDES effect, with an increase in extractive capacities compared to pure substances. In a second step, the extractive performances of 2 processes were compared: (i) a classic method by steering/heating, (ii) a new extractive formulation process developed in the laboratory. The results highlighted diversified profiles depending on the method used.

FIGURES

FIGURE 1

FIGURE 2

KEYWORDS

Natural Deep Eutectic Solvents | Microalgae | Extraction | COSMO-RS

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