NATURAL DEEP EUTECTIC SOLVENTS FOR GREEN AGRI-FOOD SOLUTIONS

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INTRODUCTION:
The food industry faces the challenges of sustainable production demanding innovative solutions to exploit food waste and by-products as bioresources for our next generation of energy, chemicals, pharmaceuticals, cosmetics, foods and other high value added products. In line with that, the principles of "green chemistry" are gaining importance (1).
Natural deep eutectic solvents (NADES) are a subgroup of eutectic solvents consisting only of natural, edible, nontoxic and biodegradable compounds. More precisely, sugars, fatty acids, organic salts, amino acids, terpenes, alcohols and other generally recognized as a safe (GRAS) compounds can be mixed in the adequate proportions to design multifunctional solvents with tailored properties for specific applications (1,2). Their edible nature, high solubilisation capacity for poorly soluble natural compounds, ability to enhance stability of extracted compounds and to promote their biological activities, make them suitable for a wide area of food applications (1,2,3).

OBJECTIVES:
The objective of the work was to test the application of NADES within the framework of "new food product development": 1) to identify sustainable plant sources rich in phenolic compounds and carotenoids; 2) to produce task specific hydrophilic and hydrophobic NADES; 3) to optimize the production of NADES extracts rich in bioactives; 4) to design a new functional beverage in the co-creation processes involving consumers and SMEs.

METHOD / DESIGN:
Interdisciplinary approach was applied, encompassing the employment of different engineering (novel extraction techniques), chemical (HPLC and spectrophotometric), mathematical (descriptive statistics, RSM and ANN modelling) and social science methods.

RESULTS:
Hydrophilic NADES composed of organic acids (citric, malic, lactic and tartaric acid) as hydrogen-bond donors and betaine or sugars (fructose and glucose) as hydrogen-bond acceptors could serve as efficient extraction agents for the phenolic compounds and alternative hydrolysis media which are edible and nontoxic for human health. On the other hand, hydrophobic NADES composed of medium chain fatty acids appear very efficient in extracting and protecting β-carotene from degradation. The selection of extraction technique and optimization of parameters have a crucial role in the process efficiency (2).

CONCLUSIONS:
Based on obtained results; NADES have a great potential in the food sector. However, a lot of fundamental research dealing with the nature of the interactions in NADES, along with their physicochemical properties needs to be done as they are relevant for industrial applications.

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