Alternative strategies for the extraction of compounds from natural resources

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Exploitable compounds from natural resources include polysaccharides, proteins and peptides, gum exudates, lipids, polyphenols and other secondary metabolites.

Traditional-water extraction (TWE) of polysaccharides is a time-consuming process that requires high solvent and energy consumptions and generates large amounts of waste. Other bioactive compounds are traditionally extracted with organic solvents or mixtures of organic solvents and water, with or without heat.

Subcritical water extraction and hydrolysis have been used as an alternative to traditional solvent extraction for many compounds in different matrices (1). Advantages include absence of chemical solvents, lower solvent costs, lower extraction times at moderate operational conditions, resulting in higher quality extracts. Furthermore, water is a solvent with very interesting properties in subcritical conditions. As temperature increases hydrogen bonds break, significantly decreasing the dielectric constant and the polarity, thus increasing solubility of more hydrophobic compounds. On the other hand water ionization increases (thus increasing H+ and OH- ions concentration), meaning that reactions catalysed by acids or bases, like biomass hydrolysis, are accelerated.

Ohmic heating is defined as a process wherein an electric current is passed through materials with the primary purpose of heating them (2). Because heat is generated inside the material to be heated (Joule effect), the heating process does not depend on heat transfer between phases and interfaces, allowing uniform heating and an extremely rapid heating rate. Furthermore, it also allows heating of large particulates and fluids at comparable rates, as long as their conductivities remain similar. Many studies also suggest that EF has also a significant effect on the cell wall permeabilization, having EF been applied to vegetable cells with different purposes: enhancing diffusion of molecules into vegetable tissues, drying, pasteurization. The process has high energy conversion efficiencies resulting in lower operational costs and in an environmentally-friendly system (2).

Enzymatic hydrolysis has been used either as an extraction process (e.g. for bioactive peptides) or as a pre-treatment to facilitate extraction (e.g. for breaking the cell wall and hydrolysing the structural polysaccharides to be used in fermentation processes).

These processes (alone or in combination) are being applied to different matrices: seaweeds, olive oil residues, wine residues, pine bark, among others, mainly in the extraction of polysaccharides, proteins and phenolic compounds. Chemical, structural and functional characterization of different extracts allow exploiting different potential applications. On-going projects include "REDVALUE - Technological Alliance to complete the forest and agroindustrial production cycle".

References

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