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DEEP EUTECTIC SOLVENTS AND IONIC LIQUIDS AS SUSTAINABLE SOLVENTS FOR THE EXTRACTION OF VARIOUS BIOACTIVE COMPOUNDS

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Deep eutectic solvents (DES) and ionic liquids (ILs) have attracted significant attention as sustainable alternatives to conventional organic solvents, showing effectiveness in the extraction of both low-molecular-weight bioactive compounds and macromolecules such as proteins. Their unique physicochemical properties, including low volatility, tunable polarity, and strong solvation capabilities, make them ideal for green extraction processes. Additionally, DES and ILs are often biodegradable, non-toxic, and environmentally benign, providing a sustainable approach to extracting phenolic compounds, flavonoids, alkaloids, terpenoids, and proteins from various biomass sources. These solvents offer distinct advantages over traditional solvents, including higher extraction efficiency and improved selectivity for complex biomolecules. In our study, we investigated protein isolation from rapeseed press cake using DES, specifically choline chloride (ChCl) combined with urea and glycerol as hydrogen bond donors. The ChCl-Urea system demonstrated superior extraction efficiency, yielding 31.3 g of protein per 100 g of dry matter with a protein purity of 89.2%, surpassing the results obtained with conventional alkaline extraction. The ChCl-Glycerol system also showed promising results, although it achieved slightly lower protein yields compared to the ChCl-Urea system. These findings underscore the potential of DES for the efficient and sustainable extraction of both small bioactive compounds and larger biomolecules. There is strong evidence supporting the use of DES and ILs in bioactive extraction, showing that they outperform conventional solvents in terms of yield, stability, and the preservation of bioactive properties. Moreover, the tunable nature of DES and ILs allows for the optimization of extraction processes by selecting appropriate cation-anion combinations. As research progresses, there is increasing interest in scaling up these eco-friendly solvent systems for industrial applications in the pharmaceutical, nutraceutical, food, and cosmetic sectors, presenting a promising future for sustainable extraction processes.

Keywords: green chemistry, deep eutectic solvents, protein extraction

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