

Rice Bran Protein Extraction Optimization: Green Approaches Using Deep Eutectic Solvents and Microwave-Assisted Extraction Techniques

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Abstract:

A novel approach for green protein extraction was developed by combining deep eutectic solvents (DES) and microwave-assisted extraction (MAE) to optimize the extraction of protein from defatted rice bran. Rice bran, an agricultural byproduct, is rich in proteins and bioactive compounds; however, it remains largely underutilized due to the inefficiency of current extraction methodologies. These proteins are widely known for their hypoallergenic properties and nutritional benefits. This research examined various DES types (choline chloride-based mixtures with different hydrogen bond donors: glycerol (neutral), oxalic acid (acid), and urea (base)). Key factors controlling the extraction and optimal operating conditions were optimized by response surface methodology. The extraction efficiency was then evaluated under different microwave power, extraction time, and sample-to-DES ratio. The extraction parameters that were determined to be optimal were as follows: a choline chloride-urea DES, a solvent to sample ratio of 5.79, 296.97 W of microwave power, and 44.75 s of extraction time. The optimization of protein extraction was characterized using a Box-Behnken Design of Experiment, with protein recovery as the response variable. The protein quality was then analyzed using SDS PAGE for molecular weight distribution. The selected DES-MAE method achieved maximum protein recovery of 39.96 ± 0.5 %. The combining method of ChCl-based DES and MAE exhibited techniques highlights the potential of DES-MAE for rice bran protein extraction.

Keywords:

Deep Eutectic Solvent, Microwave-Assisted Extraction, Protein Extraction, Response surface methodology, Rice Bran Protein