Structural, Colloidal, and Functional Modifications of Coconut Protein Induced by Defatting: Roles of Solvent Polarity and Emerging Technologies

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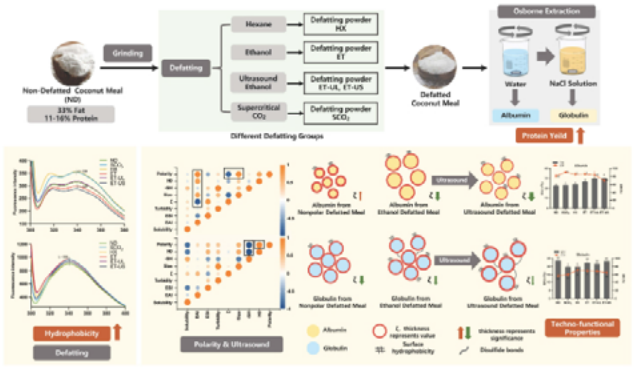
Defatting is a crucial pretreatment step in the extraction of plant proteins from food industry by-products. In this study, we evaluated the effects of several defatting methods (ethanol (EtOH), hexane (HX), supercritical fluid CO_2 (SCO_2), and high intensity ultrasound (HIUS) combined with EtOH) on the protein recovery, structure and colloidal properties of coconut albumin and globulin. The total protein extraction recovery increased from 36.4% in the non-defatted group (ND) to up to 39.2% after defatting, mainly driven by the higher globulin recovery (24.9% in ND to 28.4% with HIUS), whereas albumin recovery remained unchanged (11.4%) or slightly reduced under HIUS (10.8%). Defatting had minor effects on secondary and tertiary structures but markedly enhanced protein surface hydrophobicity. Globulin showed increased exposure of hydrophobic groups (204 a.u. in ND *versus* 222–274 a.u. in treated groups). In albumin, HIUS further amplified this effect compared with EtOH (58 *versus* 66 a.u.), leading to improved emulsifying capacity. A strong correlation ($|R| > 0.7$) was observed between solvent polarity and protein colloidal and functional properties of proteins. Defatting reduced globulin solubility (90% in ND *versus* 76–90% in treated groups), due to increased surface hydrophobicity. EtOH defatting enhanced the emulsifying properties of albumin compared with ND (26.8 *versus* 22.9 m^2/g). In globulin, however, HIUS promoted intermolecular disulfide bond formation, inducing aggregation and decreasing flexibility, which slightly impaired emulsifying performance. In contrast, SCO_2 caused minimal changes in functional properties, comparable to hexane and closest to ND. Distinct interfacial behaviors were observed across protein fractions and treatment groups. Globulin exhibited a higher diffusion rate ($k = 6.4 \times 10^{-3}$ in SCO_2 *versus* 4.3×10^{-3} in HIUS) compared with albumin ($k = 3.9 \times 10^{-3}$ in SCO_2 *versus* 2.5×10^{-3} in HIUS). SCO_2-treated proteins showed faster diffusion than those treated with HIUS. However, no significant differences were observed in the equilibrium interfacial tension at the tested concentration (0.1%). Overall, the use of SCO_2 and EtOH combined or not with emerging technologies presents a more environmentally friendly and promising alternative to conventional hexane-based defatting.

Keywords:
Coconut proteins, defatting, green extraction, interfacial properties



Overview on extraction, functional properties, and molecular state of albumin and globulin.