

## Application of deep eutectic solvents for oil extraction from rubber seed

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Solvent extraction is a crucial technique across various industries for the effective separation of substances. However, the widespread use of conventional organic solvents raises concerns due to their environmental and health hazards. In this study, the efficiency of Natural Deep Eutectic Solvents (NADESs) as eco-friendly co-solvents for oil extraction from rubber seeds was investigated. NADESs were synthesized using ammonium salt (choline chloride) and two hydrogen bond donors (glycerol and lactic acid) in a molar ratio of 1:2 and they were evaluated as co-solvents with n-pentane for the rubber seed oil extraction. Using Conductor-like Screening Model for a Real Solvent (COSMO-RS), activity coefficients at infinite dilution,  $\sigma$ -profiles were employed to simulate the molecular interactions between solvents, co-solvents and oil. The findings demonstrate that the inclusion of NADESs as co-solvents led to a significant reduction in the required extraction temperature of 20°C. Furthermore, the results suggest that the NADESs facilitate the penetration of organic solvents into rubber seed biomass, thereby enhancing extraction efficiency. This study highlights the potential of NADESs to serve as green and effective alternatives in industrial separation processes, reducing both energy consumption and reliance on hazardous solvents.



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