

Effective Lipid Recovery from *Coelastrella* Sp. and *Haematococcus* Sp. Microalgae Using Low-Cost Protic Ionic Liquids

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Abstract:

The depletion of fossil fuel resources in the world necessitates the consolidation of efforts to explore potential sources of renewable energy such as biofuels. The lipids found in various microalgae species are recognized as one of the promising storages of triacyl-glycerides precursors essential to generate biofuels. Ionic liquids have been frequently promoted as one of the greenest and most efficient solvents used to disrupt algae cells to extract lipids. However, the expensive and complex preparation process of classical aprotic ionic liquids prohibited their practical implementation in real-life applications. Protic ionic liquids are a recently popularized class of ionic liquids, characterized by their low cost and simple preparation process. In this project, we explored the use of protic ionic liquids with methanol cosolvent for the extraction of lipids from *Haematococcus* sp. and *Coelastrella* sp. microalgal biomass. Both microalgae species were first characterized for their analytical lipid, protein, carbohydrate, and ash contents before the extraction experiments. The screening experiments of four ionic liquids were performed, and the results showed that [DMBA][HSO₄] exhibited the highest extraction performance of lipids from *Coelastrella* sp. The walls of *Coelastrella* sp. have shown less resistance to getting penetrated and releasing their lipid content compared to *Haematococcus* sp. Process parameters such as the temperature, time, ionic liquid to methanol ratio, ionic liquid water content, and ionic liquid acid-to-base ratio possessed a key impact on the lipid extraction potential. The project findings highlight the potential of protic ionic liquids as a cost-effective and efficient lipid extraction approach for the sustainable production of biofuels.