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Entitled

Thermoresponsive Switchable Solvents for Enhanced, Simultaneous Microalgae Oil Extraction-Reaction for Biodiesel Production

by

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Abstract: A thermo-responsive switchable solvent (TSS) composed of n,n diethyl-N-methylammonium methane sulfonate, poly(propylene) glycol, and water, which switched hydrophobicity by the change in temperature, was successfully used for simultaneous cell disruption, oil extraction-reaction, and biodiesel separation from wet microalgae. Catalyzed by immobilized lipase, the entire process was carried out in a single pot using the same solvent without drying the microalgae. Besides being easier to operate, the biodiesel yield using the TSS was 21% higher than that achieved using CO_2-triggered switchable solvent (1,8-diazabicyclo-[5.4.0]-undec-7-ene (DBU)-1-hexanol) under the same conditions and solvent switching program. To optimize the process, a parametric study was performed to evaluate the effects of cell disruption and extraction/reaction durations and methanol amount on the biodiesel production yield. The results were used to develop a statistical model to predict the biodiesel yield under different conditions. The model was validated by repeating the reaction as defined by the model and a yield of 75.11±1.03% was observed. Moreover, we observed that the immobilized enzyme retained its activity till two rounds of reaction, and future optimization may improve the reusability further. In conclusion, our results showed that the successful use of a TSS lipids extraction-reaction from wet biomass can significantly simplify the extraction of biodiesel from wet microalgae.

Keywords: Thermo-responsive Switchable Solvent, Microalgae, Biodiesel, Simultaneous Extraction-Reaction