Optimization of cell wall disruption and lipid extraction methods by combining different solvents from wet microalgae

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Abstract

Microalgae have emerged as one of the most promising options for biodiesel production over the past few decades. Lipid extraction from microalgae for biodiesel production as a bottleneck of biodiesel production technology was the main purpose of this study. In this study different methods of the cell wall disruption were compared. Then, two methods of ultrasound and bead mill were used as methods of the cell wall disruption. The maximum lipid extracted by ultrasound was 17.10% and by bead mill was 15.16% (based on microalgae biomass dry weight). After the cell wall disruption of microalgae, for lipid extraction, chloroform-methanol solvent combination was used as a high extraction method and hexane-ethanol solvent combination was used as an environmentally friendly method. In this regard, the effect of solvent to biomass ratio, temperature and extraction time was investigated and the optimal results for chloroform-methanol solvent combination were 8 ml/g, 45°C and 60 minutes, respectively, and for hexane-ethanol combination were 6 ml/g, 35*C and 73 minutes, respectively. Under these optimal conditions, the highest amount of extracted lipid from Chlorella vulgaris with a moisture content of 87.50%, and ultrasound as a cell wall disruption method were obtained 20.39% and 16.41% (based on microalgae dry weight) with a combination of chloroform-methanol solvents and hexane-ethanol respectively. Also the highest extraction rates of 17.63% and 13.85% were obtained for the combination of chloroform-methanol and hexane-ethanol solvents, respectively by bead milling as cell wall disruption method

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