

Algae for Wastewater Treatment and CO₂ Sequestration along with Recovery of Bio-Oil and Value Added Products

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Abstract : Concern about global warming and energy security has led to increased biomass utilization as an alternative feedstock to fossil fuels. Biomass is a promising feedstock since it is abundant and cheap and can be transformed into fuels and chemical products. Microalgae biofuels are likely to have a much lower impact on the environment. Microalgae cultivation using sewage with industrial flue gases is a promising concept for integrated biodiesel production, CO₂ sequestration, and nutrients recovery. Autotrophic, Mixotrophic, and Heterotrophic are the three modes of cultivation for microalgae biomass. Several mechanical and chemical processes are available for the extraction of lipids/oily components from microalgae biomass. In organic solvent extraction methods, a prior drying of biomass and recovery of the solvent is required, which are energy-intensive. Thus, the hydrothermal process overcomes the drawbacks of conventional solvent extraction methods. In the hydrothermal process, the biomass is converted into oily components by processing in a hot, pressurized water environment. In this process, in addition to the lipid fraction of microalgae, other value-added products such as proteins, carbohydrates, and nutrients can also be recovered. In the present study was (*Scenedesmus quadricauda*) was isolated and cultivated in autotrophic, heterotrophic, and mixotrophically using sewage wastewater and industrial flue gas in batch and continuous mode. The harvested algae biomass from *S. quadricauda* was used for the recovery of lipids and bio-oil. The lipids were extracted from the algal biomass using sonication as a cell disruption method followed by solvent (Hexane) extraction, and the lipid yield obtained was 8.3 wt% with Palmitic acid, Oleic acid, and Octadecanoic acid as fatty acids. The hydrothermal process was also carried out for extraction of bio-oil, and the yield obtained was 18wt%. The bio-oil compounds such as nitrogenous compounds, organic acids, and esters, phenolics, hydrocarbons, and alkanes were obtained by the hydrothermal process of algal biomass. Nutrients such as NO₃⁻ (68%) and PO₄⁻ (15%) were also recovered along with bio-oil in the hydrothermal process.

Keywords : flue gas, hydrothermal process, microalgae, sewage wastewater, sonication

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