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Enhanced Growth of Microalgae Chlamydomonas reinhardtii Cultivated in Different Organic Waste and Effective Conversion of Algal Oil to Biodiesel

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Abstract : Microalgae are a potential bio-source for rejuvenated solutions in various disciplines of science and technology, especially in medicine and energy. Biodiesel is being replaced for conventional fuels in automobile industries with reduced pollution and equivalent performance. Since it is a carbon neutral fuel by recycling CO2 in photosynthesis, global warming potential can be held in control using this fuel source. One of the ways to meet the rising demand of automotive fuel is to adopt with eco-friendly, green alternative fuels called sustainable microalgal biodiesel. In this work, a microalga Chlamydomonas reinhardtii was cultivated and optimized in different media compositions developed from under-utilized waste materials in lab scale. Using the optimized process conditions, they are then mass propagated in out-door ponds, harvested, dried and oils extracted for optimization in ambient conditions. The microalgal oil was subjected to two step esterification processes using acid catalyst to reduce the acid value (0.52 mg kOH/g) in the initial stage, followed by transesterification to maximize the biodiesel yield. The optimized esterification process parameters are methanol/oil ratio 0.32 (v/v), sulphuric acid 10 vol.%, duration 45 min at 65 ºC. In the transesterification process, commercially available alkali catalyst (KOH) is used and optimized to obtain a maximum biodiesel yield of 95.4%. The optimized parameters are methanol/oil ratio 0.33(v/v), alkali catalyst 0.1 wt.%, duration 90 min at 65 ºC 90 with smooth stirring. Response Surface Methodology (RSM) is employed as a tool for optimizing the process parameters. The biodiesel was then characterized with standard procedures and especially by GC-MS to confirm its compatibility for usage in internal combustion engine.

Keywords : microalgae, organic media, optimization, transesterification, characterization
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