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Process Optimisation for Efficient Production of Biodiesel from Microalgae (*Chlorella* sp.) Isolated from Sri Lankan Aquatic Habitats

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Abstract

Microalgae are a diverse group of aquatic organisms, which can capture excess CO_2 levels in the atmosphere and transform them into lipids, which can be applied in biofuel industry. The primary aim of this research work was to evaluate the potential of using microalgae, isolated from Sri Lankan aquatic habitats to produce biodiesel and to increase the production efficiency by developing well-optimised high yielding novel protocols using cheap raw materials. Different genera of microalgae were isolated and initially grown in BBM (Bold's Basal Medium). Due to high cost of BBM, the medium was replaced with cheap and, nutrient compatible, commercially available Albert's solution for mass production of microalgae. Apart from that, the novel media was used to demonstrate the growth rate of the microalgae. Biomass was harvested using ECF (Electrocoagulation and Flocculation) technique. Harvested microalgae were dewatered and dried. Newly developed sand crushing and heating methods were adopted to extract lipids from the harvested microalgae. Extracted lipids were trans-esterified by optimised stoppered bottle-mixing method. Produced fatty acid methyl esters (Biodiesel) were subjected to Gas Chromatography-Mass spectroscopy to analyse fatty acid profile.Variety of microalgae species isolated and morphologically characterised. *Chlorella* sp. was chosen for further studies among isolated microalgae species due to their abundance in aquatic habitats and ability to dominate in a medium. Cultivation of *Chlorella* sp. in Optimised novel medium (3.0 mL of standard Albert's solution gave per liter of medium) recognised as a new high biomass-yielding (1.2659 g/L) medium for *Chlorella* sp. The cost reduction of the Albert's optimised medium was 99% in comparison to BBM. 172 mg of lipids were extracted from 1.0 g of biomass with a lower amount of impurities. Fatty acid profile from transesterified lipids indicated that oleic acid (38.64%), linoleic acid (36.58%), palmitic acid (11.28%) and, stearic acid (5.53%) as major components in lipids present in *Chlorella* sp. Presence of high amount (75.22%) of C-18 fatty acids, further suggests that *Chlorella* sp. isolated from Sri Lankan aquatic habitats are promising candidate for quality biodiesel production. Hence, this study would be novel approach to economical biodiesel production in Sri Lanka in near future.

Keywords: Microalgae, Biofuel, Albert's solution, Transesterification, Biomass