

Potential of Palm Oil Mill Effluent in Algae Cultivation for Biodiesel Production

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Abstract : It is estimated that about 0.65-0.67 m³ of palm oil mill effluent (POME) is generated when one tonne of fresh fruit bunches is processed. Owing to the high content of nutrients in POME, it has high potential as a medium for microalgae growth. This study attempted determining the growth rate, biomass productivity and biochemical composition of microalgae (*Chlorella* sp.) grown in different POME concentrations i.e. 6.25%, 12.5%, 25% and 50% at outdoor conditions using a 200-mL capacity high rate algae pond (HRAP) and 2 closed photobioreactors (PBRs) i.e. annular and flat panel. The strain, *Chlorella* sp. grown on 12.5% of POME in flat panel PBR exhibited the highest specific growth rate of 0.32/day and biomass productivity (27.1 mg/L/day) followed by those in HRAP and annular PBR. It further showed that a good growth of *Chlorella* sp. in 12.5% of POME could sufficiently reduce the nutrients of POME such as phosphate (PO₄), nitrate (NO₃), nitrite (NO₂) and chemical oxygen demand (COD). The extracted algal oil from POME culture showed that the saturated fatty acids decreased while polyunsaturated fatty acids increased compared to those cultured in standard culture medium (Bold's Basal medium). The biochemical compositions of the algae grown in flat panel PBR were the highest with lipid, protein and carbohydrate productivity of 17.91 mg/L/day, 34.65 mg/L/day and 21.44 mg/L/day, respectively. The microalgae cultivation in diluted POME had not only shown potential as biodiesel feedstock based on the fatty acids profile but also the ability to reduce pollutants e.g. PO₄, NO₃, NO₂ and COD in biological wastewater treatment.

Keywords : wastewater treatment, photobioreactors, biomass productivity, specific growth rate

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