Microalgae cultivation using palm oil mill effluent as growth medium for lipid production with the effect of CO2 supply and light intensity

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ABSTRACT

Malaysia is one of the world's largest palm oil producers and exporters, which generates several million tons of palm oil mill effluent (POME). POME is discharged into the water sources and considered as a major environmental pollutants in Malaysia. Alternatively, POME also contains some nutrients and several minerals, thereby POME could prove as a suitable medium for microbial-based applications, such as wastewater treatment and biofuel production. Different techniques have been employed to effectively utilize the POME at point of generation. One of the alternatives is the cultivation of microalgae in the enriched medium of POME. The present study used POME as growth medium for cultivation of Chlorella sp. and determines the effect of light intensity (ranging from 900 to 12,000 lux) and different CO2 concentrations (ranging from 5% (v/v) to 20% (v/v)) by both experimentally and design expert methods. The results revealed that biomass yield was considerably increased by increasing the CO2 concentration and further improved in the photoautotrophic conditions. The optimum value of 10.9% (v/v) CO2 concentration and 9963.8 lux of light intensity was found to capture maximum CO2 and biomass production. The result obtained from optimization of the microalgal growth under various CO2 concentration, light intensity, their interaction effects, and the squared CO2 concentration suitable for microalgal lipid production under suitable light and CO2 supply. This study suggests that the nutrient sources present in POME could be potentially used to capture the carbon or CO2 and reduce the economic impact of carbon emissions. In addition, enhanced biomass yield will increase the yield for biodiesel production by Chlorella sp.

KEYWORDS: Microalgae; Wastewater; Palmoilmill effluent (POME); Carbon dioxide sequestration

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