Lipid production by microalgae *Chlorella pyrenoidosa* cultivated in palm oil mill effluent (POME) using hybrid photo bioreactor (HPBR)

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**ABSTRACT**

Palm oil mill effluent (POME) as high organic wastewater is a promising substrate in the scenario of algae bloom, by enhancing its lipid production to be further used in biofuel manufacturing. In this research, effect of POME as high nutritional substrate, different cultivation scales such as flask or hybrid photo bioreactor (HPBR), carbon-to-total nitrogen (C:TN) ratio, various light and dark cycles, and diverse organic loading rates (OLR) on the lipid productivity of microalgae *Chlorella pyrenoidosa* was assessed. Results demonstrated high microalgae growth rate (1.80 d\(^{-1}\)) at 250 mg COD/L of substrate, while moderate increase (1.37 d\(^{-1}\)) and growth inhibition (0.80 d\(^{-1}\)) were recorded at 500 mg COD/L and 1,000 mg COD/L of substrate concentration, respectively. Furthermore, a result proved that low-volume cultivation of microalgae in a flask with lipid productivity at 1.78 mg/L d significantly restricted microalgae production compared with larger scale such as HPBR with lipid productivity at 230 mg/L d. Moreover, highest lipid production at 44.5, 114.9, and 100.5 mg/L d, C:TN ratio at 100:6 and OLR at 36 kg COD/m\(^3\) d, respectively, were documented for continuous illumination (24 h). The combination of above conditions can be optimal setting to reach the highest lipid productivity by microalgae *C. pyrenoidosa*. In addition, the results of this study can be further considered in microalgae lipid production using other wastewaters in order to enhance the lipid production as well as wastewater treating functions.

**Keywords:** *Chlorella pyrenoidosa*; Hybrid photo bioreactor (HPBR); Lipid; Microalgae; Palm oil mill effluent (POME)