A Single-Reactor System for Simultaneous Pretreatment and Fermentation of POME for Bioethanol Production

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Abstract The objective of this study was to develop an efficient method for enhancing the production of bioethanol in a single-reactor system (SRS) by implementing acid-base pretreatment and enzymatic hydrolysis techniques, thereby eliminating differentiation and removal processes. The aim was to establish a process for bioethanol synthesis using hydrolyzed palm oil mill effluent (POME) and a locally sourced cellulase enzyme. The pretreatment and enzymatic hydrolysis methods were successfully optimized, resulting in a maximum yield of reducing

sugars of 26.6 g/L (53.14%). To achieve the highest bioethanol yield, fermentation was carried out using both the one-factor-at-a-time (OFAT) and face-centered central composite design (FCCCD) approaches. The OFAT approach was employed to obtain the maximum bioethanol production, which yielded 6.75% v/v of bioethanol from the hydrolyzed POME using the same bioreactor. In the case of the FCCCD process, the optimal conditions led to a bioethanol production of 7.64% v/v during the fermentation stage. Kinetic analyses of the bioethanol produced revealed a specific growth rate (mu) of 0.198 h-1 and a specific product formation rate (qp) of 0.239 h-1 after 3 days of fermentation. These findings highlight a promising strategy for efficient management of POME through the production of biofuels, which could contribute to the economic growth of the country.

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