

Bioelectricity Generation from Palm Oil Mill Effluent in Microbial Fuel Cell Using Polacrylonitrile Carbon Felt as Electrode

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Abstract: Palm oil mill effluent (POME) is an organic waste material produced at the oil palm mills. In its raw form, POME is highly polluting due to its high content of biological and chemical oxygen demand. In the present paper, POME was treated using double chamber microbial fuel cell with simultaneous generation of electricity. Polyacrylonitrile carbon felt (PACF), a new electrode material was used as electrode throughout the MFC experiments. Various dilutions of raw POME were used to analyze the effect of initial chemical oxygen demand (COD) on MFC power generation, COD removal efficiency and coulombic efficiency. Anaerobic sludge was used as inoculum for all the MFC experiments. Since this inoculum originated from POME, it showed higher potential to generate bioenergy from complex POME. Anaerobic sludge enhanced the power production due to better utilization of substrates by various types of microorganisms present in it. Among the raw POME and different concentrations of POME used, the PACF with raw POME showed the maximum power density and volumetric power density of about 45 mW/m² and 304 mW/m³, respectively, but it showed low coulombic efficiency and low COD removal efficiency of about 0.8 % and 45 %, respectively. The MFC PACF with 1:50 dilution showed higher COD removal efficiency and coulombic efficiency of about 70 % and 24 % but showed low power density and low volumetric power density of about 22 mW/m² and 149 mW/m³, respectively. The formation of biofilm onto the electrode surface has been confirmed from scanning electron microscopy (SEM) experiments. The results confirm that MFC possesses great potential for the simultaneous treatment of POME and power generation using PACF as electrode and also shows that initial

COD has great influence on coulombic efficiency, COD removal efficiency and power generation.

Keywords: Microbial fuel cell, Polyacrylonitrile carbon felt, Palm oil mill effluent, Power density

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