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The reaction of wastewater treatment and power generation of single chamber microbial fuel cell against substrate concentration and anode distributions

Abstract

This study demonstrated the effectiveness of single chamber up-flow membrane-less microbial fuel cell (UFML-MFC) in wastewater treatment concurrently with bioelectricity generation. The objectives of this study were to examine the effect of influent substrate concentration (0.405 g/L, 0.810 g/L, 1.215 g/L, 1.620 g/L), anode distributions (11 cm, 17 cm, 23 cm) and surface morphologies for biofilm formation on the performance of wastewater treatment and power generation. The optimum performance was obtained with substrate concentration of 0.810 g/L. The COD removal efficiency, output voltage, internal resistance, power density and current density obtained were 84.64%, 610 mV, 200 Ω, 162.59 mW/m^2 and 468.74 mA/m^2, respectively. The Coulombic Efficiency (CE), Normalized Energy Recovery (NER_s and NER_v) were 1.03%, 789.38 kWh/kg COD and 22.56 kWh/m^3, respectively. The results also indicate that the output voltage and power generation obtained in a continuous up-flow MFC were higher with A3 (23 cm), which is of larger electrodes spacing followed by A2 (17 cm) and A1 (11 cm) caused by the enrichment of anaerobic microbial population at A1.

Keywords

Electricity generation; Sodium acetate; Substrate; UFML-MFC; Wastewater treatment