

Membrane Bioreactor- Desalination Microbial Fuel Cell Hybrid System

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Abstract

Microbial desalination cell is relatively a new technology, which offers water desalination with zero energy consumption. Moreover, membrane bioreactors are of great reliability in treating domestic and industrial wastewater. The objective of this work is to introduce a hybrid system of membrane bioreactor (MBR) and microbial desalination fuel cell (MDFC) for simultaneous wastewater treatment, seawater desalination and production of electricity. Synthetic wastewater, composed of yeast as a model microorganisms and glucose as substrate, was used as the anode feed. Two system configurations with an immersed MBR and side-stream MBR have been proposed and compared. This study considers the closed circuit modes (three different resistive loads) of such operation. Highest total desalination rate (TDR) of 6.25 mg/hr, but lowest power density of 4.34×10^{-3} W/m³ are obtained using 302200 Ω external resistance. While the opposite has arisen using 3833 Ω external load (4.69 mg/hr TDR and 0.222 W/m³ power density). Choice of external resistance involves a trade-off between desalination efficiency and power generation. The system was also evaluated in terms of total dissolved solids (TDS), total suspended solids (TSS), chemical oxygen demand (COD), biological oxygen demand (BOD) and turbidity analyses for the permeate water from the MBR which were reduced by 55.53%, 90.21%, 29.43%, 32.94% and 94.08% respectively.

Keywords

Microbial Fuel cell (MFC); Membrane Bioreactor (MBR); desalination; wastewater treatment; bioelectricity production.