Sewage

Optimization of power generation and sewage treatment in stacked pulsating gas-liquid-solid circulating fluidized bed microbial fuel cell using response surface methodology

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Abstract

A stacked pulsating gas-liquid-solid circulating fluidized bed microbial fuel cell (SPCF-MFC) was proposed and constructed to further improve the power generation and sewage treatment performance. The impact of pulse frequency (f), pulse amplitude (A), solid circulating rate (Gs) and gas flow rate (Qg) on the maximum output voltage (Um), chemical oxygen demand (COD) removal rate (Rc) and comprehensive energy consumption (W) of the system was investigated using response surface methodology (RSM) and Box-Behnken design (BBD). The results indicated that the introduction of pulsed liquid flow coupled with gas-liquid-solid circulation operation mode can effectively improve the power output and sewage treatment efficiency. Based on the response regression model, the optimal operating condition (f = 0.268 Hz, A = 0.073 m/s, Gs = 2.88 kg/(m2 & sdot;s), Qg = 1.85 L/min) was obtained. The deviation between the predicted and experimental results was less than +/- 2.5 %, which verified the accuracy of the regression model.

Keywords
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Circulating fluidized bedStacked microbial fuel cellCentral sinusoidal pulsating liquid flowResponse surface methodologyElectricity generation performanceSewage treatment

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