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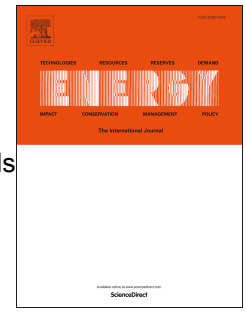

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Design of Explicit Models for Estimating Efficiency Characteristics of Microbial Fuel Cells

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Abstract

Recent years have seen the use of microbial fuel cells for the generation of electricity from wastewater and renewable biomass. The efficiency characteristics (power density and voltage output) of fuel cells depend highly on their operating conditions such as current density, chemical oxygen demand concentration and anolyte concentration. Computational intelligence methods based on genetic programming and multi-adaptive regression splines are proposed in design of explicit models for estimating efficiency characteristics of microfluidic microbial fuel cells based on the operating conditions. Performance of the models evaluated against the actual data reveals that the models formulated from genetic programming outperform the multi-adaptive regression splines models. The robustness in the best models is validated by performing simulation of the models over 8000 runs based on the normal distribution of the operating conditions. 2-D and 3-D surface analysis conducted on the models reveals that the power density of the fuel cell increases with an increase in values of chemical oxygen demand concentration and current density till a certain value and then decreases. The voltage output decreases with an increase in values of current density while increases with an increase in values of chemical oxygen demand concentration to a certain limit.

Keywords: Microbial fuel cell; MFC features modelling; MFC features prediction; fuel cell modelling; microbial microfluidic cell; computational intelligence

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