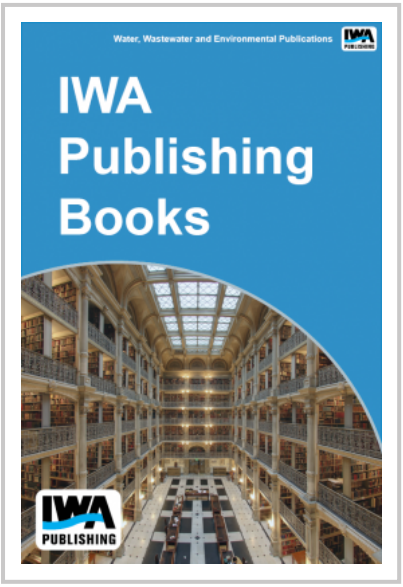
Development of a Microbial Fuel Cell for Sustainable Wastewater Treatment



Microbial Fuel Cells (MiFCs) are a promising renewable energy technology, but suffer from low power densities which hinder their practical applicability. In this work, flame deposited, carbon nanostructures (CNS) are deposited on a stainless steel mesh anode in an attempt to improve the electron transfer efficiency from microorganisms to the anode. During experimentation with anaerobic sludge in single-chamber MiFCs, cells utilizing CNS-enhanced anodes generated currents up to two orders of magnitude greater than cells with untreated stainless steel mesh anodes. Average power density with CNS-enhanced anodes was found to be 300 mW-m-2 compared to 13.6 mW-m-2 on untreated stainless steel anodes. Electron microscopy showed that microorganisms were affiliated with the CNS-coated anodes to a much greater degree than the uncoated anodes. In addition, microbial fuel cells using CNS enhanced anodes and nitrifying bacterial cultures were evaluated. With nitrifying bacteria, the MiFC power density was found to be very low.

Benefits:

- Demonstrates a microbial fuel cell with 500 mW/m2 power density utilizing anaerobic sludge with glucose as the electron donor.
- Demonstrates that CNS enhanced anodes can lead to more than a 20-fold improvement in power generation in microbial fuel cells when compared to stainless steel anodes.

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