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Sustainable Power Generation from Sewage and Energy Recovery from Wastewater with variable resistance using Microbial Fuel Cell

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Highlights

- Microbial Fuel Cell (MFC) produced power up to 810 ± 10 mW/m^2 from sewage.
- COD removal efficiency of around 78%.
- Microbes in the wastewater help in bioremediation.
- MFCs clean wastewater and generate electricity in the process.

Abstract:

Wastewater from sewage sources contribute significantly to water pollution from domestic waste; one way to recover energy from these sources while at the same time, treating the water is possible using Microbial Fuel Cell. In this work, a two chambered microbial fuel cell was designed and fabricated with carbon cloth electrodes and Nafion-117 membrane, having Platinum as the catalyst. Wastewater from an organic load of 820 ± 30 mg/l reduced to around 170 mg/l, with the change in pH from 7.65 ± 0.6 to 7. 31 ± 0.5; over the time of operation the biochemical oxygen demand from an initial 290 ± 30 mg/l reduced to 175 ± 10 mg/l. Open circuit voltage was achieved mostly between 750 - 850 mV, with inoculated sludge produced a peak open circuit voltage of 1.45 V between fed-batch cycles. For characterization of power generated, polarization curves are evaluated with varying resistance to examine system stability with varying resistance. The current density and power density are reported to peak at 0.54 mA/m^2 and 810 ± 10 mW/m^2 respectively. The development of stable biofilms on the anode contributes to the power generation and was evaluated using microscopic analysis, this shows bacteria present in wastewater are electroactive microbial species which can donate electron to an electrode using conductive appendages or nanowires, while consuming the organic matter present in the wastewater. Such systems employ microbial metabolism for water treatment and generate electricity.

Keywords: wastewater; MFC; bacteria; nanowires; bioelectricity.