



Electricity from landfill leachate using microbial fuel cells: Comparison with a biological aerated filter

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ABSTRACT

Four experimental columns were employed in this study to investigate their performance under wastewater treatment conditions. One column was set-up as a biological aerated filter and the remaining three were set-up as microbial fuel cells (MFCs), two of which were connected to an external load whereas the third was left open circuit. The performance of the columns under several flow rates and leachate strengths was studied in terms of BOD₅ removal efficiencies and electricity generation, when a fixed resistive load was connected. Results obtained demonstrated that it is possible to generate electricity and simultaneously treat landfill leachate in MFC columns. Energy generation in MFC columns improved with increasing flow rates from 24 to 192 mL/h, while BOD₅ removal efficiency levels reached a maximum at 48 mL/h and dropped to relatively low values at higher flow rates. The maximum removal efficiencies were obtained at a loading rate of 0.81 kg BOD₅/m³ d for columns C1, C2 and C4 and 1.81 kg BOD₅/m³ d for column C3. Electrical output levels and BOD₅ concentrations at the MFC columns showed a linear relationship, which allows the system to be used as a BOD₅ sensor. Part of the BOD removal was not associated with power generation and was attributed to the presence of alternative end terminal electron acceptors and volatilisation. The MFC columns could reach the same or even higher removal efficiencies than those from the biological aerated filter with the advantage of producing energy and saving cost of aeration. To the best of the authors' knowledge, this is the first study that compares the MFC technology with other conventional treatment systems for removing pollutants from wastewater.

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