Bioelectricity from Recalcitrant Municipal Leachate in a Microbial Fuel Cell

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ABSTRACT

The objective of this work was to evaluate the effect of several inocula on the treatment and bioelectricity production from municipal leachate in a two-face microbial fuel cell equipped with graphite flakes as anode and (*MFC-G*) and Pt as cathodic catalyst at a dose of 0.5 mg/cm^2 Pt. Inocula tested were: two enriched in Fe(III)-reducing bacteria (i.e., one was started with soil, *In-E*$_{Fe(III)-S}$, the other was started from a sulphate-reducing bioreactorn, *In-E*$_{Fe(III)-SR}$), one enriched in Mn(IV)-reducing bacteria (*In-E*$_{Mn(IV)}$), and a plain sulphate-reducing inoculum (*In-SR*).. Each face (I and II) of the *MFC-G* was characterized by separate, in series, and parallel connection. Parallel connection of faces increased the maximum volumetric power up to 14 954, 24 319, 28 112 and 28 113 mW/m^3 for the *In-SR*, *In-E*$_{Fe(III)-S}$, *In-E*$_{Fe(III)-SR}$ and *In-E*$_{Mn(III)}$ respectively. In general parallel connection of electrode faces significantly decreased the R_{int}. In the batch operation where the cells were connected to an external resistance of 100 Ω, the average volumetric powers $P_{V\text{-}ave}$ were 26 424, 25 548, 25 752 and 13 379 mW/m^3 for the *In-E*$_{Fe(III)-S}$, *In-E*$_{Fe(III)-SR}$, *In-E*$_{Mn(IV)}$, and *In-SR* respectively. The high $P_{V\text{-}ave}$ achieved in our work with enriched inocula could be attributed to the combined effects of increased concentrations of exoelectrogenic bacteria as well as the high total anodic surface area by the use of granular graphite. This, in turn, could have improved the electron transfer microbe-to-anode. The power values registered in this work (26 W/m^3) were in the range of power yields typical of the anaerobic digestion of municipal wastewaters (5 to 50 W/m^3). To the best of our knowledge, it is the first time that volumetric powers as high as 26 W/m^3 are reported in the treatment of recalcitrant, actual leachate in *MFC*. Our results constitute a firm step towards sustainable remediation of this problematic effluent.

Keywords: enriched inocula; leachate; microbial fuel cell

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