Alternative Proton Exchange Membrane Fitted in a Microbial Fuel Cell in Batch Operation

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ABSTRACT

It is recognized that performance and cost of microbial fuel cells (*MFC*) depend substantially on the proton exchange membrane (*PEM*) used. At present, Nafion is the most commonly used membrane in *MFC* due its good transport properties. Yet, its commercial price is up to US $ 1470/m^2 and it determines *ca.* 40 % of the *MFC* total cost. In recent years, there has been an increased interest in finding suitable replacements for Nafion as *PEM* material. Therefore, the objective of this work was to compare the effect of membrane type on the performance of *MFC* operated in long batch process. The tested *PEMs* were Nafion 117 (*NF*) and a new organic membrane (*NOM*). The treated influent was a very recalcitrant, actual leachate from Mexico City sanitary landfill.

The *MFC* was seeded with an inoculum previously enriched in electrochemically-active bacteria using a selective medium of Fe(III) salts and acetate. The batch lasted 15 days.

MFC characteristics improved with time of operation; this suggested an in-cell enrichment process or acclimation of inoculum. Indeed the values of internal resistance (R_{int}) were 650 y 350 Ω at 0 d for *NOM* and *NF*, respectively, whereas the maximum volumetric power ($P_{v,max}$) were 9 and 1100 mW/m^3 at 8 d for *NOM* and *NF*, respectively.

During the batch operation, the cell fitted with *NOM* outperformed the one fitted with *NF*. Average volumetric powers (P_Vs) were 14 and 5 W/m^3 for *MFC* fitted with *NOM* and *NF*, respectively. Considering the subperiod from 9 to 15 d when external resistances were adjusted, the average P_Vs were 18.9 and 5.1 W/m^3 for *NOM* and *NF*, respectively. At the end of the operational period, deposits of dry salts appeared on the external side of the cathode carbon cloth of the cell fitted with *NF*. This effect was not observed for the cell with *NOM*. Presumably, these deposits could be responsible for the decrease of power output during 9 to 15 d in the cell fitted with *NF*.

Key words: Natural Polymer Organic Membrane, Batch Operation, Microbial Fuel Cell, Leachate