Characteristics of a Single Chamber Microbial Fuel Cell Fitted with Low Cost Membrane

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ABSTRACT

Proton exchange membrane (*PEM*) is a key component of microbial fuel cells (*MFC´s*) design and configuration, and determines both performance and the cost of the device.

On the one hand, the membrane acts as a channel in *MFC* that allows the transport of protons to the cathode. On the other hand, the *PEM* avoids, at the same time, the oxygen back diffusion to the anodic chamber. Currently, Nafion is the most common membrane used due its good transport properties; however its cost is high and it determines about 40 % of the microbial fuel cell total cost.

Thus, the aim of this research was *(i)* to test a new organic membrane (*NOM*) based on agar in an air-cathode, single chamber *MFC*, and *(ii)* to compare its characteristics with the *MFC* performance fitted with a Nafion® 117 membrane (*NF*).

The *MFC* consisted of a horizontal cylinder built in Plexiglas 80 mm long and 57 mm internal diameter. The anodic chamber was packed with graphite flakes as anodic material The *MFC* was seeded with a sulfate-reducing inoculum. The *MFC* performance was determined using the polarization curve method, by varying the external resistances and recording both the voltage and the current intensity.

The internal resistances (R_{int}) were 192 and 110 Ω using *NOM* and *NF*, respectively, whereas the maximum volumetric powers ($P_{v,max}$) were 2120 mW/m^3 and 14,181 for *NOM* and *NF*, respectively. The relatively low value of R_{int} of *NOM*-fitted *MFC* was encouraging, although it was twice the value of the NF-fitted MFC. Power delivered with *NOM* was 15% of that with Nafion 117. However, the cost ratio *NOM*/Nafion was quite low, (US$ 14/m^2)/(US$ 1733/m^2) ~ 1/120 ~ 1%. These results point out to a trade-off between sacrificing some power output of the cell (85%) but achieving outstanding savings on membrane costs (99%).

Key words: New Organic Membrane, Nafion 117 Membrane, Microbial Fuel Cell