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EFFECT OF ANODIC MATERIAL ON THE INTERNAL RESISTANCE OF A SINGLE CHAMBER MICROBIAL FUEL CELL

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Abstract

In the search for new for alternatives to produce energy, microbial fuel cells (MFCs) have emerged as a promising. MFCs carry out at the same time pollution control of effluents and bioelectricity production. It is known that one of the important factors that reduce the electricity production in MFC is the high internal resistance (R_{int}) value. Thus, this research aimed at evaluating three anodic materials and their effect on R_{int} of a single chamber MFC.

The MFC was a horizontal cylinder built in Plexiglass 80 mm long and 57 mm internal diameter with air cathode. The internal resistance was determined by the variable resistance method and polarization curve. As inoculum, a sulfate-reducing consortia was used and with a model extract (a mixture of acetic, propionic and butyric acids as well as acetone and ethanol) from spent solids generated in fermentative hydrogenogenic process, the MFC was fed.

The cell with granular activated carbon (GAC) as anodic material, with total surface of 0.2 m^2 had a high R_{int} (10 KΩ); it was associated to a low electrical conductivity of GAC ($\sigma < 0.012$ S/m). The cell equipped with an anodic graphite rod (GR, which also worked as electron collector) with a surface of $9.15X10^{-4}$ m^2 displayed an R_{int} of 800 Ω. Finally, using small equilateral triangles of graphite (GT) of 1.4x1.8x0.5 cm (side x height x thickness, respectively) as anode with a total surface of 0.06 m^2, the lowest R_{int} was obtained (400 Ω). Volumetric powers (P_v) were in the following order: GT >> GR >> GAC

The type of anodic material and the geometric configuration had a significant effect on the R_{int} and P_v, the P_v increased and the R_{int} decreased in two materials (GR and GT). Some authors used graphite granules as anode, and the R_{int} was 500 Ω; others used a graphite brush as anode, but their R_{int} was relative high (1000 Ω) compared with this work.

In this work, the best results could be explained by the high electric conductivity of GR and GT. Comparing GT with GR, GT displayed the highest Pv and the lowest R_{int} and this could be attributed to the relative high value of the specific surface of GT.