(*Abstract) 242 included in the programme of the 3rd Biological Fuel Cells Symposium (B3) of the 213th Electrochemical Society Meeting, 18-23 May 2008*, Phoenix, AZ.

Small scale Microbial Fuel Cells – Large scale power

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Abstract

This study reports on the findings from the investigation into small scale (6.25mL) Microbial Fuel Cells (MFC), connected together as a network of multiple units. The MFCs contained unmodified (no catalyst) carbon fibre electrodes and a standard ion-exchange membrane for the proton transfer from the anode to the cathode. A stack of four (4) of these units connected together were - in terms of volume - the equivalent of a single analytical size (25mL) MFC with the same unmodified electrode material and PEM, but produced a peak power density of 60mW/m^2. This was 2 orders of magnitude higher than the power density produced from a single analytical size MFC. The anode microbial culture was of the type commonly found in domestic wastewater fed with 5mM acetate as the carbon-energy (C/E) source. The cultures had matured in the MFC environment for approximately 2 months before being re-inoculated in the experimental MFC units. The cathode was of the O_2 diffusion open-to-air type, but for the purposes of the polarization experimental runs, the cathodic electrodes were moistened with ferricyanide solution, which performs more efficiently during the initial experimental stages. It is furthermore shown that polarity reversal is a function of MFC internal impedance. This occurs in series connected networks in which one or more MFCs have developed a different to the rest of the stack internal resistance. To the best of the authors' knowledge, this is the first report on small scale MFCs producing such high power density figures.