Geophysical Research Abstracts
Vol. 18, EGU2016-17040-1, 2016
EGU General Assembly 2016

Energy generation by fermentation of glucose in a batch flow microbial fuel cell

Silviu-Laurentiu Badea (1), Stanica Enache (1), Radu Tamaian (1,2,3), Mihaela-Ramona Buga (1), Cristian Pirvu (4), and Mihai Varlam (1)

(1) National Research and Development Institute for Cryogenics and Isotopic Technologies, Ramnicu Valcea, Romania (silviu.badea@icsi.ro), (2) University of Bucharest, Faculty of Physics, 3Nano-SAE Research Centre, PO Box MG-38, Bucharest-Măgurele, Romania, (3) SC Biotech Corp SRL, 4th Uzinei Street, Office C52, 240050 Râmnicu Vâlcea, Romania, (4) Department of General Chemistry, Faculty of Applied Chemistry and Materials Science, University POLITEHNICA of Bucharest, 1-7 Polizu, 011061 Bucharest, Romania

In the last years, microbial fuel cells (MFCs) have emerged like a novel research technologies for production of sustainable and clean electricity energy through bioxidation of organic materials, representing a promising alternative to combustion energy sources. In this study, production of bioelectricity in MFC in batch system (dual chambered MFC) was investigated. A dual chambered MFC from glass was built for this purpose. Saccharomyces cerevisiae as an active biocatalyst was explored for power generation. Graphite plates were used as electrodes and glucose as substrate. Saccharomyces cerevisiae was initially grown on a period of 72h at 30 degree Celsius, on medium of modified Sabouraud liquid medium containing 30 g glucose/L. A volume of inoculated medium (80 mL) was transferred in the anode compartment of MFC together with 20 mL glucose 1M, while neutral red was used as mediator (electron shuttle) in concentration of 200 μM in anaerobic anode chamber. Potassium permanganate (KMnO4) was used as oxidizing agent in the cathode in wide concentration range (400 μM-40 000 μM). Cathodic compartment was loaded initially with 40 mM potassium permanganate, and afterwards was supplied two times more with KMnO4 of the same concentration, in order to maintain MFC functionality. The MFC was operated on a water bath heated by a combined hot-plate magnetic-stirrer device at 30 degree Celsius and mixed at 180 rpm. The maximum open circuit potential (OCV) recorded of about 0.6 V was reached after the 3rd loading with 40 milimolles of potassium permanganate. Using a potentiostat, the polarization curve was recorded by varying the potential between 0.5 V and 0.0 V, while the intensity of current increased from 0.0 to about 1.5 mA respectively, corresponding to an anodic current density of about 0.81 A/m2. In order to optimize the design and performance of the MFC, the goal of the further research is to use variously concentrations of potassium permanganate. Furthermore, a dual chambered MFC of large volume (0.5 L), a nafion membrane between anodic and cathodic compartments, and recirculation flows of glucose and potassium permanganate are planned to be used for a longer operability of the MFC.