In: Proceedings of the 1st Biological Fuel Cells Workshop, Surrey 23-25 July 2008. Guildford.

Improved energy output levels from small scale Microbial Fuel Cells

Ioannis A. Ieropoulos[a], John Greenman[b], Chris Melhuish[a]

[a]Bristol Robotics Laboratory, University of Bristol and University of the West of England
[b]Health and Life Sciences, University of the West of England
Bristol, BS16 1QY, United Kingdom
Email: ioannis.ieropoulos@brl.ac.uk

Abstract
Microbial Fuel Cells are receiving increased attention from the scientific community, due to their unique properties of directly converting chemical substrates into electricity, and could therefore be employed to power real applications [1, 2].

The aim of this study was to investigate the effects of connecting multiples of MFC units together as a method of scale up. The MFCs consisted of a single chamber made from rapid prototype material, which contained unmodified (no catalyst) carbon fibre electrodes and a standard cation-exchange membrane for the proton transfer from the anode to the cathode. The cathode was of the open-to-air (gas-diffusion) type and consisted of the same carbon fibre electrode as the anode. The electrode surface area was the same for both the anode and cathode and was 67.5cm^2, and the electrodes were left unmodified (metal catalyst-free) for the purposes of these experiments.

A stack of four (4) of these units connected together were - in terms of volume and electrode surface area- the equivalent of a single analytical size (25mL) MFC, but produced a peak power density of 2 orders of magnitude higher (60W/m^2). 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 were mature and acclimatised 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.

The main aims of this research are two-fold: (a) to improve the efficiency of individual MFCs as stand alone devices and (b) to develop networks of multiple MFC units that can collectively break-down organic waste and produce useful levels of electricity. To the best of the authors' knowledge, this is the first report on small scale MFCs producing such high power density figures.

References
1. Wilkinson,S. 2000a. "Gastrobots" – Benefits and Challenges of MicrobialFuel Cells in Food Powered Robot Applications. J. Autonomous Robots, Vol. 9,Paper # 99-026, pp 99-111.
2. Melhuish,C., Ieropoulos, I., Greenman, J. and Horsfield, I. 2006 Energeticallyautonomous robots: Food for thought Autonomous Robots, 21(3):187-198.