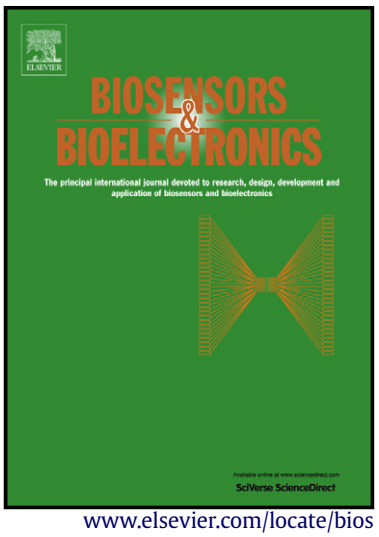

www.elsevier.com/locate/bios

Improved Current and Power Density with a Micro-scale Microbial Fuel Cell Due to a Small Characteristic Length

Hao Ren, César I. Torres, Prathap Parameswaran, Bruce E. Rittmann, Junseok Chae

PII: S0956-5663(14)00370-4
DOI: http://dx.doi.org/10.1016/j.bios.2014.05.037
Reference: BIOS6799

To appear in: *Biosensors and Bioelectronics*

Received date: 15 March 2014
Revised date: 8 May 2014
Accepted date: 15 May 2014

Cite this article as: Hao Ren, César I. Torres, Prathap Parameswaran, Bruce E. Rittmann, Junseok Chae, Improved Current and Power Density with a Micro-scale Microbial Fuel Cell Due to a Small Characteristic Length, *Biosensors and Bioelectronics,* http://dx.doi.org/10.1016/j.bios.2014.05.037

Improved Current and Power Density with a Micro-scale Microbial Fuel Cell Due to a Small Characteristic Length

Hao Ren[1*], César I. Torres[2, 3], Prathap Parameswaran[2], Bruce E. Rittmann[2], Junseok Chae[1]

[1]School of Electrical, Computer and Energy Engineering, Arizona State University, Tempe, Arizona, U.S.A.
[2]Swette Center for Environmental Biotechnology, Biodesign Institute at Arizona State University, Tempe, Arizona, U.S.A.
[3]School for Engineering of Matter, Transport and Energy, Arizona State University, Tempe, Arizona, U.S.A.
*To whom correspondence should be addressed. E-mail: hren12@asu.edu

Abstract:

A microbial fuel cell (MFC) is a bio-electrochemical converter that can extract electricity from biomass by the catabolic reaction of microorganisms. This work demonstrates the impact of a small characteristic length in a *Geobacteraceae*-enriched, micro-scale microbial fuel cell (MFC) that achieved a high power density. The small characteristic length increased the surface-area-to-volume ratio (SAV) and the mass transfer coefficient. Together, these factors made it possible for the 100-μL MFC to achieve among the highest areal and volumetric power densities -- 83 μW/cm^2 and 3,300 μW/cm^3, respectively -- among all micro-scale MFCs to date. Furthermore, the measured Coulombic efficiency (CE) was at least 79%, which is 2.5-fold greater than the previously reported maximum CE in micro-scale MFCs. The ability to improve these performance metrics may make micro-scale MFCs attractive for supplying power in sub-100 μW applications, especially in remote or hazardous conditions, where conventional powering units are hard to establish.

Keywords: Micro-scale microbial fuel cell; mass transfer; scaling effect; power density.