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Sudeep C. Popat, César I. Torres

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Critical transport rates that limit the performance of microbial electrochemistry technologies

Sudeep C. Popat[1], César I. Torres*[1,2]

[1]*Swette Center for Environmental Biotechnology, Biodesign Institute, Arizona State University, Tempe, AZ, USA*

[2]*School for Engineering of Matter, Transport and Energy, Arizona State University, Tempe, AZ, USA*

**Corresponding author e-mail: cit@asu.edu*

Abstract

Microbial electrochemistry technologies (METs) take advantage of the connection of microorganisms with electrodes. In the classic case of a microbial anode, the maximization of current density produced is often the goal. But, current production is dependent on many transport processes occurring, which can be rate-limiting. These include the fluxes of electron donor and acceptor, the ionic flux, the acidity and alkalinity fluxes at anode and cathode respectively, the electron transport flux at the biofilm, and the reactant/product crossover flux. Associated with these fluxes are inherent concentration gradients that can affect performance. This critical review provides an analysis on how these transport processes have hindered the development of METs, and how MET designs have evolved as more knowledge of these transport limitations is gained. Finally, suggestions are provided on how to design MET systems taking into consideration critical transport processes that are intimately linked to the current produced.

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