CHEMICAL ENGINEERING

SEMINAR SERIES

CESAR TORRES

Monday, January 30

Associate Professor of Chemical Engineering
Arizona State University

Proton and electron transport in anode-respiring biofilms and its importance in microbial fuel cell design

ABSTRACT: Anode-respiring bacteria (ARB) produce electrical current from the complete oxidation of organic compounds (e.g. acetate, glucose). ARB produce a biofilm at the electrode surface, where even cells on the outer part of the biofilm are participating in current production, suggesting the formation of an extracellular conductive matrix. Our team uses a variety of electrochemical techniques in order to characterize electron and ionic transport responses from various ARB. Among these, proton transport appears to be a rate-limiting process in ARB biofilms. ARB require near-neutral pH in the medium to grow. H+ ions accumulate in the ARB biofilm, creating an acidification that limits current generation. My talk will provide a basis for this limitation that relates to ARB's electron-transport mechanism.

At the cathode of a microbial fuel cell (MFC), local gradients leading to pH > 12 is typical in MXC operation; as a consequence, the pH gradient results in Nernstian concentration overpotential of > 300 mV. Thus, understanding and controlling ionic transport in MFCs is essential to ensure an efficient operation. I will discuss optimized MFC designs that has been used to test the application of wastewater primary sludge treatment with hydrogen peroxide production at the cathode.

RECEPTION 3:30 • LECTURE 4:00 – 5:00
PHYSICS ASTRONOMY BLDG. (PAA) A110

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BIOGRAPHY: Dr. César I. Torres is an Associate Professor of Chemical Engineering in the School for Engineering of Matter, Transport and Energy (SEMTE) at Arizona State University (ASU). He is also part of the Swette Center for Environmental Biotechnology and the Center for Bio-mediated & Bio-inspired Geotechnics. His main research is in microbial electrochemistry; he has published over 50 articles in peer-reviewed journals on this topic. César combines biofilm modeling, electrochemical, microscopic, -omic, and analytical techniques, to characterize microbial kinetics, electrochemical kinetics, and thermodynamics of microbial electrochemical cells.