The Effects of Catalyst Loading on Hydrogen Peroxide Production in a Microbial Fuel Cell

*Murawski, Emily[1], Popat, Sudeep[2].

[1]Graduate Research Assistant, Department of Environmental Engineering and Earth Sciences, Clemson University, [2]Assistant Professor, Department of Environmental Engineering and Earth Sciences, Clemson University

emilymurawski@ymail.com

Keywords: Water Reclamation, Microbial Fuel Cell, Food-Energy-Water Nexus

Abstract: Microbial fuel cells (MFCs) represent an emerging technology for wastewater treatment, in which electroactive bacteria convert the chemical energy contained in wastewater into electrical power, while simultaneously decreasing the organic content in the wastewater. Microbial peroxide producing cells are a variation on MFCs where a carbon catalyst is used at the cathode to partially reduce oxygen to hydrogen peroxide (H_2O_2).

H_2O_2 is a useful chemical for wastewater treatment, because it is a strong disinfectant and chemical oxidant that can be used in tertiary treatment. Especially in decentralized wastewater treatment systems which separate blackwater and greywater, such as those used on military bases and space vessels, optimizing this process may allow the energy content of the blackwater to treat greywater with the H_2O_2 produced. Optimizing the system includes addressing key factors in both the anode and cathode chambers.

This research focuses on improving the efficiency of the reaction in the cathode chamber. Preliminary data shows that lower catalyst loadings lead to a higher efficiency of H_2O_2 production, whereas higher catalyst loadings lead to the complete reduction of oxygen to water. Catalyst loadings of 0.5, 1.5, and 5 mg/cm^2 are being investigated. In addition, three different current densities of 0.1, 0.5, and1 mA/cm^2 are currently being tested to determine the effect of the current produced at the anode on H_2O_2 production efficiency. Preliminary results indicate that lower catalyst loadings and higher current densities lead to a higher production efficiency of H_2O_2.