Intern Sarah Hartman’s project, sponsored by the DWRC, was titled “Enhanced Pollutant Biodegradation by Electrode Use.” She was advised by Dr. Steven Dentel of the UD’s Department of Civil and Environmental Engineering.

Abstract

This study examines microbe activity and voltage flow under varying operational conditions within a two-chamber microbial fuel cell (MFC) using anaerobic digested sludge. In a MFC, chemical energy within the organic compounds of the digested sludge can be converted to electric energy through oxidation and reduction reactions at the interface between the anode and cathode. Numerous studies have been conducted demonstrating that anaerobic microorganisms are capable of utilizing graphite electrodes to drive electrochemical processes in a MFC. Anaerobically digested sludge is capable of driving similar electrochemical processes, but research on the optimization of such a type of energy recovery is limited. Efficient energy recovery from wastewater sludge could be used to power highly energy-intensive processes in wastewater treatment plants.

During this study, different experimental conditions examined included the quality of the membrane between the cathode and anode chambers and the type of graphite used as an electron mediator. Methane generation and COD degradation were also measured. The permeable nature of the membrane used determined the ability of the MFC to generate voltage.

Experimentation showed that an impermeable plastic membrane inhibited all exchange of electrons between the chambers. A permeable membrane allowed for a small current. The type of graphite being used did not appear to significantly alter voltage generation. During experimentation, methane concentration within the airtight chamber was increased as COD decreased, as predicted. The level of voltage produced under all conditions did not exceed 37mV, and the corresponding power production did not surpass 1.37 µW. Results showed that a MFC using anaerobic digested sludge, under varying conditions, was not a major power generator.