Report for 2003DE21B: Undergraduate Internship: Enhanced Pollutant Biodegradation by Electrode Use

There are no reported publications resulting from this project.

Report Follows

Undergraduate Internship Project #2 of 10 for FY03

The project is co-sponsored by the ***UD College of Engineering*** and the ***DWRC.*** Ms. Schutte will utilize and improve a newly discovered microbial process that can biodegrade water pollutants without aeration and that can generate electrical energy as a direct by-product. This project is co-investigated by Andrew Joslyn (project **2003DE24B,** intern project #27 of 32 to date**)** and extends the work of 2002 ***DWRC*** interns Aditya Sharma and Bret Strogen (project **2002DE40B,** intern project #22 of 32 to date).

"I am growing bacteria on electrodes under optimal conditions and attempting to transplant these electrodes into sludge [wastewater] *material. I will explore whether the bacteria or some other source is producing current. I am looking forward to the impact my work will have on future experiments."*
--Kate Schutte, University of Delaware undergraduate senior, Environmental Engineering major.

Abstract:

This research explored the use of graphite electrodes added to a zoned aerobic/anaerobic reactor, in order to speed the degradation of organic pollutants in water or wastewater. The lower electrode, located in the anaerobic section, provided a fairly simple method of supplying an electron acceptor through half-reactions occurring at or near this surface. It is believed that this can not only accelerate the degradation process, but also generate electricity as an additional benefit.

The research focused on culturing a specific microorganism, Geobacter metallireducens, to facilitate this process. This bacterium has been shown capable of direct colonization of electrode surfaces, with mitochondrial membrane surfaces available to the outer cell membrane to facilitate electron transport. The research hypothesis was that enrichment of the process with this microorganism would increase the current flow.

Our plan was to culture Geobacter on the enrichment media and, from there, directly onto the electrode surfaces, which would then be transferred to the reactor for use as a Geobacter-enhanced anode. The material selected for the electrode is key to maximize the conductivity of electrons and the sustainability of the stationary growth. This technique proved unsuccessful, probably due to the difficulty of culturing Geobacter, and especially in attempting to develop a viable population directly on the electrode surface.

Suggestions for future research include (1) avoid culturing directly in the presence of the electrode surface, and (2) identify more favorable growth conditions to increase the growth rate of the Geobacter, since the slow growth rate led to both maintenance difficulties, and less time to alter the experimental approach.