QUARTERLY PROGRESS REPORT

March 1, 2010 – May 31, 2010

PROJECT TITLE: *Sequential MBR-UV Treatment of Landfill Leachate*

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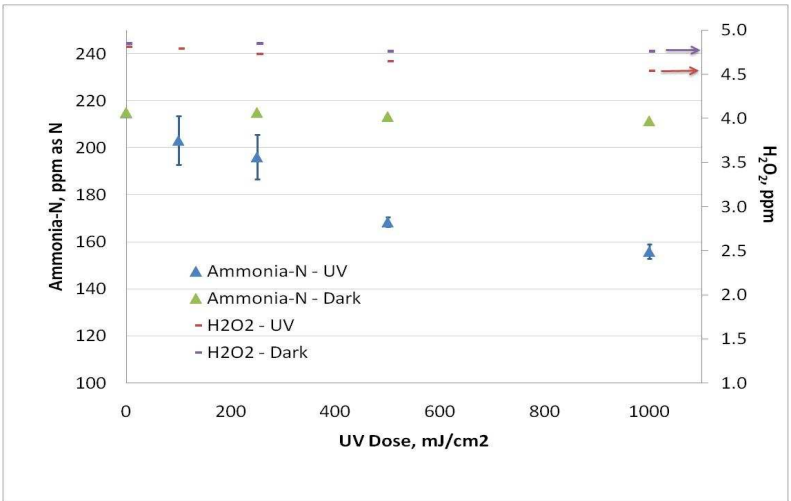
PROJECT WEBSITE ADDRESS (URL):
http://www.eng.fsu.edu/~wattsmi/UV_MBR/index.html

SCOPE OF WORK: The vast quantity of pharmaceuticals, personal-care products, and endocrine-disrupting compounds (EDCs) stored in municipal landfills poses a significant challenge to leachate-water quality. Advanced leachate treatment, utilizing combinations of biological, chemical, and physical water treatments, can be designed to protect groundwaters influenced by landfill-leachate, or provide reclaimed water for non-potable or agricultural purposes. The versatility and multiple barriers in UV treatment make it an attractive option for landfill leachate treatment. However, the rich concentration of leachate constituents which scatter or absorb light must be addressed with pre-treatment. A novel membrane bioreactor (MBR) system at USF, involving anaerobic biological process and ultrafiltration membranes, has been tested for removal of trace organic compounds and xenobiotic contaminants (17β-estradiol, a prevalent female hormone) from landfill leachate. This work seeks to apply state-of-the-art, germicidal-UV-light technology to assist MBR in removal of trace organic compounds.

CURRENT PROJECT PERIOD: Limiting the potential for reclamation, or reuse, of landfill-leachate treated with anaerobic-MBR is the absence of ammonium oxidation during the bio-filtration process. UV irradiation, however, has the potential to enhance ammonium oxidation in leachate-waters. The following figure shows the rate of disappearance of NH_4^+-N (pH <6) in a high-strength ammonia-N solution (215 mg/L as N) containing H_2O_2 (5 mg/L) and irradiated with germicidal-UV (λ=254 nm).



NEXT PROJECT PERIOD: An initial survey of local (Leon County, FL) landfill-leachates elucidated the major technical challenges to applications of UV-Advanced Oxidation. High UV_{254}-absorbance (>1 cm^{-1}), and dissolved organic carbon (>500 ppm as C) will impede light penetration and subsequent formation of oxidizing free radicals. Pre-treatment of leachate with anaerobic-MBR will be tested for its ability to produce an effluent that meets critical UV-Advanced Oxidation design goals.

The Yeh laboratory has established a population of anaerobes in its MBR using Polk County (FL) leachate. In the first week of June, effluent from the Yeh MBR will be shipped to Florida State University for water characterization. Along with UV_{254}-absorbance and DOC, the ammonia-N and nitrate/nitrite concentrations, and biodegradable organic carbon concentrations will be determined. Comparisons will be made between untreated landfill leachate and MBR-effluent. The feasibility of UV irradiation will be assessed.

Later in the month (June), batches of untreated leachate will be dosed with low-ppm (1-3 mg/L) concentrations of O_3 at Florida State University. The pre-ozonated leachate will be shipped to the Yeh laboratory for simulated anaerobic-MBR treatment. The results of these experiments could highlight the feasibility of combined MBR-O_3 treatment of leachate for reuse, as an alternative to MBR-UV.

TAG: Dr. Jeff Bandy (*Carollo Engineers*), Dr. Gang Chen (FSU), Dr. Tarek Abichou (FSU), Hooshang Boostani (Hillsborough County), Allan Choate (Polk County), and Dr. Erik Rosenfeldt (UMass-Amherst). *Next meeting:* to be scheduled in *mid*-July 2010.