

QUARTERLY PROGRESS REPORT

June 1 – August 31, 2011

PROJECT TITLE: *Sequential MBR-UV Treatment of Landfill Leachate(Year 2)*

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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 advanced oxidation 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 (17 β -estradiol, a prevalent female hormone) from landfill leachate. This work seeks to apply state-of-the-art, advanced oxidation technology to assist MBR in removal of trace organic compounds.

CURRENT PROJECT PERIOD: In conjunction with Dr. Yeh's Lab at the University of South Florida, new screening experiments were designed to determine optimum advanced oxidation pre-treatment doses to enhance anaerobic degradation of 3 target analytes listed in the project proposal: tris-2,butoxyethyl-phosphate (TBEP), trischloroethyl phosphate (TCEP), and 17 β -estradiol (E2).

In this phase of work, samples of Leon County Landfill leachate, representing an 'old leachate', are spiked with the target analytes, and treated with varying doses of either ozone or 'peroxone' (O₃ + H₂O₂) advanced oxidation. The max ozone dose is 8 mg/L, with all peroxone treatments receiving a spike of H₂O₂ at a molar ratio of 1.1:1 H₂O₂:O₃. The analyte concentrations are monitored at each stage of treatment with gas chromatography-mass spectrometry. Following advanced oxidation (1 – 2 seconds of contact with ozone was enough for complete dissipation of ozone residuals in the leachate samples), the oxidized samples were then mixed at 1:1 volumetric ratio with sampled anaerobic digester sludge from the T.P. Smith Municipal Wastewater Treatment Facility (Tallahassee, FL). The leachate-sludge mixture was then added to an aspiration bottle leaving 50% headspace (occupied by N_{2(g)}) and incubated for up to 15 days.



Figure 1 – 50:50 leachate:sludge under anaerobic conditions.

NEXT PROJECT PERIOD: Evaluation of the advanced oxidation screening experiments will continue in Quarters 9 & 10. Samples are taken from the incubated aspiration bottles after 5, 10, and 15 days. The well-mixed sample is then processed via liquid-liquid extraction with a chlorinated solvent. The solvent phase is then analyzed for E2, TCEP, and TBEP. This sample plan allows for analysis of the 3 contaminants in the combined leachate-sludge phases.

TAG: Dr. Jeff Bandy (*Carollo Engineers*), Dr. Gang Chen (FSU), Dr. Daniel Kuncicky (FDEP), Hooshang Boostani (Hillsborough County), Allan Choate (Polk County), Dr. Ben Stanford (Hazen & Sawyer, P.C.).