FAMU – FSU COLLEGE OF ENGINEERING
DEPARTMENT OF CIVIL & ENVIRONMENTAL ENGINEERING
2525 Pottsdamer Street
Tallahassee, Florida

Tag Meeting No. 1

Friday, April 8, 2016
11:30 am – 12:30 pm, Room Building A 127A

Project Title: Multifunctional Energy- and Space-Saving Reactor for the Treatment of Landfill Leachate. Year II. Incorporation of Electrocoagulation
Tag Members: Peter Grasel, Owete Owete, John Hallas, Chen Lin, Hafiz Ahmad, Matthew Hendrix and Youneng Tang
Principle Investigators: Gang Chen and Kamal Tawfiq
In Attendance: Peter Grasel, Owete Owete, Chen Lin, Tim Vinson, Youneng Tang, Houzhen Wei, Boya Wang, Gang Chen, and Zhiming Zhang. Hafiz Ahmad and John Schert attended the meeting through Gotomeeting.

A website has been developed for this research (www.eng.fsu.edu/~gchen). All the information regarding this project has been uploaded to this site to facilitate the dissemination of the research discovery.

Agenda

1. Project Overview
Detailed information is available at http://www.eng.fsu.edu/~gchen

1. Experimental Design and Setup
Multiple anodic electrodes (arranged in parallel) were coupled with coagulation, flocculation and filtration in this research (Figure 1). For this setup as shown in Figure 1, aluminum anodic electrodes were arranged in parallel. Subsequently, the electric current was divided between all the electrodes. A digital multimeter (Agilent, 34410A) was used to measure the operating current supplied by a DC power supply (HP, E3631A). The surfaces of aluminum anodes were first mechanically cleaned prior to experiments to remove any passive film that may have formed. After aluminum release from the electrodes, aluminum coagulant formed in the

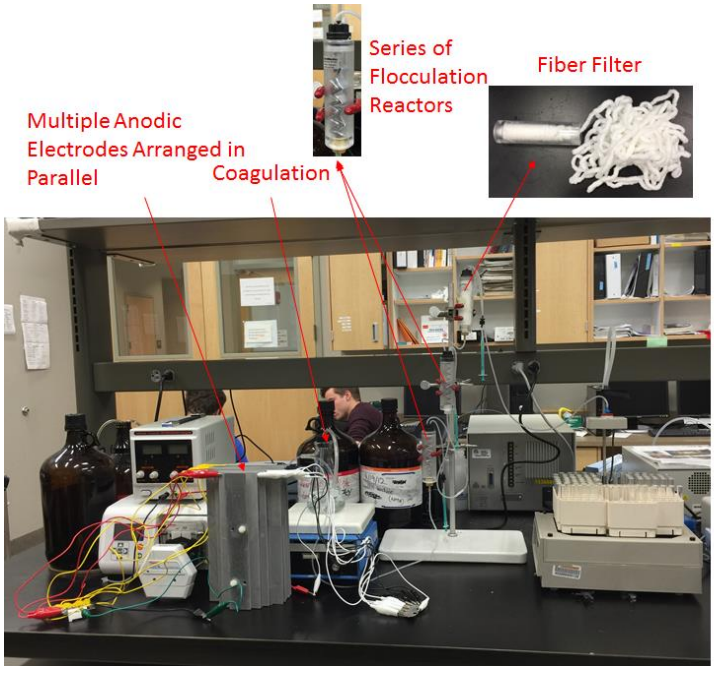

Figure 1. Experimental Setup

aqueous phase, which destabilized the contaminants in the landfill leachate. In the flocculation reactors, aggregation of the destabilized colloidal contaminants formed flocks, which can be then removed in the subsequent fiber filter.

2. Current Experimental Results

The treatment performance of the system was first evaluated in terms of the electrical current (i.e., current density) and reaction time using landfill leachate collected from Springhill Landfill. High current density led to increased decomposition of the electrode material and enhanced coagulation and COD removal. Similarly, enhanced coagulation and COD removal were also observed for prolonged reaction time, i.e., COD removal increased with the increase of reaction time until 30 minutes, after which the increase became moderate.

Since the quantity of electricity passed through was actually responsible for dissolution of metal ions at the electrodes, the relationship between current density and the quantity of the metal dissolved can be described by the Faraday's law:

$$W = \frac{i \times t \times M}{n \times F} \qquad \textbf{Equation (1)}$$

where W is the amount of dissolved electrode (g/cm^2); i is the current density (A/cm^2); t is the electrocoagulation time (sec); M is the relative molar mass of the electrode (g); n is the number of electrons involved in the oxidation/reduction reaction (-); and F is the Faraday's constant (96,500 C/mol). The aluminum release was thus calculated, which linearly increased with the increase of reaction time. Subsequently, there was a trend that COD removal increased with the increase of released aluminum.

3. Research Plan of this Project

The following functions of the reactor will be investigated in this research:

Ammonium Removal by Struvite Precipitation
Iron Removal
Phosphorous Removal
Arsenic Removal
Chloride Removal

4. Dissemination Plan for this Project

5. Potential Funding Sources for the Continuation of Related Research

— NSF/CBET/Environmental Engineering
— EREF

6. Discussion

1. The TAG members pointed that arsenic in the leachate might be from the soil instead of CCA treated wood.

2. The TAG members suggested electrocoagulation voltage and current be selected depending on the energy costs and treatment results.

3. The TAG members suggested treatment results plotted against current and intensity, or power to show electrocoagulation results as a function of input electricity.