SECOND QUARTERLY PROGRESS REPORTS

November 1, 2011 – January 31, 2012

PROJECT TITLE: Biodegradability Enhancement of Bioreactor Landfill Leachate with Fenton Processes

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INTRODUCTION

The Hinkley Center has provided critical support for exploring the concept of Bioreactor Landfills (BL) in the past two decades and nurtured the successful story of BL at the New River Regional Landfill (NRRL), in Union County, Florida. The leachate recirculation lead to accelerated waste degradation and landfill settlement; however, prolonged leachate recirculation causes the waste mass to reach its field capacity and at this stage landfill may not need any more leachate recirculation. Leachate characteristics also stabilize and the biodegradability of the leachate decreases significantly as BOD/COD ratio of leachate decreases to less than 0.10. The reduction in biodegradability reduces the effectiveness of leachate treatment using conventional biological processes and consequently increases the treatment cost. For example, in Miami-Dade County, leachate is treated at the wastewater treatment facility and causes the reclaiming wastewater treatment cost as high as $9 per gallon in 1 GDM pilot-scale water reuse plant. For the proposed 40 MGD full-scale water reuse plant, the unit cost will still be as high as $2 per gallon due to mixing of leachate with its domestic wastewater. To reduce the cost, Fenton treatment of leachate before it is mixed with the domestic wastewater may offer a great solution to this challenging problem. The current project will study the Fenton oxidation of leachate as pre-treatment to increase biodegradability of leachate for BL. Results of the study will help obtain optimal cost-effective conditions to be used for leachate treatment using Fenton oxidation.

WORK COMPLETED THIS QUARTER

In continuation to the first quarter additional peer review literature was collected and evaluated. Laboratory space was allocated at the Applied Research Center, FIU. The chemicals to be used in the experiments were identified and experiments were planned in detail as follows:

- Leachate sample will be taken from the Miami-Dade South Dade Landfill (MDSDL) and will be placed in a beaker and magnetically stirred; its pH was adjusted to fixed values by H_2SO_4 95–97% (w/w).

- The scheduled Fe^{2+} dosage will be added the necessary amount of solid $FeSO_4(7H_2O)$.
- A known volume of 35% (w/w) H_2O_2 solution or solid CaO_2 will be added in a single step.
- At the end of Fenton's treatment, stirring will be turned off and the sludge will be allowed to settle. Analysis of the treated leachate will be carried out on filtered samples

Experiments will be conducted in a batch reactor equipped with inline water quality instruments as shown in Appendix-A. The instruments to be used for the leachate sample analysis such as spectrophotometer, COD digester, total organic carbon analyzer, field parameters were also scheduled.

CONTINUED WORK: QUARTER THREE

Experiments are planned to be started by characterizing the landfill leachate collected from Miami-Dade South Solid Waste Landfill. Fenton oxidation experiments will be conducted to determine the effect of H_2O_2, CaO_2, Fe^{2+}, and pH on the COD removal efficiency of Fenton process. The obtained results will be submitted in the third quarterly report and will be presented at the technical advisory group (TAG) meeting. A joint TAG meeting with Dr. Debra Reinhart of University of Central Florida has been scheduled for February 10, 2012 at Florida International University.

A project website will be developed to provide project details such as project description, status update, proposal, presentations, quarterly reports, and pictures. The website is planned to get updated at least once a month. The details about the website will be presented in third quarterly report.

TEAM MEMBERS

Walter Z. Tang, Associate Professor in CEE at FIU, 786-350-0933, tangz@fiu.edu

Shrawan Singh, Ph.D., Post-Doctor in CEE at FIU, 603-502-1842

Georgio Tachiev, Ph.D. P.E., Program Manager, ARC at FIU, Miami, FL 33174, 305-348-6732 (O), 305-632-9386 (cell)

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Debra Reinhart, PhD, PE, BCEE, Pegasus Professor Assistant VP for Research, MH 243, University of Central Florida, Orlando, FL 32816, 407-823-2315

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Appendix A: CaO2 and the Reactor

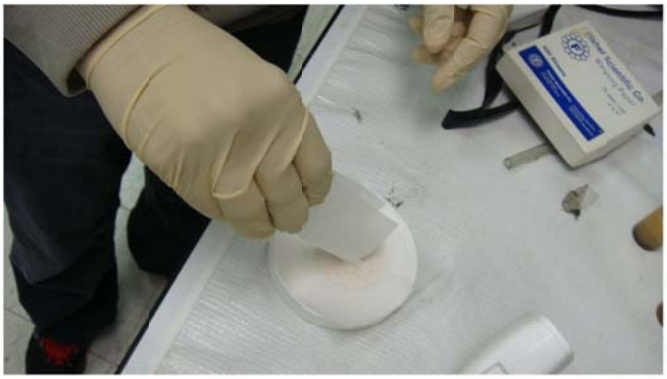

Figure A-1: Calcium peroxide to be used for Fenton oxidation of leachate

Figure A-2: Batch reactor with inline water quality measurements to be used for Fenton oxidation of leachate

Figure A-3: Total organic carbon analyzer

Appendix B: Sustainable Management of Landfill Leachate Conference Agenda

Sustainable Management of Landfill Leachate

--Joint TAG Meeting by Florida International University and University of Central Florida

EC 2300, College of Engineering and Computing, Engineering Center

Florida International University, 10555 West Flagler Street, Miami, FL 33174

Friday, February 10, 2012

Conference Agenda

8:30 am to 9:15 am	Continental Breakfast
9:15 am to 9:30 am	Opening Remarks, **Welcome to FIU! by Dr. Atorod Azizinamini, Chairman and Professor in CEE at FIU**
9:30 am to 9:45 am	Presentation: **Current Engineering Practice of Bioreactor**

	Landfills, Dr. Shrawan Singh, Post-Doctor in CEE at FIU, 603-502-1842
9:45 am to 10:00 am	Presentation: **Liquid and Solid Peroxide in Fenton Treatment of Leachate**, Walter Z. Tang, Associate Professor in CEE at FIU, 786-350-0933, tangz@fiu.edu
10:00 am to 10:15 am	Presentation: **Reduction of Toxicity after Chemical Oxidation,** Georgio Tachiev, Ph.D. P.E., Program Manager, ARC at FIU, Miami, FL 33174, 305-348-6732 (O), 305-632-9386 (cell)
10:15 am to 10:30 am	Presentation: **Reclamation of Treated Effluent of Wastewater Containing Leachate** James Ferguson, P.E., Miami-Dade Water and Sewer Department, 786-268-5775, JFERG@miamidade.gov
10:30 am to 10:45 am	Presentation: **Pump and Treat Aerobic Flushing Bioreactor Landfill** Debra Reinhart, PhD, PE, BCEE, Pegasus Professor Assistant VP for Research, MH 243, University of Central Florida, Orlando, FL 32816, 407-823-2315 Stephanie C. Bolyard, EPI, Graduate Research Assistant, Civil, Environmental, and Construction Engineering, University of Central Florida, 4000 Central Florida Blvd. Eng. I Room 340, Orlando, Florida, 32816, 727-505-9770, Stephanie.Bolyard@ucf.edu
10:45 am to 11:55 am	**Discussion and Feedback on FIU and FCU projects**
11:55 am to 12:00 pm	**Closing Remarks by Walter Z. Tang**

12:00 pm to 1:00 pm	**Lunch at the FIU Faculty Club**

Appendix C: Conference Photos

1. Preparation

2. Opening remarks by Dr. Walter Tang

3. Welcome by Dr. Atorod Azizinamini, Chairman and Professor in CEE at FIU

4. Introduction of Dr. Debra Reinhard by FIU CEC Associate Dean Dr. Giri Narasimhan

5. Presentation by Dr. Shrawan Singh

6. Presentation by Dr. Debra Reinhard

7. Audience

8. Question and Answers

9. Group Pictures