QUARTERLY PROGRESS REPORT

November 1, 2014 to January 31, 2015

PROJECT TITLE: Design and Testing of a Multifunctional Energy and Space-Saving Reactor for the Treatment of Landfill Leachate

PRINCIPAL INVESTIGATOR(S): Gang Chen and Kamal Tawfiq

AFFILIATION: Department of Civil and Environmental Engineering, FAMU-FSU College of Engineering

COMPLETION DATE: November 1, 2014 to January 31, 2015 **PHONE NUMBER:** 850-4106303

PROJECT WEBSITE ADDRESS (URL): http://www.eng.fsu.edu/~gchen (Multifunctional Reactor)

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In this research, a multifunctional energy and space-saving reactor will be designed and tested for the treatment of landfill leachate with high ammonium, chloride, phosphorous and heavy metal contents. This approach will provide an efficient and energy and space-saving means of on-site management of landfill leachate. This reactor can also be configured for potential valuable commodity recovery from landfill leachate treatment.

Work Accomplished During This Reporting Period:

1. Multifunctional Reactor Design and Setup

A laboratory scale recirculation bioreactor followed by a multifunctional reactor was set up for this research (Figure 1). Through leachate recirculation, most organics and solid components can be removed from the landfill leachate. The following multifunctional reactor was designed for the removal of chloride, ammonia, phosphorous and iron. Physicochemical means was adopted in the multifunctional reactor for an efficient removal of these contaminants. Subsequently, rapid reaction and effective separation was the key to the success of the multifunctional reactor. The design and experimental setup of the laboratory-scale multifunctional reactor are illustrated in Figure 1.

2. Aerated Leachate Recirculation

Through aerated leachate recirculation, organic contents can be significantly reduced. The leachate recirculation not only improves the leachate quality, but also shortens the time required for landfill stabilization. For this research, aerated recirculation bioreactor was set up with a dimension of 15 cm ID × 150 cm Length. Silica sand from Fisher Scientific (8 mesh) was packed in the recirculation bioreactor. The silica sand was treated with sodium acetate, hydrogen peroxide, sodium dithionate and sodium citrate to remove organic matter after rinsing with de-ionized water. Landfill leachate collected from the Springhill Landfill was recirculating in the bioreactor to stimulate the growth of indigenous microorganisms of the landfill leachate for organic decomposition.

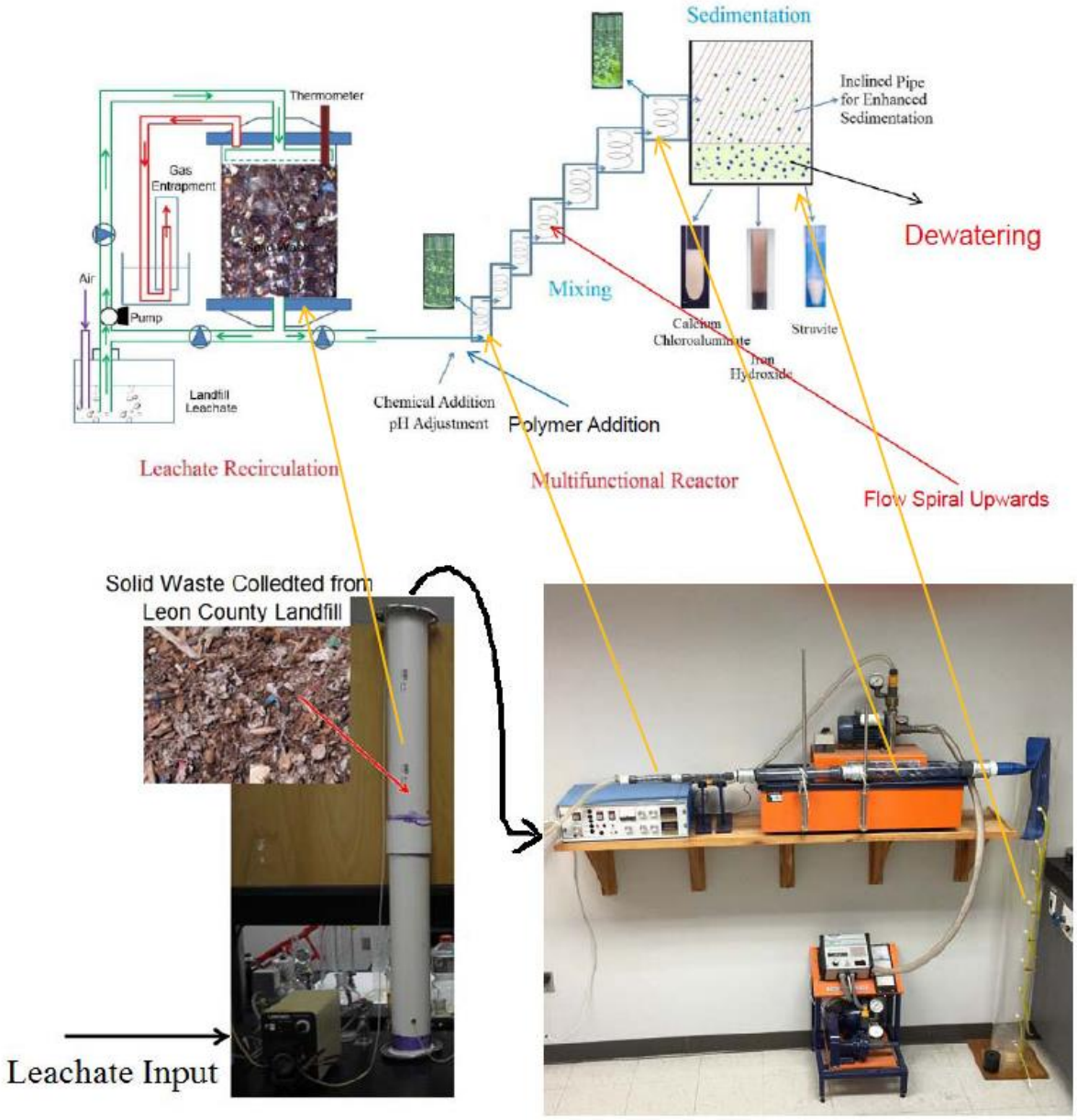

Figure 1. Experimental Setup of This Research

Information Dissemination Activities:

Metrics:

1. List graduate or postdoctoral researchers funded by this Hinkley Center project

Last name, first name	Rank	Department	Professor	Institution
Boya Wang	M.S.	Civil and Environmental Engineering	Gang Chen	Florida State University
Kien Vu	Ph.D.	Civil and Environmental Engineering	Gang Chen	Florida State University

2. List undergraduate researchers working on this Hinkley Center project

Last name, first name	Department	Professor	Institution
TBA	Civil and Environmental Engineering	Gang Chen	Florida State University

3. List research publications resulting from this Hinkley Center project
Wang, B., Tawfiq, K. and Chen, G. "Design and Testing of a Multifunctional Energy and Space-Saving Reactor for the Treatment of Landfill Leachate", Environ. Technol., to be submitted (2015).

4. List research presentations resulting from this Hinkley Center project
Chen, G., Wang, B. and Tawfiq, K. "Design and Testing of a Multifunctional Energy and Space-Saving Reactor for the Treatment of Landfill Leachate", South Carolina Environmental Conference, Myrtle Beach, SC, March 14 to March 17, 2015.

5. How have the research results from this Hinkley Center project been leveraged to secure additional research funding?
A proposal of "Nitrous Oxide Emission from Landfills under Different Operation Conditions" by Gang Chen has been submitted to Environmental Research and Education Foundation in response to Request for Proposals – Research in Sustainable Solid Waste Management.

6. What new collaborations were initiated based on this Hinkley Center project?
We have initiated collaboration with John Hallas from Talquin Electric Cooperative, Inc. and Hafiz Ahmad from Florida State University at Panama City Campus from this research.

7. How have the results from this Hinkley Center funded project been used (not will be used) by the FDEP or other stakeholders? (1 paragraph maximum).
We shared our research results of iron and chloride removal with Patrick Johnson, Solid Waste Director and Brent Schneider of Escambia County Solid Waste Management. In addition, we discussed the results with FDEP Solid Waste Section through TAG members of Gary Millington and Peter Grasel. We also consulted the results with Talquin

Electric Cooperative, Inc., which operates seven wastewater treatment plants as well as Leon County Division of Solid Waste.

TAG members: Peter Grasel, Gary Millington, John Hallas, Chen Lin and Hafiz Ahmad

TAG meetings: First TAG meeting was held on January 16, 2015 at FAMU-FSU College of Engineering. The meeting minutes and presentation and discussion were available at www.eng.fsu.edu/~gchen. The second TAG meeting will be scheduled in July at FAMU-FSU College of Engineering.