

QUARTERLY PROGRESS REPORT

February 1, 2014 to April 30, 2014

PROJECT TITLE: Aerated Recirculation and Pressurized Suspended Fiber Biofiltration for the Treatment of Landfill Leachate

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In this research, leachate from landfills in Northwest Florida is to be treated by aerated recirculation, MAP precipitation, ultra-high lime with aluminum process, and suspended fiber biofiltration. The suspended fiber biofilter is designed to be operated under pressurized aeration conditions to achieve biological contact oxidation, which can remove organic compounds and iron more efficiently. For this period time, the ultra-high lime with aluminum process was investigated and the suspended fiber was examined after biofiltration under a digital microscope.

WORK ACCOMPLISHED DURING THIS REPORTING PERIOD:

The experimental setup is illustrated in Figure 1. After aeration, landfill leachate collected from the Leon County Landfill was re-circulated to the recirculation reactor, after which an aliquot was introduced to the next treatment step and the other aliquot was aerated and re-circulated.

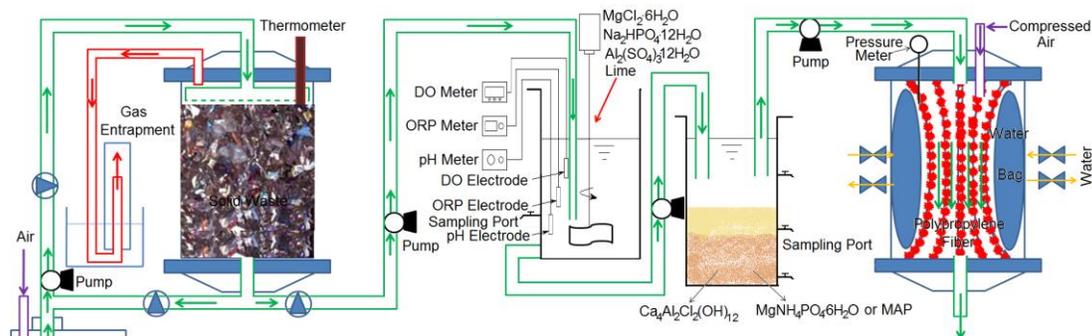


Figure 1. Experimental Setup

After recirculation, the aliquot introduced to the precipitation reaction tank was tested for chloride removal. The precipitation tank was continuously stirred by a single mechanical blade. For chloride to precipitate as $\text{Ca}_4\text{Al}_2\text{Cl}_2(\text{OH})_{12}$ in the presence of calcium and aluminum, high pH was preferred. The chloride content of the sample we collected from the Leon County Landfill was 430 mg/l. $\text{Al}_2(\text{SO}_4)_3 \cdot 12\text{H}_2\text{O}$ at a concentration of 100 mg/l was added and the pH was adjusted with lime. At pH = 7.5, around 50% chloride was removed; at pH =9, around 75% chloride was removed; at pH = 10, around 95% chloride was removed (Figure 2).

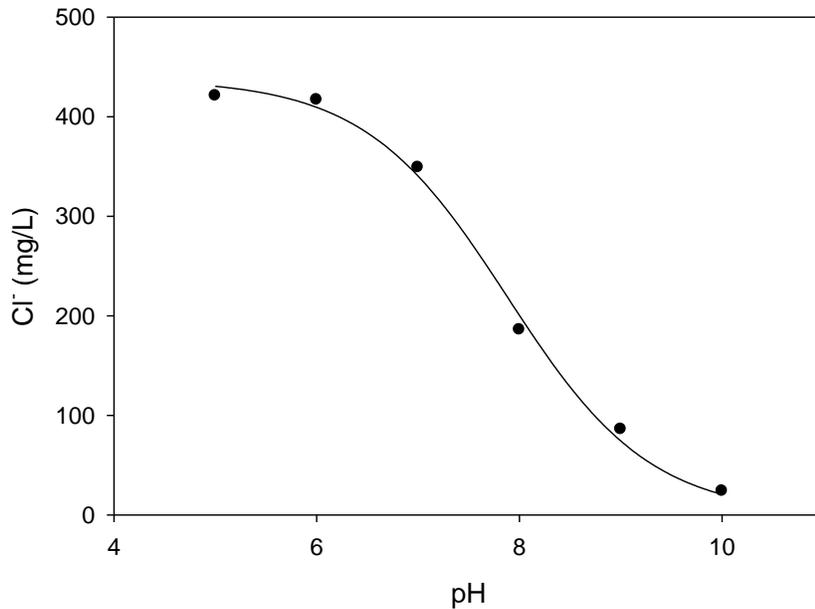


Figure 2. Chloride Removal as a Function of pH

The custom-made pressurized suspended fiber biofilter with a working volume of 35 L (height = 50 cm and diameter = 30 cm) was tested for iron and organic removal. In the pressurized suspended fiber biofilter, polypropylene fiber was arranged to be suspended in the column. Two water rubber bags were arranged on two sides of the column, each with a capacity of 8 L. After two months' operation, iron removal and organic decomposition have been observed. The fiber was then taken out (Left Image of Figure 3) and observed under a digital microscope (Figure 4). After usage in the pressurized biofilter, the dark color indicated iron removal, which was attributed to iron fixation bacteria. As shown in Figure 4, iron fixation bacteria were found to accumulate on the fiber.

NEXT WORKING PERIOD:

Recirculation ratio and aeration rate on leachate treatment will be further investigated in the recirculation reactor. Impact of dissolved oxygen, alkalinity and pH on iron and organic removal inside the pressurized biofilter will also be studied.



Figure 3. Polypropylene Fiber after (Left) and before (Right) Usage in the Pressurized Biofilter

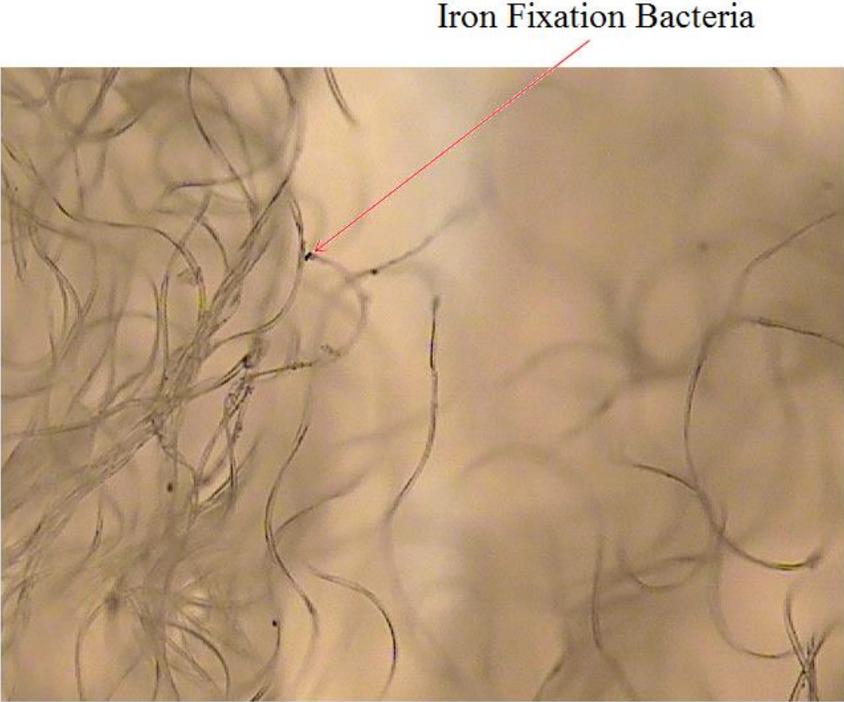


Figure 4. Iron Fixation Bacterial on Polypropylene Fiber

INFORMATION DISSEMINATION ACTIVITIES:

TAG members: Peter Grasel, Lee Martin, John Hallas, Brian Lee Moody, Tarek Abichou and Hafiz Ahmad

TAG meetings: First TAG meeting was held on January 24, 2014 at FAMU-FSU College of Engineering. The meeting minute will be available at www.eng.fsu.edu/~gchen. The second TAG meeting will be scheduled in July at FAMU-FSU College of Engineering.

A website has been created for this project (URL): www.eng.fsu.edu/~gchen (Biofilter)

CONFERENCE PRESENTATION:

Yang, G., Lee, Y. and Chen, G. (Presented 2013, November) *Aerated Recirculation and Pressurized Suspended Fiber Biofiltration for the Treatment of Landfill Leachate*. Poster presentation at 99th Annual American Society of Microbiology Southeastern Branch Conference, Auburn, AL: American Society of Microbiology Southeastern Branch.