

QUARTERLY PROGRESS REPORT

December 1, 2010 – February 28, 2011

PROJECT TITLE: Diverting Food Waste from Landfills

PRINCIPAL INVESTIGATOR: Dr. Ann C. Wilkie (acwilkie@ufl.edu)

AFFILIATION: Soil and Water Science Department, University of Florida-IFAS

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PHONE NUMBER: (352) 392-8699

PROJECT WEBSITE ADDRESS: <http://biogas.ifas.ufl.edu/foodwaste/>

OBJECTIVES:

1. Continue lab-scale experiments to optimize food waste digestion.
2. Conduct food waste audits at local schools.
3. Demonstrate anaerobic digestion at local schools.

WORK ACCOMPLISHED DURING THIS REPORTING PERIOD:

Objective 1:

Pretreatment experiments were completed this quarter. Practical mechanical pretreatment (in-sink food disposer, meat grinder) greatly facilitates the short-term solubilization and enzymatic hydrolysis of food waste. Mechanical pretreatment improves the degradation of food waste through tissue and cell destruction, which has a two-fold effect on the digestion process. Soluble materials contained within the tissues and cells are immediately released into the soluble phase of the digester, and hydrolytic enzymes produced by microbes in the digester have greater access to the particulate substrate. Increased solubilization of food waste is desirable because microbes within the digester can only assimilate soluble organic matter. By increasing the rate of food waste solubilization, the rate of microbial assimilation and methane production are potentially increased.

To study the effect of pretreatment on methane production from food waste, a series of biochemical methane production (BMP) assays were conducted. A BMP assay is a laboratory-scale experiment that allows methane production kinetics to be measured using a simulated anaerobic digester. The experiments indicate that using traditional, low-rate anaerobic digestion, pretreatment does not enhance methane production over intact food waste and, in fact, at a high loading rate, pretreatment can reduce the methane production through increased acid production. However, for feasible commercial-scale anaerobic digestion of food waste at schools, restaurants, grocery stores, etc., high loading rates and high methane production kinetics are necessary. Therefore, a high-rate anaerobic digester, such as a fixed-film reactor, is required to benefit from the increased solubilization kinetics of pretreated food waste and to handle a high loading rate while preventing acidification.

Objective 2:

Waste audits at three local schools were conducted in the previous quarter as part of the analysis of food waste generation by sector. The three schools included a public elementary school, a public high school, and a private middle/high school. Data analysis of the food waste audits is ongoing. These audits are essential to provide real data on food waste generation and thus allow a determination of the biogas potential of the schools' food waste.

Objective 3:

Experimentation with the portable, food waste anaerobic digester continues and the process of optimizing the performance of the digester is ongoing. The portable digester is being used to demonstrate anaerobic digestion of food waste to students and staff at local schools.

As part of guided tours of our laboratory, the digester was demonstrated to high school students from the Academy of Environmental Science, Crystal River (December 3, 2010); elementary school students from the Expressions Learning Arts Academy, Gainesville (February 2, 2011); and high school students participating in the Junior Science, Engineering, and Humanities Symposium (February 7, 2011). The portable digester was transported to Newberry Elementary School on February 16, 2011 for demonstrations to five 4th grade classes and their teachers. There was great interest in food waste digestion from both the students and teachers alike.

INFORMATION DISSEMINATION ACTIVITIES:

- December 3, 2010
A group of 35 high school students from the Academy of Environmental Science in Crystal River, Citrus County, toured the laboratory. The tour included demonstration and discussion of food waste digestion and its importance to sustainability. A cooking demonstration using biogas from the portable food waste digester was also given to the students.
- December 7, 2010
The UF Office of Sustainability held a "One Less Car" event at the Natural History Museum at which food was catered. We collected food waste generated from the event for use in our food waste digesters. By collecting food waste at events such as these, not only are we helping to reduce waste, but we are helping to spread awareness of food waste digestion to the general public.
- January 25-26, 2011
The *Educational Alliance for a Sustainable Florida Roundtable* was held on-campus at UF. Several meals were catered for this event, and food waste generated at the meals was collected for our food waste digesters. In addition, we displayed the portable food waste digester at the event.
- January 28 2011
Representatives from the Heart of Florida Solid Waste Group and the Citrus County School District visited the laboratory to discuss the possibilities of implementing food waste digestion at schools in Citrus County.

- February 1, 2011
 Ryan Graunke, graduate student, gave a seminar to approximately 30 students and faculty in the School of Natural Resources and Environment. The seminar included discussion of his research on the pretreatment of food waste.
- February 2, 2011
 A group of 25 elementary school students from the Expressions Learning Arts Academy, a public charter school in Gainesville, Florida, toured the laboratory. The tour included demonstration and discussion of food waste digestion and its importance to sustainability. A cooking demonstration using biogas from the portable food waste digester was also given to the students.
- February 7, 2011
 We hosted 8 high school students at our laboratory as part of the *Junior Science, Engineering, and Humanities Symposium*. The symposium was held by the UF Center for Precollegiate Education and Training and brought students to different laboratories around campus. We demonstrated our research in food waste digestion, bioenergy, and sustainability to the students.
- February 16, 2011
 We exhibited the portable food waste digester at Newberry Elementary School as part of the *Annual Educational Fair*. Discussions and demonstrations were given to five 4th grade classes (approximately 60 students) and their teachers. This is the second year that we have participated in this event and each year there has been great interest in food waste digestion from both the students and teachers alike.
- February 22, 2011
 A “zero waste day” was held at Gator Corner Dining Hall, sponsored by Gator Dining Services and the UF Office of Sustainability. Our laboratory participated in the event by collecting all the food waste generated during the day for digestion in our food waste digesters.
- February 24, 2011
 Ryan Graunke, graduate student, gave a presentation to 10 undergraduates at the School of Natural Resources and Environment general body meeting. The presentation included discussion of food waste digestion and his research in food waste pretreatment.