Cal Energy Corps - Summer 2012 Participants at Work - Lauren Steinbaum

Lauren Steinbaum ***is spending twelve weeks in Ghana at Waste Enterprisers.***

June 4, 2012

Our lab space: small but contains everything we need

I'm really excited to be here in Ghana working with Waste Enterprisers. Waste Enterprisers is a social enterprise, so their goal is to be a profitable company while having a positive impact on society. Since the inception of the UN's Millenium Development Goals, NGO's have worked extensively to improve water and sanitation in developing countries. While there has been great progress in improving access to clean drinking water, access to improved sanitation has not yet met the goals. Waste Enterprisers is tackling inadequate sanitation in Kumasi, Ghana by turning fecal sludge into biodiesel. The approach that Waste Enterprisers takes is unique in that it treats waste as a resource.

Waste management is a huge issue in Ghana. Sewage pipelines are uncommon. Instead, pit latrines and private septic tanks are most commonly used. In Accra, pump trucks dump sewage directly into the ocean at a site called Lavender Hill. Nearby, a lagoon is black and viscous, and it is so polluted that it bubbles. Kumasi is more inland, so ocean dumping is not an option. Instead, fecal sludge is dumped into a landfill. Solid waste management is also not universally available, so trash may be burned, thrown on the ground, or thrown into open drains. Trash cans do exist, but they are very rare.

Can you guess what this is?

My academic background prepared me for the sanitation-related part of the project that I am working on, but it did not prepare me to work with biodiesel. I knew very little about biodiesel and how it is made before arriving. I've been reading many journal articles and observing laboratory procedures, I now have a much better understanding of the production of biodiesel. Most biodiesel is made from vegetable oil, but this project is working with fecal sludge instead of vegetable oil. A major limitation for biodiesel use is its cost compared to gasoline, so using a cheaper source material, such as fecal sludge, may make it a more economically attractive option. However, there are distinct issues and challenges when working with fecal sludge that need to be addressed before this technology can be adopted on a larger scale.

June 18, 2012

Two KNUST PhD students, Martin and Edward, working in the lab

I have now been in Ghana for about a month. I cannot believe how fast the time has gone by. I'm glad that I am staying here for two more months because I still have so much to do. As of now, most of my time has been spent in a lab at the house of a KNUST professor. A typical day at the lab consists of drying and grinding up fecal sludge, running experiments to determine a viable process to turn fecal sludge into biodiesel, and constant cleaning and sanitization of everything. Because we are working with fecal sludge, we have to be very careful about keeping everything clean and avoiding cross-contamination.

We have encountered difficulties that I didn't anticipate. Our primary issue is that the electricity goes off sporadically without warning. Normally, a power outage would just be an inconvenience, but in a lab setting it has the potential to ruin the results of an experiment. In order to mitigate the impact of power outages, we have people in the lab from 7 am to 10 pm. So if the power goes out, we can note when it goes out and set the experiments back up when the power goes back on. It is still possible that the power could go out between 10 pm and 7 am, but it is unreasonable to have people working at those times.

We have also had other electrical issues. First, some of the equipment was brought over from the United States, so the plugs are different. Second, we have had problems with using 110 versus 220 volt power. We also experienced difficulties with the wiring of the lab that resulted in some of the equipment giving us electrical shocks. I think that we have finally fixed these problems, but we continue to deal with power strips that cannot handle the electrical load from all of our equipment.

July 6, 2012

There is much more to the Cal Energy Corps experience than just gaining lab and research experience. For those of us that are abroad, we are experiencing foods, languages, climates, and customs that may be much different than what we

2010 Symposium

are used to. We are learning how to live and work in a new place with an unfamiliar culture. We also have the opportunity to explore beyond the boundaries of where we live to see other parts of the country. This is probably what I have enjoyed most about being part of Cal Energy Corps and have enjoyed about my time in Ghana. Even though I have only been here for six weeks, I have already met many amazing people and have seen some pretty amazing things.

Kintampo Falls

Many parts of my daily life here are similar to what I am used to, but some things are startlingly different. Food, for example, is both familiar and different. There are sit-down restaurants that serve Lebanese, Chinese, Indian, and African dishes. Many of these restaurants also serve food that caters to *obruni* tastes, with continental dishes ranging from burgers to pizza to pasta. Fast food restaurants exist as small open stalls that often only sell one African dish. I have tried some African dishes, with my favorites being jollof rice, red-red, and waakye. Probably the strangest thing I have eaten is fufu, which is kind of like a gooey ball of dough in stew that you swallow instead of chew.

The circus at the Ghana National Cultural Center in Kumasi

Language is also both familiar and unique. Most people in Ghana speak English, which makes it much easier for me to communicate with people. This is especially convenient when I am lost or don't know where to buy something for the project I am working on. Speaking the same language also makes it easier to build strong relationships with the people I work with. In Ghana, most people also speak a tribal language based on what part of the country they are from. In Kumasi, Twi is most common. The alphabet is a little different than ours, but not by much. While it is convenient to be able to speak English, it is important to learn some Twi to be able to greet people. Greetings are very important here, definitely more so than in the United States. Most Ghanians are very excited and somewhat amused when a foreigner greets them in Twi, as it shows interest in the language and culture. I've definitely been laughed at when I say something wrong or don't know what to say, but people always help me with the correct greetings and responses. It's kind of surprising how friendly and helpful people have been to me. It might be to a certain extent because I am a foreigner, but I also think that it is just part of the culture.

I am trying to get the most out of my experience here, so I have also been trying to travel and explore. I spent some time in the capital city, Accra, before arriving in Kumasi. Within Kumasi, I have been to the largest market in West Africa, have watched a World Cup qualifying match, have toured the Guinness brewery, and have been to a circus. Kumasi is an impressively large city and there is a lot to see and do. So far, I have only ventured outside Kumasi once. I travelled with the people I live with to Boabeng-Fiema monkey sanctuary and Kintampo Falls.

Monkeys at Boabeng-Fiema

Boabeng-Fiema monkey sanctuary was pretty amazing. The village believes the monkeys are sacred, so the monkeys are safe to roam around the surrounding forest and sometimes even into the village. Their beliefs are so strong that if someone kills a monkey, they will be killed. The highlight of our trip was having monkeys eat bananas out of our hands. We also went to Kintampo Falls to see waterfalls, but we didn't go into the water. There are still many things I would like to do and see before I leave, and I really hope that I will be able to do them in the next six weeks.

August 1, 2012

At the beginning of my time here, I was working on research related to turning fecal sludge into biodiesel. I spent a lot of time in the lab running experiments and learning about the process of making biodiesel. In order to run our experiments, we needed to start with dry fecal sludge. It takes a lot of time and energy to dry fecal sludge in an oven, so we started to look into alternate ways of drying fecal sludge. Waste Enterprisers is also working on drying fecal sludge with their Industrial Fuel project, so they already had some ideas of what technologies they wanted to look into. They picked two technologies that they wanted me to look into and test out; a solar dryer and a vortex separator.

Solar drying of fecal sludge is an attractive option in Ghana because it is sunny and hot. And the sun's energy is free! The solar dryer that I tested was designed by Edward, one of the KNUST students. He based it on a solar water purifier design that he used for a project with his NGO. The idea behind the design is that pure water evaporates and leaves the system, leaving contaminants behind. Since fecal sludge from private and public septic tanks has a high moisture content, usually greater than 95%, we tested the system to see if it could also be used to dry fecal sludge.

The first setup I used for the vortex separator.

I am also testing a vortex separator to see if it will effectively dewater sludge. This project is interesting because the technology was designed by another group that was awarded a Bill and Melinda Gates Foundation grant. They designed the system as a bioreactor to kill *E. coli* in water. We are using it to use it to separate fecal sludge into a solid and liquid waste stream. I think that it is helpful to collaborate with people outside of the project because they have a different perspective.

So far I have been assembling and reassembling the vortex separator to make it work for dewatering sludge. The main challenge I have faced is finding the right parts. It is difficult to know where to go to buy parts, and there are certain parts that just don't seem to exist here. One thing I have learned is that if you can't find something, go into town or to the market. When I ask someone where to find something, their response is usually "Central Market". The market is huge. I think it is the largest market in West Africa, according to a guide book I read.