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feature ARTICLE

Producing Biodiesel from *Jatropha* in Egypt: The Research of Emmanuel Pitia

—**Tammy Wolf**, *Inquiry* Editor (Edited by Lee Fetters)

While many students spent their summer vacations working regular summer jobs and relaxing by the pool, Emmanuel Pitia, a chemical engineering major at the University of New Hampshire, was across the ocean learning how to produce his own biodiesel. With funding obtained through a Summer Undergraduate Research Fellowship (SURF), Emmanuel spent July through August of 2006 at the National Research Center in Cairo, Egypt, exploring the use of the *jatropha* plant as a source of biodiesel. His efforts were part of a collaborative project between the UNH Biodiesel Group and Egypt's National Research Centre.



Emmanuel Pitia and Professor Farag at the National Research Centre lab in Cairo, Egypt, comparing the color and flow of oil extracted from *jatropha* using Hexane (yellowish sample) and isopropanol (dark sample) as solvents.

Biodiesel can be used in the same capacity as petroleum-based diesel to run engines, home heating units, and power generators. With energy costs being what they are today, alternative and renewable fuels such as biodiesel are receiving more and more attention around the world. The *jatropha* plant is of particular interest as a source for biodiesel in Egypt. It is easy to propagate and thrives in relatively infertile soil such as sandy desert regions; it often is planted to simply “green” parts of Egypt where no other plants will grow. Unlike corn and soybeans, two of the United States' major biodiesel crops, the *jatropha* plant is inedible, so no one can argue that it would be better used as a food source. This means that it can be

irrigated using municipal waste water, which would otherwise go unused. But perhaps most important to Emmanuel and scientists interested in biodiesel technology, the *jatropha* plant yields more oil that can be converted to biodiesel than other plant in the northern region of Egypt.

Emmanuel's research focused on finding the most efficient way to extract oil from the *jatropha* seeds and the best means by which to convert that oil into biodiesel—a process called transesterification. In studying extraction methods, Emmanuel used two different procedures: mechanical extraction and solvent extraction. To perform mechanical extraction, Emmanuel used a hydraulic press machine to compress a measured amount of *jatropha* seeds and extract their oil. To perform solvent extraction—the method he found to be far more effective—Emmanuel used two solvents, isopropanol and hexane, to extract oil from the crushed *jatropha* seeds. He experimented with these solvents in varying combinations and concluded that a 3:2 mixture of

hexane to isopropanol yielded the most oil. In a similar fashion, Emmanuel compared the efficiency of two different catalysts, potassium hydroxide and sodium hydroxide, that are often used to convert extracted oils into biodiesel. His results showed that the use of potassium hydroxide (KOH) in the transesterification process resulted in a higher production of biodiesel from jatropha seed oil.



From left to right: Dr. Guzine Eldiwani, Professor Farag, Emmanuel Pitia, Dr. Hani Hamrouch, and embassy personnel

The production of biodiesel has always been of interest to Emmanuel, who says that rising gas prices due to the limitations of imported oil sparked his desire to produce his own alternative fuel. "I always had that interest to be able to make your own kind of fuel and to make your own car run or your own machines run," Emmanuel said.

Conducting this research as an extension of his work with the UNH Biodiesel Group, Emmanuel found working in Egypt to be a bonus. "Egypt was great, really nice—a change of environment. Every time I went into a research lab, I would say I got more excited than I would if I were in the U.S," he said. "Over there, it's just different."

According to Emmanuel the lab equipment was much simpler in Egypt, at least in comparison to what is available to him here. And the rules of the lab were much more relaxed. In many ways, the lab was his office; sometimes he even ate in the lab. Rather than the simpler equipment posing an obstacle, using basic, less advanced tools made his research more enjoyable. "The most exciting part was working with something that was old, but still finding a way to make it work," commented Emmanuel.



Emmanuel Pitia and Professor Farag at the NRC lab looking at the meter of a high pressure reactor. The reactor is used for producing biodiesel via supercritical methanol method.

Though he has since redirected his research to a study of latex, you may still be able to find Emmanuel concocting his own batch of biodiesel. "It doesn't take a lot of equipment or energy to make biodiesel," he says, laughing. "You can do it in your own basement and it will not cost you a lot."

Emmanuel, who was born in Sudan, hopes to return to his native country one day to pursue a teaching career in college-level chemical engineering or material science, or in introductory-level physical science or chemistry.

However, he won't be making the trip any time soon. First he plans to attend graduate school, possibly at the University of Delaware, and gain work experience in his field.

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Author Bio

Tammy Wolf, is a senior English/Journalism major from the small town of Ridgefield, Connecticut. She will graduate in May 2007 with her BA. Tammy's love of writing drew her to UNH. After taking several journalism courses and finding that reporting wasn't her passion, she found her niche, editing. Tammy sees her work as a student editor for *Inquiry* over the past two years as the practical, outside-the-classroom experience an editor needs, working with writers to prepare their work for publication. This should help her during her spring editing internship with the *Portsmouth Herald*. After graduation, Tammy sees herself moving back to Connecticut. Above anything, she wants to find a career that engages her, one that she loves. She hopes some day to be an editor for magazines such as *Cosmopolitan* or *Glamour*. Recently, Tammy has taken up painting pottery.