Thrust Area 3: Biomass (Biochemical Conversion)

Development of Biofuel Production Processes from Synthetic and Biomass Wastes

PI: Pratap Pullammanappallil
Students: Diane Chaulic (PhD), Zhuoli Tian (PhD),
Gayathri Ram Mohan (MS), Nicholas Locastro (BS)

Description: With the ever-increasing price of petroleum and its finite supply, it is of high priority to develop domestic sources of transportation fuel, as well as other chemicals. Ethanol is an attractive alternate fuel that is being produced from corn starch. It is necessary to target other feedstocks for biofuel production and develop processes that have a minimal environmental impact. There is considerable ongoing research on developing processes and catalysts for conversion of biomass to biofuels like ethanol (called cellulosic ethanol process). But this project addresses other feedstocks with the following objectives: 1) development of biocatalysts for the conversion of waste biodegradable poly lactic acid based plastics to ethanol and 2) development of processes that processes for the production of additional fuels like biogas, bio-oil and biochar from the waste and byproducts of a cellulosic ethanol plant for the clean-up and reuse of these waste streams

Budget: $192,000
Universities: UF
External Collaborators: UCF

Progress Summary

Process development for biogasification and clean-up of cellulosic ethanol stillage

- Demonstrated that struvite (a slow release fertilizer containing ammonia and phosphate) can be recovered from the anaerobically digested stillage.
- A process was developed to recover struvite along with other organic carbonaceous residue remaining in the digested stillage.
- Showed that this process can be applied with or without prior anaerobic digestion of stillage.
- Estimated that sufficient phosphorous is contained in the recovered sludge to grow the biofuel crop. The application of this sludge to grow the bioenergy crop offsets the need for addition of phosphate fertilizer.
- Demonstrated that nanoceria enhances anaerobic digestion of biomass.

Process development for preparation of enzymes to saccharify pectin rich biomass feedstocks.

- Developed a process that can be implemented in the biorefinery to prepare biocatalysts for saccharification of pectin-rich biomass and a method for saccharifcation of such biomass. This process has applications for pretreating citrus pulp, sugar beet pulp, apple pomace, fruit and vegetable wastes etc prior to production of liquid fuels.

Biocatalyst development for conversion of waste PLA based plastics to ethanol

- An *E.coli* mutant was constructed that is incapable of utilizing lactic acid.
- Into this mutant a Lactate dehydrogenase (LDH) gene was inserted. Currently experiments are underway to verify the expression of this gene.