Undergraduate Research Symposium May 17, 2013 Mary Gates Hall

Online Proceedings

POSTER SESSION 3

Balcony, Easel 96

2:30 PM to 4:00 PM

Fast Pyrolysis Optimization for Softwoods and Hardwoods

Austin L (Austin) Montgomery, Senior, Mechanical Engineering

McNair Scholar

Mentor: Fernando Resende, School of Environmental and Forest Sciences

Mentor: Oliver Jan, School of Environmental and Forest Sciences

With an international focus on limiting greenhouse gas production, advancements in biomass conversion are needed. Conversion of biomass into more convenient fuels can lead to carbon neutrality. Biomass has the potential to be converted to transportation fuels after undergoing oxygen-free thermochemical decomposition, known as fast pyrolysis, and upgrading in a Fluid Catalytic Cracking reactor. Wood, one form of biomass, is largely made up of cellulose, hemicellulose and lignin. Lignin is comprised of polymers constructed of p-coumaryl alcohol, coniferyl alcohol and sinapyl alcohol monomers. In the present project, pyrolysis of these monomers will be modeled using phenol, guaiacol and syringol, respectively. Individual monomers and mixtures of monomers will be pyrolyzed using a Pyroprobe and the bio-oil contents will be quantified by gas chromatography-mass spectroscopy. It is expected that when combinations are pyrolyzed, the bio-oil production will be suppressed due to secondary reactions of each monomers' product. As combinations of these monomers are characterized, pyrolyzed lignin can be characterized. Eventually, all aspects of pyrolyzed wood will be characterized and optimum conditions for pyrolysis of woody biomass can be assessed, thus yielding the highest quality bio-oil.

POSTER SESSION 4

Balcony, Easel 116

4:15 PM to 5:45 PM

Optimization of Bio-oil Production

Matias Carrau Gonzalez, Senior, Bioresource Science and Engineering

Mentor: Fernando Resende, School of Environmental and Forest Sciences

The objective of this research is to produce bio-oils from biomass at high temperature in water or ethanol at different pressures. The high pressures and temperatures takes the solvents near or into supercritical conditions where small changes in pressure have great effects on the solvents' physiochemical properties. Conditions are tailored to increase the yield of bio-oil that can be hydrogenated and then refined in existing petroleum refineries to produce high-quality level jet fuel. Char, coke, and tar - unwanted byproducts - must be decreased to a minimum as they deactivate catalysts and clog reactors. These unwanted byproducts are a ubiquitous problem in biomass themro-chemical conversion; removing them would help the industry develop. It is possible to get no char, coke and tar produced, as I have been able to attain, though a better understanding of how to reproduce it consistently and at larger scales is necessary. Temperature are adjusted within the sand-bath - apparatus for heat transfer- and to increase pressure more reactants are placed into the chamber to which the pressure can be calculated.