UNIVERSITY OF CENTRAL FLORIDA

Integrated Florida Bio-Energy Production with Carbon Capture and Sequestration

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Description: The aim of this project continues to be production of liquid hydrocarbon fuels derived from lignocellulosic and aquatic biomass employing a two-step thermocatalytic process. In the first step, pre-treated biomass is gasified with oxygen (or air) and steam yielding synthesis gas (syngas) containing hydrogen and carbon monoxide. In the second step, syngas generated by the gasifier enters a Fischer Tropsch (FT) synthesis unit where it reacts to form a range of liquid hydrocarbon fuels – including diesel.

Budget: $425,506
Universities: UCF/FSEC

Progress Summary

We have completed fabrication and testing of new updraft oxygen blown gasifier (see Fig. 1). A fuel chamber with two gate valves can be seen at the top of the reactor. A high pressure water pump and an oxygen feed line connect to the bottom of gasifier supplying oxidants at elevated pressures. Syngas from gasifier is routed into a condenser placed in a chilled ice bath which then passed through a gas-liquid separator. The gas then passed through a bed of activated charcoal and through a bed of drierite. A three way-valve was setup so that the syngas produced can be used to pressurize and purge the lock hopper chamber. The fuel chamber can accommodate several kilograms of biomass feed. In a typical experiment, biomass is feed to the gasifier at approximately 110 g batches, in regular intervals.

Fig. 1. Continuous flow gasifier.

The gasifier was operated with oxygen flow of 3 L/min and 5 g/min of added steam – giving an input $[H_2O]_0/[O_2]_0$ ratio of 2.23. The gasifier was initially charged with 200g of pine wood charcoal pellets. The lock hopper was filled with 100g of pine wood charcoal which was fed into the gasifier (using the valves) at 20 min intervals. The gasifier was run continuously for approximately 3.8 hrs.

The gas concentration and syngas flow rate profiles are shown in Fig. 2.

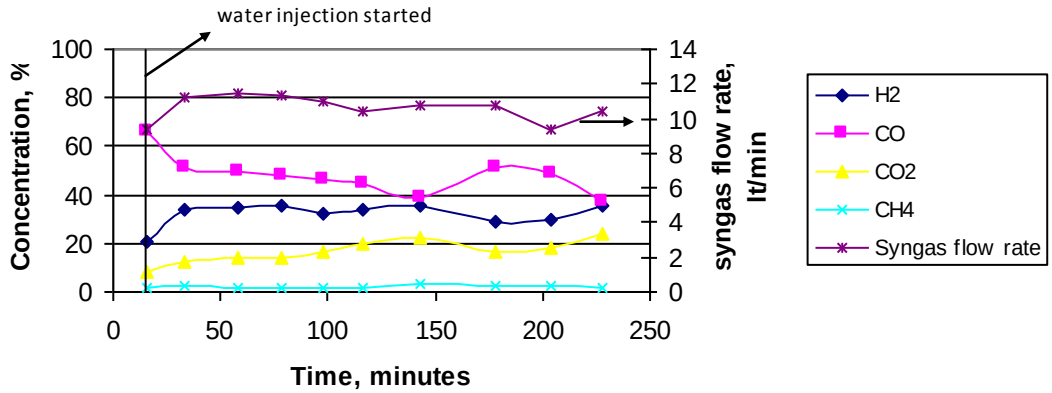

Fig. 2. Syngas composition and flow rate profile with time.

No oxygen bypass was observed. The exit syngas flow rate was around 10 L/min and the CO_2 concentrations were consistently below 25%. The H_2/CO ratios are also lower than that obtained for previous runs (at similar $[H_2O]/[O_2]$ ratios).

New collaborations		
R.J. Saxton	Chevron Energy Technology Company	FT catalyst development and evaluation
H. Chen	Bing Energy Inc.	Fuel reformation for PEMFC

Proposals						
Title	**Agency**	**Solicitation No.**	**Role**	**Funding requested**	**Duration**	**Date submitted**
Conversion of Biomass into Liquid Fuel with CO_2 Capture	U.S. Dept of Energy	DE-FOA-0000337	Co-PI Lead: Dr. Steve Xiao, Savannah River National Laboratory, Aiken, SC	UCF share: $300,000	3 years	February 4, 2011
Fuel-flexible Reformers for Converting Raw High-Sulfur Fuels to Fuel Cell-grade Hydrogen	U.S. Dept of Energy	DE-FOA-0000360	PI Collaborator: Bing Energy Inc., BEI	$1,012,020	3 years	March 3, 2011