

Title: An Integrated Hydrogen Production-CO₂ Capture Process from Fossil Fuel

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ABSTRACT

The new technology concept integrates two significant and complementary hydrogen production and CO₂-sequestration approaches that have been developed at Oak Ridge National Laboratory (ORNL) and Clark Atlanta University. The process can convert biomass into hydrogen and char. Hydrogen can be efficiently used for stationary power and mobile applications, or it can be synthesized into Ammonia, while char can be used for making time-release fertilizers (NH₄HCO₃) by absorption of CO₂ and other acid gases from exhaust flows. Fertilizers are then used for the growth of biomass back to fields.

This project includes bench scale experiments and pilot scale tests. The Combustion and Emission Lab at Clark Atlanta University has conducted the bench scale experiments. The facility used for pilot scale tests was built in Athens, GA.

Objective:

- Determine the feasibility of using the char from a coal/biomass pyrolysis-reforming process and CO₂ emissions at a smokestack to form a solid NH₄HCO₃-char product that may subsequently be used as a fertilizer.
- Increase diversity of the Nation's workforce and the broader impact of the project through the education and training of minorities.

Accomplishments:

- Completed NH₄HCO₃-char (Fertilizer) production process optimization
- Completed fertilizer characteristic evaluation
- Developed process models for process scale up
- Performed techno-economic analysis based on pilot results

Future work:

- Perform 1000 hours run

- Test the scaled up CO capture reactor
- Construct final report

Published paper:

1. Zhicheng Wang, Bo Xiong Liao, Kofi B. Bota, Yaw D.Yeboah, “An Integration System for Producing Hydrogen from Biomass,” World Hydrogen Technologies Convention (WHTC 2005), Singapore, Oct. 3-6, 2005.
2. Zhicheng Wang, Bo Xiong Liao, Kofi B. Bota, Yaw D.Yeboah, “Hydrogen and Char Production from Biomass by Integration Process,” International Conference on Energy, Environment and Disaster (INCEED 2005), Charlotte, North Carolina, USA, July.24-30, 2005.

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