An Integrated Hydrogen Production-CO2 Capture Process from Fossil Fuel

Zhicheng Wang
Clark Atlanta University
223 James P. Brawley Drive, S.W., Atlanta, GA 30314
Phone: 404-880-6934, Fax: 404-880-6963
zwang@cau.edu

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OBJECTIVES

The increasing anthropogenic CO_2 emissions and possible global warning have challenged the United States and other countries to find new and better ways to meet the world's increasing need for energy while, at the same time, reducing greenhouse gas emissions. The improved technology for integrated hydrogen production/CO2 capture that we plan to develop through this R&D effort could significantly support President Bush's Global Climate Change Initiative (GCCI) that commits America to an aggressive strategy to reduce greenhouse gas intensity by 18 percent over the next 10 years. Our new technology concept integrates two significant and complementary hydrogen production and CO_2-sequestration approaches that have now been developed at Oak Ridge National Laboratory (ORNL) and Clark Atlanta University.

The objective of the proposed study is to determine the feasibility of using the char from a coal and/or biomass pyrolysis-reforming process and CO_2 emissions at a smokestake to form a solid NH_4CO_3-char product that may subsequently be used as a fertilizer. Part of the hydrogen from the pyrolysis-reforming process may be converted to ammonia that is used to solidify the CO_2 as NH_4CO_3 in the char. The balance of the hydrogen may be purified and sold at market prices or used as a feedstock.

Another objective of this project is increasing diversity of the nation's workforce and the broader impact of the project through the education and training of underrepresented minorities.

ACCOMPLISHMENT TO DATE

Below is a summary of the specific progresses to date to achieve the above goal and objectives.

- An integrated hydrogen-char production-CO_2 capture process has been developed.
- A pilot scale test facility has been built and tested to demonstrate the developed process.

• 24-hour continuous operation has been successfully run. 49% hydrogen at N2-free based was produced.
• The co-product, 32% char, was successfully produced through this integrated hydrogen-char production from bio-mass via pyrolysis
• Bench scale study of NH_4HCO_3-char production and fertilizer characteristics has been conducted.

FUTURE WORK

Among the key future works are:
• Build the facility of NH_4HCO_3-char **(**Fertilizer) production at pilot scale.
• Perform NH_4HCO_3-char **(**Fertilizer) production at pilot scale
• Evaluate the produced fertilizer's performance.• Develop process models for scale up and process optimization.
• Perform detailed techno-economic analysis based on pilot results.

PUBLICATION

Z. Wang, B. Liao, Y.D. Yeboah, K.B. Bota, An Integrated Process for Hydrogen Production from Biomass via Pyrolysis and Fluidized Catalytic Reforming, World Hydrogen Technologies Convention 2005, Singapore, 3^{rd}-6^{th} October. Accepted.

STUDENT TRAINING AND EDUCATION

Through this project, one engineering undergraduate student at Clark Atlanta University and two graduate students of University of Georgia undertake research internships at CAU and Eprida Inc.