U.S. Department of Energy
Energy Efficiency and Renewable Energy
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Biomass Program

Thermochemical R&D

Fundamentals of Biomass Gasification

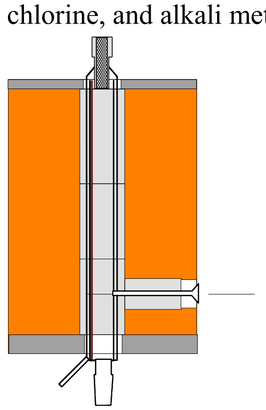
Thermochemical processes such as gasification and pyrolysis have the potential to convert lignocellulosic biomass into a gas or liquid intermediate suitable for further refining to valuable products. Although there is a good understanding of gasification and pyrolysis chemistry, there has been less emphasis on understanding the chemistry of minor products (tars) and trace impurities (N, S, Cl, and alkali species) and their impact on downstream unit operations and final product quality. This project will address this gap by developing tools to understand the fundamental mechanisms and reaction kinetics of biomass pyrolysis and gasification.

Researchers will focus on fundamental chemical kinetic measurements of trace product formation in biomass thermochemical conversion, including tar formation and destruction, transformation of sulfur, nitrogen, chlorine, and alkali metal release rates. The results will be extrapolated to larger-scale systems and used in global models for more complex process modeling. This work will enable process engineering, reactor design, and technology development for economically-viable integrated gasification systems and gas cleanup operations.

R&D Pathway

A laboratory-scale laminar entrained flow reactor. (LEFR) will be used in conjunction with molecular beam mass spectrometry to measure the conversion of model compounds (e.g., furans, phenols, levoglucosan, xylan, lignin, benzene, naphthalene) and selected biomass feedstocks as a function of temperature.

Quantitative reaction kinetics will be determined by combining the experimental data with computational fluid dynamic simulations of the LEFR.



Bench scale laminar entrained flow (LEFR) reactor system and molecular beam mass spectrometer system.

Benefits

- Advanced understanding of biomass thermochemical conversion kinetics
- Improved capability for optimized design of gasification and gas clean up systems

Applications

The results of this project will advance gasification technology and contribute to an economically-viable gasification biorefinery.

Project Partners

National Renewable Energy Laboratory
University of Colorado - Boulder

Project Period

FY 2003 – FY 2006

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Visit the Web site for the Office of the Biomass Program (OBP) at
www.eere.energy.gov/biomass.html

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A Strong Energy Portfolio for a Strong America. Energy efficiency and clean, renewable energy will mean a stronger economy, a cleaner environment, and greater energy independence for America. Working with a wide array of state, community, industry, and university partners, the U.S. Department of Energy's Office of Energy Efficiency and Renewable Energy invests in a diverse portfolio of energy technologies.