Biomass and Biofuels

Equipment/Test Systems

- Micro rapid catalyst screening system
- Automated model compound reactor
- Bubbling fluidized bed reactor system
- 1 Ton/day catalytic biomass pyrolysis unit
- Pilot-scale dual reactor hydroprocessing system

Drawing on decades of experience in gasification research and catalyst development, RTI International is conducting R&D to help make advanced biofuels processes technically and economically viable. RTI is active in biomass pyrolysis research—an attractive method for converting biomass to transportation fuels utilizing the existing infrastructure for fuel production and distribution. We are also developing process technologies to remove tar, ammonia, and sulfur from biomass gasification derived syngas and are developing catalysts for converting syngas into fuels.

Research to Enhance the Viability of Biomass Pyrolysis

Pyrolysis involves the thermal depolymerization of biomass at modest temperatures in the absence of added oxygen. Traditional flash pyrolysis processes have a relatively high yield of liquid product, but the resulting biocrude is less than ideal due to chemical and physical properties that make it unsuitable in the production of transportation fuels. Also the resulting biocrude has limited long-term storage due to high oxygen content and low pH.

The quality and utility of biocrude can be significantly improved by reducing its oxygen content. RTI is developing a catalytic biomass pyrolysis process that uses proprietary catalysts to maximize carbon efficiency and energy recovery, remove oxygen, and control the properties of a biocrude product so that it can be processed within the existing refinery infrastructure. RTI is conducting parametric catalytic pyrolysis studies using an in-house catalytic biomass pyrolysis unit that converts one ton of biomass per day into a stable, deoxygenated biocrude.

Novel, Direct Biomass Liquefaction Process with Improved Hydrogen Utilization and Carbon Recovery

The primary aspect of this concept is to improve hydrogen utilization during in situ catalytic biomass pyrolysis to maximize the biomass carbon and energy recovery in a low-oxygen-content, thermally stable biocrude intermediate that can be efficiently upgraded into a finished biofuel. The secondary aspect of this concept is to improve the carbon efficiency of the integrated process by converting the carbon in the various aqueous streams to methane for hydrogen production or value-added by-products.

This technology development effort supports DOE's Office of Biomass Programs' goal to produce hydrocarbon transportation fuels in the gasoline, diesel, and jet range by improving hydrogen utilization and carbon efficiency in an integrated, in situ catalytic biomass pyrolysis process with aqueous phase carbon recovery.

1 Ton/Day Biomass Pyrolysis Unit

Hydroprocessing System Capabilities

Unit Operations

- Oil feed system including pumps and flow control
- Gas feed system
- Reactor system
- Separator system
- Gas and liquid sampling system

Operating Conditions

- Design temperature: 450 °C
- Max. operating temperature: 430 °C
- Design pressure: 3000 psig
- Max. operating pressure: 2500 psig

For more information, contact us at
energy@rti.org

Hydroprocessing Reactor System

RTI International is developing a novel single-step catalytic biomass pyrolysis process to produce a hydrocarbon-rich biocrude intermediate. This biocrude is more thermally stable and has lower oxygen content than conventional biomass fast pyrolysis oil, so it can be effectively and efficiently upgraded with traditional hydroprocessing technology to produce gasoline and diesel.

RTI operates its own hydroprocessing unit. Hydroprocessing conditions (T,P, SV,H_2 requirements) will be optimized for maximum carbon conversion efficiency while attempting to minimize pressure and hydrogen consumption. Product distribution between gasoline, naphtha, and heavy fractions will be determined with a goal of maximizing diesel-range hydrocarbon production.

Building Blocks from Biocrude: High Value Methoxyphenols

Research Triangle Institute is partnering with Arkema and AECOM to investigate the technical feasibility and economic potential, as well as the environmental and sustainability benefits, of recovering mixed methoxyphenols from biocrude as building block chemicals alongside the production of biofuels. These methoxyphenols can be used in the production of pharmaceuticals, food flavorings, and perfume products. Achieving technical success in recovering high-value methoxyphenols prior to upgrading to biofuels could provide a significant source of revenue to improve overall process economics and help meet the modeled $3/gasoline gallon equivalent production-cost target for advanced biofuels technologies by 2022.

Doing Business with RTI

We work closely with commercial, government, and academic partners to maintain a portfolio of innovative energy technologies with a high potential for commercial success. Strategic alliances with industry partners ensure that economic and technical feasibility are part of our thinking, from initial concept through to the development stages. Our focus is on joint development activities, but we also provide commercial clients with specialized research and development, testing, and analytical services.

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