



Biomass Gasification and Syngas Cleaning

Bioeconomy Institute engineers are conducting research to convert biomass into clean syngas using gasification. A pilot-scale 25 kilograms per hour fluidized bed gasifier and syngas cleaning system was built at the BioCentury Research Farm. The reactor vessel incorporates a novel guard heating system to simulate near-adiabatic operation of industrial gasifiers, and is effective for gasification temperatures up to 900°C and operating pressures up to 1 atmosphere. The system features continuous online sampling of both contaminants and gas species and a state-of-the-art control system. The cleaning system downstream of the gasifier removes the contaminants using several techniques: oil scrubbing is used to remove tars, sulfur compounds are removed via solid-phase adsorption and ammonia is removed by water scrubbing. The primary gasification feedstock is switchgrass, but other possibilities include corn stover, wood fiber, corn fiber and red oak.

Accomplishments

- » Produces Fischer-Tropsch quality clean gas:
 - H₂S < 0.2 ppm, COS < 0.6 ppm, CS₂ < 0.01 ppm
 - NH₃ < 0.9 ppm
- » Continuous limestone injection system for extended operation with high ash content feedstocks.
- » Slipstream syngas conditioning system suitable for gas fermentation applications.

Future Work

- » Hybrid processing of synthesis gas through fermentation.
- » Gasification of refuse-derived fuel (RDF) and cleanup of produced syngas.

Team Members



Robert C. Brown
Distinguished Professor
Mechanical Engineering

(515) 294-7934
rcbrown3@iastate.edu

Lysle Whitmer
Bioeconomy Institute

Andrew Friend
Bioeconomy Institute

Jordan Funkhouser
Bioeconomy Institute

Patrick Johnson
Bioeconomy Institute

Iowa State University does not discriminate on the basis of race, color, age, ethnicity, religion, national origin, pregnancy, sexual orientation, gender identity, genetic information, sex, marital status, disability, or status as a U.S. Veteran. Inquiries regarding non-discrimination policies may be directed to Office of Equal Opportunity, 3410 Beardshear Hall, 515 Morrill Road, Ames, Iowa 50011, Tel. 515 294-7612, Hotline 515-294-1222, email eooffice@iastate.edu