

Biofuels Subgroup

S-1007 Multi-State Research
Committee



Biochemical conversion

Thermal conversion

Secondary conversion



Biochemical Conversion

- Feedstock quality/physical properties
- Standards for feedstock characteristics?
- Pretreatment
- Saccharification
- Inhibitors
- Fermentation (yield, cost, substrates, coproducts)
- Downstream purification



Biochemical Conversion

Ethanol production from biomass

- Ethanol production from ag. residues: physical and chemical pretreatment (steam explosion, acid pretreatment, controlled pH with liquid water) of the lignocellulosic materials and enzymatic hydrolysis of the pretreated materials.
- Process modeling and characterization of co-products of ethanol production from corn



Biochemical

Developing biocatalysts for SSF and SSCF biomass sugars to ethanol and other products. The main problem for economical production of biomass-derived products, as we see it, is the cost of sugar production from biomass (cellulase cost).

A secondary problem is the inhibitors in hemicellulose hydrolysate (produced during acid hydrolysis). Modification of acid hydrolysis of hemicellulose fraction which minimizes the inhibitors (furfural, etc.) would be an interesting option.



Biochemical Conversion

- Biogas production from biomass and residues
 - anaerobic digestion of ag. biomass (animal waste, ag. residues) for methane production.
 - Hydrogen and methane production from microalgae biomass fermentation



Thermal-Biochemical Conversion

Continuing Challenges

Gasification-fermentation system.

- Specific research activities include gasification efficiency, evaluation of producer gas quantity and quality from a number of feedstocks, producer gas cleanup and storage, bioreactor design, media optimization and recovery, and product separation. Each provides its own set of challenges, but most important are conversion efficiency and cost per unit of output.



Thermal Conversion

- Continuing Challenges
 - Improved syngas cleanup methods for applications in thermal gasifier based power and fuel systems.
 - a. Lack of inexpensive and environmentally acceptable gas cleaning remains the primary obstacle to adoption of small-scale gasification power systems for remote and developing country applications using biomass. Investigating combined thermal and biochemical treatment systems.
 - b. Higher efficiency and lower maintenance gas cleaning systems are needed for gas turbine, gas reforming, and fuel cell applications at all scales.



Thermal Conversion

- Continuing Challenges
 - Reducing ash slagging and fouling in thermochemical conversion systems.
 - a. Alkali metals and chloride can largely be removed by simple water leaching, but more effective approaches are needed to eliminate complications from resulting high fuel moisture and waste water discharges.
 - b. Mineral phase relationships are still only poorly understood for predicting ash behavior with single fuels and fuel blends.



Thermal Conversion

Continuing Challenges

- Hydrogen and FT liquids production via thermochemical biomass conversion.
 - a. Steam reforming and autothermal gasification of biomass for fuel cells of various types, including internally reforming molten-carbonate and solid oxide cells, and for production of Fischer-Tropsch liquids.



Thermal Conversion

Biodiesel Production

Heat animal processed fiber with water under pressure. Resulting tar mixed with diesel for use in engines. Challenge: proof of concept on pilot scale.



Technical Expertise and Facilities

Multi-regional expertise – regional differences can be investigated

Microbiologists; agricultural biotech scientists, biological engineers; chemical engineers; agricultural engineers;

Interaction between researchers involved in organism development, enzyme production, biochemical conversion and thermal conversion; synergistic ideas generated

