Sugarcane Biomass Pyrolysis

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Overview

- Pyrolysis Process
- Whole Sugarcane Pyrolysis Considerations
- Why Pyrolysis
- Position of Bioenergy
Pyrolysis – Basic Principles

- The thermo decomposition process of biomass without oxygen
- Biomass chemical composition:
  - hemicellulose, cellulose, lignin
- Products:
  - Gas (CO, H2, methane)
  - Char (carbon)
  - Bio-oil (complex mixture)
Pyrolysis Process
Features

- High temperature and heating rate
- Short vapor residence time
  - Normally less than 2s.
- Rapid cooling of pyrolysis vapor to form bio-oil.
- Electrostatic precipitator

Sugarcane Pyrolysis – Technical Consideration

- Drying difficulties
  - 50% water
  - Pre-treatment: Sun drying
  - Gasification to extract water after bio-oil produced

- Reactor Configuration
  - Fluid Bed
  - Particle size limit: 2mm in smallest dimension
Sugarcane Pyrolysis – Technical Consideration

- Reaction Condition
  - 500-525 degree Celsius for maximum liquid fuel production from wood. Yield: 80%
  - Experiments needed to optimized reaction condition for sugarcane.

Economic Consideration

**Ethanol**
- Direct use
- Transportation: truck
- Yield: 80L/ton of sugarcane
- Time: 10hr processing time
- Cost: US$0.25 – 0.3/liter

**Bio-oil**
- Further processing needed
- Transportation: pipeline
- Yield: expected 50% - 75%
- Time: Shorter than bio-process
- Cost: comparison with ethanol

Why Pyrolysis?

- Logistic cost reduction
  - Transport cost reduction as sugarcane is transported in chops instead of the whole
- Higher energy conversion
  - Lignin decomposition
- Shorter process time, higher efficiency of the plant

Position of Bioenergy

- Supportive
- Positive energy conversion
  - Net energy ratio (NER) is 8.0 for Brazil sugarcane-derived ethanol production
- Decrease competition with food
- Market force resolve food shortage
- Cheaper than other alternative energy resources
References

References


Thank You!