Methane and Nutrient Salts from Waste Biomass: Development of a Catalytic Conversion Process in Supercritical Water

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**Vision**

Synthetic natural gas (SNG) can potentially be produced from biomass (liquid manure, wood) by a hydrothermal process. The hydrothermal route carries two major advantages over conventional gasification:

1. Drying is unnecessary.
2. Nutrient salts are recovered.

**Experimental**

- Solids content \(\leq 30\%\).
- Batch reactor, Raney nickel catalyst.
- 400\°C, 300 bar. Supercritical.

**Results**

Gas composition achieved:

![Complete conversion to gases and water](image)

- Thermodynamic equilibrium
- Nickel catalyst
- No catalyst

**Ongoing Work**

- Salt separation studies in supercritical water.
  - In-situ visualization using neutron radiography.
  - Finite-element modeling of fluid flow and heat transfer.
  - Realization of continuous process.
  - Gasification of liquid model systems with same C-H-O composition in biomass in continuous test rig.
  - Salt separation in continuous fashion, preliminary design.
  - Pumping of real biomass slurry, up to 20\% solids, ground to xD \(\leq 100\) microns.
  - Environmental systems analysis.

**Global Warming Potential per 1000 kg Biomass**

Example of preliminary results for manure feed.

- Chemical process simulation (ASPEN+) and life-cycle assessment will be used to optimize the environmental performance of the process in a systems perspective.

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