



Hydrothermal Gasification of Woody Biomass

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Introduction

- Wet biomass (manure, wood, sewage sludge) contains **large energy potentials**.
- Synthetic natural gas (SNG) from biomass is a viable alternative to fossil fuels.
- The **catalytic hydrothermal gasification** is a promising biomass conversion technology, as the **thermal efficiency** is high (**no drying**) and **nutrient salts** can be recovered from the biomass.

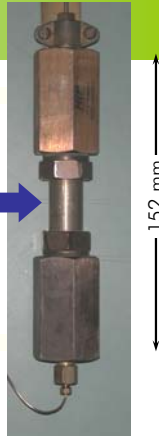
Experimental

Equipment:

- Batch reactor** (316 SS) for high feed conc. (w_{wood} up to 30 wt%); with cooler or as bomb
- Rapid heating in a fluidized **sand bath**
- Quenching** by immersing into water bath
- Online T & p monitoring**

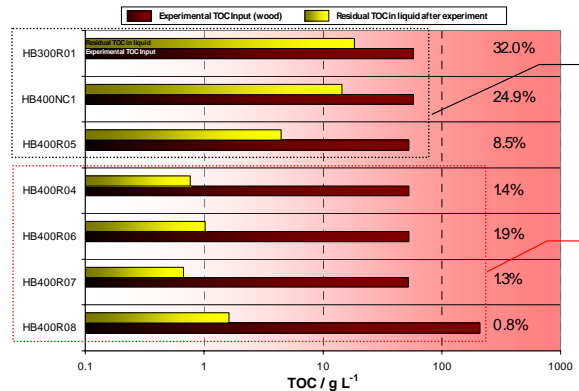
Analytics:

- Gas Chromatography (gases)
- Dohrmann DC-190 TOC Analyzer
- HPLC/EC/DAD (aqueous phase)
- XPS / TPO (catalyst)



OD: 25.4 mm
ID: 14.3 mm

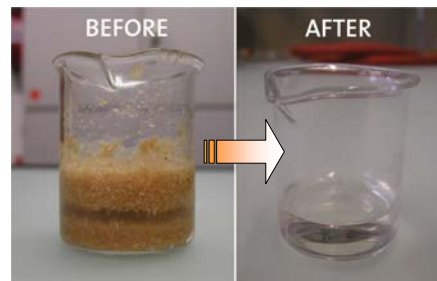
Residual carbon in liquid product (water):



Liquefaction, Products w/o catalyst and quench experiment

Complete gasification

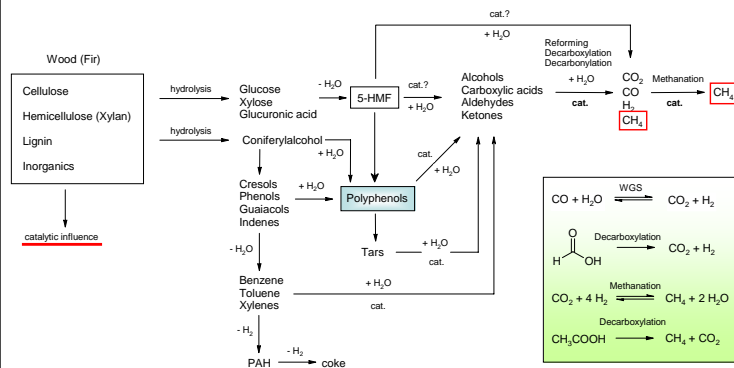
Reactant mixture and liquid product:



Complete Conversion

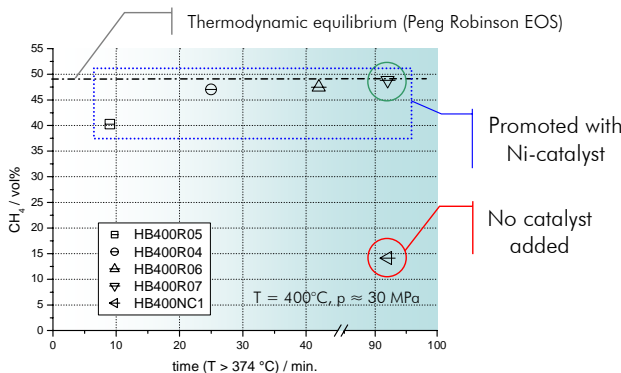
Products: water and gases

Proposed reaction network:



Results

Gas composition achieved (selected experiments):



Promoted with Ni-catalyst

No catalyst added

Very close to thermodynamic equilibrium

Economics:

For a 20 MW_{th} plant (70% thermal process efficiency), SNG can be produced at a cost of:

- 10 USD/GJ for wood (price for wood 3.5 USD/GJ)
- 6 USD/GJ for zero-cost biomass (manure, sewage sludge)