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NORTH CAROLINA AGRICULTURAL AND TECHNICAL STATE UNIVERSITY

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Department: *Energy & Environmental Systems*

Dissertation Title: *"Experimental Studies and Process Modeling of Pyrolysis of Biomass to Biofuels and Chemicals"*

Major Professor: *Dr. Lijun Wang*

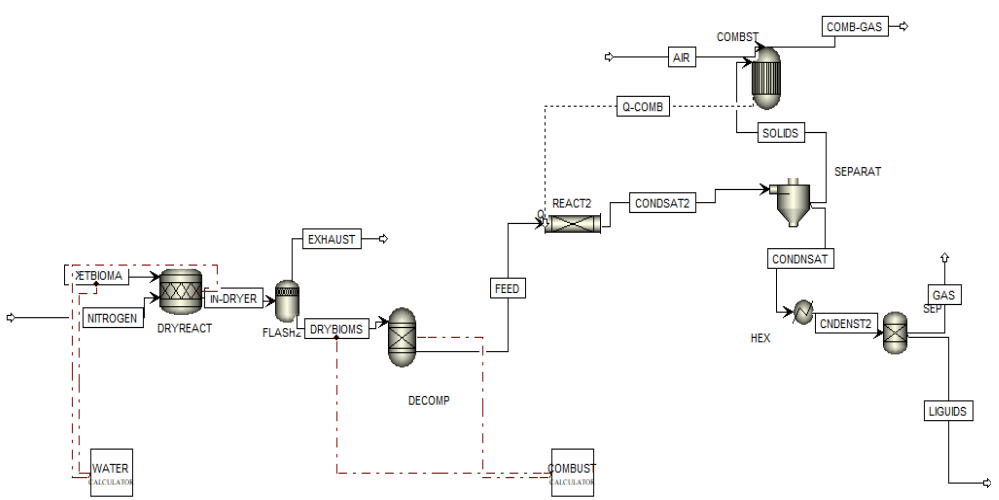

Fig 1. Simulation of pyrolysis of biomass to aromatic H.C

RESEARCH QUESTIONS / PROBLEMS:

- What is the effect of temperature on yields of aromatic hydrocarbons, bio-char and syngas?
- How does the yields of products compare with experimental results (model validation)
- What is the total capital investment (TCI) and operating cost (OC) for production of aromatic liquids?
- What is the effect of plant size on cost of aromatics?
- What is the effect of changing process conditions on cost of aromatics?

METHODS:

- A kinetic rate equation for the formation of aromatic compounds was incorporated in Aspen Plus V8.8
- Raw wood biomass, torrefied wood and co-pyrolysis of wood and polyethylene plastic of known elemental compositions were simulated in Aspen Plus
- The pyrolysis process was simulated as combination of Yield, Plug Flow and Gibbs reactors in Aspen Plus
- Economic and sensitivity analysis were performed

RESULTS / FINDINGS:

- The aromatic yield increased from 29.6% to 38.0% while char and syngas yield decreased from 25.5 to 15.2% and 5.2% to 3.9% respectively as temperature increased from 400 to 700^{o}C.
- Torrefied wood showed decreased aromatic yields while co-pyrolysis of wood and polyethylene plastic showed significantly increased aromatic yields.
- Production cost of aromatic hydrocarbon was $2.48 per gallon for the pyrolysis plant with 25 MT per day wood biomass loading capacity

SIGNIFICANCE / IMPLICATIONS:

- This study provides information and data for the technical and economic assessment of production of aromatic hydrocarbon compounds from waste wood biomass.