Introduction
A major advantage of Biomass Gasification is that any type of biomass (including low cost feeds e.g., agricultural residues, forest waste etc) can be converted to syngas. Pyrolysis and Char gasification proceed sequentially.

The objectives of this research are two-fold: (1) to obtain experimental data on the rates of carbon gasification and formation of tar and hydrocarbon contaminants during pressurized gasification of biomass as a function of operating parameters (pressure, temperature, gas-phase composition), and (2) to develop kinetic models that describe the carbon gasification rates and the formation of hydrocarbons and tar species.

Results
Effect of Temperature at Constant Pressure

![Image of char at different temperatures](Image)

Pine Char(LEFR, 1bar)-600 °C, 800 °C, 1000 °C. Increased pyrolysis of pine as temperature increases. The particles swell up and become more spherical.

Effect of Pressure at Constant Temperature

![Image of char at different pressures](Image)

Pine Char at 600 °C-1 bar, 5 bar, 10 bar: Char appears much more rounded at higher pressures than at 1 bar.

Gas Species evolution

Pyrolysis of Pine in PTGA was performed at 900 °C and at pressures 5-30 bar. Evolution of gas species was monitored over a period of time. The plots below show the evolution with time of major gas species (CO, CO2, H2, and CH4) at 5 bar and 30 bar. Integration of these signals over the entire run gave the total amount of a particular species at that pressure. The adjoining plots illustrate impact of pyrolysis pressure on major and minor gas species evolution.

Major light gases (CO, CO2, H2, and CH4) as well as ethylene and benzene increased with increasing pressure while oxygenated species and hydrocarbon fragments (CH3OH, C6H5OAcid, formaldehyde) decreased.

Conclusion and Path Forward

- Melting and reforming of chat at high pressures and temperatures lead to formation of an internal skeletal structure. Gas filled pores are formed at higher pressures. These pockets may contain high concentrations of primary pyrolysis products and lead to different pathways as compared to when primary gases escape the particles and become diluted.

- Char morphology and structure is strongly impacted by the increased pressure during devolatilization and is likely to affect char gasification activity. Surface area measurements will be done to supplement morphology studies.

- PTGA shows the significance of high pressure on the evolution of pyrolysis gases. The increase in pressure leads to an increase in evolution of major gas species. The analysis of gaseous exhaust from PEFR during pyrolysis/gasification will be done along similar lines.

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