The gasification of black liquor, as opposed to its combustion, offers many advantages to the pulp and paper industry such as increased energy efficiency and potential for higher value products and product diversification. Pressurizing the gasifier further increases the energy efficiency of the process and is necessary when using the syngas in a biorefinery. The effect of pressure on the physical characteristics of char is an important consideration in the overall effect of pressure on pyrolysis and gasification. Pressure can impact characteristics such as porosity, particle size, and pore diameter of the resultant char. Given the large differences in mass diffusion rates between gaseous and condensed phases, these characteristics could significantly impact the diffusion rates of the resultant chars.

A series of experiments were conducted using a pressurized entrained-flow reactor (PEFR) in which pyrolysis and gasification chars were generated at 900^{o}C and 5, 10, and 15 bars of total pressure. The gasification experiments were conducted at constant partial pressures of 0.25 bars H_2O and 0.5 bars CO_2. These chars were then analyzed using a suite of techniques for particle size distribution, surface area, porosity, and morphology. Results show that increasing pressure has the effect of:

- Decreasing particle porosity
- Increasing particle size
- Decreasing surface area at low carbon conversions.

The data indicate that the effect of pressure on black liquor gasification manifests itself as the black liquor devolatilizes after entering the reactor. The high liquor heating rates of the PEFR, which are similar to those of industrial gasifiers, make these observations particularly important to industry.

The char surface area became independent of pressure and dependent on carbon conversion at carbon conversions greater than 40%. Surface area was shown to go through a maximum near 60% carbon conversion before reducing as carbon conversion increases to 100%. Pore radii, Weisz moduli for gasification reactions, and critical diameters for chars generated at the experimental conditions were calculated and will be discussed.