**303f Effects of Biomass-Generated Syngas Constituents on Cell Growth, Product Distribution and Hydrogenase Activity of *Clostridium Carboxidivorans* P7$^T$**

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Previous studies have demonstrated the fermentation of biomass-generated syngas produced in a fluidized-bed gasifier to obtain end products such as ethanol and acetic acid. The fermentation system utilized a novel bacterium, *Clostridium carboxidivorans* P7$^T$. Several effects of the syngas, as compared to "clean" gases of similar composition, were observed during the fermentation including 1) growth inhibition of cells after 1.5 days, 2) immediate cessation of hydrogen consumption, and 3) a burst of ethanol production and a decrease in acetic acid production.

Syngas typically contains CO, CO2, and H2 (along with N2 and methane in certain cases). The syngas for this study, which was obtained from Switchgrass, also contained other trace species such as ethane, ethylene, acetylene, and nitric oxide (NO). Tars like benzene and toluene(both volatile and particulate) were also identified. Several of these "contaminants" of syngas were tested to determine the cause of cell dormancy. Additional cleaning of the syngas via a 0.025 μm filter negated cell dormancy while studies with other gaseous contaminants showed no effect on cell growth. Analysis of the filter using a scanning electron microscope showed the presence of tar particulates, suggesting that tars inhibited the cell growth. Batch studies in the presence of tars showed a similar growth-inhibition, confirming the above hypothesis.

As for hydrogen consumption, the bacterium converts CO, CO2 and H2 to biomass, acids and alcohols. Several enzymes play important roles in the process. The enzyme hydrogenase catalyzes the reversible conversion of hydrogen to electrons to allow for growth and product formation and thus plays a key role in the conversion efficiency of CO (and CO2) to products. NO is known to be a powerful inhibitor of hydrogenase and was detected (~140ppm) in the syngas. Studies were conducted to determine the extent of inhibition of hydrogenase activity as a function of NO concentration. The effect of various partial pressures of CO on hydrogenase activity was also determined as CO is another known inhibitor of the enzyme.

Finally, results will also be presented with regards to product redistribution although studies have not yet been completed to assess the reasons for the redistribution.