Production of high-valued chemicals from fractional catalytic pyrolysis of biomass

Foster A Agblevor and O. Mante*

Biological Engineering Department

Utah State University, Logan UT.

*Brookhaven National Laboratory, Upton, NY

Abstract

The production of high-valued chemicals from biomass feedstocks is a very important complementary activity that can make biofuels production economically viable and competitive with fossil derived fuels. Pyrolysis technology can convert biomass feedstocks into a complex mixture of oxygenated compounds and a small fraction of hydrocarbons depending on the feedstock and pyrolysis conditions. Traditional petrochemical separation methods do not yield useful results because the pyrolysis oils are too reactive and tend to form solids and so prevents useful separations. We have developed the fractional catalytic pyrolysis (FCP) method that uses catalysts to target specific decomposition products of the biomass during pyrolysis and converts them to a defined fraction of compounds. The oils are more stable and the pH is relatively high compared to conventional pyrolysis liquids. In the production of phenol-rich liquids, we used catalysts that targeted carbohydrate decomposition products and selectively gasified these components into C1 to C4 compounds and thus enriching the pyrolysis liquids in phenols. The phenols produced can be used for applications such as non-formaldehyde resins, phenol/formaldehyde resins, epoxidized novolacs and other products. We have also demonstrated that by judiciously selecting suitable catalysts, we can selectively convert the lignin fraction of the pyrolysis oils into gases and obtain anhydrosugar-rich liquids that can be used for various applications. Liquids generated using the fractional catalytic pyrolysis process require minimal post pyrolysis separation and can be used as is. Thus we have successfully substituted 95% of phenol with FCP oil in the preparation of phenol/formaldehyde resins and we have used the anhydrosugars-rich liquid to prepare biobased polyurethane foams.