ONE-POT SACCHARIFICATION AND FRACTIONATION OF LIGNOCELLULOSIC BIOMASS IN INORGANIC MOLTEN SALT HYDRATE MEDIUM TO PRODUCE HIGH-CONCENTRATION SUGAR AND HIGH-QUALITY LIGNIN

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Molten salt hydrates (MSH) have unique properties, such as high salt solubility, high boiling point elevation and freezing point depression, depressed water vapor pressure, high enthalpy of mixing, and enhanced acidity. Some MSHs have the ability to swell and even solubilize cellulose. Recently, we found that lignocellulosic biomass including corn stover, switchgrass, hardwood and softwood could be directly and quickly saccharified without any pretreatment and enzymes under moderate conditions (120-140 °C in 10-60 min) in molten salt hydrate systems. Both cellulose and hemicellulose in the biomass were completely hydrolyzed into fermentable sugars at high yield and selectivity (>90%) with limited sugar degradation. Meanwhile, lignin in the biomass remained as insoluble residue and could be easily separated from the sugars and salt. It was found that the lignin had high purity and low molecular weight and was soluble in many common solvents, suggesting that the lignin be significantly depolymerized during the saccharification and have good potential for co-product development. After the saccharification, the inorganic salt could be efficiently separated from the resultant sugars by means of liquid-liquid extraction and/or ion exclusion chromatography and reused in next batch of saccharification. It was also found that small amount of residual salt in the sugar stream did not inhibit fermentation of the sugar. In this presentation, we report our latest progress in this process, including proposed reaction mechanism, optimization of process conditions, establishment of mass balance, lignin characterization, and the separation and recovery of the salt.