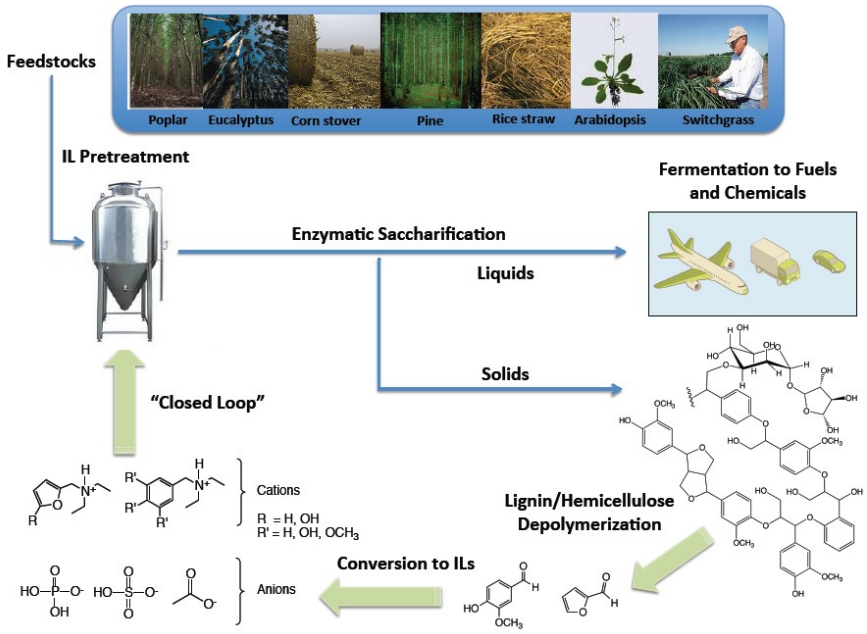
226. Efficient Biomass Pretreatment using renewable Ionic Liquids derived from Lignin and Hemicellulose

Seema Singh[1,4*], Aaron M. Socha[1,2], Ramakrishnan Parthasarathi[1,4], Jian Shi[1,4], Dorian Whyte[1,2], Maxime Bergeron[1], Sivakumar Pattathil[3], Sivasankari Venkatachalam[3], **Blake A. Simmons**[1,4]

Presenter email: ssingh@lbl.gov, seesing@sandia.gov

Abstract: Ionic liquids (ILs), solvents composed entirely of paired ions, have been utilized in a wide variety of applications. For Biomass pretreatment, imidazolium based ILs have shown remarkable potential as a solvent and reaction medium. Although very efficient, imidazolium cations are currently derived from petroleum, making this IL expensive and limiting its larger scale use and industrial deployment. In an attempt to replace imidazlium based ILs with ILs derived from renewable sources that retain their efficiency for biomass pretreatment, we synthesized a series of novel ILs from monomers derived from lignin and hemicellulose, the major byproducts of lignocellulosic biofuel production. Molecular modeling allowed for the selection of three ILs for biomass pretreatment studies. A comprehensive glycome profile of extractable cell wall carbohydrates and sugar yields from raw switchgrass and switchgrass pretreated with ILs derived from vanillin, *p*-anisaldehyde and furfural confirmed new ILs effectiveness for biomass pretreatment and comparable to those observed after pretreatment with 1-ethyl-3-methylimidazolium acetate. Our concept of deriving ILs from lignocellulosic biomass show potential of a closed loop process for future lignocellulosic biorefineries and has far- reaching economic impact for other IL based processes currently using ILs synthesized from petroleum sources.



Hypothetical process flow for a "closed-loop" bio-refinery using efficient renewable ionic liquids derived from lignocellulosic biomass.