Direct Biomass Conversion through the One-Pot Ionic Liquid Technology

Ezinne C. Achinivu[1,3]* (eachinivu@lbl.gov), Gabriella Papa,[2] Eric Sundstrom,[2] Fabrice Masson,[2] Junko Yaegashi,[1] Jipeng Yan,[2] Ning Sun,[2] Blake Simmons[1,4] and **John Gladden**[1,3]

[1]Deconstruction Division, Joint Bio Energy Institute, Emeryville, California; [2]Advanced Biofuels Process Development Unit, Lawrence Berkeley National Laboratory, Berkeley, California; [3]Biomass Science and Conversion Technology, Sandia National Laboratories, Livermore, California; and [4]Biological Systems and Engineering Division, Lawrence Berkeley National Laboratory, Berkeley, California

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Project Goals: Pretreatment using ionic liquids (ILs) is one of the most effective methods for producing high yields of biomass-derived fermentable sugars. We are also exploring the utility of a related class of compounds, deep eutectic solvents, for their ability to pretreat lignocellulose. Our current research focuses on developing IL pretreatment technologies that enable the efficient depolymerization of both polysaccharides and lignin that can be tightly integrated with downstream processes, including saccharification and fermentation.

Successfully attaining a low-cost, high efficiency, lignocellulose deconstruction is a critical step towards the widespread adoption of lignocellulosic biofuels. Renewable ionic liquids (ILs) are a novel alternative solvent for biomass pretreatment and conversion. The use of bio-derived ILs such as choline lysinate [Ch][Lys] in a ***one-pot process*** reduces the need for solid-liquid separations and water washing of pretreated solids. This unconventional approach results in an increased techno-economic and environmentally benign process and will enable the direct commercialization of lignocellulosic biofuels. To assess the potential of the "one pot" ionic liquid-based configuration, different feedstocks including grasses and woody biomass (sorghum and poplar) were pretreated with the IL choline lysinate. Sorghum and poplar were pretreated at high solid loading of (15-30 wt%) using IL/water solution of [Ch][Lys] (7 wt%) at [120-160] °C for 1-3 h. After extensive process optimization, a glucose titer of ~50 g/L and 60 g/L was achieved from sorghum and poplar, respectively. These hydrolysates were then converted to advanced biofuels using the *Rhodosporidium toruloides* conversion host, demonstrating a complete feedstocks-to-fuels pipeline. Therefore, this approach has been demonstrated to be an efficient means to deconstruct and convert biomass to biofuels.[1,2,3] The fully consolidated process eliminates the requirement for IL separation prior to saccharification and fermentation thereby improving the potential for commercialization of lignocellulosic biofuels.

References

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