Sandia National Laboratories

# Biofuels: Ionic Liquid Processing

*Increasing sugar yields from diverse biomass feedstock with ionic liquid processing and cultivation of renewable ionic liquids*

## Liberating Sugars from Biomass

Lignocellulose, one of the most abundant plants on Earth, has the potential to displace a substantial portion of the fossil fuels currently consumed within the transportation sector. Converting lignocellulose to biofuels requires the disruption of the lignin-carbohydrate complex within the plant and conversion into fermentable sugars suitable for producing fuels. Current processes require multiple steps that are time and water intensive, and utilize expensive enzyme treatments making lignocellulose a viable but costly-to-produce renewable. Utilizing ionic liquid-based pretreatments to break down the lignin-carbohydrate complex and generate a product that is readily converted into fermentable sugars, will improve the economies of advanced biofuels production from lignocellulose.

## Diverse Feedstocks

Sandia National Laboratories is developing ionic liquid (IL) based pretreatment technologies for biomass processing that increases the sugar yields from a variety of lignocellulosic feedstocks including:

- Agriculture Waste
- Woody Biomass
- Mixed Feedstocks
- Municipal Solid Waste (MSW)

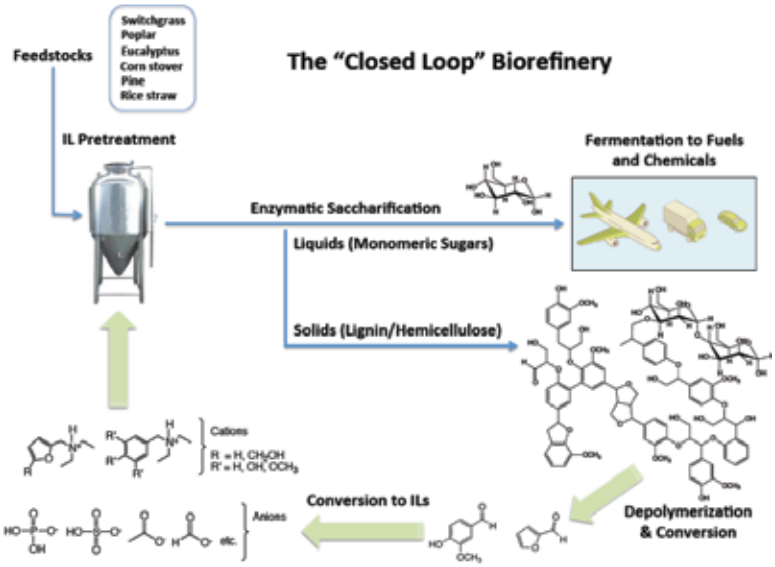
*Sandia Researchers are investigating blending options to maximize sugar yields. Municipal Solid Waste (MSW) has the potential to be a cost effective blending agent with other lignocellulose feedstocks that will drive down the cost of biomass to biofuels conversion.*

## Sandia researchers have developed a feedstock agnostic ionic liquid pretreatment process that:

- Enables more than 90% sugar recovery
- Utilizes 1/10th the enzyme loading of previous processes
- Offers faster saccharification (converting carbs to sugar) kinetics
- Uses renewable ionic liquids derived from lignin
- Recycles ionic liquid after pretreatment
- Uses less water than current processes

## One Pot to Prep Biomass

The “One Pot” pretreatment process developed by Sandia researchers is streamlining the process of converting biomass into biofuel. By combining ionic liquid pretreatment and saccharification into a single vessel, it eliminates the wash cycle currently used to remove ionic liquid from biomass before enzymes are added in saccharification. This also drastically simplifies the downstream sugar / lignin recovery process and enables the ionic liquid to be recycled; all factors that help drive down biofuel production costs. This process was recently scaled up at the Advanced Biofuels Process Demonstration Unit (ABPDU) at JBEI; resulting in production of high sugar yields.




*The lignin and hemicellulose derived from biomass was used to synthesize novel renewable ionic liquids enabling for the first time a closed-loop process viable for future lignocellulosic biorefineries.*

## Current Process


## New One Pot Process


## Accelerating Innovation at JBEI

The Joint BioEnergy Institute (JBEI) is a U.S. DOE BioEnergy Research Center in Emeryville, California that is investigating the efficient conversion of lignocellulosic biomass into fuels. Sandia joined Lawrence Berkeley, Lawrence Livermore and Pacific Northwest national labs, the UC Campuses of Berkeley and Davis and the Carnegie Institution of Science in the formation of JBEI. Currently, Sandia researchers lead the deconstruction division that is focused on liberating sugars from biomass.

# Partnership Opportunities Available

Sandia has a variety of current ionic liquid pretreatment processes available for license. Research is continuing on optimizing and augmenting enzyme cocktails to improve sugar yields, and identifying other ionic liquids that are even easier on hydrolyzing enzymes than current sources.

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BIOENERGY TECHNOLOGIES OFFICE

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