NREL Highlights SCIENCE

High-Speed Pipeline Revs Up Biomass Analysis

High-throughput system can analyze thousands of poplar, maize, and switch grass samples at a time to help determine which biomass feedstocks are best suited for biofuels.

Researchers at the National Renewable Energy Laboratory (NREL) have developed a new biomass evaluation process that opens up research avenues into understanding and manipulating biomass recalcitrance.

Plants evolved to resist degradation, and efficient conversion of recalcitrant plant cell walls to sugars (biomass recalcitrance) is a major technical challenge to producing cost-competitive, sustainable biofuels. Measuring this conversion process is difficult, costly, and slow. Standard bench-scale pretreatment and enzyme hydrolysis assays require dozens of labor hours per sample and are limited to a few dozen samples per week. The inability to analyze samples in high throughput has limited research to evaluating feedstock processing condition and relationships without gaining any understanding of the underlying recalcitrance factors. NREL's novel high-throughput (HTP) system has increased throughput more than 100-fold, opening up new research avenues. Rapid HTP biomass conversion allows researchers to probe the complex influences of genetic and environmental factors on biomass recalcitrance using thousands of diverse samples. NREL has coupled this HTP recalcitrance pipeline with HTP compositional analysis and HTP genome sequencing at DOE's Joint Genome Institute and other research partners to elucidate the complex relationships between genetic variation, plant cell wall composition, and biomass recalcitrance, as well as HTP enzyme evaluations.

This research will lead directly to improved biomass conversion technologies and, ultimately, economically viable and sustainable lignocellulosic-derived biofuels.

NREL scientists have published this work in several peer-reviewed manuscripts, presented it at numerous international conferences, and filed one patent application. A local Colorado fabrication company is currently manufacturing the technology under license.

References: Decker, Stephen R.; Brubecky, Roman; Tucker, Melvin P.; Himmel, Michael E.; and Selig, Michael E. "High-Throughput Screening Techniques for Biomass Conversion." *BioEnergy Research* 2:179-192.

Selig, M. J., M. P. Tucker, R. W. Sykes, K. L. Reichel, R. Brunecky, M. E. Himmel, M. F. Davis, and S. R. Decker. (2010). "Biomass Recalcitrance Screening by Integrated High Throughput Hydrothermal Pretreatment and Enzymatic Saccharification." *Industrial Biotechnology*, 6:104-111.

Photo by Patrick Corkery, NREL/PIX 17132

Key Research Results

Achievement

NREL developed the world's first high-throughput biomass assay system, coupling compositional analysis with thermochemical pretreatment and enzymatic hydrolysis assays to evaluate plant cell wall recalcitrance and identify those genetic and environmental factors that influence recalcitrance.

Result

This system can screen thousands of samples per week with the same effort it takes bench-scale processes to screen a few dozen samples.

Potential Impact

This research will lead directly to improved biomass conversion technologies and bring the United States closer to the production of large-scale, economically viable lignocellulosic biofuels.

NREL
NATIONAL RENEWABLE ENERGY LABORATORY

1617 Cole Boulevard | Golden, Colorado 80401-3305 | 303-275-3000 | www.nrel.gov

NREL is a national laboratory of the U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, operated by the Alliance for Sustainable Energy, LLC.

NREL/FS-2700-50849 • February 2011