

223. High-throughput cellulase activity profiling on ionic liquid pretreated biomass

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Project Goals: To develop a database of lignocellulosytic enzymes whose activities have been characterized across a matrix of conditions (T, pH, ionic liquid concentration) to identify the enzyme features that govern activity.

Abstract

Technoeconomic modeling at JBEI shows that an industrial cellulosic biofuel process based on the ionic liquid 1-ethyl-3-methylimidazolium acetate can be cost-competitive with fossil fuels provided that cellulases can be found with activity at ≥ 70 °C in $\geq 20\%$ ionic liquid[1]. To identify cellulases compatible with ionic liquids, our high-throughput pipeline must rapidly and thoroughly profile candidates. Discovery of cellulases with activity in the presence of ionic liquids has been hampered by labor-intensive, low-throughput assays and poor model substrates. Using standard liquid handling robots, we have developed jSALSA – an automated, high-throughput process for precisely dispensing sub-milligram quantities of ionic liquid pretreated biomass. With this solid substrate in microplate format, we are thoroughly profiling cellulase activities as a function of temperature, pH and ionic liquid concentration. This dataset will allow us to (1) understand the response of enzyme activity to ionic liquid pretreatment conditions and downstream saccharification requirements (2) explore correlations between protein sequence, thermotolerance and ionic liquid tolerance and (3) select the best matched set of candidate enzymes for optimization of multi-component cellulase mixtures.

References

1. Klein Marcuschamer D, Simmons BA, Blanch HW (2011) Techno-economic analysis of a lignocellulosic ethanol biorefinery with ionic liquid pre-treatment. *Biofuels, Bioproducts and Biorefining*; 5: 562–569.