Synthetic Chemical Probes for Studying Lignin Deconstruction and Analysis of Biofuel Molecules Using nanostructure-initiator Mass Spectrometry (NIMS)

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Project goal: To develop analytical tools to study enzyme function during lignin depolymerization and evaluate strains for biofuel production by utilizing bioconjugation chemistry and mass spectrometry readout. Adaptation of these tools in our automation platform will enable high throughput quantitation of enzyme or microbial strain libraries.

Lignocellulosic biomass is primarily composed of two polysaccharides (cellulose, hemicellulose) and a phenylpropanoid polymer (lignin). The complexity of the biomass structure requires the development and optimization of effective and affordable enzyme mixtures for depolymerization of these substrates. In addition, a robust and rapid method to screen biofuel-producing strains for desired products is needed to support development and optimization of strains with high titer, rate and yield. In order to meet these crucial challenges, we are developing mass spectrometry based assays that are high-throughput, small sample volume, good sensitivity and importantly, the integration of these screening technologies to automated workstations that facilitate the quantitative annotation of enzyme or microbial strain libraries. Central to our approach is to use synthetic organic chemistry to prepare chemical probes that enhance nanostructure-initiator mass spectrometry (NIMS) based analysis. This includes model substrates suitable for screening the activities of cellulases, hemicellulases and ligninases. This poster will focus on our progress on the development of model substrates to study ligninases and our approach to detecting alcohol products (fatty alcohol et. al) from biofuel production strains.

References

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