



'Characterizing lignocellulosics from Biomass to Bioethanol'

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PROGRAM DESCRIPTION

- This project aims to develop a fundamental understanding of the composition of biomass feedstock and the impact of chemical and enzymatic processing on its constituents
- Three different feedstocks being studied
 - Softwood
 - Hardwood
 - Agro-energy crop
- Diverse pretreatment strategies are being investigated for the biomass feedstocks
- Impact of pretreatments on chemical structure and reactivity towards enzymatic hydrolysis is being studied



TECHNICAL DETAILS

- Cellulose ultra-structure studied using solid-state CP/MAS ^{13}C NMR
- Determination of lignin structure with quantitative ^{13}C and ^{31}P NMR
- Lignin and cellulose molecular weight distribution measured with GPC
- Carbohydrate profile and glucose release during enzymatic hydrolysis quantified by HPLC



PAYOFF

Detailed characterization of biomass is essential for the efficient processing of biomass feedstocks to biofuels and gives insights on:

- Reducing recalcitrance caused by
 - Lignin fragments, extractives, hydrolyzed biomass fragments
- Inorganic elements
 - Waste and process equipment management strategies
- Cellulose crystallinity
 - Influences reactivity of cellulose towards enzymes

KEY ACCOMPLISHMENTS

- Developed understanding of the changes in lignin structure during dilute acid and organosolv pretreatment of softwood biomass
 - Residual lignin is more condensed
 - Organosolv lignin has low molecular weight and higher phenolic content and is well suited as a value-add co-product
- Determined changes in cellulose structure and crystallinity during dilute acid pretreatment of softwood
 - cellulose crystallinity increases (less ordered forms of cellulose being preferentially degraded)
- Developed novel pretreatment strategy for hardwoods



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