‘Advanced Biomass Characterization’
Nan Jiang

PROGRAM DESCRIPTION
• Characterization of plant cell walls, particularly lignin, is crucial for biofuel and biomaterial research.
• Development of novel ionic liquid system for biomass dissolution.
• Direct dissolution and NMR analysis of the whole plant cell walls via perdeuterated ionic liquids.
• Determination of inter-unit lignin bonding, lignin content, H:S:G lignin ratios; hemicelluloses, LCC

PAYOFF
• 13C NMR spectra of biomass show detailed lignin structures and be used to determine H/S/G lignin ratio.
• 2D HSQC spectra of biomass give H, S, G lignin cross signals and other lignin side-chain signals.
• 1H NMR spectra can be used to determine lignin content via Linear Extrapolation method.
• Facile characterization of whole cell biomass
• Improved processing of biomass to biofuels

TECHNICAL DETAILS
• Pyridinium-based ionic liquid [Hpyr]Cl prove optimum for IL/DMSO-d6 bi-solvent system for biomass dissolution.
• Perdeuterated ionic liquid [Hpyr]Cl-d6 was simply prepared for NMR characterization of the plant cell walls.
• Both ball-milled and Wiley milled (20 mesh) biomass samples can be dissolved in [Hpyr]Cl-d6/DMSO-d6 (solubilities up to 100mg/g).

Fig 2. Preparation and 1H NMR spectra of [Hpyr]Cl-d6

KEY ACCOMPLISHMENTS
• Develop novel perdeuterated system for direct dissolution and NMR characterization of biomass
• 13C NMR and 2D HSQC spectra of biomass reveal detailed lignin structure.
• 1H and 13C NMR analysis of biomass provide fast and efficient determination of lignin content and H/S/G lignin ratio.
• Identify key recalcitrance components of biomass

Professor AJ Ragauskas, Supervisor