

HIGH THROUGHPUT ANALYSIS METHODS FOR SHORT-ROTATION CROPS

Timothy G. Rials* and Nicole Labbé

The Institute of Agriculture, University of Tennessee

While biomass yield is a convenient measure of the potential of short-rotation crops as feedstock for bioenergy and biofuels, other characteristics may ultimately determine overall quality for a particular conversion platform. Chemical composition, especially total sugars, will impact ethanol yield from biochemical processes. Inorganic compounds present in the biomass will influence the amount and type of residue from thermochemical conversion methods like pyrolysis and gasification. Information on these fundamental measures of biomass quality is limited, largely because of the time and expense associated with the laboratory techniques required to determine the chemical, physical, and mechanical properties of lignocellulosic material. Recently, several spectroscopy techniques have been developed as high-throughput analytical tools that make it possible to quickly determine fundamental characteristics of biomass, including chemical composition.

Near Infrared Spectroscopy (NIRS) and Laser-Induced Breakdown Spectroscopy (LIBS) are of particular utility because of the complementary information they provide, and because they are both rugged and robust instruments. NIRS provides data on the organic matrix, and LIBS on the inorganic composition of biomass. Recent advances in the use of multivariate statistical methods for analysis make it possible to obtain the complete chemistry of the biomass. Projection to latent structures modeling allows development of calibration curves to predict the properties of interest. Typical correlation coefficients (R^2) for cellulose content predicted from NIRS data are 0.90 or above. Importantly, this capability reduces the time for analysis to seconds, and the expense to pennies. This presentation will describe applications of high-throughput methods for biomass assessment, and discuss the implications for future advances.

KEY WORDS: chemical composition, spectroscopy techniques, multivariate analysis

*Corresponding author: University of Tennessee, Institute of Agriculture, Forest Product Center and Sun Grant Center, 2506 Jacob Drive, Knoxville, TN 37996-4570; Phone: (865) 946-1130; Email: trials@utk.edu