CORRELATING LASER-INDUCED BREAKDOWN SPECTROSCOPY (LIBS) AND NEUTRON ACTIVATION ANALYSIS (NAA) FOR RESOLVING THE SPATIAL VARIATION IN THE POPULUS TRICHOCARPA LEAF IONOME

Madhavi Martin[1], David Glasgow[2], Timothy Tschaplinski[1], Gerald A. Tuskan[1], Lee E. Gunter[1], Nancy Engle[1], Ann Wymore[1], David J. Weston[1,3]

[1]Biological Sciences Division at Oak Ridge National Laboratory, Oak Ridge, TN 37831, USA,

[2]Chemical Sciences Division at Oak Ridge National Laboratory, Oak Ridge, TN 37831, USA,

[3]Climate Change Science Institute, Oak Ridge National Laboratory, Oak Ridge TN, 37831

Contact e-mail: martinm1@ornl.gov

Abstract:

The black cottonwood poplar (*Populus trichocarpa*) leaf ionome (inorganic trace elements and mineral nutrients) is an important aspect for determining the physiological and developmental processes contributing to biomass production. A number of techniques are used to measure the ionome, yet characterizing the leaf tissue and organ spatial heterogeneity remains a challenge, especially in solid samples. Laser-induced breakdown spectroscopy (LIBS) has been used to determine the elemental composition of leaves and is able to raster across solid matrixes at 10 micrometer resolution. Here, we evaluate the use of LIBS for solid sample leaf elemental characterization in relation to neutron activation. In fact, neutron activation analysis is a laboratory-based technique which is used by the National Institute of Standards and Technology (NIST) to certify trace elements in candidate reference materials including plant leaf matrices. Introduction to the techniques used in this research will be presented. NAA data will be correlated to the LIBS spectra to achieve quantification of the elements or ions present within poplar leaves. The regression coefficients of calibration and validation using multivariate analysis methodology for six out of seven elements have been determined. The range for the regression coefficients were determined to be between 0.81 and 0.99. LIBS and NAA data will be presented for the elements such as, calcium, magnesium, manganese, aluminum, copper, and potassium. This research shows that LIBS can be used as a faster, high resolution technique to quantify elements in such large-scale field phenotyping projects in the future.