Prediction of Extractives and Lignin Contents and Classification of Anatolian Black Pine (Pinus nigra Arn. Var Pallasiana) and Turkish Pine (Pinus brutia Ten.) Trees Using Infrared Spectroscopy and Multivariate Analysis

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Determination of quality parameters such as extractives and lignin contents of wood samples by wet chemistry analyses takes long time. Near infrared (NIR) and mid-infrared (MIR) spectroscopy coupled with multivariate calibration offer a fast and nondestructive alternative to obtain reliable results. However, due to the complexity of the multi-wavelength spectra, some wavelength selection is generally required to improve the predictive ability of multivariate calibration methods. Turkish pine and Anatolian black pine trees are the most growing pine species in Turkey. Determination of extractives and lignin contents of wood provides information to tree breeders when to cut and on how much chemical needs to be used in pulping and bleaching process. In this study, 58 samples of Turkish pine and 51 samples of Anatolian black pine trees were collected to investigate the correlation between NIR and MIR spectra of these trees and their extractives and lignin contents which were determined with standard reference (TAPPI) methods. Genetic inverse least squares (GILS) method was used for multivariate calibration [1]. Standard error of calibration (SEC) values were less than 1.86% (w/w) for lignin and 1.19% (w/w) for extractives whereas standard error of prediction (SEP) values were less than 3.81% (w/w) for lignin and 2.04% (w/w) for extractives. Resulting $R^2$ values for all calibrations were larger than 0.8. Classification for Turkish pine and Anatolian black pine trees was performed by genetic algorithm based principal component analysis (GAPCA) and these two pine species were classified by using NIR and MIR spectra.

References


Figure 1. GILS results for 51 Anatolian black pine samples with NIR spectroscopy.

Figure 2. Plot of PC scores of GAPCA results with MIR spectroscopy.