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PREDICTION OF BLACKWOOD WOOD AND PULP QUALITY PARAMETERS USING NIR-PLS-R SPECTRAL MODELLING: WAVENUMBER RANGES AND SMOOTHING POINTS

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A total of 120 *Acacia melanoxylon* R. Br. (Australian blackwood) stem discs, belonging to 20 trees from four sites in Portugal, were used in this study. Wood basic density was determined and pulp yield and fibre morphological characteristics were analysed using a standard Kraft pulping targeted to a kappa number of 15. NIR spectra of the solid wood and wood meal, and the unbleached pulps were recorded. The NIR spectral information was used for prediction using partial least squares regression (PLS-R) models of wood basic density, pulp yield, fibre morphological characteristics, Kappa number and ISO brightness. An analysis of the wavenumber ranges used by the models, as well the different smoothing points were made.

Wavenumber ranges from 8250-7494 + 5450-5304 cm⁻¹, 9087-5440 + 4605-4243 cm⁻¹, 7506-5440 cm⁻¹, 6110-5440 cm⁻¹ and 9404-7498 + 4605-4243 cm⁻¹ were identified respectively for basic density, pulp yield, fibre morphological characteristics, Kappa number and ISO brightness.

Smoothing points of 5, 9, 13, 17, 21, and 25 were used as pre-processing in derivatives models, obtained by applying the Savitzky-Golay algorithm filter and a second-order polynomial. The 17-point smoothing was the best option for wood basic density, fibre morphological characteristics and ISO brightness; while the 13 and 5-point smoothing respectively to pulp yield and Kappa number.

The results show that NIR spectral information of wood and pulps may be used for predicting a large array of parameters, with property-specific wavenumber range and smoothing.