

## 2D-NMR characterization of milled wood lignin from different eucalypt species

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Eucalypt species are grown as raw material for paper pulp manufacturing in Spain, Portugal, Brazil, South Africa and other countries. The use of eucalypt wood for paper pulp manufacture has greatly increased during last decades, world production attaining near 10 million tons per year (i.e. near one third of the total hardwood pulp produced). Among the different eucalypt species used by the paper pulp industry, *Eucalyptus globulus* provides the best raw material for kraft pulp manufacturing due to the high pulp yield and quality obtained. More information on the structure of lignin in eucalypt species is needed to optimize the use of this fast-growing forest crop for paper pulp manufacture. In this paper, the chemical structure of milled-wood lignin (MWL) from *Eucalyptus globulus*, *Eucalyptus nitens*, *Eucalyptus maidenii*, *Eucalyptus grandis* and *Eucalyptus dunnii* was thoroughly investigated using 2D-NMR spectroscopy. 2D-NMR provides information of the structure of the whole macromolecule and is a powerful tool for lignin structural characterization [1].

The HSQC spectra of the selected MWL showed three regions corresponding to aliphatic, side-chain and aromatic <sup>13</sup>C-<sup>1</sup>H correlations. The side-chain region of the spectra gave useful information about the inter-unit linkages present in the eucalypts MWL. All the lignins showed a predominance of β-O-4' ether linkages (66-72% of side-chains), followed by β-β' resinol-type linkages (16-19% of side-chains) and lower amounts of β-5' phenylcoumaran-type (3-7% of side-chains) and β-1' spirodienone-type linkages (1-4% of side-chains). The main cross-signals present in the aromatic region of the HSQC spectra corresponded to the benzenic rings of lignin units. Signals from syringyl (S) and guaiacyl (G) units could be observed in all the spectra, which revealed a predominance of S over G units and only traces of *p*-hydroxyphenyl (H) units. A NMR estimation of the molar S/G ratios in the different lignins was calculated, and ranged from 1.7 to 2.9. The highest S/G value corresponded to the *E. globulus* lignin while the lowest value corresponded to that from *E. grandis*.

[1] Ibarra, D., et al., Journal Agricultural Food Chemistry, **2007**, 55, 3477-3499.