

WOOD-EP-N₂



Wood composition of Eucalyptus and Poplar from pure and mixed plantations

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Context — Forest plantation sustainability is a major concern. The introduction of nitrogen-fixing species in forest plantations may provide an additional nitrogen input necessary for the intensification of production while reducing environmental hazards..

Objectives — The purpose of WOOD-EP-N₂ is two-fold : (1) to develop methods for the rapid characterization of wood components using analytic tools available in the collaborative technical platform Xylosciences in Nancy ; (2) to evaluate the impact of the introduction of nitrogen fixing tree species on the wood composition and quality of non nitrogen-fixing species. WOOD-EP-N₂ is a collaborative project with a multidisciplinary dimension

Approach — The study was performed on wood samples coming from two experimental plantations from temperate (poplar / black locust, St Cyr en Val, 3 years old in 2013) and tropical (eucalypt / acacia, Congo, 7 years old in 2013) areas. The analytical methods currently used in wood chemistry for wood analysis have been adapted to the analysis of a population of trees through a statistical approach (high throughput screening).

The analysis of the chemical composition of the wood of eucalyptus and poplar was performed by determining the levels of cellulose, holocellulose and lignin compounds after hydrolysis. The quantification of structural and non structural sugars was also established. Crystallinity Index (CrI) and crystallites size of cellulose and wood microdensitometry were determined through crystallographic and radiologic methods.

Key results — The presence of the nitrogen fixing species (black locust / acacia) seems to have a significant impact:

- on lignin contents of both woody species, poplar and eucalypt. Klason lignin for poplar and soluble lignin for eucalyptus were $\approx 2\%$ higher in mixed plantations;
- on wood density. Density of eucalyptus wood from mixed plantation was significantly higher.

On the other hand, there is no appreciable effect of the treatment:

- on the crystallinity and the crystallites size of cellulose;
- on the structural and non structural sugar compositions.

Main conclusions including key points of discussion — Methods allowing a rapid and efficient chemical and physical characterization of large series of wood samples were successfully developed. A significant effect of species mixture on lignin content and on wood density was shown. A low or a non significant impact on the content and on the microstructure of cellulose was observed.

Future perspectives — The modification of wood structure and composition observed in the mixed plantations has to be evaluated in terms of final uses. An increase of the wood density and of the lignin content could have a positive impact for the production of energy. Regarding the utilization in the field of pulp and paper, the impact of nitrogen fertilization seems to have no effect on the cellulose quality. On the other hand, higher lignin content could have a negative impact on the processes and pulp yields. These preliminary results have to be confirmed.

Valorisation —

Laamiri R., Z. Menana, N. Marron, J. Ruelle, L.S. Koutika, D. Epron, D. Gérant and N. Brosse. 2015. Wood composition of eucalyptus and poplar from pure and mixed plantations. Poster & oral presentations in Atelier REGEFOR 2015 (Atelier de Recherche et de Gestion forestière de Champenoux) de thématique « Les innovations dans les usages du bois interpellent la gestion forestière.