Editorial

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The COST action FP1105 – a research network to understand wood cell wall structure, biopolymer interaction and composition

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Wood, as a multi-purpose renewable resource, has been used by humans throughout history for energy, building materials and many derived products (paper, textiles and chemicals). The COST action FP1105 – entitled “Understanding wood cell wall structure, biopolymer interaction and composition: implications for current products and new material innovation” – was brought about to establish a pan-European network focusing on wood research including scientists and engineers from multiple institutes and universities throughout Europe and abroad. Supported by the EU Framework Programme Horizon 2020 from 2012 to 2016, the COST action FP1105 promoted a multi-disciplinary approach to integrate different fields of research to better understand wood formation and utilization from both a fundamental and applied point-of-views. Bringing together a vast array of complementary expertises – ranging from basic cell biologists, molecular biologists, biochemists, chemists, physicists, polymer and material scientists, mathematical modelers and product engineers – new insights and discoveries have been produced during the action. The COST action FP1105 not only promoted the dissemination of new breakthrough knowledge on wood formation but also paved the way for the latest and future developments of a more economically sustainable Forest Based Sector.

This special issue presents some examples of the successful research performed within the COST action FP1105. These include studies focusing on different aspects of wood formation and processing ranging from (i) the impact of the biomass origin on pulping, (ii) the modeling of woody biomass enzymatic disassembly, (iii) the physical properties of wood based resins and films to (iv) the reutilization of wood waste products. As all wood products can derive from multiple tree species, Svärd et al. (2016) investigate the impact of the biomass origin (softwood vs. hardwood) on the technical lignin properties produced during the kraft pulping process. Kraft derived technical lignin is currently under-utilized, Svärd et al. (2016) performed thorough characterization of the biochemical and physical properties of technical lignin produced from different wood species in response to different cooking time of the kraft process. These authors clearly observe the influence of the wood origin on the properties of kraft derived technical lignin, establishing the basis for a future utilization of this underused resource. Extending our understanding of woody biomass processing, the kinetic behavior of different hardwoods to enzymatic degradation is further analyzed by Valchev et al. (2016) by comparing the saccharification yields of different species and pretreatments. Valchev et al. (2016) show that cellulase activity was best described by a modified Prout-Tompkins (P-T) topochemical equation which opens a wide array of applications such as simulation and optimization of the saccharification process for larger scale production. The properties of wood derived products transformed into films and resins are also investigated within the COST action FP1105 in three studies presented in this special issue. An innovative technique is presented by Papadopoulou et al. (2016) who investigate the valorization of the hydro-soluble pyrolytic products of woody biomass generally considered as a waste product. Papadopoulou et al. (2016) use the aqueous phase of the pyrolysis of wood biomass to synthesize urea-formaldehyde (UF) resins which exhibited similar performance to conventional UF resins prepared from petrochemicals. Papadopoulou et al. (2016) breakthrough discovery opens new perspectives for resin synthesis from a renewable feedstock. In an aim to extend the uses of wood derived products, Žepič et al. (2016) investigate the properties of adding differenly acetylated cellulose nanofibrils (CNF) in polylactic acid (PLA) films. Clear improvement on film transparency and mechanical properties were obtained by introducing acetylated CNFs, thus opening new avenues for the reliable use of CNFs in bio-based polymer materials. As any product development requires the fine characterization of its properties, Ganser et al. (2016) estimate the limits
of atomic force microscopy (AFM) to characterize xylan coated cellulose films. However, Ganser et al. (2016) conclude that AFM did not allow a clear distinction between the different polymers of the film thereby defining the limit of this investigation method. Aiming to capitalize on all aspects of wood products, Janiszewska et al. (2016) investigate how sawdust waste can be reutilized as a binder for the production of wood particleboards with the same European quality standards as currently used in UF resins. The innovative approach used by Janiszewska et al. (2016) was achieved using liquefied sawdust mixtures of hardwood and softwood to partly replace UF resins in particleboards manufacturing.

The research made within the COST action FP1105 clearly enhances our understanding of wood formation and utilization by presenting innovative solutions [such as liquified wood use, Janiszewska et al. (2016) or wood pyrolysis, Papadopoulou et al. (2016)] extending the use of neglected resources derived from woody biomass. Moreover, a more precise understanding of the outcomes and the limits are also estimated for wood biomass saccharification (Valchev et al. 2016), characterization (Ganser et al. 2016) and conversion into bio-polymer based materials (Žepič et al. 2016). Finally, the articles presented in this special issue clearly demonstrate the importance of establishing and maintaining strong scientific pan-European networks such as the one initiated by the COST action FP1105.

References


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