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Influence of substitution of phenol by lignins in PF resins on the impregnation of kraft paper

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Decorative laminates are high density boards made of stacked Kraft papers impregnated with a phenolic resin that have been pressed and cured at high temperature. The quality of such laminates, in terms of avoidance of defects and mechanical properties, depends on the ability of the resin to impregnate the paper. The use of bio-based molecules such as lignins constitutes an eco-friendly and economic solution to substitute partially phenol, which is a toxic, in the resins polymers. The lignin materials, which are in the form of powder, have already relatively high molar weights according to their origin and need to be liquefied in the resin preparation. Such preparation provides different changes in the resin properties that can affect both the impregnability of the paper and the adhesive properties of the resin. In order to characterize the impregnation behavior of a resin with the porous substrate it is supposed to penetrate, measurements of conductivities of drops put on the surface of paper were carried out. Two lignins were tested: lignosulfonates and kraft, with two levels of phenol substitution. The effect of a phenolation pretreatment of the lignin material was also analyzed. According to their preparation (substitution level, lignin material, pretreatment), the resins drops penetrate Kraft paper relatively quickly. The more the phenolation substitution, the more a part of the liquid stays on the side the drop is put. The phenolation treatment of the Kraft lignin makes the resins penetrate the paper easier whereas the inverse behavior is observed when lignosulfonates are used. These results are compared with the visual observation of cross sections of impregnated papers and laminates made therefrom. The trend of resin to stay on the surfaces of paper rather than inside tends to make inhomogeneous cured layer in laminates and lower mechanical properties.

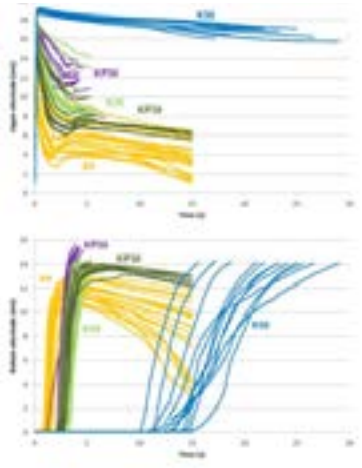

Figure 1: Conductivities curves of drops of resins put on the side of paper where they are put (above), and between the two surfaces of paper (below): (PF) control phenolic resin without lignin; (K30) resin with 30% phenol mass substitution by Kraft lignin; (KP30)) resin with 30% phenol mass substitution by Kraft lignin with phenolation pretreatment; (K50) resin with 50% phenol mass substitution by Kraft lignin; (KP50)) resin with 50% phenol mass substitution by Kraft lignin with phenolation pretreatment.

Biography

Marion Thébault got her Diploma of Wood Engineer (Master's degree) in ENSTIB (National School of Technologies and Industries of Wood, Epinal, France) in 2010 and worked as an R&D Engineer on special finishes for the wood-based furniture industry. She obtained her PhD in Science of Wood and Fibers in the University of Lorraine (France) in 2014. Many of her works until now concerns the valorization of biochemicals in materials such as adhesives, polymers, foams and composites, particularly tannins and lignins.

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