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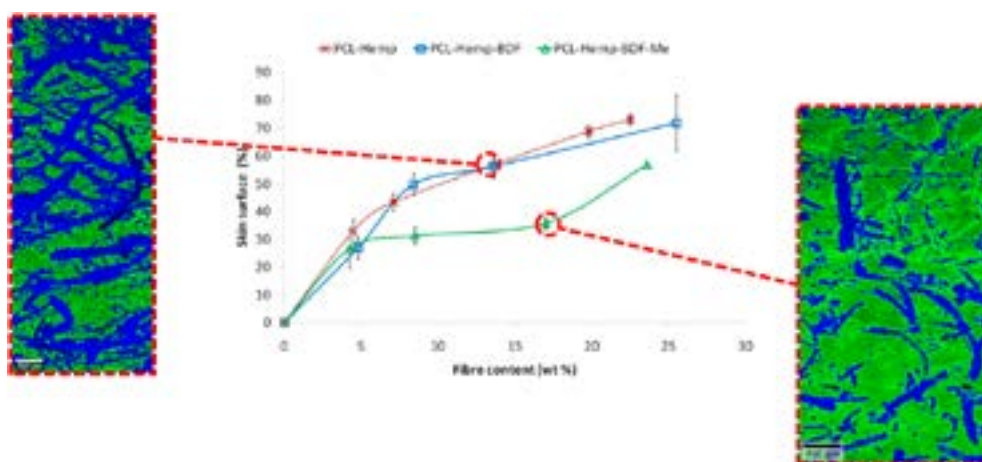
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How can a single methyl group drastically affect the microstructure of an injected biocomposite reinforced with natural fibers?

Antoine Gallos^{1,2}, Johnny Beaugrand², Gabriel Paes² and Florent Allais¹¹Chaire Agro-Biotechnologies Industrielles (Chaire ABI) – AgroParisTech CEEB, France²University of Reims Champagne-Ardenne, France

According to the global trend in the world, many studies are conducted to valorize plant biomass as materials. Plant fibers are used to reinforce composites and to enhance their properties. The lignin fraction produced by wood and paper industries, which is burnt now to produce energy, should be valorized through chemistry for the synthesis of high value-added compound. In this work, ferulic acid and its derivatives, which can be obtained from lignin, were used to influence the aspect ratio of lignocellulosic fibers, one of the key parameters for mechanical thermoplastic's fiber reinforcement. Two ferulic acid derivatives were synthesized by enzymatic chemistry following a green process and subsequently pulverized on hemp fibers. The first derivative was a macrobisphenol while the second one was obtained after the methylation of the phenolic functions of the latter. These pretreated lignocellulosic fibers were incorporated in a polycaprolactone matrix during a single screw extrusion process. Tensile test specimens were injected and mechanical properties were measured. Chemical analysis were conducted by SEC to measure the impact of the ferulic acid derivatives on the molar mass of the matrix. Rheological analysis provided information about the plasticizing effect of the ferulic acid derivatives on the materials. Hemp fibers, ferulic acid derivatives and crude polycaprolactone were also analyzed by Raman spectroscopy to define their spectral profile⁷. The microstructure of the composites was determined by Confocal Raman Imaging and was correlated with the mechanical properties measured by tensile tests. We evidenced that the very single methylation of the macrobisphenol led to significant differences on the mechanical properties and the structure of the composites. Two hypothesis were investigated to explain such effects: a stronger interaction between hemp fibers and ferulic acid derivative changing the microstructure and/or an increased plasticizing effect of the ferulic acid derivative on the polymeric matrix.



Biography

Antoine Gallos is a Postdoctoral Researcher in Dr. Florent Allais group at chaire-abi-agroparistech. He has 6 publications in peer-reviewed journals and 7 oral communications & 4 posters. His Research interest lies in Reactive extrusion and extrusion processes of composites and nanocomposites, Upscaling of the extrusion processes of polymeric materials.

antoine.gallos@agroparistech.fr