NANOCELLULOSE IN HIERARCHICAL NATURAL FIBRE COMPOSITES

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Natural fibre composites have gained attention during the last decade and are currently being used in a large number of applications. To enhance the performance of these composites, investigations have mainly focused on modifying the surface of the fibres or the interface between the fibres and matrices. Nonetheless, there is an unexplored option: to utilize hierarchy to improve the properties of natural fibre composites, by using a nanosized and green reinforcement, nanocellulose. How? By utilizing the fact that nanocellulose can form a strong network structure, which can entrap natural fibres [1] (or/and polymer fibres). Different manufacturing methods have been used to create these hierarchical natural fibre composites, depending if the matrix used was a thermoplastic or a thermoset polymer [2,3]. Nevertheless, does the nanocellulose reinforcement always increase the properties of the hierarchical natural fibre composites? No, it strongly depends on the type of fibres and matrices used. In this work, hierarchical natural fibre composites were manufactured and the effect of the nanocellulose on the mechanical performance of the composites will be presented and discussed. It was observed that when thermoplastic polymers were used as matrix, the viscosity of the polymer melt was a key factor determining the effect of the nanocellulose on the performance of the composites. When using thermoset matrices, the nanocellulose reinforcement increased the mechanical performance of the composites when the main reinforcing fibres (natural fibres) and (not or) the matrix to be reinforced were low or medium performance fibres/polymers.

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[3] Lee, K.-Y.; Ho, K. K. C.; Schlufter, K.; Bismarck, A., Hierarchical composites reinforced with robust short sisal fibre preforms utilising bacterial cellulose as binder. *Compos. Sci. Technol* **2012,** *72* (13), 1479-1486.