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Optimizing a plastination technique for preserving natural fibre composites

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ABSTRACT

Natural fibre-reinforced polymer composites (NFRPs) are highly sensitive to moisture. Exposure to water causes the fibres to swell and weakens their bond to the polymer matrix, thus deteriorating the composite's strength. Plastination is a new process that removes water from natural fibres and replaces it with a polymer—improving their resistance to moisture degradation. The process steps include dehydration where the water is replaced with acetone, forced polymer impregnation where the acetone is replaced by a polymer using vacuum pressure, and polymer curing. It has been shown that this process can reduce the degradation in mechanical properties of bamboo after soaking in water. Although these results are promising, plastination is lengthy, complex, and in need of optimization. In this work, the methods used to optimize the plastination process for treating bamboo will be presented, along with experimental results. Both the polymer curing, and dehydration steps have been improved by changing to a different polymer and using a higher process temperature, respectively. The forced polymer impregnation step was improved by lowering the vacuum pressure more quickly. Future work will focus on comparing the mechanical and physical properties of untreated bamboo samples with those of samples treated with the optimized plastination process. As well, the preliminary results from a feasibility study on the plastination of flax woven fabrics will be discussed.

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