Studies of Water Absorption Behavior of Plant Fibers at Different Temperatures

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Natural fibers have shown great promise in a variety of applications that were previously dominated by synthetic fibers due to their important aspects of biocompatibility, possible biodegradation, non-toxicity and abundance. Currently, the automotive and construction industries have been interested in composites reinforced with natural plant fibers as alternative materials for glass-fiber reinforced composites in structural applications with modest demands on strength reliability. It has been known that the high level of moisture absorption by natural fibers, the poor wettability, and the insufficient adhesion between untreated fibers and the polymeric matrix lead to bonding failure with age. Moreover the absorbed moisture has many detrimental effects on the mechanical performance of these fibers. Therefore, understanding of the hygroscopic properties of natural fibers is very important to improve the long-term performance of composites reinforced with these fibers. In the present study, we have taken different plant fibers such as leaf fiber of bowstring hemp, bark fiber of okra and seed fiber of betel nut, which are available in North East India to study their hygroscopic properties by using ordinary gravimetric methods. In order to study the hygroscopicity of these fibers, the gain in moisture content in the fibers due to water absorption was measured as a function of exposure time. The water absorptions behaviors of all fibres were studied at temperature range 300-340 K. All fibers displayed a two-stage diffusion behavior. The increase of diffusion with temperature indicated the activation of the diffusion process at higher temperature. The water uptake was found to increase with increasing temperature for all samples. The thermodynamic parameters of the sorption process, such as diffusion coefficients and corresponding activation energies were estimated.