448d Studies on Wood and Other Natural Fiber Reinforced Poly(Lactic Acid) Composites

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Environmentally friendly wood fiber reinforced poly(lactic acid) (PLA) composites were produced by extrusion followed by injection molding. Wood fiber-reinforced polypropylene (PP) composites were also processed and compared to PLA/wood fiber composites. The mechanical, thermal-mechanical and morphological properties of these composites have been studied. PLA/wood fiber composites have mechanical properties of sufficient magnitude to compare with conventional thermoplastic composites. The tensile and flexural properties of the PLA/wood fiber composites were significantly higher when compared with the virgin resin. The addition of 20 wt% of wood fibers in PLA/wood fiber composite improved the flexural strength of PLA by 19 %, the flexural modulus by 115 %, and the tensile strength and tensile modulus by 5 % and 77 % respectively. The flexural modulus (8.9 GPa) of the PLA/wood fiber composite (30 wt% fiber content) was comparable to that of traditional (i.e. polypropylene/wood fiber) composites (3.4 GPa). Incorporation of the wood fibers in PLA resulted in a considerable increase of the storage modulus (stiffness) and a decrease in the tan delta values. The addition of the maleated polyolefin coupling agent improved the flexural properties, Izod impact, and heat deflection temperature of the wood fiber reinforced composites. The morphology as indicated by scanning electron microscopy (SEM), showed good dispersion of wood fiber in the PLA matrix. Microstructure studies also indicated a significant interfacial bonding between the matrix and the wood fibers. The use of wood fibers, as reinforcements in PLA, gives interesting alternatives for production of low cost and ecologically friendly composites. Acknowledgements: The financial support from NSF-DMI 2004 award #0400296 for the project “PREMISE II: Design and Engineering of Green Composites From Biofibers and Bioplastics” as well as USDA-MBI Award Number 2002-34189-12748-S4057 for the project “Bioprocessing for Utilization of Agricultural Resources” are gratefully acknowledged.