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Development of potentially biodegradable cellulose nano-crystal reinforced PBS-HBPP bio-nanocomposites

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A cost effective green approach has been used for the preparation of cellulose nanocrystals (CNC) from isora fiber which is a bast fiber obtained from the bark of *Helicteres isora* plant. The process involves microwave liquefaction followed by persulfate treatment. CNC's were extensively characterized by SEM, TEM, AFM, TGA WAXRD etc; to establish the morphology, aspect ratio, crystallinity, thermal stability etc. The aim of this work is to study the property enhancement of poly butyl succinate (PBS)- hyper branched polyester polyols (HBPP) blends by adding CNC's at different proportions to give green composites with potential applications in areas such as food packaging and medicines. Biodegradable (PBS)/(HBPP) blended films were processed using a brabender twin-screw compounder machine. This paper reports a single step reactive extrusion process for the fabrication of thermally stable PBS-HBPP grafted CNC's bio nanocomposite films using dicumyl peroxide as a cross linking agent. The effect of addition of CNC particles on the mechanical, thermal and barrier properties of PBS-HBPP blends were studied. Spherulitic morphology, chemical structure and crystalline structure of neat PBS and PBS-HBPP blended films were examined by optical polarizing microscopy (OPM), FTIR spectroscopy and WAXRD, respectively. The addition of HBPP increased the toughness, and wettability of the film. FTIR spectroscopy studies showed that the PBS-HBPP blend was grafted on CNC through a stable C-C bond formation. This strong chemical link led to the efficient transfer of modulus of CNC's to the PBS-HBPP blend thereby increasing the tensile strength and young's modulus to a greater extent. Significant reduction in water vapor and oxygen permeability rates was also observed for PBS-HBPP nanocomposite over neat PBS. Experimentally, it was observed that the CNC's wt. content, size and morphology are the parameters that substantially influence the mechanical, thermal and barrier properties of the composite samples. The surface of the nano particles act as initiators for network formation, as observed by a scanning electron microscope (SEM) image of the fractured sample.

Biography

Lovely Mathew has completed her PhD from Cochin University of Science and Technology in 2006. She was the Professor of Chemistry Faculty in Newman College, Kerala since 1981. After her retirement in 2015, currently she is working as a Professor and Project Coordinator (Research) at the Viswajyothi College of Engineering and Technology, Kerala, India. She has published more than 20 papers in reputed international/national journals and has presented several research papers in various international conferences abroad. Her research area is natural fiber/nanocellulose reinforced polymer composites/nanocomposites. She has completed several major research projects funded by DST, UGC KSCSTE, etc. She is a Registered Guide of International and Inter University Centre for Nanoscience and Nanotechnology at the Mahatma Gandhi University, Kerala, India.

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