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Green bionanocomposites from renewable resources

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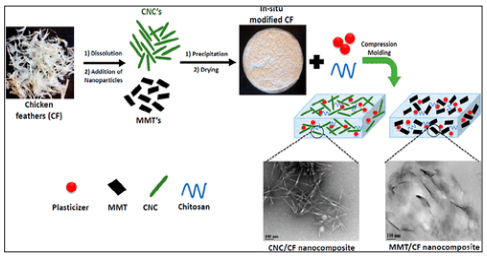

Biodegradability and renewability has led renewed interest in protein based films reinforced with nanoparticles. Bionanocomposites have gained attention because of their enhanced material properties with the aid of nano-reinforcements. The effects of two different nanoparticles, montmorillonite (MMT) and cellulose nano-crystals (CNCs), at different loading contents (0%, 1%, 3%, 5% and 10%) were studied as a reinforcement material in modified chicken feather keratin. Compression molding was employed to prepare bionanocomposites films thermo-plastically. The effect of CNC and MMT addition, their disposition and impact on the final material properties was investigated by differential scanning calorimetry (DSC), thermo-gravimetric analysis (TGA), tensile testing and dynamic mechanical analysis (DMA). The morphology of in situ modified keratin-based nano-composites and the extent of nanoparticle dispersion was observed through scanning electron microscopy (SEM), transmission electron microscopy (TEM) and wide-angle X-ray diffraction (WAXD), respectively. The molecular level interactions of CNC's and MMT's with keratin biopolymer were investigated by X-ray photoelectron spectroscopy (XPS) and Fourier transform infrared spectroscopy (FTIR) techniques. Results indicated improved thermal stability and shift in glass transition temperature for both nano-reinforced bio-composites. Tensile strength was enhanced significantly with the addition of MMT; however, increased percent elongation was observed in case of CNC-reinforced biomaterials. The changes in the chemical bonding of keratin biopolymer reinforced with MMT/CNC compared to neat keratin biopolymer were observed by XPS spectra. These results suggest that high performance bio-nanomaterials can be developed from feather keratin through in situ dispersion of MMT and CNC nanoparticles, followed by compression molding.

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Recent Publications

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2. Arshad M, Kaur M, Ullah A (2016) Green Biocomposites from Nanoengineered Hybrid Natural Fiber and Biopolymer. *ACS Sustainable Chemistry & Engineering*; 4(3): 1785-1793.

Biography

Aman Ullah received his PhD in Chemical Sciences and Technologies in 2010 at the University of Genova, Italy by working together at Southern Methodist University, USA. He worked as a postdoctoral fellow before accepting an Assistant Professor position at the University of Alberta. He has published more than 40 papers in reputed journals and three patents/patent applications. His research is focused on the development of biochemicals, biopolymers/biomaterials from lipids and other renewable resources.

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