

Cellulose nanocrystals/ZnO as a bifunctional reinforcing nanocomposite for poly (vinyl alcohol)/chitosan blend films: fabrication, characterization and properties

ABSTRACT

In this study, cellulose nanocrystals/zinc oxide (CNCs/ZnO) nanocomposites were dispersed as bifunctional nano-sized fillers into poly(vinyl alcohol) (PVA) and chitosan (Cs) blend by a solvent casting method to prepare PVA/Cs/CNCs/ZnO bio-nanocomposites films. The morphology, thermal, mechanical and UV-vis absorption properties, as well antimicrobial effects of the bio-nanocomposite films were investigated. It demonstrated that CNCs/ZnO were compatible with PVA/Cs and dispersed homogeneously in the polymer blend matrix. CNCs/ZnO improved tensile strength and modulus of PVA/Cs significantly. Tensile strength and modulus of bio-nanocomposite films increased from 55.0 to 153.2 MPa and from 395 to 932 MPa, respectively with increasing nano-sized filler amount from 0 to 5.0 wt %. The thermal stability of PVA/Cs was also enhanced at 1.0 wt % CNCs/ZnO loading. UV light can be efficiently absorbed by incorporating ZnO nanoparticles into a PVA/Cs matrix, signifying that these bio-nanocomposite films show good UV-shielding effects. Moreover, the biocomposites films showed antibacterial activity toward the bacterial species *Salmonella choleraesuis* and *Staphylococcus aureus*. The improved physical properties obtained by incorporating CNCs/ZnO can be useful in variety uses.

Keyword: Biocomposites; Cellulose nanocrystals; Bi-functional filler; Poly(vinyl alcohol)/chitosan blend; UV absorption