Cellulose nanofiber-incorporated PLA nanocomposite films with improved thermal and mechanical properties

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In recent years, cellulose nanofibers (CNFs) have attracted much attention owing to their inherent properties such as excellent mechanical performances as well as biodegradability and renewability. Therefore, incorporation of such nanofillers into polymer resin have been attempted to yield high performance nanocomposites. In this study, we also prepared PLA-based nanocomposite in the form of film by using CNFs, which were obtained via tetramethylpiperidine-1-oxyl (TEMPO)-catalyzed oxidation of native cellulose followed by physical exfoliation. The morphology, thermal, mechanical properties of resultant nanocomposites with various CNFs loadings were investigated. The tensile strength and modulus of the nanocomposite films with load of 15 wt% CNF were dramatically increased by 320% and 212%, respectively, compared to those of neat PLA film. In addition, it was revealed that the simple mixing time during blending is a significant process parameter to control intercalated or exfoliated nanostructure.