Preparation and Characterization of Cellulose Nanocrystal from Pineapple Leaves for Use in PLA/PBAT Composites

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Abstract:

This research involves utilizing CNCs technology derived from pineapple leaves to enhance the properties of polylactic acid (PLA) to create a nanocomposite film product with effective UV protection. It also examines the effects on other material properties, such as strength and flexibility, for practical applications of the polymer blend. The experimental process involves extracting nanocrystalline cellulose (CNCs) from pineapple leaves, which are treated through an alkali surface treatment, bleaching to remove lignin, and acid hydrolysis with sulfuric acid to obtain CNCs. The synthesized CNCs are then used as a filler in polylactic acid (PLA), which is blended with polybutylene adipate terephthalate (PBAT). The mixture is then formed into nanocomposite films and tested for various properties. The results showed that PLA/PBAT/CNCs films exhibited a reduction in mechanical properties, such as tensile strength and elongation at break. This is due to the CNCs agglomerating and distributing unevenly within the PLA/PBAT matrix. When the films were tested for UV absorption properties, it was found that the PLA film allowed light to pass through in the wavelength range of 200-224 nm, allowing both UV and visible light to transmit. In contrast, the nanocomposite PLA films exhibited reduced light transmission. Regarding the thermal stability of the PLA and PLA nanocomposite films, adding CNCs to PLA caused the recrystallization temperature (Tcc) to decrease, indicating slower molecular arrangement. At the same time, the melting temperature (Tm) increased when CNCs were added. The presence of two melting temperature peaks indicates the incompatibility between PLA/PBAT and CNCs.

Keywords:

Blends, PBAT, Pineapple leaves, PLA, Nanocellulose.