

The impact of chemically-treated carbonized wood fiber (CWF) in polyethylene oxide (PEO)/chitosan blend films

Abstract

In this study, we investigated the effect of acid/alkaline-treated carbonized wood fiber (CWF) in polyethylene oxide (PEO)/Chitosan (70/30) blend film prepared by solution casting. We investigated the electrical conductivity, crystallinity percentage, crystal orientation, tensile properties, and morphology of the blend films filled with 25 wt% of untreated and acid/alkaline-treated CWF. From the results, the film filled with acid-treated CWF displayed the highest electrical conductivity when compared to the films filled with untreated and alkali-treated CWF. The x-ray diffraction (XRD) diffractograms reveal that the film filled with acid-treated CWF has the lowest crystallinity than the films filled untreated and alkaline-treated CWF. The reduction in d-spacing for the films filled treated CWF suggested improved crystal orientation for the promotion of electron transfer. The tensile properties were not affected much by the incorporation of CWF regardless of untreated or treated filler. The films with treated CWF showed slightly lower tensile strength and modulus but slightly higher elongation at break. The tensile results agree with reduced crystallinity for the blend films with both acid and alkaline treated CWF. The surface morphology of the films investigated by scanning electron microscopy (SEM) also displayed better dispersion of the conducting CWF inside the PEO/Chitosan matrix for the blends with treated CWF. The improved dispersion is due to less blockage with the presence of more amorphous regions. The presence of a broad network bridge smoothens the transfer of electrons and increases electrical conductivity.

Keywords

Electrical conductivity, Crystal orientation, Crystal structure, Materials properties, Scanning electron microscopy, X-ray diffraction