

Preparation and characterization of fire retardant nano-filler from oil palm empty fruit bunch fibers

ABSTRACT

The possibilities of utilizing an abundantly available agricultural waste, oil palm empty fruit bunch (OPEFB) fibers, for the development of nano-filler was investigated. The aim was to develop fire retardant nano-fillers from OPEFB fiber through grinding, chemical treatment (bromine water and SnCl₂), and cryogenic crushing, followed by a high energy ball milling process. The structural, morphological, and thermal properties of nano-fillers were investigated by X-ray diffraction (XRD) and transmission electron microscopy (TEM). The analysis revealed that the particle size distribution was reduced from micro to nano size in the range of around 14 to 100 nm. Scanning electron microscopy (SEM) observations revealed that the nanoparticles of OPEFB had irregular shapes. The elemental composition of the OPEFB were investigated by elemental dispersive X-ray analysis (EDX), showing the presence of tin, carbon, oxygen, chlorine, and bromine elements both before and after ball milling. Further, thermo-gravimetric analysis (TGA) and *differential* scanning calorimetry (DSC) indicated that the developed nanofillers exhibited enhanced thermal properties compared to the untreated fibers. Such results suggest that the developed nano-filler can be used for the fabrication of nanocomposites with improved fire retardancy.

Keyword: Oil palm empty fruit bunch fibers; High energy ball milling; Nano-filler; Structural properties; Morphological properties; Thermal properties