Hybridization of MMT/lignocellulosic fiber reinforced polymer nanocomposites for structural applications: a review

ABSTRACT

In the recent past, significant research effort has been dedicated to examining the usage of nanomaterials hybridized with lignocellulosic fibers as reinforcement in the fabrication of polymer nanocomposites. The introduction of nanoparticles like montmorillonite (MMT) nanoclay was found to increase the strength, modulus of elasticity and stiffness of composites and provide thermal stability. The resulting composite materials has figured prominently in research and development efforts devoted to nanocomposites and are often used as strengthening agents, especially for structural applications. The distinct properties of MMT, namely its hydrophilicity, as well as high strength, high aspect ratio and high modulus, aids in the dispersion of this inorganic crystalline layer in water-soluble polymers. The ability of MMT nanoclay to intercalate into the interlayer space of monomers and polymers is used, followed by the exfoliation of filler particles into monolayers of nanoscale particles. The present review article intends to provide a general overview of the features of the structure, chemical composition, and properties of MMT nanoclay and lignocellulosic fibers. Some of the techniques used for obtaining polymer nanocomposites based on lignocellulosic fibers and MMT nanoclay are described: (i) conventional, (ii) intercalation, (iii) melt intercalation, and (iv) in situ polymerization methods. This review also comprehensively discusses the mechanical, thermal, and flame retardancy properties of MMT-based polymer nanocomposites. The valuable properties of MMT nanoclay and lignocellulose fibers allow us to expand the possibilities of using polymer nanocomposites in various advanced industrial applications.

Keyword: Bamboo; Kenaf; MMT; Natural fiber; Polymer composites