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REVIEW

Thermal stability of natural fibers and their polymer composites

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Abstract

Natural fiber-based composites are applied in many structural engineered products from civil constructions to automobile manufacturing due to the properties such as low density, high aspect ratio, biodegradability and ease to work. During the past decades such composites have been thoroughly studied for their mechanical properties and failure behavior and their properties compared with those of synthetic fiber-based composites. Other properties, such as the thermal behavior of natural fibers and composites, have also been studied because they determine the performance of their products possible. It deals with the effect of temperature on adhesive curing, effect of high temperature and fire damage during fabrication. Further, the thermal properties have equal importance in structural applications such as temperature transfer from end to end, load capacity at specific temperature, material behavior and dimensional stability at high temperature. In this respect the isothermal and non-isothermal thermogravimatric analyses are discussed and the improtance of glass transition temperature is studied during prepapration of composites to ensure their ultimate properties. Although there are several works that have been done on thermal behavior, especially thermogravimetric analysis of natural fibers and their composites, there is no review article available specially focused on natural fiber-based composites, hybrid composites, and nanocomposites. The aim of this review was to focus on the advances in the comprehension of thermogravimetric behavior of natural fibers and compare the effect of natural fibers as reinforced materials in polymer composites.

Keywords Thermogravimetric analysis · Natural fibers · Hybrid composites · Biopolymers · Nanocomposites

Introduction

Natural fibers are characterized as biodegradable, recyclable, and lignocellulosic fibers; however, recent studies have identified them as the best alternative to credible economics and natural protection [1]. Lignocellulosic fibers have many inherent advantages like non-abrasive nature, low energy consumption, high aspact ratio, low density, low cost, and biodegradability as compared to synthetic fibers [2–4]. Although the synthetic reinforced polymer composites possess higher mechanical properties in comparison to the natural fiber, they have a major limitation of being an environmental pollutant and non-biodegradabe material [5].

The advance application of composites is based on the detail study of high specific strength-to-weight and specific stiffness-to-weight ratios of composite [6]. Apart from these specific properties such as mechancial, physical, thermal and electrical properties [7], other fundamental aspects need to be focused is life cycle assesment of the products. Further, the environmental concerns of their production are aimed to

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