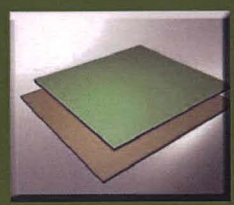
ADVANCES IN COMPOSITE MATERIALS



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Chapter 012

Thermal and Morphological Study of Biopolymer Cotton-Albumen Clay (BCAC) Composites

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Abstract: Research in clay-composites technology has been growing worldwide to formulate a new class of biodegradable and environmental friendly composite materials due to environmental concerns. The science of filling biopolymer has been practiced for many years in order to increase stiffness of the matrix. Thereby, this study concerns on fabricating of egg albumen reinforced cotton composites with two types of clay: nanoclay montmorillonite and ball clay were used as the fillers. Bio-polymer cotton albumen clay (BCAC) composites were prepared by dispersing the clays into albumen matrix, prior to the wetting of cotton layers through hands lay-up technique. The BCAC composites containing clay from 1-10 wt% were cured at room temperature, before the samples were prepared for thermal properties analysis and morphological study. Thermogravimetric analysis (TGA) illustrates that the nano-composites sample have less amount of absorbed water, increased in thermal stability by 125°C and better thermal decomposition at 80% weight loss. In addition, finer particles of the nano-clay montmorrillonite produced better wettability of bio-matrix albumen-clay to cotton compared to ball clay.

Introduction

The interest in clay-composites, nano-sized material dispersed within a matrix, has been increasing significantly in new era of polymeric materials. Due to the high surface area of the nano-material, the interfacial areas between the two combined phases are substantially higher than the traditional composite. Clay is an example of the nano-material reinforcement that has being incorporated in the polymer matrix to change and alter the matrix properties.

The literature reported the use of montmorillonite nanoclays as filler for composites in which the matrix polymers are synthetic polymers, such as polyimides, polyamides, methacrylates, and polystyrene [1]. Clay is a naturally abundant mineral material that is cost effective and toxin-free that can be used as one of the components for food, medical, cosmetic and healthcare recipients. Most products desire a balance between stiffness and impact properties of nanocomposites, using layered silicate structures of clay loadings of 10% or less. These clays enhance mechanical, thermal, dimensional and barrier properties [2]. Thermoplastic starch (TPS) reinforced by nanoclay has recently been investigated. Wang et.al [3] has investigated epoxy/clay composites with clay concentration from 1-3 wt% by