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PAPER

An inquisition on alkaline treated Banana/Sisal/Pineapple fiber epoxy composites for light to moderate load applications

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Abstract

To address the sustainable development goals, an attempt was made to investigate the alkaline treated and untreated Banana, Sisal, and Pineapple fiber epoxy hybrid composite for their mechanical and thermal properties. Tensile, Flexural, Impact, modulus, and Heat Deflection temperature (HDT) were evaluated and analyzed for low-load structural applications. The performance of Alkaline Treated Fiber composites was better than the untreated fiber composites. The treated Banana, Sisal, and Pineapple hybrid fiber epoxy composite has a high HDT value of about 78 °C, a maximum tensile strength of 104 MPa, a tensile modulus of 25 MPa, a flexural strength of 78 MPa, a flexural modulus of 5286 MPa,and an impact strength of 286 J m^{-1} when compared to other composites. Interfacial failure analysis was also carried out with the help of a Scanning Electron Microscope (SEM) to study the microstructural behavior of the tested specimens. It was observed that the alkaline treatment increases fiber-matrix interaction.

1. Introduction

Various bio-based products with improved and high performance have been developed inrecent years to address long-term environmental challenges. Engineers and scholars areconcerned about this issue since traditional resources are few and limited globally [1–4]. Petroleum and coal are two commodities that are highly helpful in creating a variety of goods for the automotive, aerospace, energy, and home markets. The output of plastics derived from petroleum increased dramatically from 1.5 million tonnes to 367 milliontonnes in 2020, according to Tiseo [5]. Since there are fewer conventional-based materialsupplies available, there is greater worldwide demand, which raises the price of rawmaterials significantly. As a result, the global community began to show increased interestin materials made from natural fibers, biopolymers, and biocomposites [6, 7].

Numerous natural fiber composites are respectable and have been successfully shown instudies. A variety of natural fiber composites, including jute, pineapple, bamboo, and kenaf, etc, have been studied in the past regarding their mechanical and physical features [1–7].

Natural fiber composites have a slew of drawbacks, including weak interfacial bonding and the hydrophilic nature of cellulose fiber. As a result of these, composites' poor mechanical, thermal, and physical properties may be caused. Thus, many researchers have suggested that fibers be modified using either chemical or physical processes to address theseproblems [8–10]. On the other hand, to improve the quality of composites, it is alsosuggested by many researchers that fibers with the best orientation and lamination order be hybridized [11, 12].