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PAPER

Realization of mechanical and tribological properties of hybrid banana, sisal, and pineapple fiber epoxy composites using naturally available fillers

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Abstract

In recent days the use of Natural fiber-reinforced composites in all sorts of consumer goods. A wide variety of technologies necessitate the use of materials with unusual property combinations, such as high strength-to-weight and stiffness ratios. Traditional metal alloys fall short of these quality standards, which has led to a significant increase in the applications of natural fibers. Hence, an effort has been made to investigate the effect of fillers like Coconut shell (CS), Saw dust (SD), Kolam (KP), and Fly ash powder (FA) on the mechanical and wear properties of Epoxy reinforced hybrid Sisal, Banana, and Pineapple fiber composites in this work. The Natural fibers weight percent was taken around 45 wt%, with the same quantity of epoxy blended with 10 wt% Naturally available fillers. The findings revealed that the CS fillers in the composite have a more positive influence on tensile strength and modulus than the composite with other fillers which are used in this study. SEM analysis of tensile-fractured CS specimens also reveals an improved fiber-matrix bonding. Similarly, the CS-filled composite also exhibits better flexural strength, modulus, and Impact strength maximum of up to 18% higher than the BS, SD, KP, and FA-filled Hybrid composites. Further, CS-filled composite has reduced weight loss against wear and friction due to higher lignin content.

1. Introduction

Many scientists and academicians are actively exploring natural fiber-based polymer composites. Different dimensions of research have been done over the last few decades to create a polymer composite strengthened by natural fibers in terms of mechanical properties [1]. Natural fiber-reinforced composites have the potential to replace synthetic materials [2–4]. Fiber composites made of polymers and wood flour have gained research attention recently. Numerous studies revealed that by adding fillers improves several properties of composites [5, 6]. The fillers such as nano-clays, nanotubes, and many other inorganic fillers seem to be expensive as compared to wood dust fillers in polymer matrices hence they are more affordable. High-density polyethylene (HDPE) was reinforced with pinecone powder at various weight percentages (5, 10, 15, and 20%). Adding 10% fillers to HDPE increased Tensile, Flexural, and Compressive strengths with improved elastic and flexural modulus as well [7]. The machinability of natural composites is enhanced by the addition of 20–40 wt% Banyan tree sawdust filler, whereas the surface roughness and Kerf taper angle properties of Polypropylene-based composites are diminished. In order for the polymer composites to endure the pressure generated by the abrasive particles, sawdust was added to make the matrix stiffer by reducing porosity [8]. The standoff distance

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