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RESEARCH ARTICLE

Exploring the effects of fiber content and length on mechanical, free vibration, electrical, and water absorption properties of *Phoenix* sp. fiber-reinforced polyester composites

G. Rajeshkumar, K. Vigneshwaran

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Abstract

This work addresses the experimental investigation of the mechanical, free vibration, electrical resistivity, and moisture uptake characteristics of *Phoenix* sp. fiber-reinforced polyester composites (PFRPC) fabricated using the compression molding method. The polyester matrix (PM) was added with *Phoenix* sp. fibers (PSFs) of different content (5, 10, 15, 20, and 25 wt%) and length (10, 20, and 30 mm) and studied their effect on the aforesaid properties. The results reveal that the composites having 20 wt% of 20 mm length PSFs exhibited optimum mechanical properties. At this loading, the ultimate tensile strength and modulus were 48.36 MPa and 2.86 GPa, respectively, while the flexural strength and modulus were 83.89 MPa and 2.91 GPa, respectively. Furthermore, this composite exhibits an impact strength of 22.04 kJ/m^2 and an interlaminar shear strength of 41.88 MPa. The increase in PSF content and length resulted in greater stiffness and decreased mass of the composites, leading to an enhanced natural frequency. The inclusion of PSFs showed a decline in electrical resistivities due to their moisture-absorbing capability. In contrast, the hydrophilic behavior of PSFs led to a rise in the water absorption rate of the composites due to the increase in fiber variables. Scanning electron microscopy examination shows that short fiber-reinforced composites have more fiber pull-outs due to the limited area of contact, whereas long fiber-added composites possess better bonding with the PM.

Highlights

- Various properties of *Phoenix* sp. fiber/polyester composites were investigated
- Increase in fiber content enhanced the mechanical performance of composites