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Enhancing Epoxy Composites: A Study on the Integration of Rice Husk and Coconut Fiber Reinforcements

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Abstract

This study investigates the mechanical and structural properties of hybrid epoxy composites reinforced with rice husk (RH) and coconut fiber (CF), with a focus on sustainability and waste reduction. The research specifically examines the impact of Sodium Chloride (NaCl) treatment on these natural fibers, comparing the performance of both treated and untreated composites. Various composite formulations were subjected to rigorous tensile, flexural, hardness, and density testing, complemented by Scanning Electron Microscopy (SEM) analysis to observe microstructural characteristics. The findings reveal that NaCl-treated composites generally exhibit enhanced tensile strength, with the treated 80:10:10 sample achieving a tensile strength of 42.22 MPa. However, the treated samples demonstrated reductions in flexural strength and hardness compared to their untreated counterparts. Notably, the untreated 80:10:10 sample exhibited the highest tensile strength at 48.72 MPa, the highest flexural strength at 169.87 N/mm², and the highest hardness at

44.08 HV1. Density measurements remained consistent regardless of NaCl treatment, indicating minimal impact on composite density. SEM analysis highlighted microstructural defects, including voids, fiber pull-out, and poor adhesion, which adversely affected mechanical properties. In conclusion, while NaCl treatment can enhance the tensile properties of hybrid epoxy composites, further optimization is needed to improve other mechanical characteristics, contributing to more sustainable engineering practices. © 2026, National University of Malaysia. All rights reserved.

Author keywords

coconut fiber; Epoxy; hybrid composite; NaCl treatment; rice husk

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