Recycling and Utilization of Fiberglass–Resin Powder from Waste Glass Fiber Reinforced Polymer (GFRP's) for the Production of Sustainable Phenolic Molding Products (SPMP)

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Abstract

This study investigates the mechanical properties of phenolic molding compounds (PMCs) formulated with varying compositions of waste glass fiber reinforced polymer (GFRP) powder and additives. Five different samples (E1 to E5) were prepared, with E1 serving as a control using Bakelite, while subsequent samples incorporated GFRP powder, vinyl silane treatment, and calcium hydroxide as fillers. The experimental densities, porosities, compressive strengths, and hardness values were systematically evaluated. Results indicated that E4, with optimized filler content, achieved the highest compressive strength of 128.3 MPa and a hardness of 42.4 BHN, highlighting the significant impact of filler optimization on mechanical performance. In contrast, E2, composed solely of waste GFRP powder, exhibited the lowest compressive strength (86.48 MPa) due to the absence of a cohesive matrix. The study underscores the importance of interfacial bonding and matrix cohesion in enhancing the load-bearing capabilities of PMCs. The findings suggest that the incorporation of treated GFRP powder and careful formulation can lead to improved mechanical properties, making these materials suitable for various industrial applications.

Keywords
Waste GFRP, Sultanate of Oman, Specimen mounting, Sustainable phenolic molding products, Metallurgical investigations, Fiberglass–resin powder, Recycling

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Biographies
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