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| **Abstract:** |  |
| This study investigated a composite material combining epoxy with hybrid jute (J) and glass (G) fibers. A straightforward and effective fabrication method was employed, utilizing five layers with various reinforcement materials. To identify the optimal combination, a comprehensive series of tests were conducted using a range of characterization instruments, including Scanning Electron Microscopy (SEM), Universal Testing Machine (UTM), pendulum impact tester, density measurement, specific gravity evaluation, water absorption, and swelling thickness tests. The composite's physical, mechanical, microstructural, and fracture properties were thoroughly analyzed. The findings revealed that Type C exhibited the highest impact strength of 378 kJ/m2, a Young's modulus of 10.567 GPa, and a flexural modulus of 13.872 GPa. Conversely, Type F demonstrated superior performance in terms of minimal water absorption (5.676 %) and swelling thickness (3.1 %). These results suggest that incorporating glass fibers in the outer layers and using woven jute fibers significantly enhanced mechanical properties while reducing water absorption and swelling. However, the inclusion of short jute fibers led to a decrease in mechanical performance. Microstructural analysis supported these findings, indicating a semi-brittle behavior with increased strength at the outer layers containing glass fibers. The fibers displayed greater strength than the matrix, resulting in matrix phase cracking before the fibers themselves. Overall, the fabricated composites show promising potential for various applications, offering a viable alternative to wood, plastic, or metal materials due to their lightweight nature and improved durability. | |