

Effects of nanoclay on mechanical and dynamic mechanical properties of bamboo/kenaf reinforced epoxy hybrid composites

ABSTRACT

Current work aims to study the mechanical and dynamical mechanical properties of non-woven bamboo (B)/woven kenaf (K)/epoxy (E) hybrid composites filled with nanoclay. The nanoclay-filled BK/E hybrid composites were prepared by dispersing 1 wt.% nanoclay (organically-modified montmorillonite (MMT; OMMT), montmorillonite (MMT), and halloysite nanotube (HNT)) with high shear speed homogenizer followed by hand lay-up fabrication technique. The effect of adding nanoclay on the tensile, flexural, and impact properties of the hybrid nanocomposites were studied. Fractography of tensile-fractured sample of hybrid composites was studied by field emission scanning electron microscope. The dynamic mechanical analyzer was used to study the viscoelastic properties of the hybrid nanocomposites. BK/E-OMMT exhibit enhanced mechanical properties compared to the other hybrid nanocomposites, with tensile, flexural, and impact strength values of 55.82 MPa, 105 MPa, and 65.68 J/m, respectively. Statistical analysis and grouping information were performed by one-way ANOVA (analysis of variance) and Tukey method, and it corroborates that the mechanical properties of the nanoclay-filled hybrid nanocomposites are statistically significant. The storage modulus of the hybrid nanocomposites was improved by 98.4%, 41.5%, and 21.7% with the addition of OMMT, MMT, and HNT, respectively. Morphology of the tensile fracture BK/E-OMMT composites shows that lesser voids, microcracks and fibers pull out due to strong fiber–matrix adhesion compared to other hybrid composites. Hence, the OMMT-filled BK/E hybrid nanocomposites can be utilized for load-bearing structure applications, such as floor panels and seatbacks, whereby lightweight and high strength are the main requirements.

Keyword: Hybrid composites; Nanoclay; Bamboo fibers; Kenaf fibers; Mechanical properties; Dynamic mechanical properties