

Effect of fiber orientation and fiber loading on the mechanical and thermal properties of sugar palm yarn fiber reinforced unsaturated polyester resin composites

ABSTRACT

Sugar palm [*Arenga pinnata* (Wurmb.) Merr] fiber reinforced unsaturated polyester resin composites with 0°, 45°, and 90° fiber different orientations were prepared and tested. The composites were characterized for tensile, flexural, impact and compression properties using ASTM D3039, ASTM D790, ASTM D250, and ASTM D3410 standards, respectively. For the thermal characterization, dynamic mechanical analysis (DMA) was conducted to characterize the on storage modulus (E'), loss modulus (E'') and damping behavior ($\tan \delta$) of the composites. The highest mechanical performance of composites was achieved at 0° of fiber orientation composites followed by 45° and 90° fiber orientations. The fiber loading was insignificant for the 90° fiber orientation as the properties were inconsistent. The theoretical value of modulus from the tensile test was calculated using rules of mixture (ROM) and compared with the experimental values for all composites specimens. This research showed that the optimum properties occurred at 30 wt % fiber loading as reflected by the superior tensile and flexural strengths. The optimum properties of compression, impact, storage modulus and better damping properties were achieved at 40 wt % fiber loading.

Keyword: Sugar palm fibers; Unsaturated polyester resin; Different fiber orientation; Fiber loading; Mechanical properties; Thermal properties

