

Mechanical performance of unstitched and silk fiber-stitched woven kenaf fiber reinforced epoxy composites

ABSTRACT

Fiber composites are known to have poor through-thickness mechanical properties due to the absence of a Z-direction binder. This issue is more critical with the use of natural fibers due to their low strength compared to synthetic fibers. Stitching is a through-thickness toughening method that is used to introduce fibers in the Z-direction, which will result in better through-thickness mechanical properties. This research was carried out to determine the mechanical properties of unstitched and silk fiber-stitched woven kenaf-reinforced epoxy composites. The woven kenaf mat was stitched with silk fiber using a commercial sewing machine. The specimens were fabricated using a hand lay-up method. Three specimens were fabricated, one unstitched and two silk-stitched with different stitching orientations. The results show that the stitched specimens have comparable in-plane mechanical properties to the unstitched specimens. For the tensile mechanical test, stitched specimens show similar and 17.1% higher tensile strength compared to the unstitched specimens. The flexural mechanical test results show around a 9% decrease in the flexural strength for the stitched specimens. On the other hand, the Izod impact mechanical test results show a significant improvement of 33% for the stitched specimens, which means that stitching has successfully improved the out-of-plane mechanical properties. The outcome of this research indicates that the stitched specimens have better mechanical performance compared to the unstitched specimens and that the decrease in the flexural strength is insignificant in contrast with the remarkable enhancement in the impact strength.

Keyword: Textiles; Stitching; Kenaf; Natural fibers; Through-thickness mechanical properties