

Lateral crushing properties of non-woven kenaf (mat)-reinforced epoxy composite hexagonal tubes

ABSTRACT

The current study investigated the energy absorption capability and load carrying capacity of non-woven natural kenaf fiber (mat)/epoxy–hexagonal composite tubes subjected to a lateral quasi-static crushing test. The hexagonal composite tubes were manufactured by the hand lay-up technique. Natural non-woven kenaf (mat) was chosen as reinforcement due to low cost, low specific weight, easy processing, no need for tooling when dealing with the raw material, and no skin irritation and epoxy resin was used as the matrix to manufacture three configurations of $\beta=40^\circ$, $\beta=50^\circ$ and $\beta=60^\circ$ of natural non-woven kenaf (mat)/epoxy laminate. The effects of hexagonal angles, supporting plate inside the tubes, and failure modes were studied by a lateral compression test. The crashworthiness of the tubes was evaluated by analysis of the specific energy absorption in quasi-static lateral compression. Specific energy absorption (SEA) was obtained from the load–displacement curve during testing. The failure mode of the tubes was analyzed from high-resolution photographs. Overall, the tube with $\beta=40^\circ$ had the best crashworthiness among the tubes. Furthermore, the results showed that the tubes with supporting plates have better specific energy absorption for all tested specimens and exhibited approximately 69% better crashworthiness than the non-supporting ones. The results also demonstrated that all specimens failed by the longitudinal failure mode.

Keyword: Supporting plate; Specific energy absorption; Kenaf fiber