Effect of Cyrtostachys renda fiber loading on the mechanical, morphology, and flammability properties of multi-walled carbon nanotubes/phenolic bio-composites

ABSTRACT

This research focuses on evaluating the effect of Cyrtostachys renda (CR) fiber and the impact of adding multi-walled carbon nanotubes (MWCNT) on the morphological, physical, mechanical, and flammability properties of phenolic composites. MWCNT were supplemented with phenolic resin through a dry dispersion ball milling method. Composites were fabricated by incorporating CR fiber in 0.5 wt.% MWCNT-phenolic matrix by hot pressing. Nevertheless, the void content, higher water absorption, and thickness swelling increased with fiber loading to the MWCNT/phenolic composites. The presence of MWCNT in phenolic enhanced the tensile, flexural, and impact strength by as much as 18%, 8%, and 8%, respectively, compared to pristine phenolic. The addition of CR fiber, however, strengthened MWCNT-phenolic composites, improving the tensile, flexural, and impact strength by as much as 16%, 16%, and 266%, respectively, for 50 wt.% loading of CR fiber. The CR fiber may adhere properly to the matrix, indicating that there is a strong interface between fiber and MWCNT-phenolic resin. UL-94 horizontal and limiting oxygen index (LOI) results indicated that all composite materials are in the category of self-extinguishing. Based on the technique for order preference by similarity to the ideal solution (TOPSIS) technique, 50 wt.% CR fiber-reinforced MWCNT-phenolic composite was chosen as the optimal composite for mechanical and flammability properties. This bio-based eco-friendly composite has the potential to be used as an aircraft interior component.

Keyword: MWCNT; Phenolic; CR fiber; Mechanical properties; Morphology; Flammability; TOPSIS