Effects of simple abrasive combing and pretreatments on the properties of pineapple leaf fibers (PALF) and PALF-vinyl ester composite adhesion

ABSTRACT

Despite being mechanically and environmentally sound, pineapple leaf fibers (PALF) are of little use in Malaysia and the least studied for composite applications. In this study effects of abrasive combing and simple pretreatments on PALF and their adhesion to vinyl ester were investigated. In pineapple leaves, PALF are present in top lamina as large vascular bundles and bottom lamina as fine strands. Tensile strength and modulus of fine PALF strands are 155% and 134% higher than those of vascular bundles respectively. Abrasive combing reduced PALF diameters by 50.3% resulting in finer bundles with 48.6% higher modulus and 51.5% greater strength without much negative effects on fiber integrity. Water-soak did not change PALF tensile properties significantly, while dilute sodium hypochlorite (NaOCl) solution improved PALF modulus and strength by as much as 123% and 35% respectively while reducing elongation at break by 47%. Dilute solution of NaOCl changed PALF structurally through higher crystallinity and closer packing resulting in increased tensile strength and modulus. PALF thermal stability was also enhanced. PALF-vinyl ester adhesion improved due to bleach pretreatment indicated by significantly reduced fiber pull-out length of broken PALF-vinyl ester composites. Morphological study using scanning electron microscope was used to confirm the findings. This study indicated that abrasive combing and simple pretreatment of dilute sodium hypochlorite are potential techniques to produce cost-effective PALF for reinforcing plastics.

Keyword: Fiber separation; Fiber-matrix adhesion; PALF; Tensile properties; Thermal stability; Vinyl ester