

The Effects of Wettability, Shear Strength, and Weibull Characteristics of Fiber-Reinforced Poly(Lactic Acid) Composites

John O. Akindoyo, Mohammad Dalour Hossen Beg, Suriati Ghazali, Muhammad Remanul Islam
Faculty of Chemical and Natural Resources Engineering, Universiti Malaysia Pahang, Lebuhraya Tun Razak, Gambang 26300, Kuantan, Malaysia

ABSTRACT

The wettability, interfacial shear strength (IFSS), and Weibull characteristics of oil palm empty fruit bunch (EFB) fibers were studied to evaluate the mechanical properties of EFB- and poly(lactic acid) (PLA)-based composites. The fiber surface was modified through ultrasound and poly(dimethyl siloxane) treatment. The effects of treatment on the morphology, wettability, and structure of fibers were examined by scanning electron microscopy, contact angle, and Fourier transform infrared spectroscopy analysis, respectively. In addition, the Weibull characteristic was used to find the variability in strength of the fibers with respect to surface treatment. Furthermore, the IFSS of EFB fiber-PLA sandwich was investigated through single-fiber pull-out test, using a less strenuous technique. The mechanical properties (tensile strength, tensile modulus, flexural strength, and flexural modulus) of the composites were determined through mechanical testing. A comparison was drawn among the properties of PLA, raw EFB fiber-based composites, and treated EFB fiber-based composites. Additionally, the inter- and intra-relationship of fiber treatment, wettability, and IFSS with the mechanical properties of the PLA/EFB composites were also accounted.

KEYWORDS: contact angle; fiber-matrix adhesion; interfacial shear strength; single-fiber pull-out test; wettability

DOI: 10.1515/polyeng-2015-0215