

The effects of chemical treatment on the structural and thermal, physical, and mechanical and morphological properties of roselle fiber-reinforced vinyl ester composites

ABSTRACT

Roselle fiber is a type of natural fiber that can potentially be used as a reinforcement material in polymer composites for different applications. This study investigated the chemical, physical, thermal, mechanical, and morphological characteristics of roselle fiber-reinforced vinyl ester subjected to different fiber treatments. The roselle fiber was treated with alkalization and a silane coupling agent, and samples were prepared using the hand lay-up method. Treated roselle fiber significantly enhanced most of the properties of vinyl ester biocomposites compared with an untreated biocomposite. The results revealed that alkalization and silane treatment of the fiber changed its chemical properties. The treated fiber improved water repellence behavior of the roselle fiber-reinforced vinyl ester compared with the untreated fiber. Use of a silane coupling agent was determined as the best chemical treatment for the water absorption effect. Thermogravimetric analysis (TGA) demonstrated that alkalization-treated fiber had improved thermal stability; however, the opposite result was obtained with the silane-treated fiber. The morphological examination of treated and untreated roselle fiber-reinforced vinyl esters showed a good fiber adhesion between the treated fiber and the matrix, and less fiber pull-out from the matrix was observed. This observation provides good indication of the interfacial interlocking between the fiber and the matrix, which improved the tensile properties of the composites. In contrast, the impact results revealed that the treated fiber had a decreased impact energy compared with the untreated fiber. POLYM. COMPOS., 39:274–287, 2018. © 2016 Society of Plastics Engineers.