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Characterization and analysis of novel natural cellulosic fiber extracted from Strelitzia reginae plant

N. LEMITA, S. DAGHBOUDJ, M. ROKBI, F. M. L. REKBI, R. Halimi

Abstract: The purpose of this study is to evaluate in detail the usability of new cellulosic fibers extracted from the stem of the plant Strelitzia reginae, as a potential reinforcement for polymer composites. The morphological, physical, thermal, and mechanical properties of fibers were addressed for the first time in this paper. Both untreated and alkali-treated fibers were characterized, using scanning electron microscopy (SEM), Fourier-transform infrared, thermogravimetric analysis (TGA), differential scanning calorimetry (DSC), optical microscope, and X-ray diffraction (XRD) and applying tensile test for determining the mechanical behavior. For both fiber treated at one hour (T1H) and at four hours (T4H), the stem anatomy and fiber SEM micrographs showed a strong presence of fiber cells. Thermogravimetry and DSC showed that the fiber was thermally stable up to 233°C for untreated fiber, 254 and 240°C, respectively, In single-fiber tensile tests, it was observed that the fibers extracted from the stem of Strelitzia reginae were strong. The mean values of Young's modulus exhibited by untreated fibers and treated (T1H) and (T4H) are, respectively, 9.89 GPa, 12.08, and 18.39 GPa. Also mean values of tensile strength are 271.79, 306.23, and 421.39 MPa. The XRD reveals the presence of cellulose with a Crystallinity Index of 70% for raw fiber and 72% for the treated one. Fourier-transform infrared analysis well demonstrated the effect of chemical treatment. It can be concluded from the results of all above experiments that the Strelitzia reginae fibers (SR) could serve as a possible reinforcement in composite materials.

Keywords : natural fibers, Biocomposite, Surface analysis, SEM, FT-IR, thermal analysis, TGA, XRD, DSC