PREPARATION AND CHARACTERIZATION OF VINYLSILANE CROSSLINKED THERMOPLASTIC NANOCOMPOSITES FILLED WITH SISAL NANOWHISKERS

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ABSTRACT

In this work sisal nanowhiskers (SNW), extracted from sisal fibres, were used to reinforce high-density polyethylene (HDPE) and low-density polyethylene (LDPE). The nanocomposites were prepared by solution casting from toluene and melt-mixing, both followed by melt pressing. In the case of melt-mixing, the surfaces of the SNW were chemically modified with 1 phr of triethoxy vinyl silane (VTES) to improve their dispersibility in and compatibilization with the matrices. The nanocomposites and sisal nanowhiskers were characterized by Fourier-transform infra-red (FTIR) spectroscopy, transmission electron microscopy (TEM), thermogravimetric analysis (TGA), differential scanning calorimetry (DSC), dynamic mechanical analysis (DMA) and X-ray diffractometry (XRD). The sisal nanowhiskers, obtained through sulphuric acid hydrolysis (65 wt.%) treatment, showed dimensions of 6-12 nm × 122-250 nm and a crystallinity index of 89 %. FTIR analysis confirmed the surface chemical modification of the sisal nanowhiskers. TGA revealed that the treated melt-mixed nanocomposites and the untreated solution cast nanocomposites displayed increased thermal stability compared to the untreated melt mixed nanocomposites. DSC showed that the processing methods and treatment did not influence the crystallization behaviour of the host polymers. The linear mechanical properties of all the nanocomposites at higher temperatures were found to increase compared to the neat polymers. These may be attributed to the synergistic effect of the crystallites and the filler/filler interactions. XRD showed a slight decrease in crystallinity for all the nanocomposites upon the addition of the sisal nanowhiskers.