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Tensile Behaviours of Sansevieria Ehrenbergii Fiber Reinforced Polyester Composites with Water Absorption Time

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Abstract : The research work investigates the variation of tensile properties for the sansevieria ehrenbergii fiber (SEF) and SEF reinforced polyester composites respect to various water absorption time. The experiments were conducted according to ATSM D3379-75 and ASTM D570 standards. The percentage of water absorption for composite specimens was measured according to ASTM D570 standard. The fiber of SE was cut in to 30 mm length for preparation of the composites. The simple hand lay-up method followed by compression moulding process adopted to prepare the randomly oriented SEF reinforced polyester composites at constant fiber weight fraction of 40%. The surface treatment was done on the SEFs with various chemicals such as NaOH, KMnO4, Benzoyl Peroxide, Benzoyl Chloride and Stearic Acid before preparing the composites. NaOH was used for pre-treatment of all other chemical treatments. The morphology of the tensile fractured specimens studied using the Scanning Electron Microscopic. The tensile strength of the SEF and SEF reinforced polymer composites were carried out with various water absorption time such as 4, 8, 12, 16, 20 and 24 hours respectively. The result shows that the tensile strength was drop off with increase in water absorption time for all composites. The highest tensile property of raw fiber was found due to lowest moistures content. Also the chemical bond between the cellulose and cementic materials such as lignin and wax was highest due to lowest moisture content. Tensile load was lowest and elongation was highest for the water absorbed fibers at various water absorption time ranges. During this process, the fiber cellulose inhales the water and expands the primary and secondary fibers walls. This increases the moisture content in the fibers. Ultimately this increases the hydrogen cation and the hydroxide anion from the water. In tensile testing, the water absorbed fibers shows highest elongation by stretching of expanded cellulose walls and the bonding strength between the fiber cellulose is low. The load carrying capability was stable at 20 hours of water absorption time. This could be directly affecting the interfacial bonding between the fiber/matrix and composite strength. The chemically treated fibers carry higher load and lower elongation which is due to removal of lignin, hemicellulose and wax content. The water time absorption decreases the tensile strength of the composites. The chemically SEF reinforced composites shows highest tensile strength compared to untreated SEF reinforced composites. This was due to highest bonding area between the fiber/matrix. This was proven in the morphology at the fracture zone of the composites. The intra-fiber debonding was occurred by water capsulation in the fiber cellulose. Among all, the tensile strength was found to be highest for KMnO4 treated SEF reinforced composite compared to other composites. This was due to better interfacial bonding between the fiber-matrix compared to other treated fiber composites. The percentage of water absorption of composites increased with time of water absorption. The percentage weight gain of chemically treated SEF composites at 4 hours to zero water absorption are 9, 9, 10, 10.8 and 9.5 for NaOH, BP, BC, KMnO4 and SA respectively. The percentage weight gain of chemically treated SEF composites at 24 hours to zero water absorption 5.2, 7.3, 12.5, 16.7 and 13.5 for NaOH, BP, BC, KMnO4 and SA respectively. Hence the lowest weight gain was found for KMnO4 treated SEF composites by highest percentage with lowest water uptake. However the chemically treated SEF reinforced composites is possible materials for automotive application like body panels, bumpers and interior parts, and household application like tables and racks etc.

Keywords : fibres, polymer-matrix composites (PMCs), mechanical properties, scanning electron microscopy (SEM)
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