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Assessing the Mechanical Properties of Kenaf Fiber and LDPE Composites

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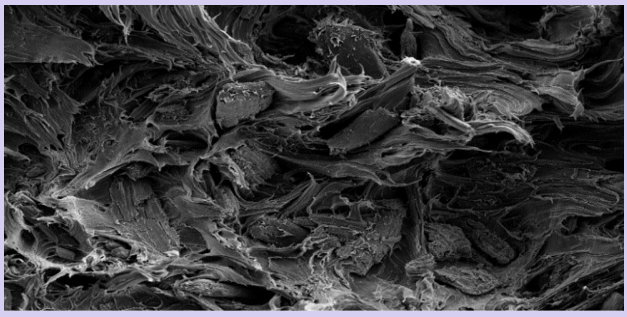
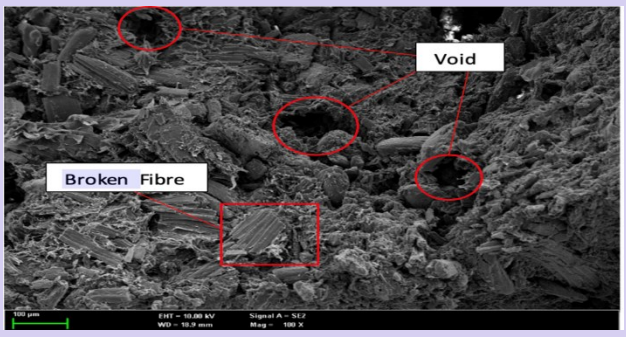
The escalating accumulation of plastic waste is engendering severe environmental ramifications, thereby catalysing the investigation of natural fiber composites to mitigate production expenses and enhance the mechanical properties of industrial products. Natural fiber, sourced from animals, minerals, and plants, are favoured due to their brief growth cycles, renewability, and abundant availability. This study specifically investigates bast fibers, such as kenaf fiber, which can attain lengths exceeding 3 meters within a three-month period and are suitable for reinforcing high-performance biodegradable polymer composites. However, the hydrophilic nature of kenaf fibers poses challenges when integrating with nonpolar hydrophobic polymer matrices. The objective of this study is to evaluate the mechanical properties of composite materials by effectively integrating kenaf fiber with a polymer matrix and a coupling agent to augment reinforcement. Low-Density Polyethylene (LDPE), known for its flexibility, toughness, and corrosion resistance, is employed as the polymer matrix. Biocomposites reinforced with LDPE and natural fibers present a viable solution. The study utilizes the reactive extrusion method to amalgamate Kenaf with other polymeric materials and coupling agents.

Kenaf fibre after washing

The primary focus of this research is the application of Kenaf fiber and Low-Density Polyethylene (LDPE) as a polymer matrix in composite materials. Through the reactive extrusion process, Kenaf was combined with polymeric materials and coupling agents, including Itaconic Anhydride (IA) and peroxide. Kenaf composites were synthesized by incorporating varying percentages of Kenaf fibers into the matrix. Thermal Gravimetric Analysis (TGA) revealed that a high weight percentage of Kenaf within the LDPE matrix might diminish the composite's thermal stability. Fourier Transform Infrared Spectroscopy (FTIR) analysis indicated the presence of chemical bonds between the fibers and the matrix, such as C-O, C=O, and O-H. Morphological examination of the composites suggested that the coupling agent could enhance the interphase layer at the Kenaf and LDPE interface. Scanning Electron Microscopy (SEM) imagery of composites with 10% Kenaf displayed a smooth surface with minimal void spaces, whereas composites with 60% Kenaf exhibited a rough surface with minor fiber damage. An increased percentage of Kenaf in the composite was observed to reduce the chain mobility of the polymeric matrix.



SEM image taken from fracture surface of 10 wt% of Kenaf/LDPE composites at 100µm



SEM image taken from fracture surface of 60 wt% of Kenaf/LDPE composites at 100µm

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