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The Physical and Chemical Properties of Kenaf/Empty Fruit Bunch Fiber Reinforced (Poly)Lactic Acid (PLA) Composite

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Structured Abstract

Background: The researchers are working on creating an environmentally friendly bio-composite by using kenaf and empty fruit bunches to reinforce PLA polymer. This aligns with the UN's Sustainable Development Goal, addressing waste management and promoting renewable materials for sustainability. PLA, derived from renewable sources, offers cost-effectiveness and eco-friendliness. The hybridization of fibres aims to improve physical, and chemical properties, contributing to a more sustainable future.

Methods: The study focuses on developing an eco-friendly bio-composite using kenaf and empty fruit bunches (EFB) with polylactic acid (PLA) as the matrix. The fibres undergo alkaline treatment with 6% NaOH, washed, and dried. The composite is prepared with 15wt% of each fibre and 70wt% PLA using an internal mixer. The samples are pressed at 190°C for 5 minutes. Alkaline treatment tests, density test, and FTIR are conducted to analyse Physical and Chemical properties, respectively. Scanning electron microscopy is used to examine the fractured samples.

Results: Density testing show the result of treated PLA/EFB/Kenaf is higher compared to untreated fibers. Alkaline treatment testing show both treated fibers of Kenaf and EFB have increase the amount of cellulose compared to untreated fibers. Chemical Constinuents of Hemicellulose and Lignin for both treated fibers of Kenaf and EFB have been decreased compared to untreated fibers. FTIR testing have shown O-H hydroxyl group and C-O group for ester in treated kenaf and EFB fibre have a larger and less intense peak as compared to untreated kenaf and EFB peak.

Conclusion: In conclusion, the study focused on developing eco-friendly bio-composites using kenaf and empty fruit bunches (EFB) reinforced with polylactic acid (PLA) polymer. Kenaf/Empty Fruit Bunch Fibre/PLA composite have been successfully fabricated. The addition of natural fibers resulted in higher density to pure PLA for the physical properties, it's also can reveal differences in density between untreated and treated fibre, revealing that treated fibre composites have much higher density than untreated fibre composites. Scanning electron microscopy confirmed improved fiber- matrix adhesion in the hybrid composites. In terms of chemical characteristics, it can be observed that the O-H hydroxyl group and C-O group for ester in treated kenaf and EFB fibre showed a larger and less intense peak as compared to untreated kenaf and EFB peak.

Keywords: Bio composite, kenaf, empty fruit bunch, PLA, Fourier Transform Infrared

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