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Effect of Chemical Treatment on the Mechanical Properties of Sugarcane Bagasse Fiber

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Structured Abstract

Background: One of the most popular natural fibers for making natural fiber reinforced polymer-based composites is bagasse fiber, which is widely abundant as waste after processing sugarcane. Previous studies show that chemically altering the raw fibers improved their compatibility and adhesion with the epoxy polymer.

Methods: Bagasse fibers were prepared using retting process and subjected to chemical treatment using sodium hydroxide (NaOH) at varying concentration (0%, 1%, 3% and 5%) to modify the physical and mechanical properties of the fibers. The bagasse fibers were soaked in the NaOH at room temperature for 2 hours, maintaining a liquor ratio of 50:1. The tensile strength of raw and treated bagasse fibers was measured using an SDL testometric tester while the morphology changes were observed by FESEM.

Results: In this study, it was found that the distribution of fiber length decreased after being treated with NaOH solution, falling between 70 and 90 mm for 5% treated fiber and this bagasse fiber can be classified as short fiber. It was also demonstrated that chemical treatment removed the impurities on the fiber surface, resulting in the diameter of untreated bagasse dropping from 390.2 um to 346.0 um at 3% NaOH. However, the bagasse fibers' diameter rose to 362.5 um after they were treated with 5% NaOH. This result was supported by FESEM image. By comparing the mechanical force of the fiber after treatment, the best mechanical property results are obtained with 3% treated fiber which achieved the highest force of 3.50 N/mm2. The highest elongation and stress were 2.28 mm and 0.56 N/mm2, respectively. The 3% treated fiber showed the maximum Young's Modulus with a lower reading of strain, suggesting that the chemical treatment has significantly improved the fiber's mechanical properties and its ability to withstand deformation under stress.

Conclusion: The bagasse fiber after chemical treatment demonstrates significantly improved mechanical properties, making it a highly promising biodegradable material for various applications. The 3% treated fiber offers enhanced mechanical qualities, which was determined to be the optimum value of fiber treatment.

Keywords: Baggase Fiber, Mechanical Properties

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