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Agro-waste from Bambusa Flexuosa stem fibers: A sustainable and green material for lightweight polymer composites

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Abstract:	<p>The growing environmental concern has forced researchers and industries to focus more on eco-friendly materials for replacing synthetic materials; therefore, natural fibers from plants become an interest choice due to their various outstanding properties. However, there is always a demand for the sustainability of supply and requirement of a natural fiber with promising properties. Hence this current work is focused on the extraction and characterization of natural fibers from the Bambusa flexuosa which is a species of Bambusa bamboo. The discarded bamboo stem after the harvest was chosen for fiber extraction. The extracted bamboo fibers were characterized and analyzed in terms of physical, chemical, thermal, and morphological properties to examine the influence of chemical treatment. The physico-chemical and morphological properties of the raw and chemically treated fibers were analyzed using TGA, XRD, FTIR, and Scanning microscopic images for ensuring the suitability to be used as a reinforcement phase in polymer composites. The test results revealed the diameter of the extracted bamboo fibers ranging 140-176 μm and a density of 0.81 g/cm^3. The density of the extracted fibers was improved up to 1.14 g/cm^3 by alkali treatment. The raw fibers were thermally stable up to 251.32° C; however, the alkali treatment enhanced the thermal stability up to 264.57° C. Furthermore, the kinetic activation energy of the bamboo fibers was analyzed using Coaf's Redfern equations. The kinetic activation energy of the untreated and treated bamboo fibers was 67.69 kJ/mol and 69.78 kJ/mol, respectively. From the results, it was presented that the extracted fibers from the discarded bamboo stem can be potentially used as reinforcement phase in the polymer composites for lightweight structural applications. The alkali treatment potentially improved the physical, chemical, and morphological properties of the bamboo fibers.</p>