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Silica infused regenerated banana pseudo stem fiber: A sustainable materials Approach

Abstract

India leads the world in *Musa paradisiaca* (banana) production, with an annual output of approximately 14.2 million tonnes. Other major banana producers include Brazil, Ecuador, China, the Philippines, Indonesia, Costa Rica, Mexico, Thailand, and Colombia. However, there is a problem associated with banana production: around 60% of the banana crop is discarded or composted after harvesting, leading to waste management challenges. To address this issue, a sustainable approach has been proposed.

The incorporation of silica in to regenerated cellulose is a notable improvement for the production of composite materials with improved mechanical, thermal and functional properties. The object of this work concerned the incorporation of silica nanoparticles into the regenerated cellulose, with the goal of obtaining new composite that combines the enhanced performance characteristics. Cellulose which is regenerated due to its biodegradability, flexibility and biocompatibility as well as the ability to dissolve in different liquids was compounded with silica which is known for its thermal stability, mechanical strength, and low coefficient of thermal expansion. The preparation process involved dissolution of cellulose in appropriate solvent then mixing of silica nanoparticles either through in-situ sol-gel technique or direct addition. These cellulose composites containing silica give better performance in many fields such as filtration membranes, biomedical scaffolds, and packaging materials. The enhanced properties and functionalities of the silica-infused regenerated cellulose make it possible to use as a versatile base material for various industries and biomedical fields while offering the complimentary characteristics of both the organic and inorganic parts of the material.

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