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Development of sisal fiber reinforced cement composites as substitute of asbestos cement composites: A green chemical approach

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The need for economical, sustainable and safe shelter is well pronounced globally. Numerous challenges are unaddressed to produce environment friendly construction materials which are structurally safe and durable. Roofing is one of the most important components in housing. It alone represents more than 25-30% of the total construction cost of a house. The use of asbestos fiber for making asbestos cement roofing sheet causes many health problems as it is a carcinogenic material. There is great need to replace asbestos, the mineral fiber, by eco- friendly materials. Plant fibers are renewable, eco friendly and have good mechanical properties hence they can be an appropriate alternative to asbestos. Agave sisalana (Family: Agavaceae) yields stiff fiber, traditionally used in making twine and rope. Sisal fiber (the green material) obtained from this species is exceptionally durable with low maintenance and minimal wear and tear. The fiber is tough for textiles and fabrics. It is biodegradable too. It can establish and easily grow in every climate covering sub humid to arid and semiarid regions. Sisal plant can survive in almost all soil types and the input costs are least for its survival, regeneration and maintenance on sustainable basis. Sisal tolerates prolonged droughts and high temperatures also. It yields parallel hard fibers. Sisal fiber is traditionally extracted by retting, a biodegradation process involving microbial decomposition of sisal leaves, which separates the fiber from pith. The fibers are washed and processed further. This process takes 15-21 days for a single cycle of extraction and degrades the quality of fiber. The retting process is water intensive, unhygienic and not eco-friendly. The other methods available for the extraction of fiber are chemical treatment and mechanical extraction. The mechanical extraction is the best method and done with the help of Raspador machine. This green material is easily available and eco-friendly. It will substitute the carcinogenic material, asbestos. The green material was chopped and pulp was prepared with chemical and mechanical treatments and then reinforced with cement and the sheets prepared, is a substitute of asbestos sheets. These sheets have many engineering applications. The present proposed development may open new avenue to use sisal fiber cement sheet in buildings where presently asbestos cement sheets are used globally.

Biography

Shipra Roy is a PhD holder from University of Allahabad, Allahabad, India in 1986 at the age of 27 years. She is Assistant Professor at Sarojini Naidu Government Girls Postgraduate Autonomous College, Bhopal, India. She has one United States Patent and four Indian Patents in her name and two new patent applications have been filed in Indian Patent Office. Her field of research is Green Chemistry.

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