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Use of Natural Fiber-Reinforced Polymer Composites in Construction Materials

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Structured Abstract

Background: The construction industry is under pressure to move towards sustainable materials that have less environmental impact, yet they must have reasonable structural and functional performance. Natural fiber-reinforced polymer composites (NFRPC) have become a candidate alternative to the traditional fiber-reinforced polymers because of its renewability, low density, biodegradability and low carbon footprint. Although the number of studies has increased, NFRPC are still not being applied practically in construction because of performance inconsistency, durability issues, and standardization of guidelines.

Methods: The paper is a critical research review of published literature on the application of the natural fiber reinforced polymer composites in construction materials. Articles on peer-reviewed journals, standards, and technical reports were critically analysed to assess material properties, method of fabrication, construction use, mechanical, thermal, acoustic, and environmental performance. The focus was on the recent trends, the performance comparison, and the challenges that were found to be in regard to the durability and serviceability in the long run.

Results: Fiber reinforced NFRPC using fiber like jute, flax, kenaf, hemp, sisal, banana and coir have shown promising characteristics of mechanical strength, thermal insulation, and sound absorption that can be used in the construction industry as wall panels, facades, insulations, floor tiles, sandwich structures and structural reinforcement of concrete elements. Chemical treatment, hybridization and optimization of processing methods help in better bonding of fibers in a matrix, which leads to better performance of the composites. Nonetheless, moisture absorption, weathering resistance, flammability, and inconsistency in natural fiber properties are still the focus of the limitations.

Conclusion: In conclusion, natural fiber-reinforced polymer composites have great potential to be sustainable construction materials in the event that they are designed and treated accordingly. Although research today has validated their appropriateness in terms of non-load-bearing and specific semi-structural use, there is still needed to carry out research in terms of durability, fire resistance and standardization concerns. Research and sustained performance assessment and design guidelines need to be developed to facilitate the wider use of NFRPCs in the construction sector.

Keywords: Natural Fibers, Construction Materials, Durability, Natural Fiber-Reinforced Polymer Composites, Sustainability

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