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Performance Review of Composite Materials Used for Green Building Construction and it's Future in India

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1. Abstract

Construction of green structure are seen to be growing rapidly in India with handholding profit in economic sector of construction. As it is eco-friendly, easy to construct and budget oriented, builders and engineers are absorbing this technology for a viable construction and development. These structures are also very productive along with saving the resource. Keeping the profit and other benefits, nowadays architect, builder and policy maker are focusing more on the green building construction in India where we have seen in past year almost 6-8 Indian states provide incentive for green building development. But here a question arises, what make this green building a profitable and resource saving way of construction?

Focusing on the point, we can conclude that, the material used is the one viable part of this technology which make this green building to stand strongly in the field of construction and development. This defines the more quality in material, the more strength will be defined to take the conditional and unconditional loads as well.

This review paper defines, material comparison, cost effective composite material formation, strength graph of a cube through analysis done by researcher on preparing composite material and an overview of literature available on green building development and materials used.

Keywords: Green Building, Composite Materials, Cost Effective, Material Performance.

2. Introduction:

In India, the green building has been recognised as one of the beneficial, high productivity and resource saving way of infrastructure construction, whereas this technology is not yet implemented in huge construction industries (e.g. Bridge Construction). To take this method of development to a next level, some of Indian states are showing interest in investing funds and providing incentives for them who actually works on the green building construction development. Going through a comparison between the normal construction material and green building material we can measure a wide range difference between them. But going through the notes, this review completely focuses on the materials used for the green building construction which may be the core material or else the

composite material. Core materials are primarily used for the green building constructions which drag our vision towards the composite materials [1, 2, 3, 4, 5, 6, 9, 10, 15].

2.1. Composite material-

This makes us understand that the material which basically manufactured, by replacing some percentage of conventional material with other supplementary materials components to increase the strength of the material whilst reducing manufacturing cost. Manufacturing is also not so difficult.

Various waste materials can be used to prepare composite. Bio degradable wastes such as agro waste, rice husk ash can be used for manufacture of composite materials. Hazardous wastes like fly ash, geopolymer, silica fume, red mud, Bauxite, GGBS can be used as partially in concrete. This use of wastes in concrete resolves the land pollution issues caused by open dumping in yard. Now researchers are looking for complete replacement of binder with this wastes. In Geopolymer concrete replacement of waste needs alkali activated solution in proper proportion as they have very less binding energy. Use of such wastes as construction material also lowers the cost of structure.

2.2. Literature Review on Composite Materials-

Going through research done on composite materials for green structures, the focused part are reinforced plastic composite materials, corrosion resistance, Lightweight, durable, high strength, cost effective, resource saving and low maintenance. Hence to integrate all these qualities in a material, developers need a lot of research. This need a proper engineering which will lead us to generate a material having all the above-mentioned qualities with strength and capacity to hold the external and internal load applied over it.

Overviewing the article on composite material, Geopolymer provides good result. Geopolymer can also be strengthened by reinforced with coconut coirs. Already researchers found beneficial in adding various organic fibres e.g. coconut fibre [1], jute fibre [36], bamboo fibre [44], banana fibre [37, 38], human hairs [39], sisal [42] etc. in concrete. Some inorganic fibres such as nylon [43, 44, 45], PET [46], steel fibre [47], glass fibres [48] can also be used. Here studies carried out taking coconut coirs into consideration.

Properties of Coconut Fibre

2.3. **Composite Property:**

Coconut fibre shows a different quadrant while overviewing its mechanical properties on volume and length of concrete reinforced with these organic fibres. During various test on different fraction of volumes of fibre reinforced concrete derives an increment of 2-6 % more tensile strength and modulus of rupture. [4, 10, 11]

2.4. **Chemical Property**:

The property of coconut fibre can be manipulated by initiating pre-treatment over it as they are filled with cellulose, Lignin and hemi-cellulose. By continue immersion for 60 days, with alternate wetting and drying can show a variation in tensile strength and chemical composition. Before, during different test, this organic fibre has shown good percentage of retaining the original tensile strength as well. [2, 3]

2.5. **Mechanical and Physical property**:

Through software solution for analysis, it was concluded by the researcher that the inside part has the capacity to show high strength while compared to the outer part. Here from the output of mechanical property of coconut fibre, it can be noted that the compressive strength is gradually follows the up lift in every scaling condition. [1,2, 5, 17, 6, 7, 8, 9]

Table 1: Mechanical and Physical Property of Coconut Fibre

Diameter	Length	Tensile Strength	Specific Tensile Strength	Avg. tensile Modulus	Specific Tensile Modulus	Tensile Strain	Elongation	Toughness	Specific Young's Modulus	Young's Modulus	Permeable Void	Moisture Content	Water Absorption Saturation	Elastic Modulus	Density
0.4	93-243	14-330					75.2								
0.21		107e					37.7de				56.7-73.3	93-161	2.6e	1103-1370	
0.3		69.5f													
		50.7g					17.5g								
0.27	53	146					25								
0.13-0.50		108-253					13.6-41n								
0.12		137	157												
		500	0.42q	2.54	2.18q	19.7									
		175					29.7								
0.1-0.4		174													
0.1-0.4	50-250	100-`130													
0.1-0.45		106-175													

[Ref 1, 2]

Table 2: Mechanical Property

Fibre volume fraction (%)	Modulus of rupture (MPa)	Tensile strength (MPa)
2	3.6	1.9
3	4.9	2.9
4	5.4	2.8
5	5.4	2.2

6	4.6	1.6

[Ref 50]

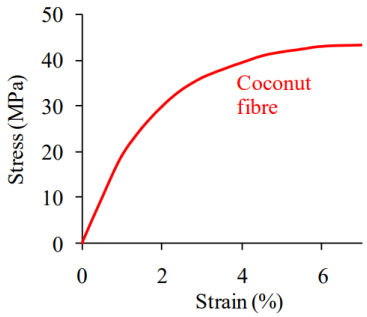
3. Engineering Applications:

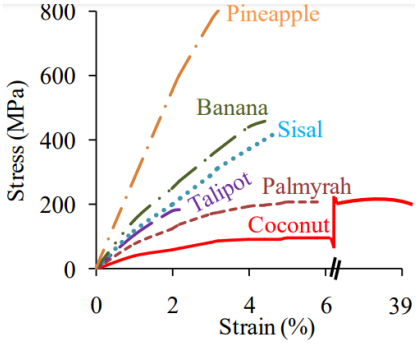
3.1. **Plastering**:

While the sample of mortar from 12-year-old home was taken for test by reinforcing 2% of coconut fibre inside it, shows no significant behavioural changes of the materials and also fibre is found undamaged. [13, 14]

3.2. **Roofing Materials**:

It has been observed that the cost of fibre reinforced materials is cheaper than the existing common construction materials. Other properties like bending, permeability, fire resistance and bending are also investigated by the researcher on this optimum composite. [15, 19]





[Ref 15,19]

4. Conclusion

By reviewing various research journals and review publications on coconut fibre as composite material to get reinforced with the mortar concludes that the materials will be light weight, cheaper, provides high strength, sustain bending force, retain tensile strength, good in permeability property, best performance in various weather condition and behaves properly in different thermal conditions as well. These organic materials can improve the ductility property of the manufactured material with enhanced crack resistance properties.

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