



Natural Fibre Composites and Its Potential

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Natural fibres have been used to reinforce materials for over 3000 years. Most of the developing countries are very rich in agricultural and natural fibre. Except a few exceptions, a large part of agricultural waste is being used as a fuel. India alone produces more than 400 million tonnes of agricultural waste annually. It has got a very large percentage of the total world production of rice husk, jute, stalk, baggase and coconut fibre. All natural fibres have excellent physical and mechanical properties and can be utilized more effectively in the development of composite materials for various building applications. Natural fibres have the advantage that they are renewable resources and have marketing appeal. These agricultural wastes can be used to prepare fibre reinforced polymer composites for commercial use.

Introduction

The interest in using natural fibres such as different plant fibres and wood fibres as reinforcement in plastics has increased dramatically during last few years. With regard to the surrounding aspects it would be very interesting if natural fibres could be used instead of glass fibres as reinforcement in some structural applications. Natural fibres have many advantages compared to glass fibres, for example they have low density, and they are recyclable and biodegradable. Additionally they are renewable raw materials and have relatively high strength and stiffness. Their low-density values allow producing composites that combine good mechanical properties with a low specific mass. In tropical countries fibrous plants are available in abundance (Sakthivei and Ramesh, 2013).

Natural fibre composites in India: Due to the light weight, high strength to weight ratio, corrosion resistance and other advantages, natural fibre based composites are becoming important composite materials in building and civil engineering fields. In case of synthetic fibre based composites, despite the usefulness in service, these are difficult to be recycled after designed service life. However, natural fibre based composites are environment friendly to a large extent. Few of these important composites are summarised in the following text. (Rai and Jha, 2001).

Natural fibres as reinforcing agent in composite matrices (such as cement and polymer) are attracting more attention for various low-cost building products. The natural fibres are abundantly available locally and extracted from renewable resources. Presently, the production of natural fibres in India is more than 400 million tonnes. The approximate production of various types of natural fibres is given in table 1.

Table 1. Availability of natural fibre in India and its applications in building materials.
(Rai and Jha, 2001)

S. No.	Item	Source	Qty. in Mt./Yr.	Application in Building Material
1.	Rice Husk	Rice Mills	20	As fuel, for manufacturing building materials and products for production of rice husk binder, fibrous building panels, bricks, acid proof cement.
2.	Banana Leaves/ stalk	Banana plants	0.20	In the manufacture of building boards, fire resistance fibre board.
3.	Coconut husk	Coir fibre industry	1.60	In the manufacture of building boards, roofing sheets, insulation boards, building panels, as a lightweight aggregate, Coir fibre reinforced composite, cement board, geo-textile, and rubberized coir.
4.	Groundnut shell	Groundnut oil mills	11.00	In the manufacture of buildings panels, building blocks, for making chip boards, roofing sheets, particle boards.
5.	Jute fibre	Jute Industry	1.44	For making chip boards, roofing sheets, door shutters.
6.	Rice/wheat straw	Agricultural farm	12.00	Manufacture of roofing units and walls panels/boards.
7.	Saw mill waste	Saw mills/wood	2.00	Manufacture of cement bonded wood chips, blocks, boards, particle boards, insulation boards, briquettes.
8.	Sisal fibres	Sisal plantation	0.23 (Asia)	For plastering of walls and for making roofing sheets, composite board with rice husk, cement roofing sheet, roofing tiles, manufacturing of paper and pulp.
9.	Cotton stalk	Cotton plantation	1.10	Fibre boards, panel, door shutters, roofing sheets, autoclaved cement composite, paper, plastering of walls.

The present requirement of wood in India is about 29 million cubic meters, whereas, the estimated production is about 16 million cubic meters only. Apart from wood, natural fibre composites are emerging with an increasing role in building industry to replace timber, steel, aluminium, concrete etc.

Coir Composites: Since coconut is available in India in abundance, the second highest in the world after Philippines, coir fibre has been recognised as highly durable fibre in all types of matrices viz. polymer, bitumen, cement, gypsum, flyash-lime, mud etc.

Jute Coir Composites: Jute –coir composite provides an economic alternative to wood for the construction industry. It involves the production of coir-ply boards with oriented jute as face veneer and coir plus waste rubber wood inside. The coir fibre contains about 46% lignin as against 39% in teak wood. Therefore, it is more resistant than teak wood against rotting under wet and dry conditions and has better tensile strength. The composites board namely, coir-ply boards (jute + rubber + wood + coir) as plywood substitute and natural fibre (Jute +

coir) as Medium Density Fibre board (MDF) substitute can be used in place of wood or MDF (boards for partitioning, false ceiling, surface panelling, roofing, furniture, cupboards, wardrobes etc.

Bamboo and its Composites in Housing: Bamboo is very well known and popular construction material throughout the tropics, particularly in bamboo rich regions. Bamboo is the fastest growing plant and possesses excellent physical and mechanical properties- Weight by weight it is stronger than steel. Bamboo Mat Board, Bamboo Mat Veneer composites and Bamboo Mat Corrugated sheets are developed by IIRTI, Bangalore

Sisal Fibre and its applications: Sisal Fibre obtained from the leaf of sisal plant has been proved to be very suitable reinforcement in various polymeric matrices. The Central Building Research Institute, Roorkee and Regional Research Laboratory, Bhopal has investigated several techniques for sisal fibre surface modification for its use in production of roofing sheets.

Conclusion

Natural fibres due to its technical superiority over the synthetic fibres have proved that it is a versatile material for application in rural areas to high tech applications. It is an urgent need to use these naturally available materials in order to save the environment and energy consumption which is required in the processing of manmade synthetic composites and more Research and Development is required for its commercial and production viability.

References

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