Jute Aggregates as Lumber Substitute

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ABSTRACT -*Jute fibre is anauspicious reinforcement for use in composites on account of its low cost, low density, high specific asset and modulus, no health risk, easy availability, renewability and much lower energy prerequisite for processing. In recent years, there has been an increasing interest in finding new applications for jute fiber reinforced composites that are conventionally used for making ropes, bags, hessians, sacking, mats, and carpet.To protect environment, consumptions of wood should be reduced that will increase number of tree in the world which can maintain the balance in nature. A major serving of woods are used for making home furniture, household products and erection and constructions. In all these cases wood can be replaced by composite materials made from natural fibers like jute, coir, sisal etc. Jutefibercombinations enjoy excellent probable as wood substitutes in view of their low cost, easy accessibility, saving in energy and pollution free production. In order to improve upon the laboratory-industry linkages towards application development & commercialization, some advanced composites mission launched on jute composites such as 'Jute-Coir Composites Boards', 'Jute-glass composite components for railway coaches' and others.The use of jute fiber mats in combination with polymer films theoretically offers a rapid and simple means of manufacturing combinations through film stacking, heating and press-consolidation.*

Keywords -*Jute Fiber, Jute Composite, Wood, Natural Fiber, Composites.*

I. INTRODUCTION

Natural fibresstrengthened composites have a good impending as a substitute for wood-based material in many applications. The enlargement of environment-friendly green materials is because of natural fibre's biodegradability, light weight, low cost, high specific strength matched to glass and carbon, recycling and renewing natural sources. Complexes, the wonder substantial with light-weight, high strength-to-weight ratio and stiffness properties have come a long way in changing the conservative materials like metals, woods etc. The material scientists all over the world intensive their attention on natural composites reinforced with jute, sisal, coir, pineapple etc. primarily to cut down the cost of raw materials. The jute fiber is an important bestfiber and comprises bundled ultimate cells, each comprehending spirally oriented micro- fibrils bound together. From the point of view of wood exchange, jute composites could be an ideal solution. With ever diminishing forest reserves, a composite based on renewable resources is poised to penetrate the market. Aboriginal wood supply for plywood manufacturing have been stopped virtually and with growing landed cost of imported plywood veneers, the jute composite boards offer very good value for the customers without any concession in properties.

The jute-coir boards attesting superior over application plywood boards find potential in railway coaches for sleeper berth backing, for construction interiors, doors & windows besides in carrying sector as backings for seat & backrest in buses. Typical jute composites boards do not prove well on the grounds due to its moisture absorption & screw holding strength. Comprehensive evaluation of the jute-coir board samples has been carried out for their submissions as berth backings & partitions in railway coaches; the results conform to the railways' requirements. The use of jute fiber mats in amalgamation with polymer films potentially offers a rapid and simple means of engineering composites through film stacking, heating and press-consolidation.

II. DEFINITIONS

2.1. Composites

A composite material is one in which two or more materials that are dissimilar are collective to form a single structure with distinguishable interfaces at multi-scales to achieve properties that are superior to those of its constituents. In general, compounds can be defined as a select arrangement of dissimilar

material formed with a specific internal structure and with a specificexternal shape or form. Combinations are designed to achieve unique mechanical properties and superior presentation characteristics not possible with any of the component material alone.

2.2. Textile Composites

Textile composite materials are collected of fibres fibre, yarn or fabric system and matrix material that is bind and protect the fibres. The fibres are frequently the load bearing members, while the polymeric matrix provides transverse integrity and transmissions the load onto the fibres. Besides of the properties of two main components of fibre and matrix, the fibre/matrix interphase also plays a crucial role for the load transfer. It is not a dissimilar phase, as the interphase does not have a clear boundary. This region exits between bulk fibre and bulk matrix and may contain several diverse layers as in the case of sizing.

2.3. Jute Composites

Jute composite materials comprise of jute fibres of high asset and modulus embedded in or bonded to a matrix with dissimilarinterfaces between them. In this form, both fibres and matrix recollect their physical and chemical identities, yet they produce anamalgamation of properties that cannot be accomplished with either of the constituents acting alone. In general, jute fibres are the principle load carrying member, while the neighboring matrix keeps them in the desired location and orientation, acts as a load transfer medium between them, and defends them from environmental damages due to eminent temperature and humidity.

III. PROPERTIES OF WOOD

Timber as felled has extensive moisture content present as 'free' moisture within the cell cavities and 'bound' or 'combined' moisture saturating the cell walls. The recently sawn lumber will lose perhaps 50% of its total weight, shrink somewhat and become much stronger, harder and more durable throughout the seasoningprocess. The excitement process also improves timber workability and the attachment of adhesives and surface finishes. The target MC for the process is normally 12% but it may vary between 10% and 15% in sensible climate conditions; at these levels only bound moisture remains. Timber with MC between 15% and 25% is occasionally regarded as partially seasoned. The peripheral shrinkage is only about 3.5% and the radial shrinkage is around 2.5%. The specific gravity of the cell wall material is about the same in most timbers is about 1.50.

3.1. Density Classification: The density of experienced timber is usually measured for classification purposes — at 12% air-dries MC.

- Exceptionally light — under 300 kg/m³
- light — 300 to 450 kg/m³
- Medium — 450 to 650 kg/m³
- Heavy — 650 to 800 kg/m³
- Very heavy — 800 to above kg/m³

Wood is collected of cellulose, lignin, ash-forming minerals, and extractives formed into a cellular structure. Variations in the appearances and volumes of the four components and differences in the cellular structure result in some woods being heavy and some light, some stiff and some flexible, and some hard and some soft.

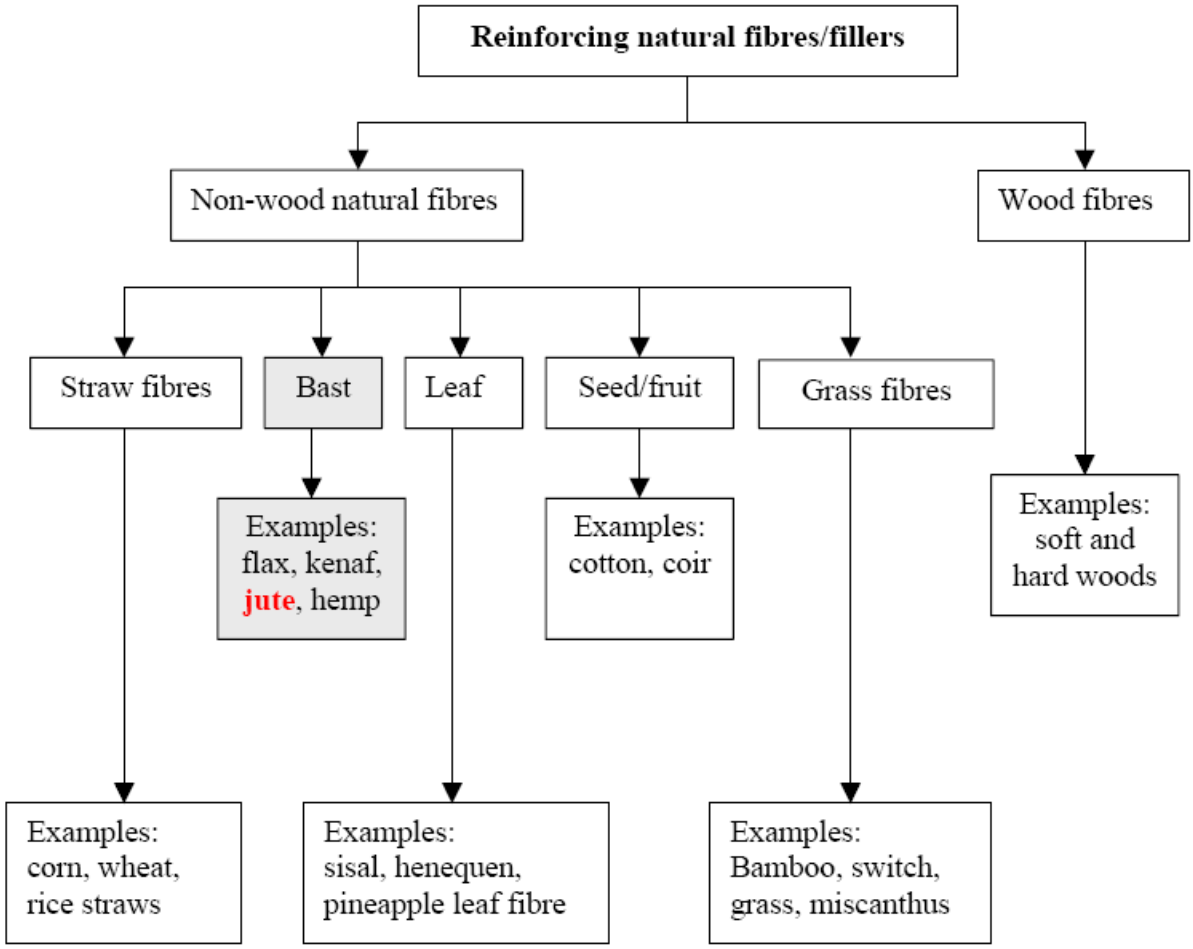

Fig 1. Classification of natural fibres which can be used as reinforcement or fillers in polymers

3.2 Jute fibre structure: Jute is multicelled in structure (Fig. 2). The cell wall of a fibre is made up of a numeral of layers: the primary wall and the secondary wall (S), which again is made up of the three layers (S1, S2 and S3)**.** As in all lignocellulose fibres, these layers principally contain cellulose, hemicellulose and lignin in changing amounts. The individual fibres are bonded together by a lignin-rich region known as the middle lamella. Roughage attains highest absorption in the S2 layer (about 50%) and lignin is most concentrated in the middle lamella (about 90%) which, in principle, is free of cellulose. The S2 layer is regularly by far the thickest layer and controls the properties of the fibres. Cellulose, a primary component of the fibre, is a linear compression polymer consisting of Danhydro-glucopyranose units joined together by ß-1, 4-glucosidic bonds. The long chains of cellulose are accompanying together in bundles called micro-fibrils.

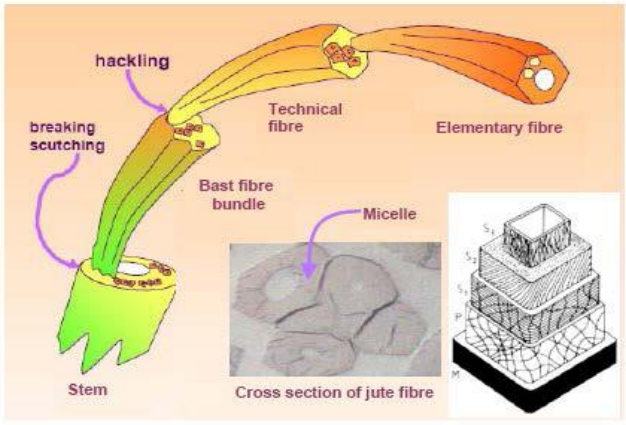

Fig2. Jute fibre structure

IV. SOME APPLICATION OF JUTE COMPOSITE AS WOOD SUBSTITUTE

4.1. Jute mat: Jute mat is an example of a non-woven jute fibre composite. The material is unruffled of jute fibre, resin and a small amount of synthetic fibre. The business process creates a mat that can be then beingprepared into creative shapes, such as a car door panel. The result is a light but strong component.

Uses: - Constructors might consider using a jute fibre combined mat for products that require the characteristics of wood, but have a shape that cannot be made with a standard wood product. Industrialists can use the mats in their molding process. Heat and pressure will set the lignin and resins in the mat, resulting in a hard, lightweight shape. Typical harvests made using jute fibre composite are molded door skins, automotive interior trim and architectural moldings. The mat itself has also been used gardening products to hold seeds in place prevent weeds and add slow release fertilizer to seedlings.

4.2.Jute Fibre-Thermoplastic Composites: Wood flour is charity as filler with thermoplastics. The consequential mixture can be used in injection molding or compression molding processes. Clothes hangers and almost any molded plastic objects can be made from this product.

4.3. Building & Construction: Building &production technology trends worldwide establish the fact that the combinations occupy a prominent position as the building material extricating many conventional ones. Composites are an attractive proposition seeing the embedded energy particularly against metals. Other important properties such as impact resistance, corrosion resistance, thermal & acoustic padding all subsidizefavorably to composite claiming its position as an ideal building material. A wide array of innovative composite products appropriate for building &building sector and bio-medical appliances had been established by the Advanced Composites Programme. Jute-coir merged boards, FRP sandwiched door shutters, FRP toilet blocks etc.

Fig 3. Jute-coir Composite Boards

V. CONCLUSIONS

From the point of view of wood exchange, natural fibre compounds would enjoy wider acceptance. India enjoys a niche for the natural fibre syntheses as the country is endowed with large varieties of natural fibres such as jute, coir, sisal, pine needles etc. Thus, the usage of normal fibre based products in post-disaster administration of recuperation& rebuilding would become cost reasonable compared to other building materials. Environmental apprehensions and increasing competition are forcing to think about heightening the wood resource and exploiting performance as opposed to the old focus on price. The natural fibre based composite products are good example of such an optimization strategy. Use of jute based composites increases its overall utilization of the wood resource. These products are a result of research into inventionincrease and process technology. Effectiveness and innovation are keys to maintaining a competitive edge in the global markets of today and tomorrow. With ever depleting forest investments and corresponding premium on wood, a composite based on renewable resources such as jute, coir, sisal etc. is poised to penetrate the market. Indigenous wood stream for plywood industry have been stopped essentially and with increasing landed cost of imported plywood veneers, the jute composite panels provide very good value for the customers without any compromise in properties. By converting flexible jute materials into rigid/semi-rigid sheet for use in packing as a additional for wood and plywood suitable jute composite materials or products of

market probable like soft packaging for tea and other food packages; crates for fruit packaging and jute-resin bonded transitional products/materials for various padding purposes were developed.

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