Comparison and Characterisation of Coir Shortfibre Polyester Composite and Coir Short Fiber Polyester Composite with Calcium Carbonate

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Abstract **- The main objective of this project is to develop a composite made of two different materials which is reinforced with polyester resin, respectively. First is coir short fiber i.e. coconut coir fiber which is light in weight and posses good mechanical properties, and the other one is coir short fiber with calcium carbonate as filler with polyester i.e. calcium carbonate which is good at water absorption and increases the flexural strength ,heat resistant and also posses good mechanical properties. After curing these fabrics are conducted with various tests like Tensile, Impact, Flexural and shear tests. Finally, the material with better properties and results is selected and used in commercial, automotive, and building and household applications.**

INTRODUCTION

COMPOSITES

Composites are generally combinations of two or more material during which the reinforcing phase is either polymer or ceramic/metallic material. There are differing kinds of fibers which are reinforced within the matrix of which natural fibers have gained much importance in recent past. Fiber Reinforced Polymer (FRP) composites play a vital role all told spheres of day to day life because of their low cost, processing advantage of lower density and possessing good mechanical behavior over traditional reinforcement materials.

FIBER

Fiber or fibre could be a natural or synthetic substance that's significantly longer than it's wide. Fibers are often utilized in the manufacture of other materials. The strongest engineering materials often incorporate fibers, for instance carbon fiber and ultra-high-molecular-weight polyethylene.

Synthetic fibers can often be produced very cheaply and in large amounts compared to natural fibers, except for clothing natural fibers can give some benefits, like comfort, over their synthetic counterparts. Natural fibers are used some 3000 years ago in composite systems within the ancient Egypt, where straw and clay were mixed together to make the walls. within the previous couple of years, biological fibers became a beautiful reinforcement for polymeric composites from economic and ecological point of view. there is a rise within the environmental awareness within the world which has aroused an interest within the research and also the development of biodegradable materials. Natural fibers are obtained from natural resources like plants, animals or minerals. With the rise of world energy crisis and ecology risk, the unique advantages of biological fibers like its abundance quantity, non-toxic, non-irritation of the skin, eyes, or system, non- corrosive property, biological fiber reinforced polymer composites have attracted much interest as a result of their potential of serving as alternatives reinforcement to the synthetic ones.

The lower weight and better volume of the biological fibers as compared to the synthetic fibers improve the fuel efficiency and reduced emission in auto applications. Natural fibers are classified into three categories. These are plant fibers, animal fibers and mineral fibers.

RESINS

Resins are usually mixtures of organic compounds. this text focuses on naturally-occurring resins. Plants secrete resins for his or her protective benefits in response to injury. The resin protects the plant from insects and pathogens.

MATERIALS AND METHODS

COCUNUT COIR:

Coir, or coconut fibre, is a natural fibre extracted from the husk of coconut and used in products such as floor mats, doormats, brushes, and mattresses. Coir is the fibrous material found between the hard, internal shell and the outer coat of a coconut. Other uses of brown coir (made from ripe coconut) are in upholstery padding, sacking and horticulture. White coir, harvested from unripe coconuts, is used for making finer brushes, string, rope, and fishing nets. It has the advantage of not sinking, so can be used in long lengths on deep water without the added weight dragging down boats and buoys. Chemical composition of coconut coir fiber are lignin (45.84%), cellulose(43.44%), hemi cellulose(0.25%), pectin and related components(3%), water soluble(5.23%), ash (2.22%) physical composition of coconut coir fiber are length inches (68), density (1.40g/cc), tenacity (10g/Tex), rigidity of modulus (1.8924dyne/cm2).

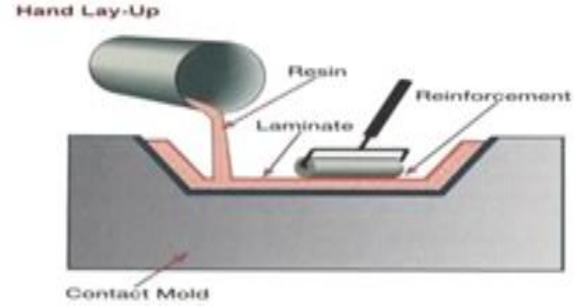
Fiber Type	Density (g/cm^3)	E-modulus (GPa)	Specific modulus (modulus/density)
E-glass	2.55	73	29
Hemp	1.48	70	47
Flax	1.4	60-80	43-57
Jute	1.46	10-30	7-21
Sisal	1.33	38	29
Coir	1.25	6	5
Cotton	1.51	12	8

CALCIUM CARBONATE:

Calcium carbonate is a chemical compound with the formula CaCO3. It is a common substance found in rocks as the minerals calcite and aragonite (most notably as limestone, which is a type of sedimentary rock consisting mainly of calcite) and is the main component of pearls and the shells of marine organisms, snails, and eggs. Calcium carbonate is the active ingredient in agricultural lime and is created when calcium ions in hard water react with carbonate ions to create limescale. It is medicinally used as a calcium supplement or as an antacid, but excessive consumption

POLYESTER RESIN:

Polyester resins are unsaturated synthetic resins formed by the reaction of dibasic organic acids and polyhydric alcohols. Maleic Anhydride is a commonly used raw material with diacid functionality. Polyester resins are used in sheet moulding compound, bulk moulding compound and the toner of laser printers.



Mould Preparation

Methodology for Fiber Reinforced Fiber Composites

Step 1: Lay sufficient OHP sheets above the plywood.

Step 2: Mix the resin with the coir short fibre with calcium carbonate in separate mug or beaker.

Step 3: stirr the mixed proportion in the mug or beaker.

Step 4: Apply the mixed solutions in separate square shaped wood block.

Step 5: Allow to heal for few hours arrangement.

Step 6: Conduct various test for comparison

SL. No.	Maximum Force (KN)	Max. Stress (MPA)
1.	0.50	5.70
2.	0.56	5.67
3.	0.51	5.90
4.	0.54	5.52
5.	0.53	5.73
Mean	0.53	5.70

- Tensile Test
- Flexural Test
- Shear Test
- Impact Test
- Hardness Test

RESULT

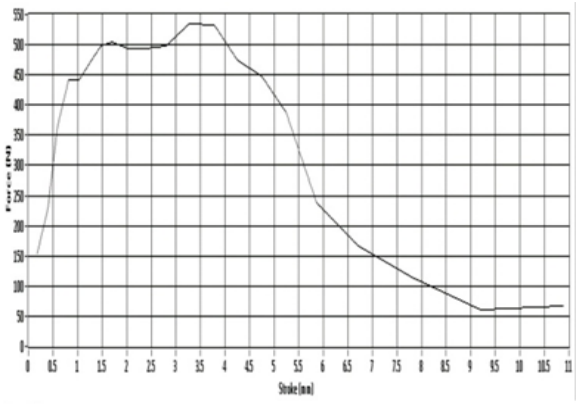
COIR SHORT FIBER POLYESTER COMPOSITE:

Tensile Strength

The tensile tests were conducted on five samples for each Natural and Synthetic fiber composite. The tensile was carried out in ASTM D638 testing method.

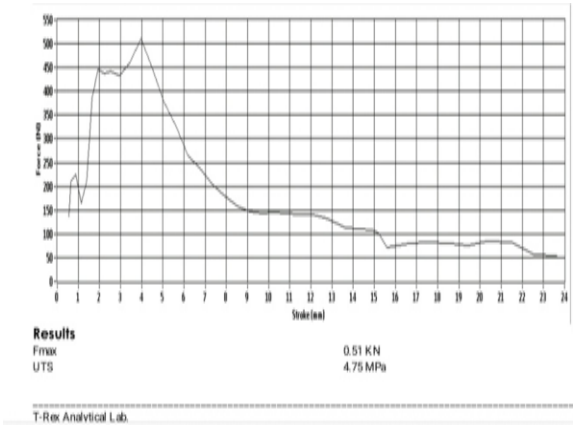
The Tensile test values are tabled below. In the table we are calculated the Mean value, this mean value gives the average strength of each samples.

SpecTimen 1: Coir short fiber polyester composite

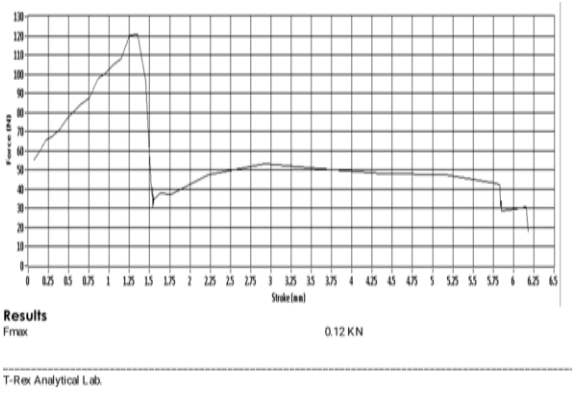


Tensile test graph for coir short fiber polyester composite

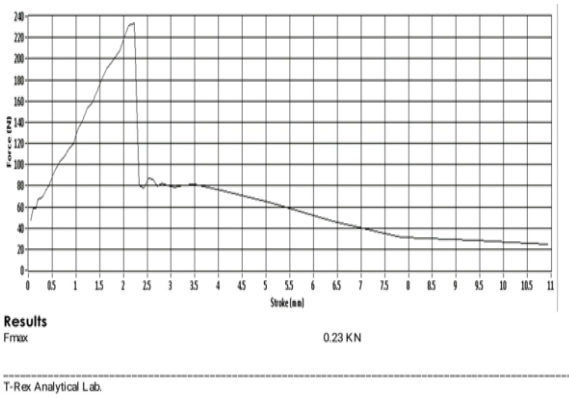
Tensile test result for coir short fiber polyester with calcium carbonate composite



FLEXURAL TEST

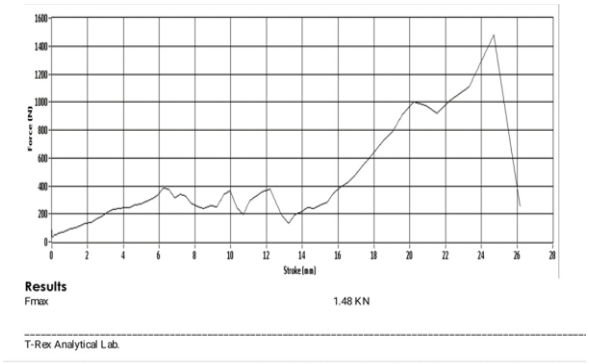


Short fiber polyester



Flexural test graph for coir short fiber calcium carbonate composite

SHEAR TEST



Shear test graph for coir fiber calcium carbonate composite

Experimental Properties

SL. No.	Properties to be compared	Coir polyester composite	Coir+caco3 composite
1.	Tensile Strength	5.70 (Mpa)	4.75 (Mpa)
2.	Flexural Load	0.12 (KN)	0.23 (KN)
3.	Shear Load	0.11 (KN)	0.1808 (KN)
4.	Impact Strength	4 joules	4 joules

CONCLUSION

From the above tests it was noted that the specimen-1 Coir fiber, has proven having the better results in terms of flexural, impact, shear loads and coir fiber with caco3 is better in case of flexural strength. Hence the potential new material for commercial and other various purpose of metal, wood replacement has been found.

The coconut coir composite was prepared suing different resin system viz polyester, vinyl ester and epoxy, in order to characterized three mechanical properties tensile, hardness and bending. The

experiments were planned using L9 orthogonal array by changing level of calcium carbonate, filler weight, resin type and fiber length. The ANOVA was performed to check the significance of factor level and following conclusion was drawn. It has been observed that increasing the filler weight % increases the hardness and bending strength of the polymer composites. Also, caco3 treatment of filler increases the bending strength. This is due to the increase in adhesion property of particles. Increasing the coir fiber length, the tensile strength can be increased.

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