Experimental Study on Glass Fiber/Coir Reinforced Composite

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Abstract— **In present work, an attempt is made to hybridize the material using synthetic (glass) as well as natural fibers (chemically treated jute), such that to reduce the overall use of synthetic reinforcement, to reduce the overall cost, and to enhance the mechanical properties. All composite specimens with different weight percentages of fibers were manufactured using hand lay-up process and testing was done by using ASTM standards. The attractive features of natural Fibers are their low cost, light weight, high specific modulus, renewability and biodegradability. It has been observed from this work the tensile strength of the composites slightly increase in all three samples. The maximum tensile strength among all the composites is 58.573MPa for 5mm Fiber length 25% of coir and 10% of glass Fiber respectively. The maximum flexural strength was 219.004 MPa for 25% of coir and 10% of glass Fiber and the maximum impact strength was 3.143 for 15% coir and 20% glass Fibe**

Index Terms— **Fibers, reinforcement, Glass fiber, tensile tests**

I. INTRODUCTION

Composite materials have a long history of usage. Their beginnings are unknown, but all recorded history contains reference to some form of composite material. For example, straw was used by Israelites to strengthen mud bricks. Plywood was used by ancient Egyptians when they realized that wood could be rearranged to achieve superior strength and resistant to thermal expansion as well as to swelling owing to the presence of moisture. Medieval swords and armor were constructed with layers of different materials.

Composite Materials

A composite is a material which is made up of two or more distinct (i.e. Macroscopic, non- macroscopic) materials. A familiar composite is reinforced cement concrete, which is basically made up of sand, cement and steel rod. Polymer composites are plastics within which there are embedded fibres or particles. The plastic is known as the matrix, and the fibres or particles, dispersed within it, are known as the reinforcement.

II. EXPERIMENTAL DETAILS

Materials

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The raw materials used in this work are 1. E-glass Fibre 2. Coir 3. Epoxy resin Glass Fibre, coir, Epoxy resin DGEBA LY556, hardener DETA HY951 and acetone lab grade.

Preparation of glass Fibre / coir composite:

A flat square alloy mould with dimensions of 270x270x3 mm was used to prepare the composites. The (25%wt, 20%wt, 15%wt) of coir was added into epoxy resin system and (10%wt, 15%wt, 20%wt) of glass Fibre were added into composites. The mixture was then introduced into epoxy resin and stirred for 1.30 hours at 80° C followed by compression moulding and Curing agent was added with gentle mixing for 10 min. The glass Fibre & coir solution was then brushed onto fourteen plies of glass Fibre fabrics. The laminates were finally stacked on an alloy mould and cured in a compression moulding machine. During the heating process, the mould containing mixer was pressed up to 180 MPa and holding at 150 °C for 1 hour to promote degassing from the particle compact. The cast moulds were finally removed from the compression moulding setup.

Fabrication Methodology

The procedure adopted in the fabrication of composites is represented in the systematic diagram as shown below in fig.1

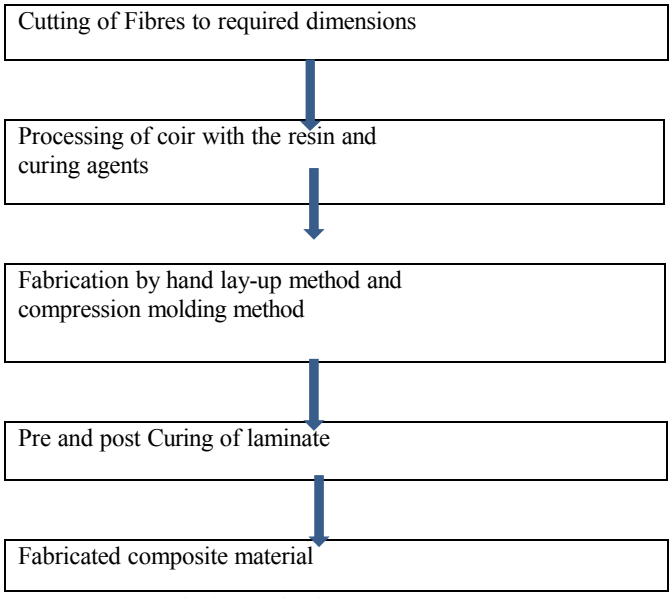


Fig 1: Fabrication procedure

Fabrication by hand lay-up method and compression molding method:

Hand Lay-Up Method:

Hand lay-up is a simple method for producing composite material. A mould must be used for hand lay-up parts unless the composite is to be jointed directly to another structure. The mould can be as simple as a flat sheet or have infinite curves and edges. For some shapes, moulds must be joined in sections so they can be taken apart for part removal after curing. Before lay-up, the mould is prepared with a release agent to insure that the part will not adhere to the mould. Reinforcement Fibres can be cut and laid in the mould. It is up to the designers to organize the type, amount and direction of the Fibres being used. Resin must then be catalyzed and added to the Fibres. A brush, roller or squeegee can be used to impregnate the Fibres with the resin. The lay-up technician is highly responsible for controlling the amount of resin and the quality of saturation. Other fabrication process such as vacuum bagging, vacuum resin transfer moulding and compression moulding can be used with hand lay-up to improve the quality of the finished part or save time.

Procedure For Hand Lay-Up Process

1. Wash the mould plate carefully with warm water and soft soap to remove any old PVC release agent, dust, grease, finger marks, etc.
2. Dry the mould thoroughly.
3. Check the mould surface for chips or blemishes. These should be repaired by filling with polyester filler. The odd small chip can be temporarily repaired filling with plastic filler.
4. If the mould surface is in good condition the mould release wax is now applied, with a circular motion, using a small piece of cloth.
5. Apply the first layer of resin above the wax applied mould plate and spread uniformly over the plate.
6. Place the coir and again pour the resin over it.
7. Then spread the resin over it uniformly using the roller.
8. Follow the same procedure for as many layer you want.
9. Finally stack the laminate on an alloy mould and cured in a compression moulding machine.

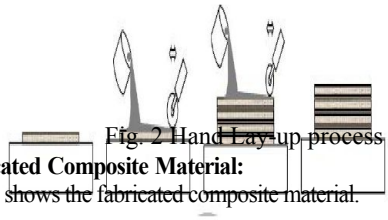


Fig. 2 Hand Lay-up process

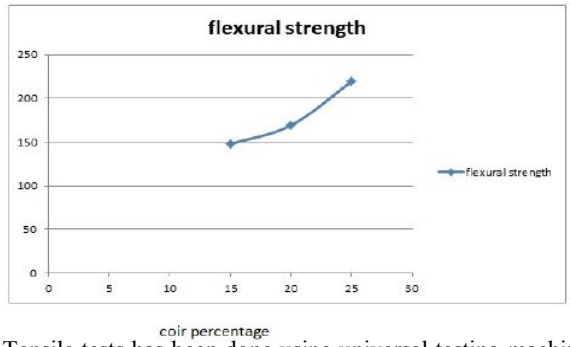
Fabricated Composite Material:

Fig.3 shows the fabricated composite material.

Result And Discussion:

Tensile Testing Result (ASTM 3039):

Percentage of coir	Peak load N	Cross sectional area(mm^2)	%Elongation	UTS (Mpa)
25	4392.959	75	2.186	58.573
20	3222.670	75	2.315	42.882
15	2790.009	75	1.457	37.199



Tensile tests has been done using universal testing machine. As perASTM-D-3039 with the uniform gauge length of 100 mm and test speedof 2mm/min. With the addition of coir, the value of tensile strengthincreased for coir loading up t o 25 wt% and then it decreased.

CONCLUSION

The experimental investigation on the mechanical properti es ofglass Fibre reinforced with various percentage of coir c ontent leads to thefollowing results.It was concluded that,

1. The performance of glass Fibre reinforced with coir was s uperior tothe glass Fibre epoxy composites.
2. From tensile test, it exhibits glass Fibre reinforced with 25% of coircontent has more tensile strength when compared to other weightpercentage.
3. From flexural test, it exhibits that glass Fibre reinforced with 25%of coir content has more flexural strength when c ompared to other weight percentage.
4. From impact test, it exhibits that glass Fibre reinforced wit h 15% ofcoir content hasmore impact strength when compa red to other weight percentage.

Upon the overall observation, it was observed that t hereinfrcement of glass Fibre with coir content at various weightproportions originated a newer material with gen eral superiorproperties and depending on the loading conditi ons.

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