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# INVESTIGATION OF MECHANICAL PROPERTIES IN HAIR FIBRE REINFORCED POLYMER COMPOSITES

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## ABSTRACT

The conventional application of fiber in relation to the technology of synthetic fiber reinforced composites reveal the clue to widen the scope and to adopt the natural fiber composites for industrial applications. In the present work, human hair fiber is incorporated in Modified Polyester resin matrix hybridized with glass fiber for preparing composite specimens at various fiber weight percentages The developed human hair fiber, glass reinforced hybrid Modified Polyester composites (VGPP) were then tested for their mechanical properties. To enhance the adhesion between the human hair fiber and the Modified Polyester matrix, maleic anhydride- grafted Modified Polyester was used as a compatibilizer for the composites. It was found that the increase in fiber content reduces the mechanical properties of human hair glass-PP composite.

## I.INTRODUCTION

The composite materials are very advantagable over conventional materials because of their different character like higher specific strength, stiffness and fatigue by which structural design to be more versatile. Composite materials consist of two or more constituents but different physically separable phases. But when the composites phase material has different physical properties then it is recognized as being a composites material. The matrix material can be metallic, polymeric or can even be ceramic.

## II.MATERIALS AND METHODS

This chapter describes the details of processing of the composites and experimental procedures followed for their mechanical characterization.
The raw materials used in this work are,

1. Human hair fibre
2. Modified Polyester resin
3. Hardener

## SPECIMEN PREPARATION

The fabrication of the various composite materials is carried out through the hand lay-up technique. Short human fibres are reinforced with Modified Polyester resin, chemically belonging to the “Vinyl” family is used as the matrix material. The low temperature curing Modified Polyester resin, catalyst, promoter and corresponding hardener are mixed in a proper ratio. The Modified Polyester resin and the hardener are supplied by Covai-seenu & Co Ltd. The human hair fibre is collected from rural areas of Madurai, India.

## DIMENSIONS AND CALCULATIONS

Mould Dimension

Length of the mould = 30cm
Width of the mould = 30cm
Thickness of the mould = 0.5cm
Volume of the mould = 450cm^3

SPECIMEN DIMENSIONS

Length = 10cm
Width = 2.5cm
Thickness = 0.5cm

EXPERIMENTAL TECHNIQUES

A. TENSIL TESTING

In a broad sense, tensile test is a measurement of the ability of a material to withstand forces that tend to pull it apart and to what extent the material stretches before breaking. The stiffness of a material which represented by tensile modulus can be determined from stress-strain diagram. This condition of plastic for not less than 40 hours prior to test in accordance with Procedure A of ASTM D618. Universal Testing Machine was used at cross-head speed of 50 mm/minute. The specimens were positioned vertically in the grips of the testing machine. The grips were then tightened evenly and firmly to prevent any slippage with gauge length kept at 50mm.

As the tensile test starts, the specimen elongates; the resistance of the specimen increases and is detected by a load cell. This load value (F) is recorded until a rupture of the specimen occurred. Instrument software provided along with the equipment will calculate the tensile properties for instance tensile strength, yield strength and elongation at break. Below are the basic relationships to determine these properties:

Tensile strength = Force (load)/Cross section area .
Tensile strength at yield = Maximum load recorded/Cross section area.
Tensile strength at break = Load recorded at break/Cross section area.
Tensile strength at yield = Maximum load recorded/Cross section area.
Tensile strength at break = Load recorded at break/Cross section area.

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Universal testing machine

However experimental design methods are too complex and not easy to use. Furthermore, a large number of experiments have to be carried out when the number of the process parameters increases, to solve this problem, the uses a special design of orthogonal arrays to study the entire parameter space with a small number of experiments.

B. flexural TEST

Flexural strength of composites at different percentageof fibre. The flexural strength i ncreased with fibre loading up
to 15% weight fraction of the fibre, and there was decrement
after 15% fibre loaded composites. The reasons for the lower flexural properties at fractions a re possibly due to the lower
fibre to fibre interaction, void and poor dispersion of fibre
in the matrix. The flexural strength of the pure polypropylene . The maximum flexural strengt h of the composite and for composite, occurring at 15% fibre fraction. There a moderate incr

ease in the flexural strength values due to the

The flexural modulus increases with the fibre loading. Since, higher Fibreconcentratio n demands higher stress for the same deformation due to increasein the degree of obstruction, modulus values has increased with the fibre content.. Again the highermodulus values of the treated composites compared to thecom So, there is an increase in stiffness in the treated com posites,compared to the composites.

- plete thought or name is cited, such as a title or full quotation. When quotation marks are used, instead of a bold or italic typeface, to highlight a word or phrase, punctuation should appear outside of the quotation marks. A parenthetical phrase or statement at the end of a sentence is punctuated outside of the closing parenthesis (like this). (A parenthetical sentence is punctuated within the parentheses.)
- A graph within a graph is an “inset,” not an “insert.” The word alternatively is preferred to the word “alternately” (unless you really mean something that alternates).

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- There is no period after the “et” in the Latin abbreviation “et al.”
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TENSILE PROPERTIES

A 20 ton capacity - Electronic Tensometer, FIE 2000 ER-I model was used to find the tensile and flexural properties of the composite specimens. Dog bone shaped tensile test specimens were made in accordance with ASTM-D 3039M to measure the tensile properties. The samples were tested at a crosshead speed of 1 mm/min and the strain was measured with an extensometer.

FLEXURAL PROPERTIES

Three point bend tests were performed in accordance with ASTM D790M test method I, Procedure A to measure the flexural properties. The samples were 150mm long by 24mm wide by 4mm thick. In three point Bending test, the outer rollers are 64mm apart and the samples were tested at a strain rate of 1mm/min. The flexural strength and flexural modulus of the composites are determined.

The flexural modulus,

EB = L3 m /4bt3

The flexural strength,

S = 3PL/2bt2

Where L is the support span (64mm), b is the width and t is the thickness, P is the maximum load and m is the slope of the initial straight line portion of the load-deflection curve.

## ADVANTAGES AND DISADVANTAGES

### ADVANTAGES OF NATURAL FIBRES

- It has Low specific weight that gives higher specific strength and stiffness than glass. This property is useful especially in parts designed for bending stiffness.
- Natural fibres are renewable resource and the production required little energy. Co2 is used while oxygen in given back to the environment.

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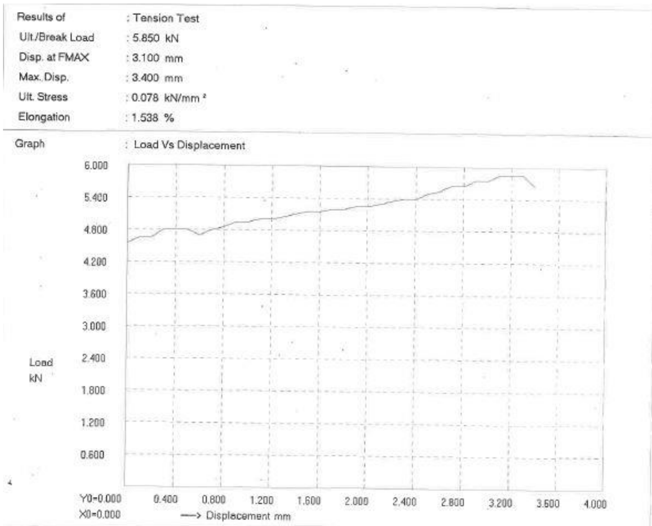
### DISADVANTAGES OF NATURAL FIBRES

- It has Lower strength properties, particularly its impact strength.
- Natural fibres have variable quality, depending on unpredictable influenced such as weather.
- It absorbs Moisture which causes swelling of fibres.

### RESULT OF TENSILE TEST

| S.NO | HAIR | GLASS | BREAK LOAD(KN) | Disp(mm) | . 2. Max.Dip (mm) | . 3. 4. UTS (kn/m $m^2$) | 5. %Elongation |
|---|---|---|---|---|---|---|---|
| **1** | **10** | **10** | **5.850** | **3.100** | 6. **3.400** | 7. **0.078** | ig. 8. **1.538** |
| **2** | **10** | **15** | **5.350** | **1.200** | 9. **1.400** | 10. **0.071** | ig. 11. **1.250** |
| **3** | **20** | **15** | **5.050** | **0.800** | 12. **1.900** | 13. **0.067** | ig. 14. **1.349** |




In this thesis, the natural fibre hybrid reinforced vinyl ester composites are fabricated and analyzed the tensile properties of fabricated composites and compared with other natural fibres results. The tensile strength comparsion for untreated hybrid fibre composites and treated hybrid fibre composites. Using universal testing machine, the tensile strength of the natural fibre hybrid reinforced vinyl ester composites are determined. The tensile test report for untreated hybrid fibre reinforced vinyl ester composites. The tensile test report for treated hybrid fibre reinforced vinyl ester.

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## CONCLUSION

The incorporation of human hair fibre hybridized with glass fibre into the polypropylene matrix has shown a moderate improvement in the tensile, bending and impact properties of the composite. 10% fibre weight fraction composites exhibited maximum tensile strength and maximum flexural strength is observed for 15 % fibre weight fraction composites.

Tensile and Flexural Modulus values increased with increase in fibre weight fraction and higher values are observed in 25% fibre weight fraction composites. Addition of resulted to an increase in both strength and modulus of all composites at different fibre weight fractions. The composite can be regarded as a useful light weight engineering material and also the manufacturing cost of the composite can be reduced considerably by adding Human hair fibre hybridized with glass fibre to the matrix.

This project is characterising new material which is eco friendly ,light weight effective usage of bio-waste with a concern of ethical value and follow the testing standard. The bio fibers are used in this project .There is no hazardness and the material is safe for handling. This project aim to protect the environment by reduceing the polymer usage by reinforceing bio fiber

## REFERENCES

1. Mohanty K,mishra Mand Drazal L.T,(2005) Natural Fibre ,Biopolymers and Biocomposites,Boca Raton,FL,CRC Press, Taylor& Francis Group,2005,875.
2. Karnali R, Krishnan M and Narayan R,"Biofibre-reinforced polypropylene composites" Polymer Engineering and Science, 37(2), 1997, 476-483.
3. Joseph K, Mattoso L.H.C, Toledo R.D, Thomas S, Carvalho L.H.de, pothen L, Kala S and James B,"Natural fibre reinforced thermoplastic composites. In Natural Polymers And Agrofibres Composites",ed.E.Frollini,A.L Leao and L.H.C.Mattoso,159-201,2000,san Carlos,Brazil:Embrapa,USP-IQSC,UNESP.
4. George J, Sreekala M.S and Thomas S,"Areview on interface modification and characterization of natural fibre reinforced plastic Composites ", Polymer Engineering and Science, 41(9), 2001, ppPolymer Engineering and Science, 41(9), 2001, pp.1471-1485

5. Van de Velde K and Kiekens P,Thermal degradation of flax: The determination of kinetic parameters with thermo gravimetric analysis ,83(12),2002,Journal of Applied Polymer Science ,pp ,2634-2643
6. Klemm D,heublein B,Fink H,Bohn A(2005) Angew chem. Int Ed 44:3358
7. Liansong W,Dongling H,Tianyao Z Lifang Z,Chengdong X (2010)Cryst Res Technol 45:275
8. Investigation of the electrical and mechanical properties of short sisal fibre –reinforced epoxy composites in correlation with structural parameters of the reinforced fibre.Annapurna Patra & Dillip Kumar Bisoyi