Experimental Studies on Mechanical Strength Properties of a Natural composite

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Abstract—. The material field and its engineering, is a greater emerging scope over the invention of composite materials. Good strength and low cost remains the winning combination that propels composite materials into new awareness. To replace conventional materials in aerospace, automotive, highly stressed parts, mobile industry equipment and hydraulic unit's applications.

The present work is carried out on the development of polymer bio-composites. The powdered coconut shell and Rice husk are used as a filler material with matrix epoxy resin of grade HSC 7600 and Hardener of grade HSC 8210 to form hybrid composite specimens. The fabricated composites were tested as per ASTM standards to evaluate mechanical properties such as tensile strength, and impact strength and moisture test are evaluated. The result of tests how that hybrid composite has far better properties than single fiber glass reinforced composite under mechanical loads. However it is found that incorporation of Resin and coconut shell and rice husk in ratio 70:15:15 have far better properties than other two ratios.

Keywords*— epoxy resin of grade HSC 7600*; coconut shell; Rice husk; tensile strength; impact strength.

I. INTRODUCTION.

Ever since the subject of the search for the alternative for conventional materials, the composite materials are dragging to achieve the better properties with more adaptation for the conventional usages. I t offers the economic aspects which cannot be affordable by the conventional materials.

High strength to weight ratio is the main advantage in using for its various kinds of applications. The basic application are now advanced in various sectors of the manufacturing the parts of the machine components. The today world is mainly is taking the advantage of up to 65% of manufacturing the system components.

The main idea is to invest on the Reinforcement method which makes the best composite. The use of fibers or the particulate matters will decide the properties of the composite. Then once the question arises with the suitable bonding material as matrix, There are several resin compounds which suits for the particular composite. The resin matrix which forms the base, contributes more in achieving the property of the material. The study is to be made through the concept of ANOVA and other variance algorithms for determining the optimality of the resin for its selection. Then, there is choice for the selection for the application of fibers or the particulate matters The reinforcement in the form of fibers which are either natural or synthetic offers more reliability in their application. The nature has provided us lager amount of different kinds fibers derived from the natural resources .The main point is what kind of natural material is more suitable and why. Once the filler or fiber is selected, the problem is to vary the percentages on their composition. The density of the fiber material or filler material is the main responsible for achieving the better bond ability in improving the strength of the composite. Therefore the better choice for the composite composition factor is a deciding factor in obtaining the optimal results.

The various research works contributed to feasibility and applicability of the particular composite. This has created enormous gap to search for the better composite which can be applied in practical and check for its feasibility and durability. Even though the main composite have been prepared and tested with respect to the ASTM standards, but they lag in their particular application. The literature work related to the study are more but we find less papers related to their application. The research papers on the particular application are to be carried out for their exhaustive study. The application of natural fibers or the filler material is one kind of fascinating study which reveals its properties closer to the conventional materials.. Hence the study is made to prepare natural composite using the coconut shell powder and rice husk powder as a filler material. The specimens prepared to Analyse the strength of the composite and its economics. The cost of obtaining the powders are very less and cost of the matrix is more which makes a deciding factor the particular application. Overall the strength results has to be recorded for the further carrying tout the process of investing on the composite material.

II. LITERATURE REVIEW.

D.Chandramohan, et al[2],the experimental results hybrid f3 different specimen possess good mechanical properties and there is no significant different in with and without moisture test results .How even it is found that the incorporation of walnut shell and coconut shell fiber can improve the properties. This work can be further extended to study other tribological aspects like abrasion, wear, hardness behavior of this composite. We can also study other aspects of such composites like use of other potential fillers for development of hybrid composites and evaluation of the ir mechanical and erosion behavior and there resulting experimental findings can be similarly analyzed. Investigation of the powder morphology and fracture surfaces of composite specimens will be carried out by using scanning electron microscopy.

Omrani et al [3]studied the tribological performance of natural reinforced composite and fiber orientation and mechanical properties and positive environmental and economic factors are studies.

Mohit sood et al,[4] In his research , the effect is conducted of fiber treatment on flexural properties of natural reinforced composite , physical and SEM analysis.The electron beam radiation and hot water treatment detoriates the flexural properties of the composite.

J Torres et al[7] ,calculated the fiber orientation of natural composite 0- 90 degrees and plotted different stress strain curves which gives elastic modulus strength ,failures strains.
The significant work is done on the natural composite materials like rice husks, walnut shell and coconut shall all the products are ecofriendly and they also improve the good mechanical strength with low amount of cost. For better utilization of this product they mixed the polymer .generating wealth from the waist products .they compare the product made with this composite is somewhat high cost with good aesthetic look.

F.A.O. Fernandesa et al[1] Initiated research on natural fibers and the cork acting core. The natural flak fiber gives a very good strength compare to the synthetic fiber the composite are manufacture and test gives compatibility of mechanical properties are better than synthetic .the main aim is to reduce the cost and better utilization of natural resources.

v.k.thakur et al [6]initiated research on The environmentally friendly materials in to new natural fiber materials and there utilization's and different uses. This research initiate long fiber –reinforced composite materials and fabricated by compression molding technique initially fiber are using 10,20,,30and 40% weight fiber are loading and mixed with the matrix of different compositions .A fiber with 30% weight was found to be optimum mechanical properties. The resign what we are using all are petroleum by product the decomposition are very difficult. For further studies the different proportions of the fiber with different propos ion of matrix we can be used.

A. Carmalin Sophia et al [5]studied and number of experiments are conducted to feasibility of carbon derived from rice husks coconut shell.these carbon is passed the water spray the decontaminated of water contain .E coil (Escherichia coil).the study were conducted the feasibility of carbon derived.).

From these papers it can be inferred that there is a lot of scope for the study of the coconut shell powder and Rice husk powder which can be realized for its applications. The study reveals the possibility and feasibility of the natural composite to an intended application. Moreover the treated filler material gives the better results and results for untreated filler material may pose some deviations , but these results are important is assessing the usage of the natural composite.

III. OBJECTIVES.

- To prepare polymer matrix composite reinforced with different volume of coconut shell and rice husk powder as filler material using hand lay-up method.
- To test the fabricated composite materials as per ASTM specimen standards.
- The main goal of the present work is to minimize the cost and maximize the effectiveness of the natural composite by conducting the tensile test, impact test.

IV. METHODOLOGY.

The Resin of grade HSC 7600 is a liquid, UN modified Epoxy resin of medium viscosity which can be mixed easily at room temperature. Enable better wetting to the particles. A weighted amount of coconut shell powder and rice husk was taken based on weight fraction as shown in Table 1. The matrix and filler material is carefully mixed under room temperature or 3 to 5 min under mechanical stirring. In the final step, the hardener in a ratio of 100:10 by weight is added. In order to obtain filled composites laminates, by hand lay-up processes composite specimen with 3 different ratios is prepared and tested.
Table 1.composite specimen with different ratio.

Total volume	Volume of Resin	Coconut shell powder	Rice husk powder
100%	70%	15%	15%
100%	60%	20%	20%
100%	50%	25%	25%

All the specimens are prepared with ASTM standards. For the Tensile test specimen will be prepared according to the ASTM standard D630 having length 155mm.Tension specimen geometry is shown in the fig 1.

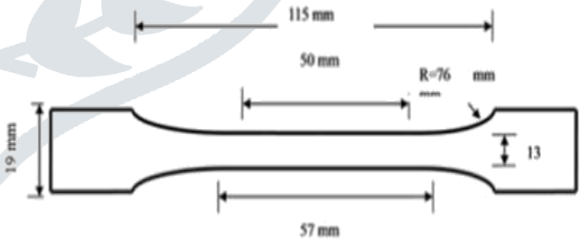

Fig.1.Tensile test specimen's geometry

Impact test specimens will be prepared according to the ASTM standard D256 of 10mmwidth and80mm long. Impact test specimen geometry is shown in Fig 2

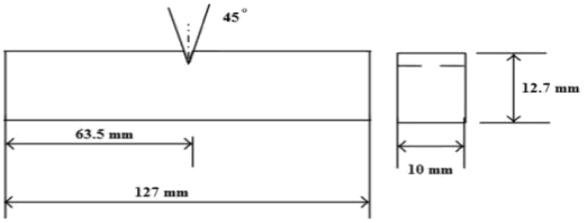

Fig.2. Impact testing specimen and its geometry

Fig.3 coconut shell and Rice husk powders

The coconut shell powder and Rice husk powders are prepared having the size of 300µm and densities are 1.6kg/cc and 1.8Kg/cc respectively. These powders are abundantly available and easier to prepare in the pulverized form. The cost of the powders is less from the economic point of view.

V. RESULTS AND DISCUSSIONS.

The tests are carried out on the various specimens prepared to determine the Maximum load ,deflection, strain energy, impact energy, Tensile strength and impact strength .

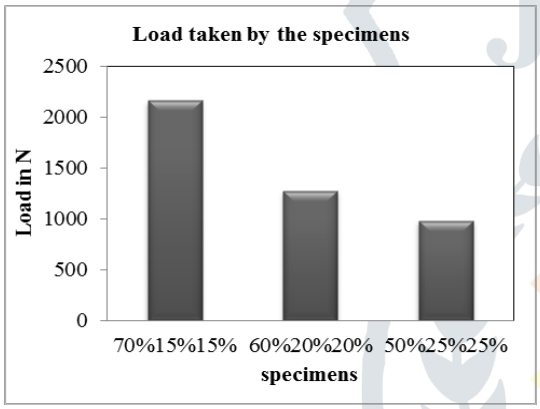

Fig 4 Maximum Load taken by specimens.

In Fig 4, the specimen with 70-15-15 composition has taken the maximum load of 2158.2 N .with the increase of 5% in filler material the load withstanding ability is reduced by **27.2%** and **45.45 %** respectively.

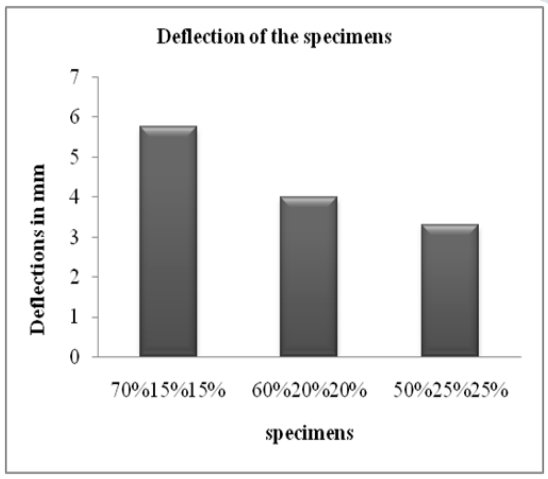

Fig 5 Deflection of the specimen.

Since the load carrying capacity of the first specimen Is more ,the deflection is observed is also more when compared to the other two specimens. sinceThe load and the deflection are directly proportional ,the load bearing capacity ratio is in the range of **1.83:1.33:1** and the corresponding the deflection ratio is **1.74:1.21:1**.

Table 2 strain energy and Impact energy

Specimen	Max load (N)	Max. Deflection in mm	Strain Energy in N-m	Impact Energy in N-m
70:15:15	1765.8	4.6	4.06	2
60:20:20	1275.3	4	2.55	1.5
50:25:25	1177.2	3.3	2.35	1.2

The Table 2 gives the amount of energy absorbed in all the specimens.The energy is absorbed more in the first specimen and is reduced by 37.2 % in both the specimens.The impact strength is reduced by 25% in both specimens with respect to the first specimen.

Table 3 Tensile strength and impact strength of the specimens

specimens	Tensile strength N/mm^2	Impact strength N-m/mm
70%15%15%	33.192	0.333
60%20%20%	24.159	0.25
50%25%25%	18.108	0.20

The Table 3 gives the tensile strength and impact strength of the specimens in which the first specimen has recorded high value of 33.192 MPa. The tensile strength of the other two specimens are reduced by **27.2%** and **45.4%.**The load bearing capcity and tensile strength percentage are found to be same. The variation is not found much larger with respect to the impact strength of the specimens.

Table 4 Moisture Test details

specimens	Weight of Moisture Material in g.	Weight of dryMaterial in g	Moisture Content %
70%15%15%	26.520	26.358	0.61%
60%20%20%	26.428	26.295	0.50%
50%25%25%	26.389	26.295	0.35%

The moisture test conducted for 1 day observation and may be approximated for the 5 days which gives 0.8gm increase in its weight , that is , increase of 0.028% only. Which makes more suitable for various implicational use?

VI. CONCLUSIONS

The experimental results show that the natural composite of 70-15-15 is the optimum ratio which gives the belter results in all the tests. As the percentage of the filler mixture is increased beyond this value, the results will to tend to fall in the all kinds of tests. Moreover the filler material added are not chemically treated and applied in the mixture. The composition proves to be the best for all the kinds of application suited for further development in the results. As further studies these composites should be applied for its feasibility. The main point is a motive to utilize the natural resources for unique application.

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