Testing of Mechanical Properties of Rice Straw Reinforced Composites

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Abstract **- Reinforced composites of 40% and 60% volume fractions of RSF.Rice straw shows potential of reinforcement for natural fibre reinforced composites. It has the ligno cellulosic content and is the by-product which is found abundantly. Rice straw is disposed mostly by open burning which causes environmental pollution. So to prevent this they can be used in making a natural fibre reinforced composite due to their renewable, environment friendly, less hazardous and biodegradable nature. Rice straw fibre reinforced composites were manufactured as per ASTM standards by using hand layup technique. The composites were tested for its bending and impact performance. The standard methods were adopted for bending and impact test procedures viz. ASTM E2248 for impact strength and ASTM D790 for the flexural test of rice straw fibre reinforced composites. The aim of this project is to perform mechanical Testing on Rice Straw Fiber (RSF) under different weight fraction (40% and 60%) of fiber. After Investigating or Performing different test we will compare the results and will decide the day to day useful application needed in human life for that particular test which is successful.**

Keywords— Fiber reinforced composites, Rice straw fiber, Mechanical testing, Hand lay-up technique.

I. INTRODUCTION

A Material produced from various constituent materials having different physical and chemical properties when combined prepares a material of different characteristics from individual component. The finished component formed consist of separate and distinct individual component. This produced material result in cost effective, well built and high in strength and lighter in weight as compared to natural material. Rice plant contains vegetative part called rice straw. Before new ploughing rice straw are burnt or left down on field which helps in enhancing soil improvement or can be used for feeding farm animals. Burning of rice straw leads to air pollution if not used for any purpose. Constituents of rice straw are silica, lignin and protein. The alternative name for rice straw is paddy straw. Through milling, chopping or grinding process we can separate rice straw. e.g. Ash, Beer, cardboard, fertilizers, particle board etc.

K Sudhakar and Ch Srinivas [1] investigated mechanical properties of rice straw fiber at different weight fraction of 0%, 5%, 10%, 15%, 20% and 25% of RSF. The composites were manufactured according to ASTM standard using Injection moulding technique. M.R. Ismail [2] \\\used filler in different polymers, two composites using polyvinyl alcohol and polystrene polymer were prepared with different ratio. Increase in polymer ratio in mixed composition increased impact, Flexural and Modulus of Elasticity indicated in results. Mechanical and physical properties improved composite properties with increase in use of electron beam irradiation dose. Mansi A. Majid et al performed alkaline treatment using NaOH to perform tensile properties of RSF strengthened with polypropylene resin 2 types of fibers i.e. MR219 (5%) and MR220 (10%) at 80° c for 24 hrs.16 samples were prepared according to ASTM standards, untreated fiber showed highest ultimate tensile strength compared to treated fiber. Feraidon Ataie [4] investigated impact of addition of RSF on Compressive and Flexural Strength. Concrete was added in RSF to decrease concrete strength increase concrete shrinkage. Results showed that sample containing washed RSF did not have improvement in compressive strength over samples containing unwashed RSF. Washed RSF Samples had lower drying shrinkage and shorter induction period over unwashed RSF samples. Buzarovska A. et al [5] investigated effect of rice straw fiber in mechanical and thermal properties. Results showed that the value of tensile modulus almost doubled with increase in RSF-content, slight decrease in Tensile Strength Panelized components showed good thermal insulation using Differential scanning calorimetry (DSC) and thermogravimetry (TGA) Method.

The aim of this project is to perform mechanical Testing on Rice Straw Fiber (RSF) under different weight fraction (40% and 60%) of fiber. The size of composite for Tensile, Flexural and Impact test are as per ASTM standards respectively. Hand-lay up method is followed to prepare composite. After Investigating or Performing different test we will compare the results and will decide the day to day useful application needed in human life for that particular test which is successful.

II. EXPERIMENTAL DETAILS :-

Material:-

Rice Straw was procured from farmers residing in near by areas. It was kept for sun drying purpose to completely remove the moisture content. Rice straw shows lignocellulosic properties such as less health hazardous, minimum abration to machine,low cost, renewable & biodegradable.

Preparation of matrix :-

EPOCOAT Epoxy 556 and hardener Finehard 1972 by Fine Finish Organics was used to fabricate the specimen for testing. The density of resin was 3000-3200 mps at 25℃. The mixing ratio to prepare composite was 5:3. To prevent the bubble formation the mixture was stirred for 10 mins.

Mould Preparation :-

The mould prepared was of wooden ply of dimension 320*90*15 (mm). The mould prepared was of dimensions slightly larger than composite size to prevent corner edges from getting damaged. The mould contained both male and female part.

Composite Preparation :-

For fabrication of composite, a plastic sheet with wax on one side was layed on the female part of mould so that composite dosen't get stuck . According to weight fraction of fiber loading , the mixture of epoxy resin and epoxy hardener was made in the wooden mould and was kept for curing. The desired amount of epoxy was mixed with hardener in a plastic container and stirred for 10 minutes. The mould containing composite was kept until the curing process was completed. To obtain a homogeneous mixture. After adding the hardener, the mixture was investigate the mechanical properties of resin based composites, the samples with various rice straw fiber loadings were prepared. Subsequently, the specimens were fabricated based on different experimental purposes. In the current study, the composites containing 40% and 60% loadings (by weight) of rice straw fibers were prepared and the samples were designated respectively. The dimension of composite laminate was 315*85*10 (mm).

Test Performed And Testing Equipments :-

A Universal testing machine was used to test flexural strength and compressive strength of materials. Modern UTM machine can perform all above test and many more. It is a great multi-purpose instrument for R&D laboratory. Capacity of UTM is form 0 to 400 KN.

The Flexural test were performed with ASTM D790 by using Universal testing machine For flexural test the crosshead speed of the UTM was 0.5 mm per minute and the gauge length was 60 mm.The flexural samples were supported at the two ends and the load was applied at the centre using three point bending test.

Impact Test (Charpy Impact Test) was performed with ASTM E2248 and Impact energy was measured.

Fig. 1. Universal testing Machine (SOM Lab, SCOE)

Fig. 2. Charpy Impact Test Machine (SOM Lab, SCOE)

III. SELECTION OF ASTM STANDARDS

TABLE 1. ASTM STANDARD

Testing	Standard	Length (mm)	Breadth (mm)	Height (mm)
Flexural	ASTM D790	125	12.7	3.2
Impact	ASTM E2248	55	10	10

IV. RESULTS AND CONCLUSION

1. 60% weight fraction of long fibers for Flexural load of 4.82 KN has maximum strength.
2. 60% weight fraction of powder form for Impact strength of 12.72 J/cm² has maximum strength.
3. For Flexural Load it is observed that there is continuous variation in load for every composition and weight fraction.
4. For Impact load it is observed that 60% weight fraction for every composition has maximum strength compared to 40% weight fraction.

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