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WEAR PROPERTY ANALYSIS OF RICE HUSK PARTICULATE REINFORCED BIOMATERIAL

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ABSTRACT

This study deals with the wear properties of multiphase material of Polyester resin hybrid composites reinforced with particulates of rice husk. It further investigates the mechanical properties, wear response of those composites, and presents a comparison between the untreated and treated samples. The wear and tear experiments are conducted as per the design of experiment approach using Pin-on disc apparatus. It is observed that the treated rice husk powder produces improved properties of the coefficient of friction and wear resistance. Keywords: Polyester, Wear, coefficient of friction, temperature, rice husk.

INTRODUCTION

The effect of filler volume fraction of rice husk on the wear properties of Epoxy is investigated by Kandula Mahesh et al. (2019). It is found that 20% reinforcement of rice husk produces better wear properties for the developed Epoxy composites.[1] The effect of rice husk ash(RHA) on the tribological properties of Aluminium matrix composites are studied and it is observed using an ANN tool that the wear behavior is improved by 20 to 40%.[2] The addition of Rice husk increased the wear resistance of the AA6061 Aluminium matrix composites and reduced the damage on the worn surface.

Padma Priya et al. [8] has developed Waste silk fabric-reinforced Epoxy laminates by varying content of silk fabric. The mechanical properties like durability and flexural strength of the composites were determined. The glass fabric-reinforced composite reinforcement produced extremely small wear loss, and is caused mainly because of matrix loss.. The wear and tear and friction behaviour of polymeric composites are taken into account as a function of load, sliding speed and distance. The surface temperature plays a very important role within the friction and wear of polymers. A rise in wear intensity

MATERIALS AND METHODS

Materials

A commercially available polyester resin cured by a polyamine hardener was considered as the matrix material in this study. Rice husk powder was selected as traditional reinforcements. Polyester

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was purchased from Sakthi enterprises, Private Ltd., Chennai. Rice

husk was obtained from the Hybrid laminates; Chennai was prepared by hand lay-up technique. The Polyester resin used in this work possesses a density of 1.1 gm/cm3. The low- temperature polyester resin and the proportions of catalysts are recommended ranging between 1% and 4 % of resin weight, depending on die type of the catalyst.

Methodology of Fabrication

Mould prepared by using glass plates. Rice husk is dried, and mat form in 300×300×10mm length was cut.As per weight fraction of the filler, the resin is weighed. Polyester resin and hardener are mixed properly as per the ratio at room temperature. Then the release agent is applied to the mould and the mould is dried in sunlight for a few minutes. The test specimens are cut according to the ASTM Standards for performing wear test.

Initially, rice husk filler is weighed separately before preparing the specimen. The required composite is then made ready, consisting of chopped where the whole net weight is measured.

Table 1.Volume fraction of the composite

Volume fraction of rice husk %	**Total volume of fibre (mm3)**	**Volume of the matrix in %**
10%	37000	90%
20%	37000	85%
30%	37000	72%

Wear Test

The wear test is performed on a pin-on-disc (P-o-D) apparatus according to ASTM D3702. As shown in Fig. 3.3.2, the specimen pin was rotated on a flat steel disc with a radius of 16.5 mm. The initial surface roughness of the counterpart was about 0.23 μm. All tests in this study were conducted for 5 hours under the dry condition at room temperature.

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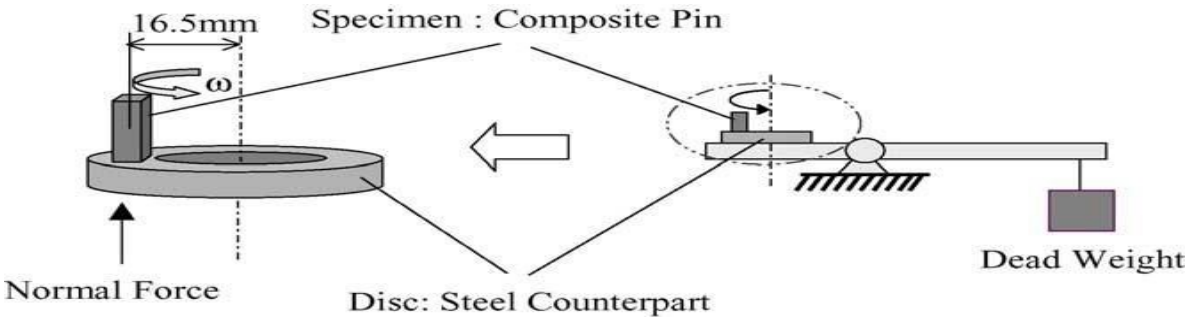

Figure 5 Schematic diagrams of the pin-on-disc test apparatus

RESULTS AND DISCUSSION

The composite specimens are prepared using hand layup technique. There are 6 specimens produced out of which 3 specimens are made of 10 %,20 %,30 % reinforcement of treated rice husk powder and another 3 samples are made with untreated rice husk powder reinforced in the polyester resin. The fabricated specimens are cut according to the ASTM standards for the wear test. The specimens are tested in pin on disc apparatus by varying load and speed parameters to find out the wear loss, frictional force and coefficient of friction.

At a time of 60 sec, upon varying the load & speed the corresponding graph was drawn below. The coefficient of friction and frictional force values noted from the experimental setup are tabulated. The developed composite materials are processed and planned to study the wear properties by varying Load, Speed and Time.

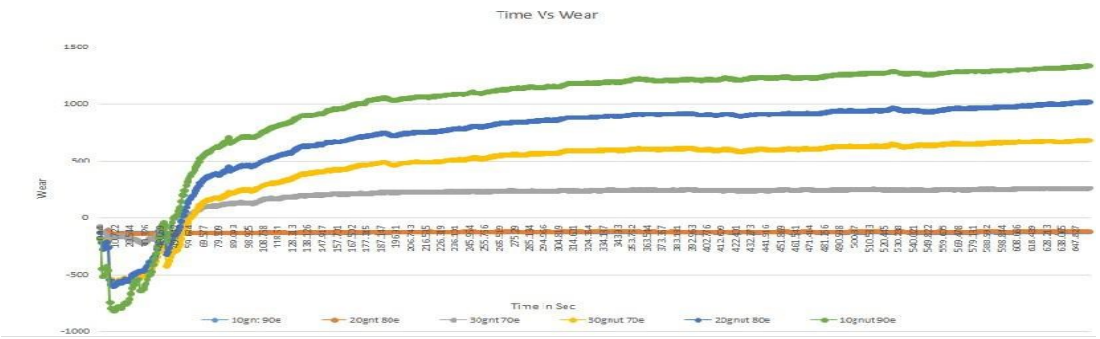

Chart 1. Time Vs Wear

Table 1 shown above gives the test parameters of the samples used for the wear testing. The samples are tested according to ASTM standards. Three different loads are used for testing and the sliding velocity and the sliding distance are maintained constant. Samples used for testing purposes are of three different compositions such as 10, 20 and 30 per cent of treated and untreated rice husk shall powder mixed with the Polyester resin mixture.

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Table 4. Machine Parameters settings for Wear Test

S.No	Sliding diameter (mm)	Rpm	Time in secs	Time in Min: sec
1	26	735	500	8.332
2	38	503	500	8.332
3	46	415	500	8.332

Table 2 gives the machine parameter settings used for testing purposes. The sliding diameter of the machine is changed for every sample. It is maintained as 26, 38 and 46. Rpm is maintained as 735, 503 and 415 for each load in all the three compositions. The running time is maintained to be 8.332 minutes.

Wear loss calculation

The wear loss calculation is calculated from the initial and final weight values of the specimen after the test is conducted. The wear loss is calculated by using the formula

Wear loss = (initial weight – final weight) / initial weight *100

UT 10 % fiber 5 N = (79.347-79.213)/79.347 * 100
= 0.1685

UT 20% fiber 5 N = (79.213-79.207)/79.213 * 100
= 0.0075

UT 30% fiber 5N = (79.207-78.945)/79.207 * 100
= 0.3307

T 10% fiber 5N = (69.992-69.989)/69.992 * 100
= 0.0042

T 20% fiber 5N = (69.989-69.690)/69.989 * 100
= 0.4273

T 30% fiber 5N = (69.690-69.671)/69.690 * 100
= 0.1047

Results reveal that upon evaluating the wear behaviour, the coefficient of friction value tends to lie between zeros to one. From the results, the minimum coefficient of friction for treated 20 volume % rice husk powder gives better filler and matrix interaction and results in good interfacial adhesion between filler/matrix and fewer voids in the composite.

CONCLUSION

The filler reinforcement percentage is varied as 10%, 20% and 30%. The samples with and without reinforcement are prepared and tested for the properties such as wear rate, coefficient of friction and temperature variation are analysed. From, the results it has been identified that for increase in percentage of reinforcement of rice husk decreases coefficient of friction and hence the wear rate and temperature variation also decrease.

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