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Experimental Study on Behaviour of Clutch Plate Lining using Jute Fibre

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ABSTRACT

Clutch plates are usually made of cast iron and high carbon steels. The cast iron has high compressive strength, low tensile strength and low ductility. Clutch lining material is made up of asbestos. In order to obtain good life and more effectiveness and to reduce the cost of clutch plate, the new fibre reinforcement with clutch material is introduced. For the reinforcement with clutch liner material, jute fibre is selected. Due to the reinforcement of the clutch material, the properties has been improved. Then, the comparison of the properties and effectiveness of the new plate with the existing plate is to be done.

Keywords: Clutch plate, Jute fibre, Epoxy resin, Wear rate, Eco friendly.

1. INTRODUCTION

A clutch is a mechanism, used to engage and disengage the driving and driven members, which connects the driving shaft to the driven shaft, when both the shafts are stationary or relative motion between them. In Existing clutch lining materials has the bonding strength based on the thermal stability, ability to retain mechanical properties, and its ability to bind its ingredients together under adverse transmission conditions. In order to prevent the drop in performance due to the reduced binding ability of asbestos at high temperature, jute fibre is used which will increase the binding ability of clutch material at higher temperatures.

2. PROBLEM IDENTIFICATION

A naturally occurring family of minerals, asbestos was a popular choice for automotive parts because of its good properties of resistance to heat and friction. When an automobile clutch begins to wear, the lining worn out and loose asbestos which gets mixed up with air. Inhaling of air which is mixed with asbestos is dangerous to human health. Disadvantage of asbestos is that it will create lung cancer such as colon, throat and esophageal cancer.

3. OBJECTIVE OF THE PROJECT

Fabrication of the Jute fibre composite clutch plate and study of their mechanical properties. To study the influence of fibre loading, filler content on mechanical behaviour of jute fibre clutch plate. To fabricate the Jute fibre clutch plate and attempt the wear test on clutch plates which runs on TVS 50 vehicle.

4. STUDY OF MECHANICAL PROPERTIES OF EXISTING CLUTCH

- Good Wearing and binding strength
- High heat resistance
- High co-efficient of friction

- High energy absorption for short period
- Withstanding high pressure plate compressive loads.

5. CLASSIFICATION OF FIBERS

Fibres in polymer composites can either synthetic/man-made fibres or natural fibres. Some commonly used synthetic fibres for composites are glass, aramid and carbon etc. There are many types of natural fibre depending upon the type of application like electrical application, corrosive environment, structural application, high temperature. Natural fibres are available in various forms such as continuous, chopped and woven fabrics etc. If the fibres are derived from natural resources like plants or some other living species, they are called natural-fibres.

6. NATURAL FIBRES

Among all reinforcing fibres, natural fibres have gained great significance as reinforcements in polymer matrix composites. Depending upon the source of origin, natural fibres are classified as plant, animal and mineral fibres. Recently, due to the growing global energy crisis and ecological risks, natural fibres reinforced polymer composites have attracted more research interests. The main advantages of natural fibres are their availability, biodegradable, renewable, environmental friendly, low cost, low density, high specific properties, good thermal properties and enhanced the energy recovery, low energy consumption, non-abrasive nature and low cost. A great deal of work has been carried out to measure the potential of natural fibre as reinforcement in polymer such as jute, coir, bamboo ,sisal, banana and wood fibres have been reported. Plant fibres are justifies their use as reinforcement for polymer composites due to their renewability with good mechanical properties. It is also observed that natural fibres are non-uniform with irregular cross sections, which make their structures quite unique and much different from man-made fibres such as banana fibres, jute fibres etc. These fibres are low-cost fibres with low density and high specific properties which are comparable to synthetic fibres.

6.1 Jute fibre

It is a Bast stem fiber obtained from the stems of various dicotyledonous plants. It is a fast growing annual plant which stands the second most important fiber apart from cotton. In hot and humid climate jute plants reach about 2.5 – 3 m in height within 4-6months. Corchoruscapsularish as a globular shaped pod whereas Corchorusolitoriusis cylindrical. Most of the jute is harvested when about 50 % of the plants are in pod because it is during this stage of growth that high quality jute fiber bundles can be obtained. The fiber bundles are separated from the woody stem by the retting process. About 10,000 to 14,000 kgs of green plant yield from 4. 5 - 8 % of their green weights in dry fiber. The fiber lies along the length of the plant's stem in the form of anannular meshwork composed of more than one fiber layer. Jute is the most widely produced of the bast fibers followed by flax and hemp fibers. It has a higher lignin content, which distinguishes it from flax and hemp fibers.

7. EXPERIMENTAL PROCEDURE

7.1 Materials/Equipment

The materials and equipment used during the course of this work are powdered jute fibre, epoxy resin, hardener, silicone spray, sodium hydroxide solution, calcium carbonate, digital weighing balance, universal testing machine, impact testing machine, hardness testing machine, pin on disc testing machine.

7.2 Methodology

There are two important stages in all moulding processes, they are laying and curing. The laying is the process in which moulding materials are laid on a mould in the mould cavity or on the mould surface that conforms to the shape of the part to be fabricated. The process of curing helps the resin to set, thereby providing the fabricated part a stable structural form. The mould release agent (silicon) was sprayed on all sides to remove the composite plate after curing.

The jute fibre is obtained from jute plant, which has been collected from local sources. The extracted jute fibre were then treated with 5% of NaOH for one hour. The fibres are then washed thoroughly with distilled water. Fibres are then dried in oven for two hours at 100 ° C to remove moisture present in it. The dried fibre were subsequently make it as powder. A calculated amount of epoxy resins and hardener (ratio of 10:1 by weight) was taken and mixed with jute fibre. The jute fibre based epoxy composite is fabricated using hand lay-up technique. The moulds have been prepared with Steel for the desired shape.

The releasing agent has been use on mould which give easy to composites removal from the mould after curing the composites. The jute fibre has been mixed with matrix mixture with their respective values by simple mechanical stirring. A sliding roller has been used to remove the trapped air from the uncured composite and mould was allowed to cure at room temperature for 24 hour. The constant load is applied on the mould in which the mixture of the jute, epoxy resin and hardener has been poured. After curing, the specimen has been taken out from the mould and machine as per the dimension using water jet machining.

Fig 1: Final clutch plate

Fig 2: Testing of clutch plate

7.3 Final Test Report

MATERIAL	ACTUAL WEIGHT IN GRAMS	WEIGHT LOSS IN MATERIAL FOR DIFFERENT DISTANCE IN GRAMS		
		50kms	100kms	150kms
Jute fibre	23.390	23.287	23.201	23.076
Asbestos	37.142	36.877	36.601	36.452

MATERIAL	WEAR RATE IN GRAMS AFTER 150 KMS
Jute fibre	0.314
Asbestos	0.690

wear rate of asbestos > wear rate of jute fibre

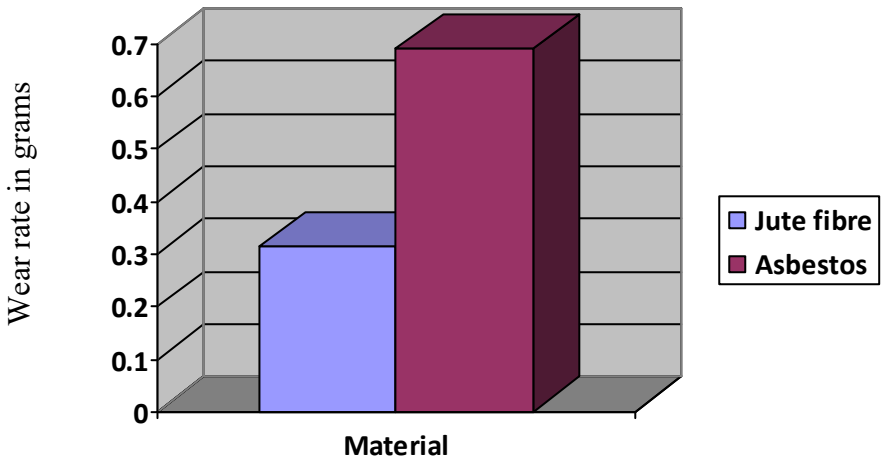

Fig : 3 wear rate graph

8. CONCLUSION

After the clear analysis of mechanical and sliding wear properties of jute fibre and asbestos. We concluded that jute fibre is more stronger than that of asbestos. The result of this project indicates that jute fibre particles can be effectively used as a replacement for asbestos in Clutch plate manufacture.

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