INTERNATIONAL JOURNAL OF RESEARCH IN COMPUTER APPLICATIONS AND ROBOTICS
ISSN 2320-7345

FABRICATION AND CHARACTERIZATION OF BRAKE PAD USING PINEAPPLE LEAF FIBER (PALF)

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Abstract: - The use of natural fibers in composite materials increases day by day because they are largely available ,in expensive, bio degradable and eco friendly in fiber rein forced polymer matrix are being worked upon various engineering application. Various natural fibers such as palm, banana, sisal, pineapple leaf fiber (PALF) and bamboo are used as filler. In this project we fabricate brake pad by using pineapple leaf fiber as a reinforcement/filler. The brake lining materials are metals, asbestos and ceramics, asbestos during wear releases the harmful gases which causes damage to health. By removing asbestos and using pineapple leaf fiber (PALF) the material is harmless. The material used for brake lining is PALF. Development of asbestos free brake pad is done by using pineapple leaf fiber (PALF) which is carcinogenic in nature which causes cancer to human life. The resin we use is epoxy which has good mechanical properties. Thus the bled of matrix is created by hand lay-up process. The result obtained in the work is compared with asbestos brake pad. The test to be examined is impact, hardness, flexural, density, compressive strength and wear.

Keywords: - Pineapple leaf fiber (PALF), carcinogenic, composite material, impact, density, wears, compressive strength and hardness.

1. Introduction

A major research in automobile industry is been taking place in the field of braking. The braking part is one of the most important parts in a vehicle, all type of vehicles need an efficient braking system. Brake pad is an important part in braking system for every vehicle that are system with disc and drum brake. Brake pads are steel plates with friction producers bound to the facing of brake disc. Different types of braking materials are been used in machines. The brake pad consists of asbestos embedded in a matrix with other materials. The use of asbestos is avoided because it is carcinogenic in nature. Hence asbestos free friction material and brake pad has been developed. It is noted that future development in braking material will closely change the current trends in automotive industries. The brake pads are generally made of asbestos fibres. In the view of good properties asbestos is removed from every application only due to its carcinogenic nature where there is for making alternate material for making non carcinogenic brake pad. Though use of asbestos brake pad is not been banned in much countries but they are taking an alternative way to produce a new asbestos free brake pad. Most of the industries are trying to avoid the asbestos brake pad because of its cancer causing properties and regarding airborne particles in factories and disposal of wastes. The braking system consist of a major part i.e. the brake pads, the use of brake pad in braking system is to slow down the vehicle whenever needed where the brake pad gets in contact with the brake drum for reducing the speed of vehicle. The composition of brake pad is abrasives, friction modifiers, fillers and reinforcement, binders. Abrasives help to maintain the cleanliness of surfaces and control the build-up of friction films. Friction producers or friction modifiers are the materials lubricate, increase the friction, and react with oxygen to control interfacial films. Fillers/Reinforcement is used

to maintain the overall matrix of the material, they can be, alloys, metals, organic materials or ceramics. The binder materials are phenolic resins in the case of vehicles and truck pads. An experimental setup procedure should be done for fabricating pineapple leaf fibre brake pad. Characterization of brake pad is based on testing the different specimens using different techniques. Researchers in the world are concentrating on the ways of using industrial or agricultural waste as a source of raw materials.

2. Experimental Procedure

A. Materials

Material used for this research purpose is pineapple leaf fiber (PALF), epoxy resin where they are mixed with suitable composition.

Fig.1. PHOTO OF PINEAPPLE LEAF FIBER

Fig.2. SLICED PIECES OF PINEAPPLE LEAF FIBER

Table 1.COMPOSITION OF PINEAPPLE LEAF FIBER

High holocellulose	85.7%
Cellulose	66.2%
Hemicellulose	19.5%
Lignin	4.2%
Ash	4.5%
Moisture	81.6%

B. Method of Production

The pineapple leaf fiber is treated with NaOH solution for one hour, then the fiber is taken out and sun dried for more than 5 hours, then the fiber is sliced into small pieces. Similarly the pineapple leaf fiber which is untreated with NaOH and sliced into small pieces is taken out as another sample. The treated fiber is mixed with proper ratio of resin where the resin is epoxy. Where different samples such as 10%, 20%, and 30% of fiber are taken and mould is created. The process of mould is done by hand layup process.

i. ***Preparation of matrix*:** The matrix used to fabricate the brake pad was epoxy of density 1.15 g/cm^3 and hardener of density 0.98 g/cm^3. The weight ratio in the mixture of epoxy and hardener is 10:1. Epoxy is a thermosetting polymer (polymerizes and cross links) when mixed with a hardener. It is flexible or transparent, rigid, or coloured, extremely slow or fast setting. A analytical balance was used to weigh the resin and hardener.

ii. ***Preparation of mould*:** The rectangular mild steel plate was made to the size 5mm x 60mm. The mould was split into three parts (Upper portion, lower base plate and Rectangular side plate). The combination of pineapple leaf fibre with epoxy resin is added for achieving proper results. Where the mould is kept dried in a hot platen temperature of 140°C for 2 minutes. After removing the brake pad from hot platen, the brake pad was cured in oven at 120°C of temperature for 8 hours. The photos of sample is shown in Fig.3

Fig.3

The asbestos free brake pad using pineapple leaf fiber is made through the process of creating a mould. The brake pad produced is made to conduct different testing for its characterization. This pineapple leaf fiber should possess high strength, durability and high resistance to impact. This brake pad should be compared with commercial brake pad.

Fig.4

This brake pad should possess good result in testing its characteristics and its nature of behavior. This brake pad should tend to posses high strength, impact, flexural, wear and tensile test.

3. Result and Discussion

To analyze the experimental procedure and its result where the pineapple leaf brake pad is compared with the commercial brake pad with various characteristics.

Where the created sample is made to test its compressive strength with its different percentage. The gradual decrease in compressive strength as the percentage of fiber increases can be attributed to the decreasing surface area and pore packaging capability of the pineapple leaf particles in the resin. Hence compressive strength increases as the percentage of pineapple leaf fiber decreases.

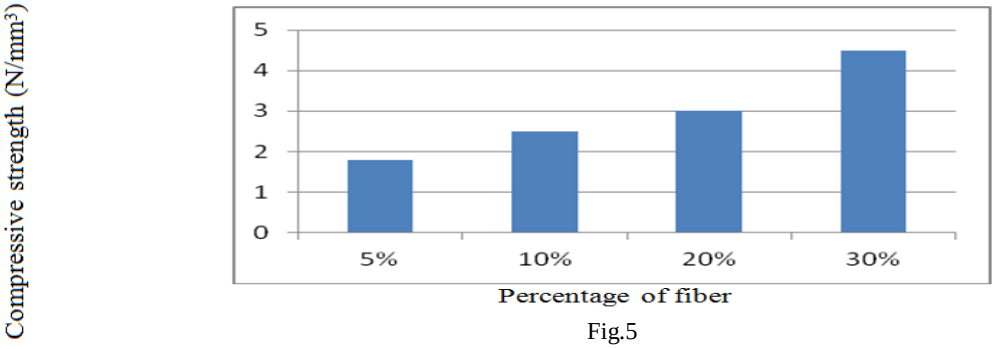

Fig.5

This is a result of proper bonding between the pineapple leaf fiber and epoxy resin as the percentage of fiber decreases and also inter packing distance. In hardness testing it can be figured out that when the percentage of pineapple leaf fiber decreases the hardness value of the sample increases.

The sample with 10% of pineapple leaf fiber has the highest hardness value of 101.6HBN. The high hardness for 10% is because due to the result of lower fiber content in it. The hardness value for this percentage is compared with other material.

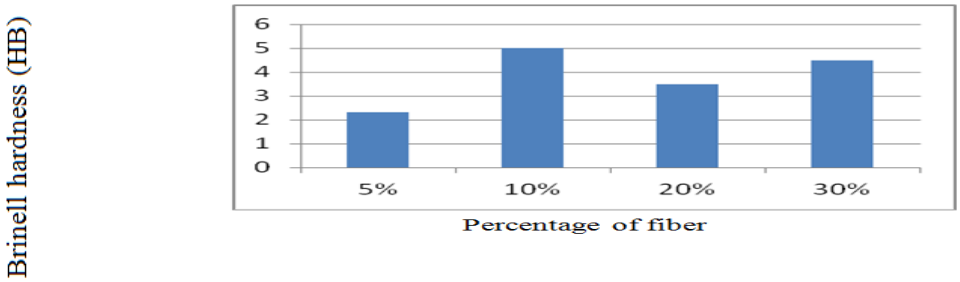

Fig.6

It can be seen that the percentage of wear rate shows that decrease in wear rate when the pineapple leaf fiber increases in different percentage.

The use of different percentage of fibers can evenly create much different characteristic results this is due to the important factor of the resin (epoxy) and fiber(PALF).

The wear experiment is tested by pin-on-disc apparatus. The pin material used here is EN31 and the disc material is pineapple leaf fiber as shown in Fig.7.

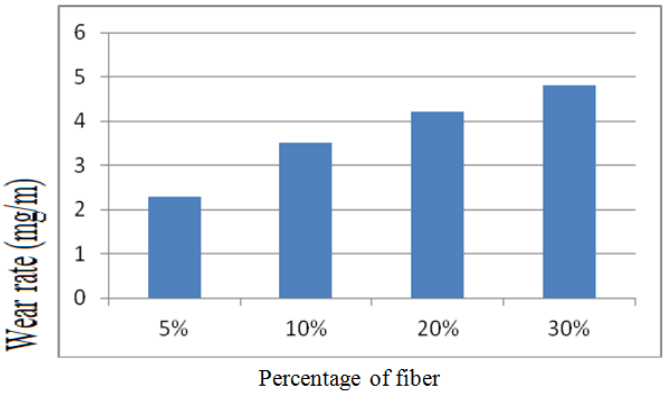

Fig.7

Fig.8

The result to higher packaging which affects stronger binding of pineapple leaf fiber. This is also due to high hardness value, compressive strength and the sample size. The water absorption rate depends upon the swelling of the sample.

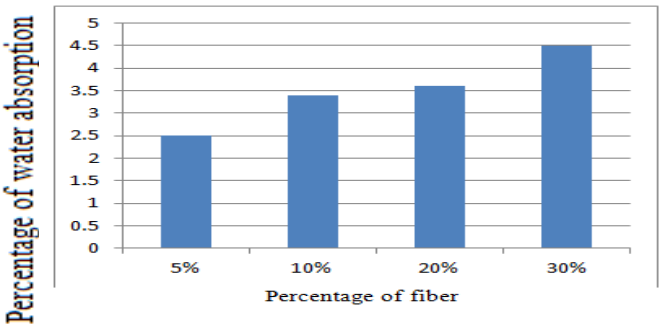

Fig.9

TABLE 2. COMPARISON

Properties	Commercial brake pad	Fabricated brake pad (pineapple leaf fiber)
Compressive strength	111	107.25
Brinell hardness	101	100.88
Average wear	3.85	4.09
Thickness swell in water	0.30	2.75

4. Conclusion

From the result and discussion from this research, the following conclusions can be given.

i. The samples with different percentage of pineapple leaf fiber can give better properties.

ii. Compressive strength, hardness and wear of different samples were seen to decrease with increase in percentage of pineapple leaf fiber. While the water absorption rate increases with increase in percentage of pineapple leaf fiber.

iii. This research results in the pineapple leaf fiber can be effectively used as a replacement of commercial brake pad i.e., asbestos brake pad which is harmful to human life, in order to avoid that pineapple leaf fiber can be used.

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