International Journal of Emerging Technology and Computer Science
ISSN: 2455-9954

# Analysis of Brake Pad Using Bagasse

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**ABSTRACT**

The aim of this paper is to develop eco-friendly new natural asbestos free brake pad using bagasse. The use of asbestos natural fibre is being avoided due to its carcinogenic nature that might cause health risks. The bagasse were sieve into sieve grade of 625(micrometre) and three different formulations were prepared with varying resin from 80%, 85% and 90%. The bagasse and resin was used in production of brake pad in ratio of 20% bagasse and 80% resin, 15% bagasse and 85% resin and 10% bagasse and 90% resin using compression moulding. The different properties examined are physical, mechanical and wear rate of the brake pad were studied. The result shown that compressive strength, hardness of the produced samples were seen to be increasing with increased in % resin addition, while the oil and water absorption and wear rate decreased as % resin increased. The all result of this research indicates that bagasse particle can be effectively used as a replacement for asbestos in brake pad manufacture.

**Keywords:** Bagasse, composite material, hardness and wear, compressive strength

## 1. INTRODUCTION

Brake pads convert the kinetic energy of the vehicle to thermal energy through friction. Brake pads are a component of disc brakes used in automotive and other applications. Brake pads are steel backing plates with friction material bound to the surface that faces the disc brake rotor.

There are numerous types of brake pads, depending on the intended use of the vehicle, from very soft and aggressive (such as racing applications) to harder, more durable and less aggressive compounds. Most vehicle manufacturers recommend a specific kind of brake pad for their vehicle, but compounds can be changed according to personal tastes and driving styles.

There are two basic types of automobile brakes: drum brakes and disc brakes. In drum brakes, the brake shoes are located inside a drum. When the brake are applied, the brake shoe is forced outward and presses against the drum. One of the major difference between drum brakes tend to be exposed to the environment.

Before 1960's most vehicles used drum brakes on all four wheels. The brake pads for these drum brakes were organic (i.e., composed of natural material) and often consisted of resins and asbestos as well as variety of other materials to help improved braking and wear. In the late 1960's and early 1970's automobile manufactures started to incorporated disc brakes, especially for larger motor vehicles, because such brakes had better braking performance. In 1975 the Federal Motor Vehicle Safety Standard 105, which required more stringent braking required more stringent braking requirement, helped expedite the transition to disc front-drum rear braking systems.

The need to develop a new material for asbestos replacement as friction material and yet maintaining the same mechanical properties, still remains a bone of contention. The purpose of this study, is to develop a new asbestos-free brake pads using agriculture waste (Bagasse). Since bagasse is easily available and not toxic.

The use of asbestos fiber is decreasing day by day due to its carcinogenic nature (Rinek and Cowen, 1995). In order to avoid this carcinogenic asbestos, efforts are ongoing for the replacement of material. However, no

information is available in literature on the use of bagasse fibre for the formulation of new brake pad materials. Therefore, new natural fibre brake pad materials have been formulated with the aim of using natural bagasse fibre as reinforcement filler material in phenol formaldehyde for the automotive application.

## 2.EXPERIMENTAL PROCEDURE

### 2.1 Raw Material and formulation

The main raw materials and equipment used in the research were phenolic resin (phenol formaldehyde), bagasse, engine oil (SEA 40), water, hydraulic press, break pad mould, heater, digital weighting balance, sieve honsfield tensometer, hardness tester, universal testing machine, wear testing machine and milling machine. The current natural fibre brake pad material was developed through the process beginning with the selection of raw materials, weighing, mixing, compacting and sintering. There are formulations with different composition of bagasse fibre content. Grouping was made based on the variation of the bagasse fibre material in the formulation and resin used as a matrix material. Bagasse with detail compositional analysis and photo as shows in Table-1 and Figure-1.

**Figure 1**. Photo of Bagasse

| Compound | % |
|---|---|
| Cellulose | 45 |
| Hem Cellulose | 23 |
| Lignin | 13 |
| Pith Fibre | 10 |
| Ash | 3 |
| Waxes | 0.6 |

**Table 1**. Compositional analysis of Bagasse

### 2.2 METHOD

1.Material & Equipment Used-

The material and equipment used during the process of making brake pad are as follows :

- Phenolic Resin (Phenol Formaldehyde )
- Bagasse
- Engine Oil (SAE 40)
- Pnematic Press
- Brake Pad Mould
- Digital weighing balance
- Sieve honsfield Tensometer

2.Method-

Firstly collect the Bagasse from the Sugar factory mill. The Bagasse was sun dried for about 3-4 days and ball mill of 250 RPM to form powder sample. The powder is packed and kept in electric resistance furnace at temperature 120 degree celcius to form totally dry bagasse powder which is humidity free.

**Fig 2** : Bagasse Power

The size of particle for analysis was decided accoding to available sieve grade in lab. Make the set of 100gm of particle was placed into sieve of 625 micrometer size fineness and shaken for 10 minutes which is required time for complete classification of particle.

**Fig 3** : Digital Weighing Blance

Test samples are made by varying the Phenolic Resin from 80 to 90 wt. % and Bagasse from 10 to 20 wt.%. The samples are properly dry to achieve the homogeneous mixture and poured it in mould kept in a square die.

The compressive strength test was done using a universal tensile testing machine. The sample of 15mm*15mm*7mm obtaining Brake Pad which is subjected to compressive force, loaded continuously until failure occurred. and then record the load at which it fails.

Testing for Hardness.The specimen is first placed on a hard flat surface. The indentor for the instrument is then pressed into the specimen making sure that it is parallel to the surface. The hardness is read within one second of firm contact with the specimen.

A wear resistance testing machine with disc made of cast iron of hardness value 62 HRC and sample dimensions for this test is (15*15*7)mm. In this test , firstly measured the weight of samples and then after the test, pin is slide on samples, disc rotating 5000cycle per secound and load attached 1kg, it gets wear. The initial and final weight is measured by single pan electronic weighing machine with accuracy of 0.0001 gm . All tests are performed at room tempearature . The wear rate from weight loss is measured by following formula :

**WEAR RATE = (W2-W1)/S**

Where W2 = Weight of sample before test in mg

W1 =Weight of sample after test in mg

S = Total sliding distance in m

The twenty-four hours water and oil absorption test was used for determine the water and oil sock behavior of the asbestos free brake pad . The sample was dried at 24degree celcius room temperature, its weight was measured . Its dimension were measured by vernier calliper and weight measured by Digital weighing balance. After 24 hours , submersion in water and engine oil at 24Degree celcius , weight has been increased.

For calculating the % of absorption following formula can be used .

**ABSORPTION% ={(W2-W1)/W1}*100**

Where W1= Weight before test in mg

W2= Weight after test in mg

**Fig 4:** The photo of the produced sample

## 3. RESULT AND DISCUSSION

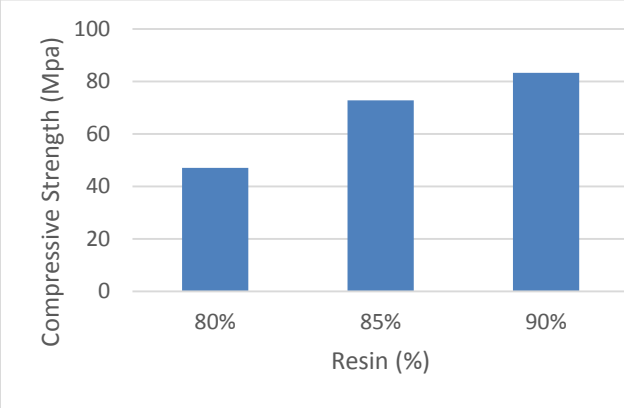


**Figure 5-** Variation of compressive strength with Percentage of Resin

The combination of 90% Resin and 10% Bagasse has a highest compressive strength of >83.23MPa (No Break). The gradual decrease in compressive strength as the bagasse increases. Hence, compressive strength increases as % of bagasse decreases.

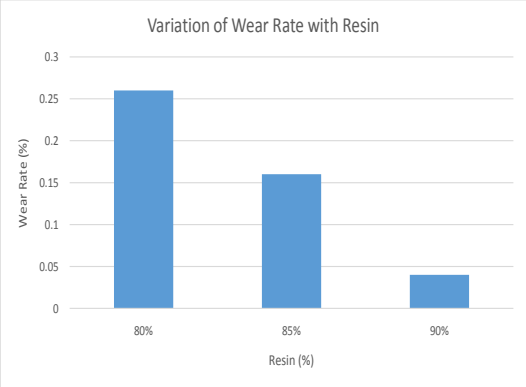


**Figure 6-**Variation of Wear rate with Resin

Fig. Shown the wear rate of the produced samples. The shows decrease in wear rate as the Resin increase. The result to higher/closer packing which has affected stronger binding of bagasse with resin. Also due to high hardness values and compressive strength of the samples as the bagasse particles addition increased in the Resin.

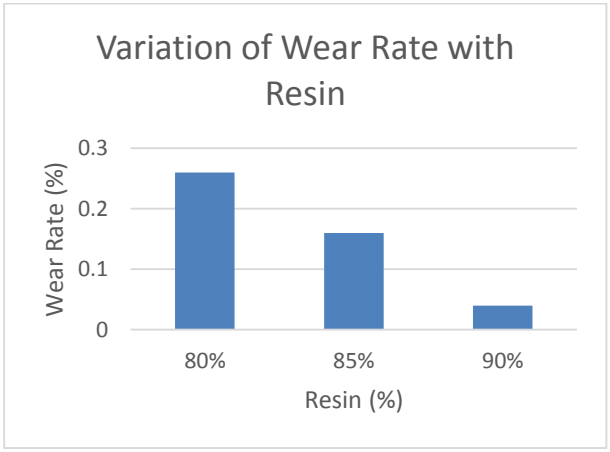


**Figure 7-** Variation Of Water Absorption With Resin

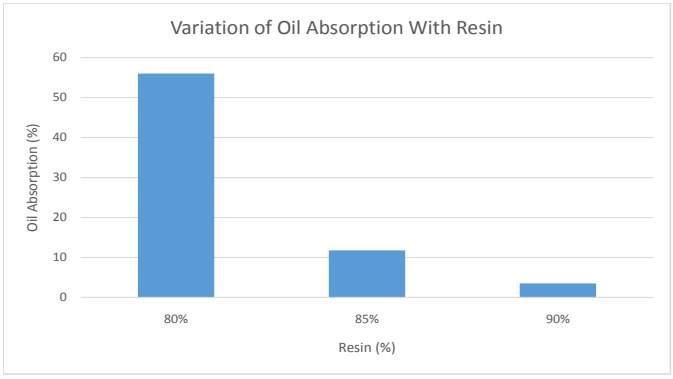


**Figure 8-** Variation Of Oil Absorption With Resin

Water, oil absorption of the produced sample. These properties increased as the as the bagasse increases and resin decrease. these result are in per with the earlier observation.It can be seen form the result that sample with 10% bagasse 90% resin the best properties as a result of a very good dispersion of bagasse particle as shown by resin.

| Property | Optimum Formulation Laboratory brake pad | Commercial brake pad (asbestos based) | New Fomulation Laboratory brake pad (bagasse based) Recommended |
|---|---|---|---|
| Compression Strength (MPa) | 103.50 | 110 | >83.23 (No Break) |
| Water Absorption (%) | 5.03 | 0.90 | 2.99 |
| Oil Absorption (%) | 0.44 | 0.30 | 0.86 |
| Wear Resistance | 4.40 (mg/m) | 3.80 ( mg/m) | 0.040 ( % ) |
| Hardness | 92 (Brinell) | 101 ( Brinell) | 64-65 (Shore D) |

**Table 2.** Summary of result findings compared with existing ones

The result of this work indicates that sample containing 625 micrometer (10% bagasse-90% resin) gave better properties then other samples tested. Hence the lower the sieve grades of bagasse, the better the properties. The 10% bagasse-90% resin result were compared with that of commercial brake pad (asbestos based) and optimum formulation laboratory brake pad as shown in the table. Which was tested under nearly similar conditions.

## CONCLUSION

From the result and discussion in the work the following conclusions can be made:

1] The sample containing 10% bagasse-90% resin the better properties in all.

2] Compressive strength, hardness of the produced sample were seen to be Increase with decreasing resin while there oil soke, water soak, wear rate and percentage charred as increased as resin decreasing.

3] The result of this research indicate that bagasse particle can be effectively

Used as a replacement for asbestos in brake pad manufacture.

## REFERENCES:

1] Development of asbestos-free brake pad using bagasse by V.S.Aigbodion., U.Akadike, S.B.Hassan, F. Asuke, J.O.Agunsoye

2] Eco-friendly asbestos free brake-pad: Using banana peels By U.D. Idris a, V.S. Aigbodion b,*, I.J. Abubakar c, C.I. Nwoye

3] new natural fibre reinforced Aluminium composite forAutomotive brake pad by *M.A. Maleque1*, A. Atiqah1, R.J. Talib2 and H. Zahurin1*

4] Asbestos free friction composition for brake linings By Arnab ganguly and Raji George*