DURABILITY AND WEAR ANALYSIS OF NON-ASBESTOS MOLDED LINERS BRAKE PADS UNDER DRY/MOIST CONDITIONS BY USE OF LAB ABRASIVE TEST METHOD

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ABSTRACT

Disk brakes are in common use in automobiles like bikes, Cars , buses , trucks etc . Various research works has been previously done on the material of disk brake but the brake caliper friction material is of equal importance as it takes part in the braking action. Brake materials have been studied so far as to determine the coefficient of friction, temperature analysis etc, but abrasion behavior of these materials has been seldom studied. Abrasion behavior with a rotating wheel-type apparatus has been examined with angular sand (silica) abrasives as a function of test conditions, namely wheel-type _rubber wheel or steel wheel and environment _dry or wet conditions. Water tends to lubricate the contact between the particles and the test piece, especially with small and/or rounded particles and thus the wear rate is reduced. With larger particles, the presence of water still affects wear, in that two-body abrasion may be favored, cutting enhanced and particle embedment reduced. The steel wheel tends to produce more fragmentation of abrasives, but in the wet environment, this is reduced as the lubricated contact with the test piece results in lower stresses in the particles. The role of water has been shown to be significant in both the rubber and steel wheel tests and affects particle motion and particle fragmentation _depending on particle type, shape and size and, thus, has a strong effect on wear rates and mechanisms observed. The conditions employed in a test used to simulate service conditions must be carefully chosen so as to mimic the latter conditions as closely as possible and the environment _wet or dry is a significant parameter that must be considered.

Keyword : - *Dry sand–rubber wheel abrasion; Wet conditions etc….*

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1. INTRODUCTION

The most important component of automobile breaking system is brake pads. The effectiveness of the brakes depends completely on the quality and proper composition of brake pads. The brakes must be strong enough to stop the vehicle within a minimum braking distance or urgently applied brake. A disc brake is a wheel brake that slows rotation of the wheel by the friction caused by pushing brake pads against a brake disc with a set of calipers. The brake disc is usually made of cast iron, but may in some cases be made of composites such as reinforced carbon–carbon or ceramic matrix composites. This is connected to the wheel and/or the axle. To stop the wheel, friction material in the form of brake pads, mounted on a device called a brake caliper is forced mechanically, hydraulically, pneumatically, or electromagnetically against both sides of the disc. Friction causes the disc and attached wheel to slow or stop. Brakes convert motion to heat, and if the brakes get too hot, they become less effective, a phenomenon known as brake fade. Brake pads are designed for high friction with brake pad material embedded in the disc in the process of bedding while wearing evenly. Friction can be divided into two parts. They are: adhesive and abrasive. Depending on the properties of the material of both the pad and the disc and the configuration and the usage, pad and disc wear rates will vary considerably. The properties that determine material wear involve trade-offs between performance and longevity. The brake pads must usually be replaced regularly (depending on pad material), and some are equipped with a mechanism that alerts drivers that replacement is needed, such as a thin piece of soft metal that rubs against the disc when the pads are too thin causing the brakes to squeal, a soft metal tab embedded in the pad material that closes an electric circuit and lights a warning light when the brake pad gets thin, or an electronic sensor. Generally road-going vehicles have two brake pads per caliper, while up to six are installed on each racing caliper, with varying frictional properties in a staggered pattern for optimum performance.

1.1 Literature Review

Disk brakes are in common use in automobiles like bikes, Cars, buses, trucks etc. Various research works has been previously done on the material of disk brake but the brake calliper friction material is of equal importance as it takes part in the braking action. Brake materials have been studied so far as to determine the coefficient of friction, temperature analysis etc, but abrasion behavior of these materials has been seldom studied. Majority of the papers describe and elaborate on the materials and design of the disk brakes and those papers on the pad material focus on the usage of these materials.

U.D.Idrisa,V.S.Aigbodian(2013),In this paper the authors have studied the use of asbestos fiber is being avoided due to its carcinogenic nature that might cause health risks. A new brake pad was produced using banana peels waste to replaced asbestos and Phenolic resin (phenol formaldehyde), as a binder was investigated. The resin was varying from 5 to 30 wt% with interval of 5 wt%. Morphology, physical, mechanical and wear properties of the brake pad were studied. The results shown that compressive strength, hardness and specific gravity of the produced samples were seen to be increasing with increased in wt% resin addition, while the oil soak, water soak, wear rate and percentage charred decreased as wt% resin increased. The samples, containing 25 wt% in uncarbonized banana peels (BUNCp) and 30 wt% carbonized (BCp) gave the better properties in all. The result of this research indicates that banana peels particles can be effectively used as a replacement for asbestos in brake pad manufacture.

2. DESIGN OF TEST RIG

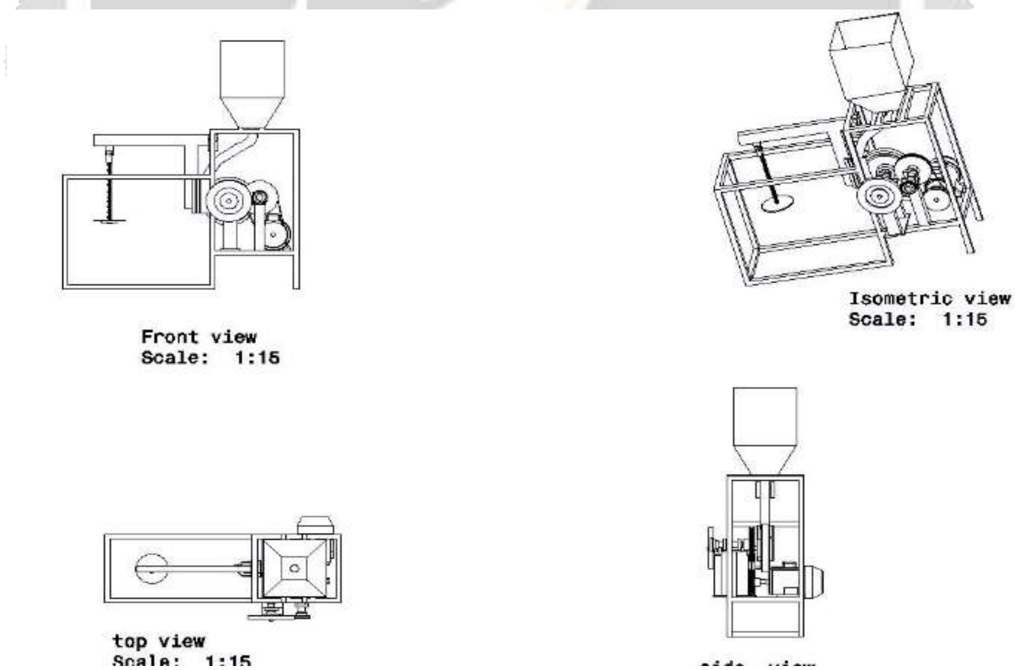

Fig.1: 2-D model of abrasive wear test rig

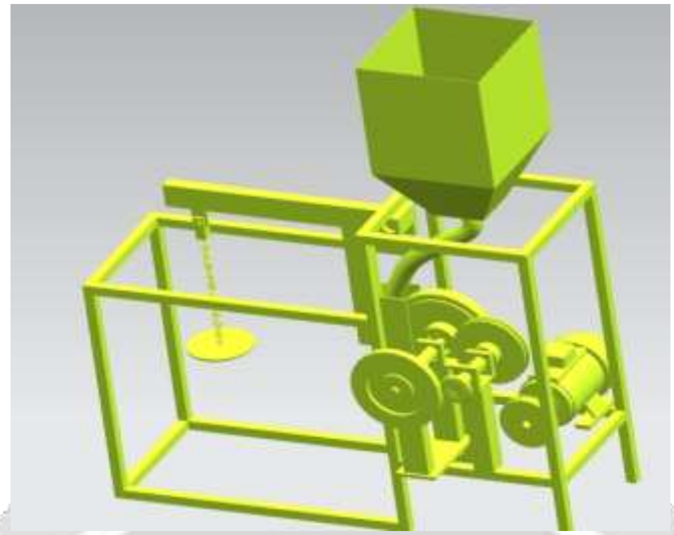

Fig.2: 3-D model of abrasive wear test rig

2.1 Test and trial on brake pad

Test and Trial on the brake liner with FTL-097 in dry condition

Procedure :

1. The band is loaded on the test mechanism .
2. The motor is started and the no-load speed is measured and noted using a digital contact less tachometer.
3. The load pan is added with a load of 100 grams, speed of the load drum is measured again and noted
4. The procedure is repeated with increment of 100 grams upto 800 gm load.

Table -1: Result table

SR NO.	LOAD (kg)	SPEED rpm	B.TORQUE N-m	%DECELRATION	FADE dimension mm/10000 cycles	Fade volume mm3/10000cycles
1.	0.1	368	0.056898	5.641026	0.01	3.103333
2.	0.2	358	0.113796	8.205128	0.01	3.103333
3.	0.3	344	0.170694	11.79487	0.015	4.655
4.	0.4	332	0.227592	14.87179	0.015	4.655
5.	0.5	310	0.28449	20.51282	0.018	5.586
6.	0.6	291	0.341388	25.38462	0.02	6.206667
7.	0.7	284	0.398286	27.17949	0.02	6.206667
8.	0.8	256	0.455184	34.35897	0.022	6.827333

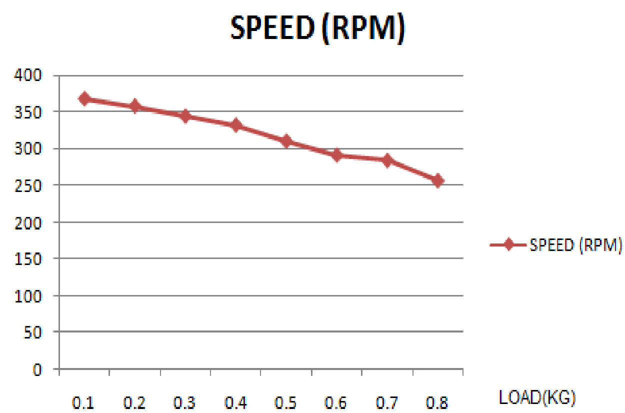

Chart -1: Speed vs. Load

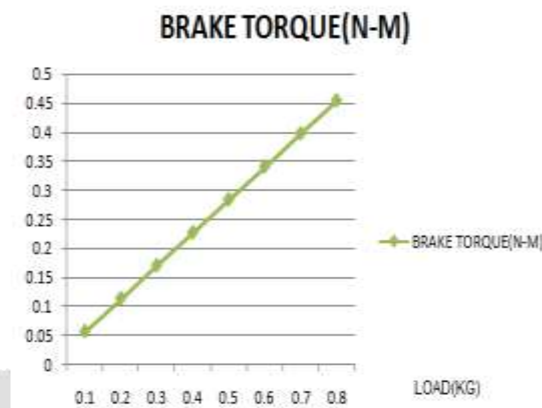

Chart -2: Brake Torque vs. Load

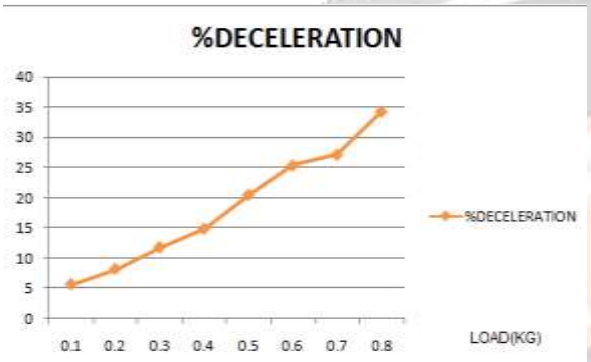

Chart -3: % Deceleration vs. Load

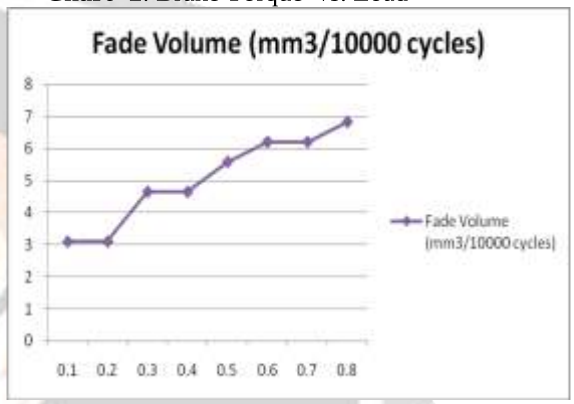

Chart -4: Fade Volume vs. Load

3. COMPARISON IN PERFORMANCE OF FTL –097 LINERS IN WET AND DRY CONDITION

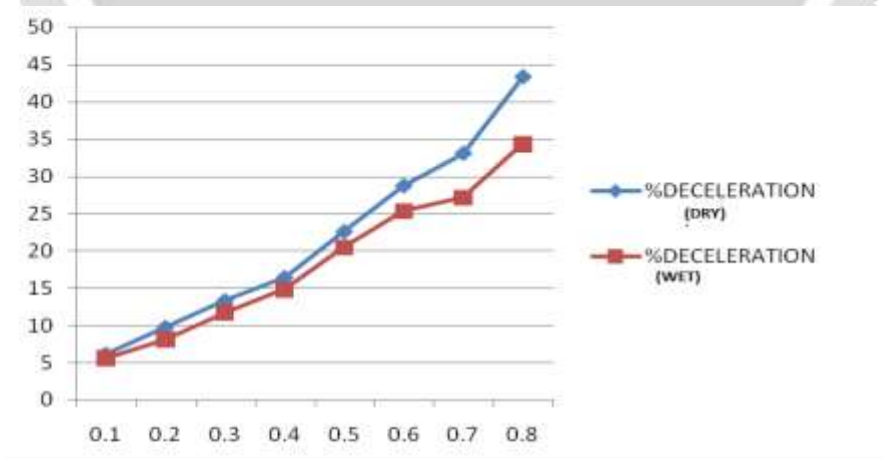

Chart -5: % Deceleration vs. Load

The retardation / decelaration of drum increases with increase in brake load indicating the effectiveness of brake, but it is observed that the FTL-097 liners show better retardation in dry condition as compared to the WET condition.

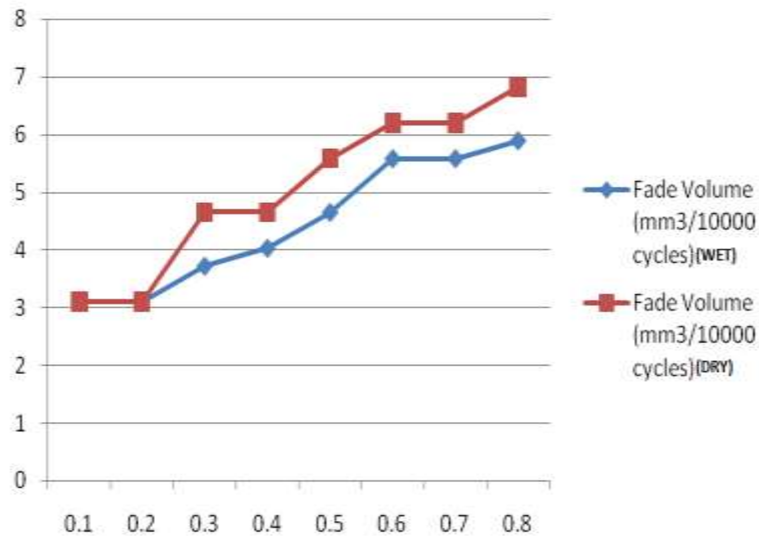

Chart -6: % Fade Volume vs. Load

4. CONCLUSIONS

- Drum speed drops with increase in brake load.
- The brake torque increases with increase in brake load.
- The retardation / deceleration of drum increases with increase in brake load indicating the effectiveness of brake.
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- The fade volume /10000 cycles is limited to 6.8 mm3 in dry condition and the fade volume /10000 cycles is limited to 5.89 mm3 which is far less than the allowable value of 40 mm3 for the FTL-097 material indicating excellent brake performance against fade by virtue of application of discrete brake liner button geometry.

6. REFERENCES

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