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# Experimental Analysis of Tribological Properties of Hbn Nanoparticles Additive in Castor & Mahua Oil Blend

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***Abstract:*** ***castor oil having competent lubrication properties are going to be present during this work with blends of mahua oil and antiwear characteristics with comparison against fossil oil lubricant for tribological properties. Analysis on bio lubricant within the field of automotive applications with experimentation on four ball tester for antiwear characteristics with numerous blends of castor and mahua oil are studied during this work. During this Paper result of addition with the nanopartical hexagonal boron nitrate (hBN) in Castor and Mahua oil mix for improve the tribological properties of lubricants. These nano particle were added in blended oil at totally different proportions (0.5%,1%, and 2% wt. %). This investigation is beneficial for comparing the result of additives on bio lubricants properties like wear, coefficient of friction with commercial lubricant SAE 10W30 engine oil. The analysis of tribological properties take a look at was calculated on a four ball oil testing machine per ASTM D 4172 B. Result show that the every set of Nanoparticle considerably reduces the friction coefficient and wear of friction pairs. The damage surfaces were analyses by scanning microscope (SEM).***
***Keywords: Hbn nanoparticles, Castor and Mahua oil, Antiwear.***

## I. INTRODUCTION

Today, vegetable oils are being thought-about for their suitableness as industrial lubricating substance. one in every of the most issues of vegetable oils is to envision performance once operating traditional operational conditions. During this paper, the performance of vegetable oils castor and mahua oil blends as a lubricant was tested employing a four ball tribometer under normal wear rate conditions that conforms to ASTM D4172. The test lubricants Castor and mahua oil mix with addition of 1.5µ hBN nanoparticles, commercial lubricant were SAE 10W30 engine oil, business engine oil. The traditional load used for this take a look at was 192N.. The results showed that vegetable oils have a low friction coefficient compared to oil. Also, the damage scars created by vegetable oil is below those produced by oil. It are often concluded that vegetable oils have potential as lubricants.[10] Over the past decade the landscape of the lubrication marketplace has considerably modified thanks to a combination of environmental, health, economic and performance challenges. To handle these challenges it's essential to develop and use lubricants that come back from natural resources. Environment friendly or "Green" lubricants ar renewable and frequently made up of vegetable oils e.g. rapeseed, canola, corn, oil, artificial esters and severely hydro treated crude primarily based oils. Compared to mineral and artificial oils, vegetable oils have variety of distinct benefits as well as considerably higher lubricity and viscousness, lower volatility and better shear stability. With higher biodegradable and toxicity properties than typical crude primarily based product, vegetable oils have tremendous potential to be used within the industrial sector.[16] The last word motivation is to analysis and develops a unique green lubricant which will be employed introducing process in industry method ability. The harm mechanisms beneath extreme environment are mentioned. Additionally, the longer term developing directions of h-BN and h-BN matrix composite ceramics ar acknowledged. Use of Castor and mahua oil blends as base oil and h-BN nanoparticles as additives is studied during this paper.[2]

## II. MATERIALS AND MEHOD

### *A. Base Oil*

Castor oil is obtained from the seeds of castor plant and it is non-edible vegetable oil. The botanical name is ricinus communis and castor plant is from euphorbiaceae family.

### *B. Blending Oil*

Mahua oil has high flash point and high viscocity index properties. as bio lubricant

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Castor oil 65% and mahua oil 35% blend is formed and testing for standard wear test is performed with four ball tester apparatus as per ASTM D4172 standard.

*C. Additive Nanoparticle*

Hbn nanoparticles with 1.5µ size are mixed with carbon and mahua oil blends in 0.55, 1% & 2% wt% of blended oil.

*D. Testing Apparatus*

Ducom Four Ball Tester The Ducom four ball testers is use as the industry standard for conducting EP and AW property test of lubricants. Ducom four ball testers experimentally evaluate lubricants for their wear preventive, extreme pressure frictional properties all in one machine.

Table No.1 Properties of h-BN additive

| Properties | Specifications |
|---|---|
| Formula | H-bn |
| Colour | White |
| Crystallie Form | Hexagonal |
| Melting Point ($^o$c) | 1185 |
| Density (kg/m$^3$) | 5.06 |

## III. EXPERIMENTAL ANALYSIS

*A. Design of Experiment*

Table No. 2 Design of Experiment

| Sample No | % of Mahua oil in Castor oil | hBN size (µ) | hBN % |
|---|---|---|---|
| 1 | 35% Mahua blend oil | 1.5 | 0 |
| 2 | 35% Mahua blend oil | 1.5 | 0.5 |
| 3 | 35% Mahua blend oil | 1.5 | 1 |
| 4 | 35% Mahua blend oil | 1.5 | 2 |

Before starting the experiment, all balls and their parts were cleaned with acetone and wiped. The tests were carried out as per the American Society for Testing Materials (ASTM) condition and usage of ASTM D 4172 method for tests.
Conditions: Temperature: (75 ± 2) $^o$C,
Speed: (1200 ± 60) rpm,
Time: (60 ± 1) minute,
Load: (392 ± 2) N.

## IV. RESULTS AND DISCUSSION

Performing experiments over Ducom four ball tester for an hour for each sample gives output of COF over frictional torque vs Time graph and WSD of four ball under high resolution image acquisition system of four ball tester
After comparing all samples frictional torque vs Time graph resulted comparison graph of 0.5%, 1% & 2% h-BN Nano particles of 1.5µ with Mahua oil 35% + castor oil 65% is represented in Fig. No. 1
Comparison graph of Frictional torque vs Time for 0.5%, 1% & 2% h-BN Nano particles of 1.5µ with Mahua oil 35% + castor oil 65% particles of 1.5µ with Mahua oil 35% + castor oil 65%

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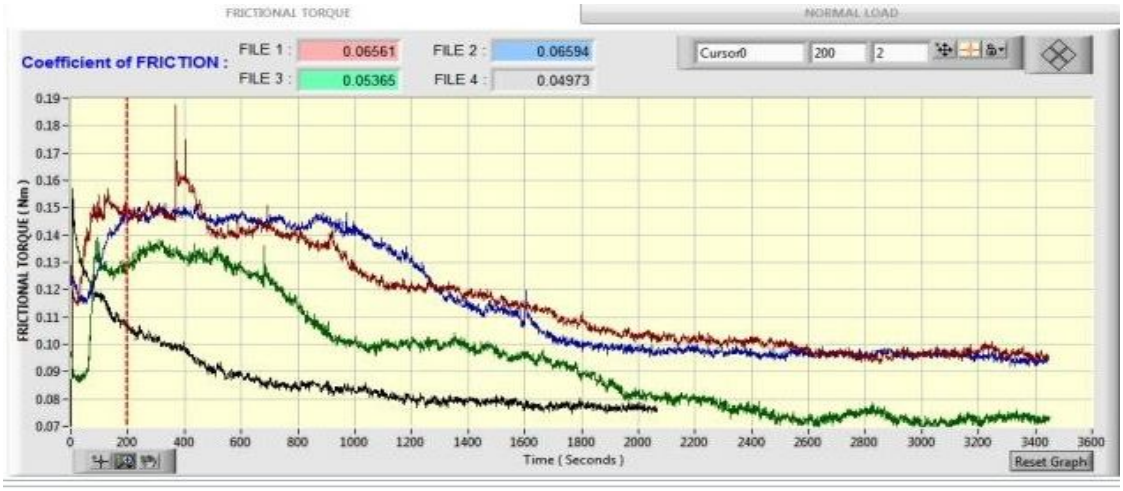



Fig. No. 1 Comparison graph of Frictional torque vs Time for 0.5%, 1% & 2% h-BN Nano particles of 1.5µ with Mahua oil 35% + castor oil 65%

*B. Result Table*

Table No. 4 Result table for for 1.5 µ hBN nanoparticle Wear Data

| | | | Readings | | | | |
|---|---|---|---|---|---|---|---|
| Sr. No. | Sample Name | hBN 1.5 µ % | Major Wear scar dia. (mm) | Min. Wear scar dia (mm) | Avg. Wear scar dia. (mm) | Area ($mm^2$) | COF |
| 1 | Mahau oil 35% + castor oil 65% | 0% | 220 | 207 | 214 | 0.036 | 0.06561 |
| 2 | Mahau oil 35% + castor oil 65% + hBN 1.5 µ | 0.5% | 248 | 231 | 240 | 0.045 | 0.06554 |
| 3 | | 1% | 224 | 202 | 213 | 0.036 | 0.05365 |
| 4 | | 2% | 230 | 198 | 214 | 0.036 | 0.04973 |

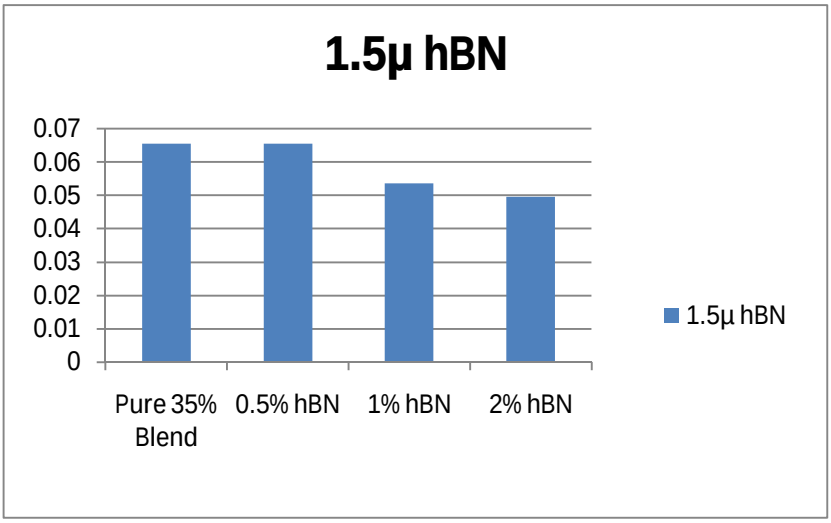



Fig. No. 2 Chart of COF of 1.5µ size & 0%, 0.5%, 1% & 2% wt% hBN

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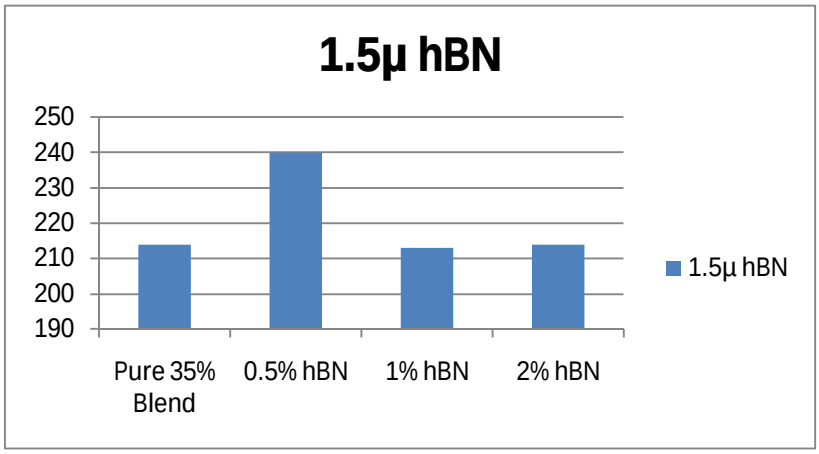



Fig. no. 3 Chart of WSD of 1.5µ size & 0%, 0.5%, 1% & 2% wt% hBN

From Table No.4 it is observed that with hBN nanoparticle size 1.5 µ when added in weight percentage of 0.5%, 1% & 2% in Castor and Mahua oil Blends hBN
Shows coefficient of friction drops from 0.06561 to 0.04973 when compared to SAE 10W30 OIL finds 49% lower.
WSD of the 0.5 wt% hBN is 240 Highest among other wt% of hBN and remaining 3 samples shows WSD in between 213 & 214 when compared with SAE 10W30 OIL finds 62% lower.

## V. CONCLUSION

Castor and mahua oil blends are showing lower value of COF and WSD than commercial engine oil.
hBN nanoparticles when added with castor and mahua oil blend shows improvement in antiwear properties of base oil.
1% wt% of hBN nanoparticles concentration in base oil finds optimum wear resistant properties however 0.5% wt% hBN concentration slightly increase WSD of balls.

## VI. ACKNOWLEDGMENT

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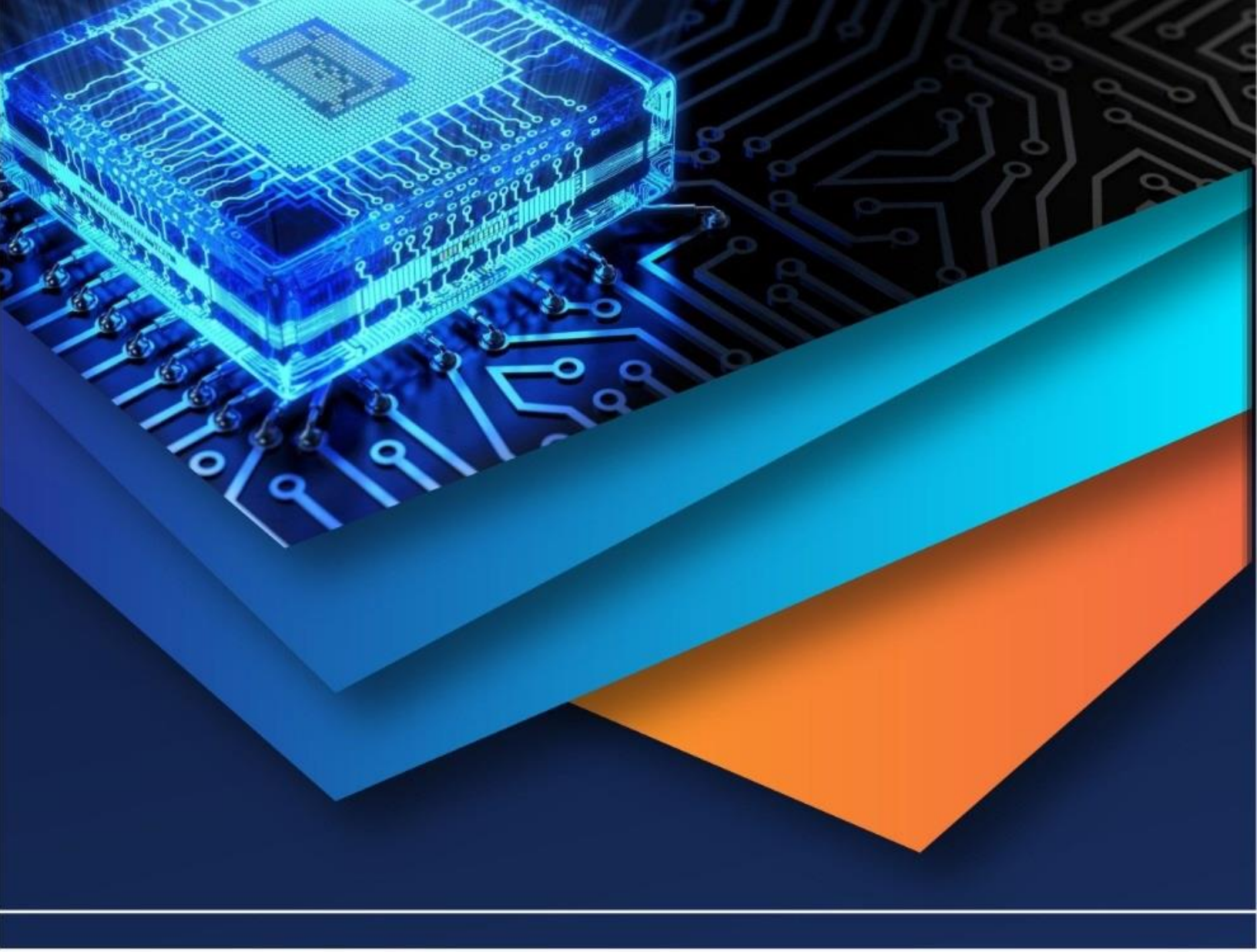
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