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Investigation of Tribological Properties of Cotton Seed Oil By Adding MoS2 and SiO2 as a Additives

Chaitali Narke[1], Dr.A.D.Desai[2], Prof A B Bhane[3]

[1]Scholar, *Dept. of Mechanical Engineering, SRCOE, Maharashtra, India*
[2] *Principal, SRCOE, Maharashtra, India*
[3]*Professor, Dept. of Mechanical Engineering, SRCOE, Maharashtra, India*

Abstract - For the high quality and environment friendly operation of an car at running stipulations requires perfect lubrication between the shifting components so that the components slide easily over every other. To reduce strength losses, discount of put on and friction has a key significance in engines and pressure trains. In IC engines from a lengthy time mineral oils have been used as a lubricant. However, Mineral oil is a product of the distillation of crude oil, so that it can be used till crude oil is available. Also, the disposal of mineral oils leads the hassle of air pollution in aquatic as properly as in terrestrial ecosystems. In addition, the combustion of mineral oil lubricants have been emit traces of metals as zinc, calcium, magnesium phosphorous and iron nanoparticles. Today, the depletion of reserves of crude oil, the developing expenditures of crude oil, and problem about defending the surroundings in opposition to air pollution have developed the activity in the direction of environment-friendly lubricants as a replacements for mineral oils in engines.

Key Words: cotton seed oil, Transesterification, Additives, Tribological properties

1.INTRODUCTION

Nowadays nanoscience is one of the most expansively creating spheres of world's science and its achievements can be utilized in special areas of science and technology. For instance nanomaterials, present in the shape of so known as nanostructures (nanotubes, nanowires, nanopowders and others) that are wider and wider used in many fields of human undertaking - from most cancers cure thru to engineered textiles or electricity storage to rocket propellant and explosives . And it is past a doubt that severa new fields of nanostructures software will occur in the nearest time. One of them looks to be the unexplored region of nanostructures use as components enhancing homes (especially tribological) of lubricating or reducing oils.

1.1 Lubrication Theory

Lubrication is the method employed to minimize put on of one or each surfaces in contact, and transferring relative to every other, via interposing a substance referred to as lubricant between the surfaces to elevate or to assist raise the load between the opposing surfaces. Functions of lubricant are as follows

It reduces the friction between the contacting surface

It decrease the wear

It raise away the frictional heat

It protects the surfaces in opposition to corrosion

It prevents the entry of overseas particles like grime and dust, to the contact zone.

1.2 Basic Modes of Lubrication

In lubrication, two contacting surfaces which have action relative to each different are separated by way of a excessive strain movie of lubricant. Based on the approach of growing the excessive stress movie of lubricant between the contacting surfaces, the lubrication can be categorized into 4 types

- Hydrodynamic lubrication
- Hydrostatic lubrication
- Electrohydrodynamic lubrication
- Solid movie lubrication

2.PROBLEM STATEMENT

The traditional lubricants used for a number mechanical structures consist of specific sorts of traditional additives. The components assist to enhance the lubricating and anti-wear homes of the lubricant. But these traditional components have sure boundaries at heavy loads. They are now not in a position to preserve their unique houses and for that reason exhibit negative lubricating and anti-wear residences at these heavy loads. So there have to be improvement in the components so as to make bigger the working vary of the lubricant by using the usage of MoS2 and SiO2 nanoparticles for my part and with the aid of mixing them at a range of attention of nanoparticles.

2.1 Objectives

The hassle declaration shows the eager want of improve nt of components so as to enhance the lubricating homes of the

lubricant. This can be performed by means of the usage of the new rising cloth i.e. nanoparticles as components in the lubricant. So the fundamental intention of this work is to test feasibility and to inspect the tribological residences of special kinds of nanoparticle components so as to enhance the lubricating and anti-wear properties. The targets of this record can be enlisted as follows,

- To find out about the Surface Modification of TCSO with MoS2 and SiO2.
- To find out about the impact of components on scar diameter and coefficient of friction of TCSO.

3. EXPERIMENTAL SETUP FOR WEAR TEST

3.1 Four -Ball Test Rig

We have chosen a trendy 4 ball trying out laptop with standardized checking out technique i.e. American Society for Testing and Materials (ASTM). DUCOM's 4 ball tester TR-30 household is designed to decide put on preventive (WP), excessive strain (EP) and shear balance conduct of lubricants. Apparatus measures the coefficient of friction, put on scar diameter and load carrying potential of lubricating oils beneath widespread working conditions. The mechanical tester consists of spindle assembly, motor, ball pot assembly, loading arrangement. There is a built-in accent storage and ball tray to maintain check balls. Also, the check rig consists of sensors,PC based totally desktop control, records acquisition machine and display.

Figure 5.2: Ducom—TR 30 L Four Ball Test Rig

3.2 Mechanical Specifications

Table 3.1: Mechanical specifications of four ball tester

Sr. No.	Part Details	Range
1.	Collect Diameter	12.7 mm
2.	Base plate height from floor	924 mm
3.	Loading Arm height from Floor	1050 mm
4.	Ball pot height from floor	1230 mm
5.	Loading Arm Length	935 mm
6.	Loading arm ratio	1:15
7.	Maximum Load	9999 N
8.	Minimum Load	60 N
9.	Dead weights	In steps of 1, 2 and 5 Kg
10.	Motor Height from floor	1580 mm
11.	Spindle speed	Min 1000 rpm and Max 3000 rpm
12.	Pulley Ratio	1:1
13.	Overall sizes of the machine L×W×H	660×935×1650 mm
14.	Weight of the Machine	388 Kg
15.	Floor Size L×W	2500×1500 mm

4. NANOPARTICLES USED

The different types of nanoparticles used in this work are as follows,

1) Molybdenum disulphide(MoS_2)
2) Silicon Dioxide nanoparticles (SiO2)

4.1 Molybdenum disulphide (MoS_2)

- Appearance: shiny dark gray
- Purity: 99.9 % (metal basis)
- Morphology: spherical
- True density: 5.06 g/cm^3
- Crystallographic Structure: cubic
- Making Method: Laser evaporating

4.2 Silicon Dioxide nanoparticles (SiO2)

- Appearance: brown black powder
- Purity: 99% (metal basis)
- APS: 25-55 nm
- SSA: 13.98 m^2/g
- Morphology: nearly spherical
- Bulk density: 0.79 g/cm^3
- True density: 6.4 g/m^3

5. EXPERIMENTATION

5.1 Sample Preparation

The pattern organized about 20 ml by means of quantity as proven in fig. the weight of components is measured on digital weighing computer having accuracy in milligrams. The magnetic stirrer is used for dispersion of nano-particle in oil.

Table 5.1: Test samples

Sample	Sample Preparation	Transesterified cottonseed oil (% by vol) ml	Additive (% by wt) gm
1.	Cottonseed oil	20	-
2.	Chemically modified cottonseed oil (TCSO)	20	-
3	1% by wt of MoS2	19.82	0.1868
3.	0.25 % by wt of SiO_2	19.98	0.0467
4.	0.50 % by wt of SiO_2	19.96	0.0934
5.	0.75 % by wt of SiO_2	19.94	0.1401
6.	1.00 % by wt of SiO_2	19.92	0.1868

6. RESULTS

The common values of the put on scar diameters and coefficients of friction for all samples of CSO oil and TCSO cottonseed oil and nano particle proportion are as proven in Table 6.1:

Table for coefficient of friction and average wear scar diameter with nanoparticle percentage, particle size

Sr. No.	Testing Samples	Coefficient of Friction	Average WSD (µm)
1	Cottonseed oil (CSO)	0.06361	690
2	Tranesterified cottonseed oil	0.06361	680
3	20W50 oil	0.08602	401
4	TCSO 1% MOS2	0.05328	654
5	TCSO SiO2(0.25%) + MOS2(0.75%)	0.04624	655
6	TCSO SiO2(0.50%) + MOS2(0.50%)	0.04335	620
7	TCSO SiO2(0.75%) + MOS2(0.25%)	0.04222	540
8	TCSO SiO2(1%)	0.04142	515

As the addition of SiO2 nanoparticle in trans-esterified cotton seed oil at the 1% of nanoparticle to the complete pattern having the minimum coefficient of friction however after subsequent stage 1.5% addition of nanoparticle coefficient of friction enlarge so the 1% of SiO2 nanoparticle is really helpful for utility purpose.

7. CONCLUSION

Based on the experimental learn about the following conclusion can be drawn:

a. Transesterified CSO indicates higher anti wear houses as evaluate to sophisticated CSO.

b. There is no discount of WSD and COF with MoS2 as additive due to the fact of its corse grain size.

c. As proportion of SiO2 will increase put on decreases.

d. As examine to TCSO, WSD reduce via 18% and Cof decreases by means the of 21%.

e. As examine to sophisticated CSO, WSD decreases by means of 33% and COF decreases by way of 27%.

f. So there is exceptional attainable of SiO2 as components to enhance the tribological properties.

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