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Performance Evaluation of Cotton Seed Oil as a Lubricant

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Abstract: Cotton seed oils have traditionally been applied in some uses but recent trends suggest their economic usefulness as industrial fluids. Increasing crude oil prices and emphasis on the development of renewable, environmentally friendly fluids have brought cotton seed oils to a place of importance. As environment pollution and health problem became more and more seriously concerned, the use of environmentally friendly lubricants is strongly supported by political parties, regional and local governments. The objective of this work is to determine the tribological properties of cotton seed oil & to determine the influence of lubricant on wear and pressure by using four ball tester machine. Further an attempt has been made to identify the influence of cottonseed oil in reducing the wear & chemical transformation. The performance of cottonseed oil is also being compared with commercial hydraulic oil.

Keywords: EP- Extreme Pressure, AW-Anti Wear.

I. INTRODUCTION

For the effective and efficient operation of an automobile at operating conditions requires proper lubrication between the moving parts so that the parts slide smoothly over each other. To decrease energy losses, reduction of wear and friction has a key importance in engines and drive trains. In IC engines from a long 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 until crude oil is available. Also, the disposal of mineral oils leads the problem of pollution in aquatic as well 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 growing prices of crude oil, and concern about protecting the environment against pollution have developed the interest towards environment-friendly lubricants as a replacements for mineral oils in engines. In comparison with mineral oil and synthetic oils, vegetable oil based lubricants possess the properties such as low toxicity, high lubricity, high viscosity index, high load carrying capacity, excellent coefficient of friction, good anti-wear capability, low emission into the environment, high flash point. Because of polar groups in the structure of vegetable oil and presence of long fatty acid chains obtain both boundary and hydrodynamic lubrications. Many of the researchers have used vegetable oil as engine oil, but only few of the researchers have reported vegetable oil-based lubricants for automotive applications.

II. EXPERIMENTAL PROCEDURE

A. Working Steps

- Carry out the literature survey carefully.
- Find out the problem statement regarding the research work.
- Find out the research gap and the objectives of the research work.
- Selection of proper engine oil for comparison.
- Test cotton seed oil on four-ball wear test machine as per ASTM standard D 4172 under prescribed condition.
- Compare the different properties of cotton seed oil with selected engine oil.
- Make a conclusion from the results.

B. Four-Ball Wear Test Machine

The four ball wear test machine as shown in Fig. 1 is going to use for wear tests and ASTM D 4172 standard procedure is followed to find out anti-wear properties of lubricants. The Ducom four ball testers is widely used as the industry standard for conducting anti-wear, extreme pressure and shear stability property test of lubricants. The test system is capable of carrying out a number of standards applicable to lubricant characterization and its capabilities extend beyond the scope of these standards, allowing users to perform a variety of customized tests. This machine uses four balls, three at the bottom which are clamped together and one on top. The bottom three balls are clamped together in a ball pot containing the lubricant under test and pressed against the test ball. The top ball is made to rotate at the desired speed while the bottom three balls are pressed against it. The lubricant under test is characterized by evaluating the wear scar formed on the bottom three balls after the test.

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The Ducom four ball testers is widely accepted as the industry standard for conducting EP, AW property test of lubricants. The Ducom four ball testers has the unique capability of evaluating lubricants for their wear preventive, extreme pressure frictional properties and shear stability properties, all in one machine. The test system is capable of carrying out a number of standards applicable to lubricant characterization and its capabilities extend beyond the scope of these standards, allowing users to perform a variety of customized tests. This instrument uses four balls, three at the bottom and one on top. The bottom three balls are held firmly in a ball pot containing the lubricant under test and pressed against the test ball. The top ball is made to rotate at the desired speed wile the bottom three balls are pressed against it. The lubricant under test is characterized by evaluating the wear scar formed on the balls after the test and evaluating the load at which the lubricant fails and the four balls weld together.

Fig.1 Four Ball Tester

C. Tribological Testing

The four ball wear test machine uses four balls, three at the bottom and one on top with both of 12.7 mm [1⁄2-in.] diameter. The balls made up of chrome alloy steel with Rockwell C hardness 64 to 66. The top ball is pressed with a force of 147 or 392 N [15 or 40 kgf] into the cavity formed by the three clamped balls for three-point contact. The temperature of the test lubricant is controlled at 75°C [167°F] and then the top ball is rotated at 1200 rpm for 1 hr. Lubricants are compared by using the average size of the wear scar diameters measured by microscope on the worn three lower balls. The microscope is capable of measuring the scar diameters with accuracy about 0.01 mm.

III. EXPECTED OUTCOME

Examine the tribological properties of the cotton seed oil is main basic task of research work. I am going to make a conclusion about different properties of cotton seed oil from wear scar diameters. So from the result it is expected that Cotton seed oil & its blends are very near to commercial hydraulic oil, they are alternative lubricant to the engine oil.

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