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Experimental investigation on comparison of lubrication properties of pure and oil mixtures

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ABSTRACT

In order to decrease the investment on lubricating oils and to increase their lubricating properties, we have added palm oil with traditional 20-40 engine oil. By mixing palm oil with 20-40 engine oil in proportions, the lubricating properties were enhanced. This mixture enhances properties like flash point, fire point, and decreases the viscosity and density which are favorable for lubrication at higher temperatures.

KEYWORDS: Viscosity, Density, Flash point, Fire point, Temperature, KV – Kinematic Viscosity.

1. INTRODUCTION

It is necessary to mix the oils in different proportions to analyze their properties for good storage conditions and to use at required situation. A study was conducted to for the best combination of canola, olive and palmolein oils. Canola and olive were mixed at different proportions of 80:20, 60:40, 50:50 and 20:80. Palm oil has greater stability in case of rancidity and oxidation thus above two oils were mixed with this oil ay 20%. Cold stability test and cloud point tests were satisfied by this mixture.

The Physiochemical properties such as viscosity, acid point of pure oils like sunflower oil, palm oil, mustered oil and their blends were found. Palm oil with the blending of soybean shows more stability than the other mixtures. It has higher viscosity than the other blends of vegetable oils. This blend can act as better lubricant because of its higher stability against oxidation and high melting point. This blending also has a low acid value which leads to the less corrosion to the metal.

The oil blending of sesame oil with different oils like palmolein, mustered and cotton seed oil in 80:20 and 20:80 proportions. These blends were undergone stability tests. After storing the blends for two months, there were near significant changes in the properties. So, they can be run up to two months of storage.

Experimental setup: The apparatus used for finding various properties are:

1. Redwood viscometer
2. Pensky marten's apparatus
3. Saybolt viscometer

Various materials used are

Test tubes, various beakers, thermometers, high temperature thermometers, candles, burners, oil cleaners, stirrers

2. EXPERIMENTAL METHODS

Determination of viscosity: Redwood viscometer is used for determining the viscosity of oil expressed as a time of flow in seconds through specified hole made in a metallic piece.

Scope: Redwood apparatus viscosity obtained is in empirical units and not in absolute units such as centistokes. It is possible to convert redwood viscometer units to absolute units for which the specification ip 70/68 issued by the institute of petroleum, London may be consulted. The method is primarily applicable for viscosity determination of oils which flows in a Newtonian manner, i.e if it possesses a linear relationship between shearing stress and rate of shear under the test condition.

Preparation of apparatus: Clean the oil cup with suitable solvent (carbon tetra chloride) and then dry it using soft tissue paper or some other material which will not leave any fluff. Clean the jet hole by fine thread.

Procedure: The prepared mixture of 20-40 engine oil and palm oil is poured into the oil cup through a filter of metal gauge. Increase the temperature of the bath and stir it to get uniform temperature. When the temperature in the bath is steady adjust the wall such that oil flow through jet. Now place a dry 60ml flask below the jet and at the same time on the timer.

After attaining 60ml of oil stop the clock and note the time taken for the flow of 60ml oil through the jet. Now again pour the oil into the oil cup through the filter and increase the temperature by 5°c and repeat the above process and note down the time taken. Repeat the process for 3 different temperatures. By some mathematical operations kinematic viscosity and absolute viscosity can be found.

Determination of flash and fire points: The flash point of oil is defined as a temperature to which the oil must be heated to give off sufficient vapor to form an inflammable mixture with air. The fire point is the lowest temperature at which the production of combustible gas from the oil is enough to maintain a steady combustion after ignition. The mixtures of oil is filled in the dry oil cup of the apparatus up to leveling point .Place the lid in position and insert the thermometer into the oil. Now increase the temperature of the oil by control box of the apparatus. As the temperature increases apply the test flame at every 10 degree increase in temperature to find flash and fire point

3. RESULT AND DISCUSSION

Kinematic Viscosity (KV) = (At-B/t) Where A=0.0022, B = 1.8 (Redwood Constants)

KV of Pure 20-40 Engine oil:

Table.1. Temperature Vs KV of pure 20-40 engine oil

Temperature(^{O}C)	Kinematic Viscosity
32	0.5449
37	0.4655
42	0.3875

KV of Pure Palm oil:

Table.2.Temperature Vs KV of pure palm oil

Temperature(^{O}C)	Kinematic Viscosity(Stokes)
30	0.6537
35	0.5063
40	0.4024

20-40 engine oil & palm oil in 1:1 by volume:

Table.3.Temperature Vs KV of Mixture of 20-40 engine oil and palm oil in 1:1 proportion

Temperature(^{O}C)	Kinematic Viscosity(Stokes)
30	1.944
35	1.2508
40	1.0191

20-40 engine oil and palm oil mixture in 3:1 proportion by volume:

Table.4. Temperature Vs KV of mixture of 20-40 engine oil and palm oil in 3:1 proportions

Temperature	Kinematic Viscosity
30	1.8303
35	1.2832
40	0.9699

Flash Point and Fire Point:

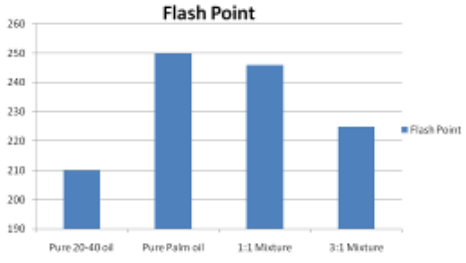

Figure.1.Flash points of different mixtures

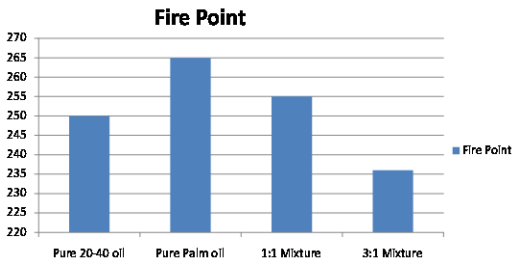

Figure.2.Fire points of different mixtures

Comparison of Viscosities of Different Mixtures:

Table.5.Temperature Vs KV of different mixtures and their pure forms

Temperature(ºC)	KV of Pure 20-40 oil	KV of Pure Palm oil	KV of 1:1 Mixture	KV of 3:1 Mixture
30	0.5766	0.6537	1.944	1.8303.
35	0.4967	0.5063	1.2508	1.2832
40	0.4187	0.4024	1.0191	0.9699

4. CONCLUSION

The properties of various proportions were found. The viscosity of the mixed oils was high compared to the pure oils thus it can withstand to high temperatures and it has high melting point in case of lubrication purposes. The flash point of 1:1 mixture is near to that of pure palm oil and the same of 3:1 mixture is near to the flash point of pure 20-40 engine oil. The fire point of 1:1 mixture is near to that of pure 20-40 engine oil. Whereas the fire point of 3:1 mixture has very low fire point compared to that of both pure oils. The Price of 1 liter of 20-40 engine oil is Rs. 280 and that of palm oil is Rs. 90. So 20-40 engine oil has better combination with the palm oil in order to increase the lubricating properties and to reduce price.

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