A CASE STUDY OF KINEMATIC VISCOSITY FOR BLENDED LUBRICATING OILS AT VARIABLE TEMPERATURE

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Abstract: Viscosity is the main property of lubricant or liquid. To get good performance from one of oil is difficult. So, to get desirable result, two or more oil are mixed together. Viscosity is defined as flow ability or resistance of a liquid to flow. The need of this experiment is to determine the viscosity index. Red wood viscometer no.1 is used to calculate the flow of four liquid sample – fresh mustard oil, fresh Kerosene oil, 10:40(kerosene: mustard oil), 40:10(kerosene: mustard oil). Viscosity of each oil sample is taken at temperature like 40°C, 50°C, 60°C, 70°C, 80°C.

Key words: *Viscosity index, red wood viscometer, lubricant oil.*

I. Introduction

Viscosity is the property of a liquid. It is an internal resistance of any fluid which prevents flow of liquid. Higher the viscosities lower the flow ability therefore.

Velocity ∞ 1/viscosity

Viscosity is also the main property of a lubricant. If the viscosity is very low, an oil film cannot be maintained between two surfaces, therefore excessive wear will form in liquid. If the viscosity is too high, due to shearing of oil excessive frication will take place and next would be generated in the system.

Temperature has an important role to measure viscosity of any fluid. The viscosity of any oil is inversely proportional to temperature that means viscosity decreases with increasing temperature. Zero viscosity is observes only at low temperature in super fluids. To determine the viscosity of oil, we use the redwood viscometer.

Say bolt is used in USA and Engler is used in Europe to determine the viscosity of any oil.

II. Red Wood Viscometer

In this experiment we use Red Wood Viscometer No. 1 to determine kinematic viscosity of different oil at different temperature. Red wood viscometer consists of vertical cylindrical oil cup and water bath. Oil cup have orifice of its base. In red wood viscometer have a hook pointing upward for filling oil up to that point. The oil cup is heat by heating water bath by immersed electric coil in it. The diameter of orifice is 1.62mm and length of jet is 10mm. Red wood seconds is defined for collection of 50ml of liquid to flow out of orifice.

viscometer	Orifice diameter	Length of jet
RW1	1.62	10mm
RW2	3.8	50mm

III. Oil used:

In this we have calculated kinematic viscosity of different samples of oils at different temperature. Oils are mustard oil taken as vegetable oil, kerosene oil taken as mineral oil and their blends. First we took pure mustard oil and kerosene oil for experiment and then two mixtures of this oils in 10:40 at varying temperature of 40°C, 50°C, 60°C, 70°C and 80 °C.

Kinematic viscosity was calculated by using specific formula.

$Y=At-B/t$

Where,

Y=Kinematic viscosity in centistokes,

A=Viscometer constant which can be determine by equipment,

B=Coefficient of kinetic energy,

t=Time of flow in seconds

S.No.	Time of flow (in seconds)	Value of A	Value of B
1.	Up to 100 sec.	0.0026	1.72
2.	Above 100 sec.	0.0024	0.5

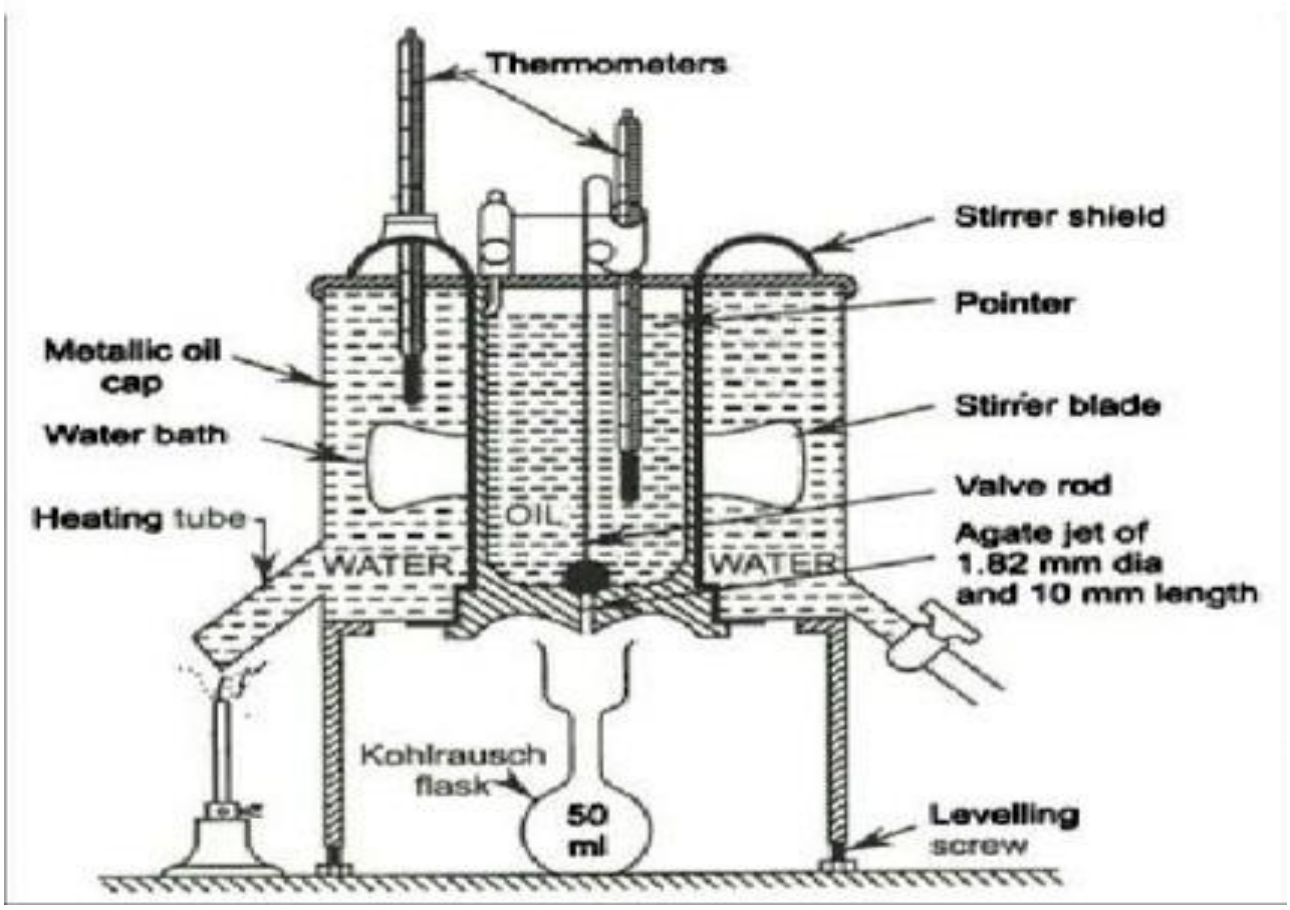

Figure 1. Red Wood Viscometer

III. Procedure:

- Clean the red wood viscometer and other equipment.
- Close the orifice with ball valve.
- Fill the oil in oil cup and water in water bath.
- Insert the thermometer in their respective places in red wood viscometer.
- Then heating and stirred the water bath and maintain uniform temperature.
- At particular temperature remove ball and collect oil in kohlrausch flask 50ml capacity.
- A stop watch is used to measure time taken by oil in filling of 50ml of kohlrausch flask.
- Increase temperature and repeat this experiment at different temperature for different oils.

IV. Observations:

S. No	Temperature (°C)	Time taken by Pure Kerosene Oil (in seconds)	Time taken by (Kerosene: Mustard oil) (in seconds) 40:10	Time taken by (Kerosene: Mustard oil) (in seconds) 10:40	Time taken by Pure Mustard Oil (in seconds)
1	40	52	68	278	558
2	50	50	60	170	326
3	60	48	55	136	231
4	70	45	48	113	166
5	80	48	47	94	143

Table 1: Relation between Temperature and Redwood Viscosity

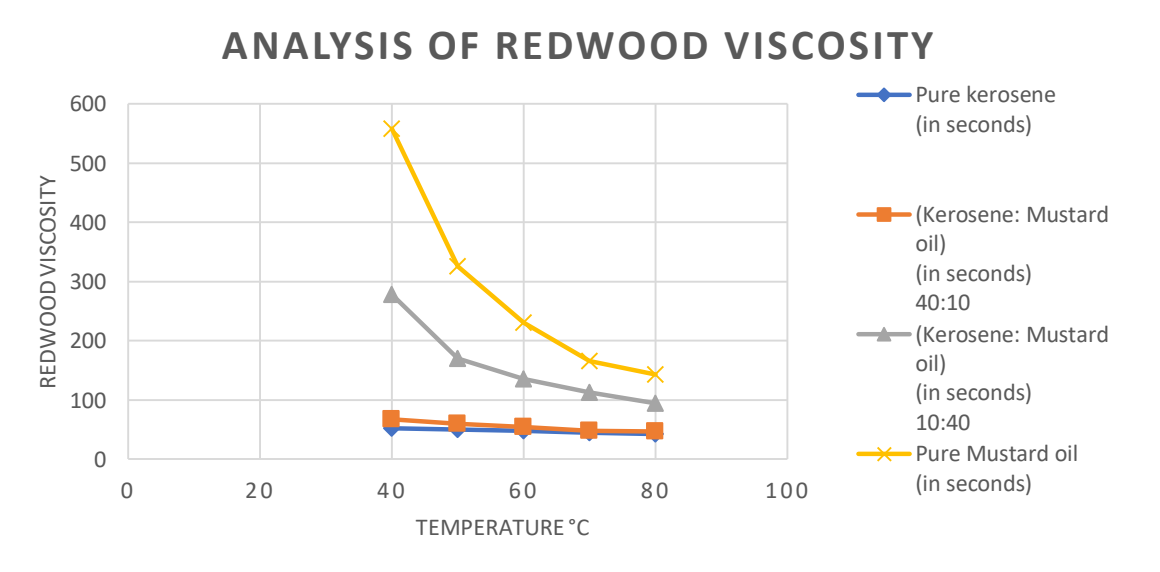

Figure 1 Relation between Temperature and Redwood Viscosity

S. No	Temperature (°C)	Kinematic Viscosity of Pure Kerosene Oil (in centistokes)	Kinematic Viscosity of (Kerosene: Mustard oil) (in centistokes) 40:10	Kinematic Viscosity of (Kerosene: Mustard oil) (in centistokes) 10:40	Kinematic Viscosity of Pure Mustard Oil (in centistokes)
1	40	0.102	0.151	0.66	1.33
2	50	0.096	0.120	0.40	0.78
3	60	0.089	0.112	0.32	0.55
4	70	0.079	0.089	0.26	0.39
5	80	0.071	0.086	0.22	0.33

Table 2: Relation between Temperature and kinematic viscosity

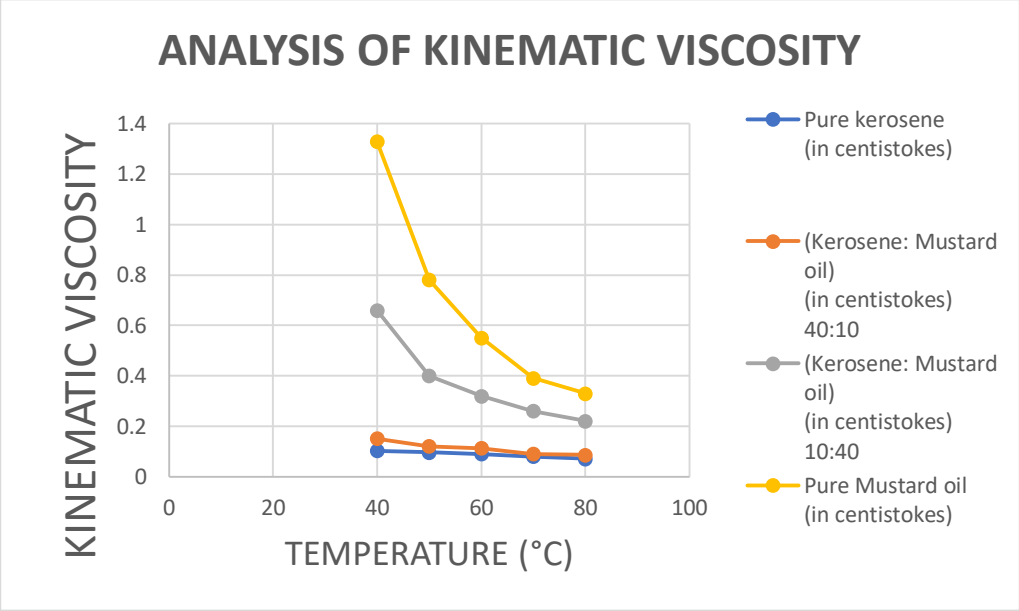

Figure 2: Relation between Temperature and kinematic viscosity

Conclusion:

From the performed experiment, we find the following conclusion-

1. We can see in graph, If we use mineral oil can show very small change in viscosity with temperature.
2. If we use pure vegetable oil can show large change in viscosity with temperature.
3. By above points , we conclude that the mineral oil is suitable with temperature vibration.
4. We use mixture of mustard and kerosene oil to show vibration of viscosity with temperature in different mixture.

V. References:

1. Guillermo Centeno, Gabriela Sánchez-Reyna, Jorge Ancheyta, José A.D. Muñoz, Nayeli Cardona "*Testing various mixing rules forcalculation of viscosity of petroleum blends",* Instituto Mexicano del Petroleo, Eje Central Lazaro Cardenas 152, D.F. 07330, Mexico. Fuel 90 (2011) 3561–3570. Elsevier. Table 2: Relation between Temperature and kinematic viscosity
2. Shubham Dhar Dwivedi, AK Akshay, Saurabh Shrivastav, Gajendra Padwa,

   Study of Dependency of Temperature on Kinematic Viscosity for Blended Oils, International Journal of Engineering Research & Technology(IJERT), ISSN: 2278-0181, IJERTV4IS100469, Vol. 4 Issue 10, October.
3. Stanciu I., "A new viscosity-temperature relationship for vegetable oil" Journal of Petroleum Technology and Alternative Fuels Vol. 3, pp. 19-23, 2012.
4. Denton E. L., "Liquid Viscosity and Temperature", California State Science Fair 2004 Project Summary.
5. Gwidon W. Stachowiak, Andrew W. Batchelor, "Engineering Tribology", Elsevier. 225, Wyman street, Waltham, MA, USA. First edition. pp 11-12.
6. Khupase N.," Temperature Dependant Viscosity of Measures of Ionic Liquids at Different Temperatures", Indian Journal of Chemistry, Vol. 49, pp. 727-730,2010.