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Significance of Flammable Property over Viscosity Index (VI) Of Oil

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Abstract: ***Viscosity is a property of a liquid related to its state transition temperatures. Oil is a complex substance with each hydrocarbon molecules consisting of many atoms of carbon, hydrogen and oxygen and others and lubrication of Oil is critical which only depend on viscosity. All oil shows decrease in viscosity with increase in temperature. The amount of viscosity loss proportional to temperature increase is called Viscosity Index (VI). It is advantageous to have oil which loses viscosity as little as possible as the temperature increases. In this paper an attempt has been made to find out quality of Oil with reference to change in temperature by showing variation in Viscosity with temperature of some domestic usable oil namely Soya bean Oil, Coconut Oil, Kerosene and 2T Oil. The viscosity is finding in terms of Redwood Seconds using Redwood Viscometer No.2,It was found that though viscosity index of kerosene oil is more but it can't use as lubricant as it has high flammable property.***

Keywords: **Oil, Redwood Viscometer No.2, Viscosity, Viscosity Index (VI).**

I. INTRODUCTION

Viscosity is a property of a liquid related to its state transition temperatures. The state a substance takes depends upon temperature and pressure to which it is being subject. We all know that the temperature can determine whether a substance is solid or liquid, but why does the viscosity of liquid like oil changes with temperature. This is due to the nature of liquids; they are substance where the molecules are loosely associated with one another. Oil is a complex substance with each hydrocarbon molecules consisting of many atoms of carbon, hydrogen and oxygen and others. The atoms in each hydrocarbon molecules are strongly chemically bonded together. The basic property which gives the characteristics we perceive as viscosity is cohesion. Cohesion is an expression of how strongly molecules of a substance are attracted to other molecules of that same substance. This in turn is partly dependent on the size (or weight) of each molecule. It is easy to imagine that a liquid made up of long, stringy molecules would be more viscous than one composed of shorter molecules. It is for this reason increasing viscosity oil is usually denser as well. Lubrication of Oil is critical which only depend on viscosity. All oil shows decrease in viscosity with increase in temperature. The amount of viscosity loss proportional to temperature increase is called Viscosity Index (VI). It is advantageous to have oil which loses viscosity as little as possible as the temperature increases.

In this paper an attempt has been made to find out quality of Oil with reference to change in temperature by showing variation in Viscosity with temperature of some domestic usable oil namely Soya bean Oil, Coconut Oil, Kerosene and 2T Oil. The viscosity is finding in terms of Redwood Seconds using Redwood Viscometer No.2

II. MATERIALS & METHODS

The material required to conduct the experiment are

i) Redwood Viscometer No. 2 , ii) Soya bean Oil, iii) Coconut Oil , iv) Kerosene Oil

v) 2T Oil , vi) 0° C to 100° C thermometer

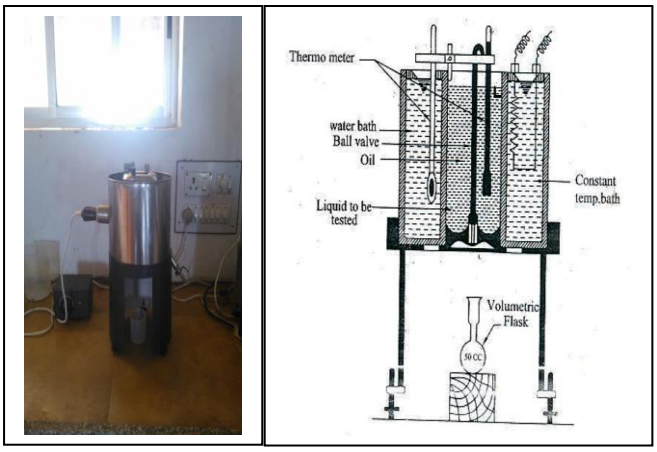

Fig 1: Redwood Viscometer No. 2

III. PROCEDURE

1. Clean the viscometer cup properly with the help of suitable solvent e.g. CCl4, ether, petroleum spirit or Benzene and dry it to remove any traces of solvent.
2. Level the viscometer with the help of leveling screws.
4. Fill the outer bath with water for determining the viscosity at 100 ^{o}C and below.
5. Place the ball valve on the jet to close it and pour the test oil into the cup up to the tip of indicator.
6. Place a clean dry Kohlrausch flask immediately below and directly in line with discharging jet.
7. Insert a clean thermometer and a stirrer in the cup and cover it with a lid.
8. Heat the water filled in the bath slowly with constant stirring. When the oil in the cup attains a desired Temperature, stop the heating.

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9. Lift the ball valve and start the stop watch. Oil from the jet flows into the flask.
10. Stop the Stop Watch when lower meniscus of the oil reaches the25 ml mark on the neck of receiving Flask.
11. Record the time taken for 25 ml of the oil to collect in the flask.
12. Repeat the experiment to get more readings.

IV. RESULTS

Table 1 Redwood time for Soya bean Oil

Sr. No.	Temperature(T) (°C)	Viscosity (Redwood sec)(t)	ΔT	Δt
1	35	15.77		
2	40	15.17	5	0.6
3	45	11.67	10	4.1
4	50	11.25	15	4.52
5	55	10.93	20	4.84
6	60	10.13	25	5.64
7	65	7.73	30	8.04
8	70	7.23	35	8.54
9	75	6.87	40	8.9
10	80	6.35	45	9.42
11	85	5.92	50	9.85

Table .2 Redwood time for Coconut Oil

Sr. No.	Temperature(T) (°C)	Viscosity (Redwood sec) (t)	ΔT	Δt
1	35	16.36		
2	40	15.64	5	0.72
3	45	12.65	10	3.71
4	50	11.87	15	4.49
5	55	11.16	20	5.2
6	60	10.69	25	5.67
7	65	10.12	30	6.24
8	70	9.78	35	6.58
9	75	8.45	40	7.91
10	80	7.72	45	8.64
11	85	7.03	50	9.33
12	90	5.98	55	10.38
13	95	5.34	60	11.02

Table.3 Redwood time for Kerosene

Sr. No.	Temperature(T) (°C)	Viscosity (Redwood sec) (t)	ΔT	Δt
1	35	5.82		
2	40	5.21	5	0.61
3	45	4.97	10	0.85
4	50	4.74	15	1.08
5	55	4.51	20	1.31
6	60	4.42	25	1.4
7	65	4.29	30	1.53
8	70	4.13	35	1.69
9	75	3.93	40	1.89
10	80	3.79	45	2.03
11	85	3.61	50	2.21
12	90	3.49	55	2.33
13	95	3.28	60	2.54
14	100	3.11	65	2.71

Table .4 Redwood time for 2TOil

Sr. No.	Temperature(T) (°C)	Viscosity (Redwood sec) (t)	ΔT	Δt
1	35	15.34		
2	40	14.56	5	0.78
3	45	13.43	10	1.91
4	50	10.67	15	4.67
5	55	10.17	20	5.17
6	60	8.58	25	6.76
7	65	7.53	30	7.81
8	70	7.39	35	7.95
9	75	7.04	40	8.3
10	80	6.77	45	8.57
11	85	6.34	50	9
12	90	6.06	55	9.28
13	95	5.68	60	9.66
14	100	5.34	65	10

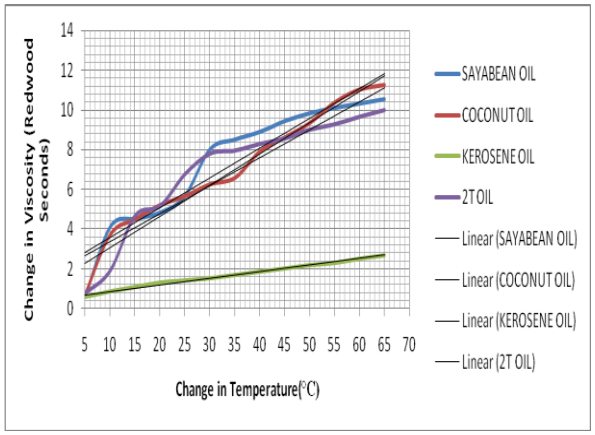

Fig: 2 Variation of Viscosity of given Oil with temperature. The viscosity is measured in terms of Redwood seconds using Redwood Viscometer No.2

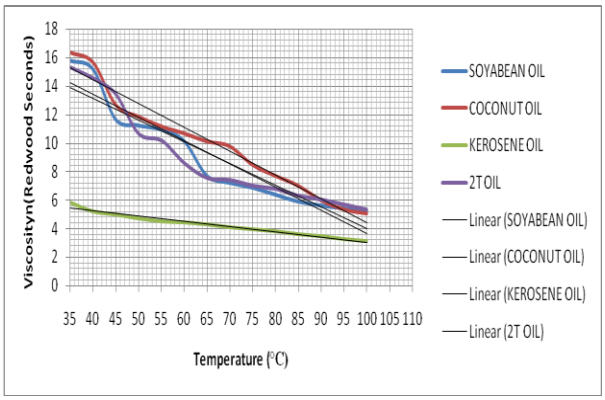

Fig: 3 Change in Redwood time with change in temperature. The viscosity is measured in terms of Redwood seconds using Redwood Viscometer No.2.

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VI. DISCUSSION

All Oil show deceases in viscosity with increase in temperature. It is an inherent characteristic of liquid in general**.** From the fig.3.1 it shows that the viscosity of all given oils are decrease but the variation for Kerosene is much less compare to other oils(Fig 3.3) because the Kerosene is less lubricant as compare to other given oils. The lubricant is the critical property of any oil which depends upon viscosity. Higher the viscosity higher the lubrication .The viscosity is the resistance to flow and less the time required to flow means less the viscous of the fluid and the above fig 3.1 shows that kerosene is taking much less time to flow as compared to other oil. This means kerosene having low viscosity while all other oils shows the high viscosity .High viscosity means high resistance to flow which in turn high Lubricating property. If lubricating oil has zero resistance to flow, it would not stay in a gap of a bearing under load [1], and would immediately flow away form the point of loading. It is the viscosity property of oil which keep it in a film, allowing it to lubricate and separate surfaces that may otherwise rub or contact with each other. This is why the oil choosing for lubrication in many engines is challenging task for us. For e.g. our domestic motor pump of cooler. It is generally observed that when the motor pump stops to work properly we put coconut oil instead of kerosene. This is only because of more viscous of coconut oil compare to kerosene. Such type of observations we can find in many automobile and other industries also. Today multi-viscosity of mixture of oils is taken as lubricants instead of mono-viscosity of single oil. On the contrary from fig 3.1 it is observing that all Oil show deceases in viscosity with increase in temperature The amount of viscosity loss proportional to temperature increase is called Viscosity Index (VI) .It is advantageous to have oil which loses viscosity as little as possible as the temperature increases. The less oil thins as the temperature increase, the higher the VI. A relatively small change/no change in viscosity with temperature is indicated by high viscosity index whereas low viscosity index shows relatively large change in viscosity with temperature On the other end of the scale, it is an advantage to have oil that thickness as little as possible when the temperature drops. High VI oil thickens less with a temperature decrease. From the above fig 3.1 it is observing that the variation in Viscosity of Kerosene oil is much less as compared to other given Oils as its viscosity changes less with change in temperature. This means that kerosene oil has high Viscosity index. This is advantage of kerosene oil over the other but kerosene oil is never use as lubricant because of its volatile nature. The high Viscosity Index oil can be used whenever there is a large variation in temperature, as high Viscosity Index Oil will maintain the lubricating property and bear the load properly.[3] The fig. 3.2 shows that the change in viscosity with increasing temperature is very less for kerosene Oil as compared to other three Oils. This graph supports the high Viscosity Index of Kerosene oil. If we go through the graph (fig.3.2) properly we finding that the slope of variation for Kerosene oil is very much less whereas for Soybean, coconut and 2T, the variation is high. The high viscosity Index also confirms that the Molecular weight of Kerosene Oil is more comparing to other given oil. Hence it is advantageous to use kerosene where temperature change is very high but we can't use kerosene oil for that purpose because of its high flammable property. Hence heavier oils can be used at higher temperature. Similarly, light oils are used at low ambient temperature but flammable property plays a very important role for choosing the lubricating oil.

VII. CONCLUSION

From the above discussion it is concluded that light oil (low molecular weight and low Viscosity Index) is used for low temperature variation whereas heavy oils (high molecular weight and high Viscosity Index) is used for high temperature variation in order to sustain and bear the load and the Viscosity Index (VI) is the important parameter to determine the lubricating and characteristic property of any oil. But along with that the flammable property must be consider.

VIII. FUTURE SCOPE OF STUDIES

As we have seen from above study that though kerosene oil having high Viscosity Index (VI) but it can't use as lubricant due to its high flammable property but this may open a new direction to think for those oils having high Viscosity Index (VI) and High flammable property.

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