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Experimental Analysis of Flash Point of Lubricating oil

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Abstract:-The current research is performed to determine the flash point of lubricating oil.The flash point is a descriptive characteristic that is used to distinguish between flammable liquids, such as petrol, and combustible liquids, such as diesel. It is also used to characterize the fire hazards of liquids. Depending on the standard used, liquids which have a flash point less than either 37.8 or 60.5 °C (100.0 or 140.9 °F) are called flammable , whereas liquids having a flash point above that temperature are called combustible. The flash point is also used for the detection of contamination in the given lubricating oil.

Keywords: -Lubricating oil,flash point, temperature, vapours

I. INTRODUCTION

In all types of machines, the surfaces of moving or sliding or rolling parts rub against each other. Due to the mutual rubbing of one part against another, a resistance is offered to their movement. This resistance is known as friction. It causes a lot of wear and tear of surfaces of moving parts. Any substance introduced between two moving/sliding surfaces with a view to reduce the friction (or frictional resistance) between them, is known as a lubricants. The main purpose of a lubricant is to keep the moving/sliding surfaces apart, so that friction and consequent destruction of material is minimized. The process of reducing friction between moving/sliding surfaces, by the introduction of lubricants in between them, is called lubrication.Function of lubricants is as follows:

a) It reduces wear and tear of the surfaces by avoiding direct metal to metal contact between the rubbing surfaces, i.e. by introducing lubricants between the two surfaces
b) It reduces expansion of metal due to frictional heat and destruction of material
c) It acts as coolant of metal due to heat transfer media
d) It avoids unsmooth relative motion
e) It reduces maintenance cost
f) It also reduces power loss in internal combustion engines

Figure 1: Lubricating oils

1.1 Properties of Lubricants

1.1.1 Viscosity

It is the property of liquid by virtue of which it offers resistance to its ownflow (the resistance to flow of liquid is known as viscosity). The unit of viscosity is poise. It is the most important single property of any lubricating oil, because it is the main determinant of the operating characteristics of the lubricant. If the viscosity of the oil istoo low, a liquid oil film cannot be maintained between two moving/sliding surfaces. On the other hand, if the viscosity of the oil is too high, excessive friction will result. Effect of temperature on viscosity:

Viscosity of liquids decreases with increasing temperature and, consequently, the lubricating oil becomes thinner as the operating temperature increases [1]. Hence, viscosity of good lubricating oil should not change much with change in temperature, so that it can be used continuously, under varying conditions of temperature. The rate at which the viscosity of lubricating oil changes with temperature is measured by an arbitrary scale, known as Viscosity Index. If the viscosity of lubricating oil falls rapidly as the temperature is raised, it has a low viscosity index. On the other hand, if the viscosity of lubricating oil is only slightly affected on raising the temperature, its viscosityindex is high.

1.1.2 Flash Point

The flash point is the lowest temperature at which vapors of a volatile material will ignite, when given an ignition source. The flash point may sometimes be confused with the auto ignition temperature, which is the temperature at which the vapor ignites spontaneously without an ignition source. The fire point is the lowest temperature at which the vapor will keep burning after being ignited and the ignition source removed. The fire point is higher than the flash point, because at the flash point the vapor may be reliably expected to cease burning when the ignition source is removed. Neither flash point nor fire point depends directly on the ignition source temperature, but it may be understood that ignition source temperature will be considerably higher than either the flash or fire point.There are two basic types of flash point measurement: open cup and closed cup. In open cup devices, the sample is contained in an open cup which is heated and, at intervals, a flame brought over the surface. The measured flash point will actually vary with the height of the flame above the liquid surface and, at sufficient height, the measured flash point temperature will coincide with the fire point. Flash point is used in shipping and safety regulations to define flammable and combustible materials and classify their hazard potential which has significant cost implications when transporting or storing products.

1.1.2.1Pensky Marten's flash pointapparatus

Flash and fire points are used to indicate fire hazard of petroleum products and evaporation loses under high temperature loses. It gives us the idea about the maximum temperature below which the oil can be used. It is used as the means of identification of specific lubricating oil for detection of contamination in the given lubricating oil.In the Pensky–Martens closed-cup flash-point test, a brass test cup is filled with a test specimen and fitted with a cover. The sample is heated and stirred at specified rates depending on the material that is being tested. An ignition source is directed into the cup at regular intervals with simultaneous interruption of stirring until a flash that spreads throughout the inside of the cup is seen.Closed cup tests aim to simulate the situation of a liquid spill in a closed environment [2]. If the liquid is at, or above, its flash point then a fire or explosion is a possibility when exposed to a potential ignition. In closed cup tests the sample is placed inside a sealed (closed) test cup and the ignition source is introduced to measure the temperature at which the sample ignites ('flashes'), known as its Flash point.Thisapparatus consists of the test cup, test cover and shutter, stirring device, heating source, ignition source device, air bath, and top plate. The assembled manual apparatus, test cup, test cup cover, and test cup. At the top of the cup a shutter is provided. By moving the shutter, opening in the lid opens and flame is dipped in to this opening, bringing the flame over the oil surface. As the test flame is introduced in the opening, it get extinguished, but when the test flame is returned to its original position, it is automatically lightened by the pilot burner**.**Oil cup is made up of Brass**.** Lid of the cup is provided with four openings of for stirrer, second is for admission of air and third is introduction test flame. The advantage of the equipment is well suited to automation; instrumentation is universally available and standardized for a wide range of products.

Figure 2: Pensky Marten's flash pointapparatus

II. PROCEDURE

Clean and dry all parts of the apparatus with the help of suitable solvent e.g. CCl_4, ether, petroleum spirit or benzene and dry it to remove any traces of solvent.Fill the oil cup with the test oil up to the mark. Fix the lids on the top through which are inserted a thermometer and a stirrer. Ensure that the flame exposure device is fixed on the top.Light the test flame and adjust it to about 4 mm in diameter.Heat apparatus as temperatures of oil increases by 5 to 60 per min as stirrer is continuously rotated.For every 10° C rise of temperature, introduce test flame into the oil vapour. This is done by operating the shutter. On moving knob of shutter, test flame is lowered in oil vapours through opening. When test flame causes a distinct flame in interior cup, note temperature which represent the flash point. Further heat the oil at the rate of 10C/ min. and continue applying the test flame as before.The temperature at which the vapours of the oil give a clear and distinct blue flash for five seconds is recorded as the fire point of the oil.

III. OBSERVATION

S. No.	Temperature (°C)	Flash observed / not observed
1.	135	NIL
2.	139	NIL
3.	145	NIL
4.	148	NIL
5.	152	NIL
6.	158	NILL
7.	163	NILL
8.	168	NILL
9.	175	OBSERVED

IV. CONCLUSION

The work has been devoted to the study of the flammability of aqueous solution of some common flammable liquid, by characterizing three flash points at various concentration.These values are necessary for the classification of flammable liquids, which is based on flash point and ebullition temperature. Flash point is defined as the lowest temperature of a liquid at which its vapors will form a combustible mixture with air. It is a convenient and reliable classification of the flammability of many substances; there are three main categories;

- Extremely flammable: Flash point below 0° C
- Highly flammable: Flash point below 21° C
- Flammable: Flash point below 55° C

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