Experiment No. 8

Determination of properties of liquid fuels

(A) Aniline point

Objective

To measure and compare the aniline points of petrol and diesel

Apparatus

A magnetic stirrer with hot plate, beaker, thermometer, benzene, liquid fuel samples

Theory

Aniline point is defined as the lowest temperature at which equal volumes of aniline and a given liquid fuel sample become completely miscible. Since aniline is aromatic, it becomes easily miscible with the aromatics in the fuel sample on heating. Thus, aniline point becomes important in giving an indication of the amount of aromatics in a given fuel. Lower the aniline point more is the aromatic content of the sample and vice versa. A higher aniline point is also indicative of higher proportions of paraffins in the fuel sample and is, thus, of particular importance in case of diesel. For diesel sample, higher aniline point suggests higher Diesel Index, which in turn indicates better ignition quality of the sample.

Procedure

1. Measure equal volumes (50 ml each) of aniline and benzene/the fuel sample.
2. Take a beaker and pour the measured volumes of aniline and the sample in it.
3. Place the beaker on the heating plate and start heating the beaker (with the liquids) gently. Also turn on the stirrer after putting the magnetic bead in the beaker. The speed of rotation of the stirrer bead should not exceed 50 rpm.
4. Observe carefully and obtain the lowest temperature at which the two liquids become completely miscible. This temperature is the aniline point of the given fuel sample.
5. Turn off the heater and let the liquid cool down. You will observe that the two liquid layers reappear on cooling.
6. Repeat steps 3 to 5 to get at least three readings for the aniline point of each of benzene, petrol and diesel. Note your observations.

Observations

Readings	Aniline point (°C)		
	Benzene	Petrol	Diesel
1			
2			
3			

Inferences

Report your conclusions from the experimental data.

(B) Cloud point

Objectives

To measure and compare the cloud points of petrol and diesel

Apparatus

Test tubes, fuel samples, cooling liquid bath and thermometer

Theory

Cloud point of a liquid fuel is the temperature at which wax compounds begin to crystallize and separate from the fuel on reducing temperature – this results in a cloudy appearance. On further cooling, a temperature is reached, at which the fuel gels and ceases to flow. This temperature is called the pour point of the fuel. At the cloud point, the wax crystals flow with the fuel and can choke the fuel filter, thereby starving the engine of fuel. The temperature at which these crystals plug the filter is referred to as the cold filter plugging point (CFPP) for the fuel. This is important for cold climates, where the ambient temperatures drop significantly and it may be difficult to fuel vehicles with oils having high cloud points.

Procedure

1. Take a small amount (approximately 15 ml.) of the fuel sample and pour it in a test tube.
2. Dip the test tube in a cooling liquid bath maintained below the ambient temperature.
3. Observe carefully and obtain the temperature at which the oil becomes cloudy with a thermometer. Note this temperature as the cloud point of the given fuel sample.
4. Take the test tube out of the cooling bath and let the sample reach room temperature.
5. Repeat steps 2 to 4 to get at least three readings for the cloud point of petrol and diesel each.

Observations

Readings	Cloud point (°C)	
	Petrol	Diesel
1		
2		
3		

Inferences

Report your conclusions from the experimental data.

(C) Flash point

Objectives

To measure and compare the flash points of petrol and diesel

Apparatus

Fuel samples, Pensky-Martens closed cup tester

Theory

The flash point of a liquid fuel is the temperature at which the fuel gives off sufficient vapors to ignite momentarily (i.e. flash) in presence of a flame. The main aim of such a test is to assess the safety hazard associated with handling and storage of a particular fuel. The apparatus being used here is a Pensky-Martens closed cup tester. It consists of a brass cup to hold the fuel sample closed with a lid and a heater below the cup to heat the fuel. Depending on the apparatus used, the cup may be open, or closed. The fuel is heated in the cup at a specified rate and a test flame introduced at regular intervals of time to ignite the vapors. A gas jet at the opening of the cup ignites the vapors as the lid is opened. The lowest temperature at which the vapors flash is the flash point of the fuel.

Procedure

1. Clean the cup and the accessories thoroughly before starting the experiment.
2. Pour the fuel to be tested into the cup up to the filling mark.
3. Close the cup and ignite the flame after turning on the LPG supply. Adjust the flame diameter to about 4 mm by changing the LPG flow rate.
4. Switch on the heater and maintain a uniform heating rate of 1°C/minute. Also rotate the stirrer at a steady rate.
5. Open the lid to introduce the flame at intervals of 1°C to check for the flash point.
6. Note the minimum temperature at which the fuel flashes and put off the heater and the LPG flame. Do not stir the contents of the cup while introducing the flame.
7. Cool the fuel sample in the cup to room temperature and repeat steps 3 to 7 to obtain 3 values of the flash point.

Observations

Readings	Flash point (°C)	
	Petrol	Diesel
1		
2		
3		

Inferences

Report your conclusions from the experimental data.