Ministry of Higher Education and Scientific Research
AL Mustaqbal university college
Chemical Engineering Department

Petroleum Properties Laboratory

2nd. Stage.

Exp. No. 2
Petroleum Products Distillation Tester

Prepared by
Asst.lect. Ban Ali Hassan

2021-2022

The Aim:

To determine quantitatively the boiling range characteristics of such products as light and middle distillates, automotive spark-ignition engine fuels**.**

Introduction and theory :

The basic test method of determining the boiling range of a petroleum product by performing a simple batch distillation has been in use as long as the petroleum industry has existed. It is one of the oldest test methods under the jurisdiction of ASTM Committee D02, dating from the time when it was still referred to as the Engler distillation. Since the test method has been in use for such an extended period, a tremendous number of historical data bases exist for estimating end-use sensitivity on products and processes. The distillation (volatility) characteristics of hydrocarbons have an important effect on their safety and performance, especially in the case of fuels and solvents. The boiling range gives information on the composition, the properties, and the behavior of the fuel during storage and use. Volatility is the major determinant of the tendency of a hydrocarbon mixture to produce potentially explosive vapors. The distillation characteristics are critically important for both automotive and aviation gasoline's, affecting starting, warm-up, and tendency to vapor lock at high operating temperature or at high altitude, or both. The presence of high boiling point components in these and other fuels can significantly affect the degree of formation of solid combustion deposits. Distillation limits are often included in petroleum product specifications, in commercial contract agreements, process refinery/control applications, and for compliance to regulatory rules. This test method can applied to contaminated products or hydrocarbon mixture. This is valuable for fast product quality screening , refining process monitoring , fuel adulteration control, or other purpose including use as a portable apparatus for field testing .This test method can uses an

automatic micro distillation apparatus privies fast result using small sample volume , and eliminates much of the operator time subjectivity in comparison to test method D86 .This test methods covers a procedure for determination of the distillation of characteristics of petroleum products and liquid fuels having boiling range between 200c to 4000c at atmospheric pressure using and automatic micro distillation apparatus .The test method also applicable to hydrocarbons with a narrow boiling range , like organic solvent or oxygenated compounds. The method designed for analysis of distillate products; it is not applicable to product appreciable quantise of residual material.

Significance and Use:

1- The basic test method of determining the boiling range of a petroleum product by performing a simple batch distillation has been in use as long as the petroleum industry has existed. It is one of the oldest test methods under the jurisdiction of ASTM Committee D02, datiog from the time when it was still referred to as the Engler distillation. Since the test method has been in use for such an extended period, a tremendous number of historical data bases exist for estimating end-use sensitivity on products and processes.

2- The distillation (volatility) characteristics of hydrocarbons have an important effect on their safety and performance, especially in the case of fuels and solvents. The boiling range gives information on the composition, the properties, and the behavior of the fuel during storage and use. Volatility is the major determinant of the tendency of a hydrocarbon mixture to produce potentially explosive vapors.

3- The distillation characteristics are critically important for both automotive and aviation gasolines, affecting starting, warm-up, and tendency to vapor lock at high operating temperature or at high altitude, or both. The presence of high boiling point components in these and other fuels can significantly affect the degree of fonnation of solid combustion deposits.

4- Volatility, as it affects rate of evaporation, is an important factor in the application of many solvents, particularly those used in paints.

5- Distillation limits are often included in petroleum product specifications, in commercial contract agreements, process refinery/control applications, and for compliance to regulatory rules.

Equipment Description:

Parts of instruments : Distillation flask, cooling bath, heater, thermometer, receiving cylinder to collect distillate.

A batch of liquid is charged to a still fitted with some sort of heating devices. The charge is boiled slowly the vapors are withdrawn as rapidly as they form to a condenser where they are liquefied and condensate is collected in the receiver. The distillation column consist of several trays which allows the simultaneous travel of liquid down the tray and vapor up the tray , allowing mixing of the two face and there for equilibrium. The liquid mixture that is to be processed is known as the feed. The feed tray divides the Colum in to a top (enriching or rectification) section and bottom section .The vapor movies up the column and as it exits the top of the unit, it is cooled by a condenser. The condensed liquid is stored in a holding vessel known as reflex drum.Some of this liquid is recycled back to the top of the column and this is called the reflux .The condensed liquid that is removed from the system is known as the top product or distillate.

Fig.1: DT107A Petroleum Products distillation tester.

Procedure :

100 ml of the sample is to be precisely poured in the receiving cylinder, and then the contents of the receiving cylinder is to be transferred as completely as particle in the distillation flask, ensuring that none of the liquids flows in the vapor tubes , the flask vapor tube as to be fitted with a rubber stopper tightly in to the condenser tube, apply heat to the distillation flask and condense with the drip tip of the final boiling point condenser away for the graduated cylinder. Regulate the heating at the stage so that there is a specific time interval between the first application of heat and initial boiling point. When the first drop appears at the lower end of the condenser tube, the thermometer reading (vapor temperature) is recorded, this temperature is the initial boiling point. Observe and record the initial boiling point to the nearest 0.50c or 0.10c as appropriate to the apparatus being used. Regulate the heating so that the uniform average rate of condensation from 5% (v/v) recovered to 5 ml residue in the flask is 4 ml per min to 5 ml per min. In the interval between the initial boiling point and the end of the distillation, observe and record data necessary for the calculation and reporting of the results of the test as required by the specification involved. When the residual liquid in the distillation flask is approximately 5ml, make final adjustment to the heat. The record the temperature at several volume percentage distilled up to the final boiling point is the maximum temperature observed on the distillation thermometer when a standard distillation is carried out observe and record the final boiling point or dry point or both us required and discontinue heating. After the distillation flask has cooled and no more vapors are observed disconnect the distillation flask from the condense ,pour its Constance in to 5 ml graduated cylinder and with the distillation flask suspended over the 5 ml graduated cylinder . Measure and record the volume in the graduated cylinder , to the nearest 0.1ml, as present residue.

Results :

Volume. ml	Time. sec	Temperature ℃
0	0	160
5	41	177
10	56	186
20	120	200
30	173	210
40	238	219
50	320	228
60	380	239
70	478	256
80	617	276
90	845	292

Discussion:

1.Why we put snow or cool water in the undivided cylinder?

2. what the effect of temperature on furnace distillation?

3. What is the purpose of knowing the initial and final temperature of product in use ?

4. At the end of experiment, why is there so little product left in the distillation cylinder?