

LIQUID FUEL ANALYSES

Aim: To gain the ability of analyzing and interpreting the petroleum fractions we use frequently in our daily lives at a basic level.

OIL

It is a complex mixture of a large number of hydrocarbons and contains a small amount of sulfur, nitrogen, oxygen and a small amount of other minerals in its composition. It is divided into three main parts;

1. Petroleum

- a) Solid as oil or paraffin,
- b) Crude oil liquid,
- c) Natural gas

2. Sand, oil-saturated sands

3. Bituminous schist.

The approximate chemical composition of petroleum is as follows:

Substance	Carbon	Hydrogen	Oxygen	Nitrogen	Sulfur	Various Minerals
%	82-87	12-18	0,1-7,4	0,1-2,4	0,1-5,5	0,1-5,5

Hydrocarbons in petroleum in general; aliphatic (straight chain) and carboxylic (cyclic) groups. The oil has a density of 0.65-1.080 g / cm³. Low density oil color is black or brown, high density oil is bright brown, yellow or green. It is possible to reach a wide variety of by-products by distillation of oil. Various cracking methods are used to increase the yield of some of the petroleum derivatives.

Gasoline: It is the most used fraction of crude oil. When the raw material cannot meet the desired requirements, it is possible to increase the efficiency of gasoline by breaking down the heavy parts.

Fuel Oil: After the distillation of the motor at a temperature of 185-360°C, a heavy residual is collected under the distillation tower to a temperature of 380°C. Part of this balance is subjected to cracking and a portion is re-distilled. It is useful to perform distillation under vacuum. Heavy distillation oils, lubricating oils and residues are taken as sub-products. By mixing distillation top products and heavy products in accordance with certain principles, heavy fuel or fuel oil of different viscosity is obtained. According to ASTM-D396 classification, fuel oils are stated as five genera. Average fuel oil values are as follows;

Carbon	Hydrogen	Sulfur	Sludge	Water	Flash point	Upper heat value	Lower heat value
%81-86	%10-13	%0,5-5	%0-0,25	%0-0-1	70-140°C	10500 cal/g	10000 cal/g

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Distillation: 100 ml of sample is distilled. The temperature value corresponding to the specific volume of the waste is read and recorded.

The first boiling point; It is the thermometer value at the time of the first decay from the end of the condensation pipe.

Last point; the highest temperature read during the test.

Dry spot; at the bottom of the distillation balloon is the temperature at which the end point evaporates.

Degradation point; The temperature at which the sample decays is determined by the gas outlet.

% Yield: The rate of collection of the collected sample in the measuring cup at the end of distillation,

% Residual: The rate at which the balloon remains at the end of distillation,

% Loss: $100 - (\% \text{ Yield} + \% \text{ More})$

Saybolt viscosity determination: This method can be applied in the temperature range of 21-99 °C. The viscosity of the Furol is about one-tenth of the universal viscosity, and fuel oil, etc., greater than 1000 SSU. used to determine the viscosity of their products.

SSU: The time required for a 60 ml sample flow from a calibrated universal orifice under given conditions.

SSF: Time required for 60 ml of sample flow from a calcified Furol orifice under given conditions.

The specimen is flushed from a calibrated orifice under certain conditions. The time required to collect 60 ml of the sample is recorded. The correction factor can be used if necessary. The value found is noted as the viscosity at the test temperature.

- a) Ensure that the sample location of the device is completely clean. Use air to remove fabric-thread particles used for cleaning.
- b) Replace the selected clean orifice.
- c) If the selected analysis temperature is higher than the room temperature, it can be preheated but the sample is never removed on the analysis temperature. In addition, the flammability temperature of the sample can be approached to a maximum of 10 °C.
- d) Place the cork attached to the chain at the lower end of the viscosity tube.
- e) Pass the prepared sample through a 100 mesh filter.
- f) Heated by stirring to the test temperature. At this temperature, the thermometer is removed.
- g) Drain the accumulated sample in the gallery from the semi-section to the bottom of the test tube.

h) Never touch the sample in the test tube.

i) Insert the clean viscosity balloon.

i) The height is adjusted so that the distance of the branded part of the balloon from the lower end of the tube is 10-13 cm.

j) Holding the chain and pulling it without hitting the balloon, start the stopwatch at the same time.

k) When the sample reaches 60 ml at the balloon length, stop the stopwatch and record the second reading (correcting it if necessary).

The viscosity device should be installed in a place where there is no sudden temperature change with air flow. Do not use cold or hot objects into the sample temperature. Otherwise the sample may also be distorted. The results should be read in accuracy of 0.1 s. 25, 38, 50, 55, 60, 82 and 99 ° C temperatures are suitable for application.

Flash point determination: This method describes the use of a Pensky-Martens closed-pot tester for fuel oil, lubricating oils, viscous substances and solid suspensions. It cannot be applied to drying oils, solvent liquids, wax or out back asphalt.

The sample is heated at constant speed with constant stirring. A small flame is applied to the mixing bowl by stopping the mixing at equal intervals. The flame is recorded as the lowest temperature at which the gases on the sample are ignited.

Determination of the combustion point: With the Klevalent open container method, it is possible to detect the combustion point as well as the combustion point. The method can be applied to fuel oil samples with a flash point temperature above 79 °C. Flash point; described as the lowest temperature at which the flame continues for 5 sec after the fuel vapor is ignited.

It is possible to heat the capacitor container with an electrical or beacon. Heating is set to 15 °C / min at 56 °C. At this temperature, the heating speed is reduced to a speed (5 °C / min) for healthy reading. The thermometer is immersed in the sample in the container. The thermometer is placed 0.5 cm above the base of the container and the center and the center of the container wall. By controlling the temperature from the thermometer, a flame is applied to each 3 °C temperature increase and flare and burning points are recorded and recorded.

Determination of the amount of ash: This method, which is used for the determination of the amount of ash in the oils, which are the products of fuel oil and other distillation, does not give good results for the mete-organic compounds and the oils used in the leaded additives. During heating, some of these compounds disappear by evaporation.

20 g sample is placed in a 50-100 ml volume platinum crucible brought into constant weight. If there are elements in the sample such as Pb, Zn, which may damage platinum at high temperature, porcelain or quartz crucible should be used. Adding 1-3 ml of absolute alcohol to the foaming samples prevents foaming. Heating is started with a small flame on the sheet metal. When the fuel vapor begins to

ignite, the fuel is ignited and the burner flame is removed. Wait until the entire sample is lit. The remaining part is held in an electric furnace or in a strong burner flame until all carbon burns,

Determination of dirtiness: 5-10 g of the sample homogenized thoroughly mixed with benzene or xylol. The sample is filtered on a dried filter sheet at 105 °C. The residue is thoroughly washed, dried and weighed.

Determination of vapor pressure: This method can be used for determination of absolute pressure in volatile petroleum products, such as volatile crude oil, semi-processed petroleum products, which can evaporate at 37.8 °C.

The method comprises two forms of application depending on the vapor pressure level of the product;

a) Samples with steam pressure less than 1.7 kg / cm² are completely saturated with air by cooling at 0 - 1.1 °C. A cold sample is filled in the steam pressure chamber. The top part is replaced immediately. The device is immersed in a water bath of 38 ± 0.1 °C. Intermittent agitation is performed until the indicator reaches equilibrium.

b) Samples with a vapor pressure greater than 1.7 kg / cm² are removed from the air in a closed container without air saturating, and the procedure (a) is exactly the same.

Determination of Engler viscosity: Viscosity of petroleum products at desired temperature is determined by this method. The viscosity value found is proportional to the value of water at 20 C. The heating medium is filled with water or oil according to the desired test temperature. The bathroom is heated with electricity. The cap and standard hole are first washed with ether, then alcohol, and dried to remove the oil dishes. The container is filled with water at the mark up to 20 C. The collection door is placed under the hole, the plug is pulled. Simultaneously, the stopwatch is pressed. 50 ml (or 100, 200 ml) water is measured for the time required to flow. With the other oil fractions, the test is repeated at the desired temperature.

Viscosity at T °C temperature = T C temp. fluid flow time / 20 °C temp. Flow time of water

Results :

The results of the above analyzes can be saved in the table below. In this test, it is preferred to carry out the flash point, the combustion point and the Engler viscosity.

Research Questions

1. What are the properties of paraffinic, mixed and naphthenic structured hydrocarbons?
2. What products can be obtained from petroleum by distillation?
3. What is Krasing? What are their types?

4. What is API Gravity? How is it calculated?
5. What is the aniline point? Which oil fractions are used for?
6. Which methods can be used for the determination of combustion and flash point?
7. How is the viscosity of liquids affected by temperature? Does the viscosity of gases show the same behavior?

Resources

1. Alpar S.R., Hakdiyen M.İ., Bigat T., Methods of Chemical Chemistry Analysis, 3rd Edition, Istanbul Un. Spring. No. 1285, Istanbul, 1967.
2. Yorulmaz Y., Petroleum Processing Technology and Refining Units, METU Eng. Fake. Spring. No. 71, Ankara, 1983.
3. Nelson W. L., Petroleum Refinery Engineering, 4th Ed., McGraw Hill Kagakusha Ltd., Tokyo, 1958.
4. World Energy Congerance Conservation Comission. Press, New Delhi, 1983.
5. ASTM D 2161-93, (Reapproved 1999).
6. TS 3082-EN 590, Dec. 1994.
7. TS 2177, Apr. 1995.

Group No:

Date:

Numbers and names of students

Distillation	
First boiling point T	
Last point T	
Dry point. temp	
Decomposition temp	
Sample quantity	
The remaining amount	
% yield	
% residue/ waste	
% lost	

Sayboltviscometer							
Temp							
Temp °C							

Closed cup, flash point temperature	
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Klevelent flash point temperature	
Klevelent burning point temperature	

Determination of ash	
Amount of sample used	
Remaining sample quantity	
% ash	

Determination of dirt	
Amount of sample used	
Amount of sample remaining on filter paper	
% Dirtiness	

Steam pressure	
1. value in the display	
2. value in the display	
3. value in the display	

Englerviscometer	
Flow time of water	
1. Flow time of sample	
1. the viscosity of the sample	
2. Flow time of sample	
2 the viscosity of the sample	
3. Flow time of sample	
3. the viscosity of the sample	