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CLASSIFICATION OF CRUDE OIL AND ITS CHARACTERISTICS

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Abstract - *A Petroleum crude is the most important substance consumed in modern society. It provides not only raw materials like plastics and other products, but also fuel for energy, industry, heating and transportation. These fuels are derived from petroleum supply more than half of the world's total supply of petroleum energy. The petroleum can exist in gaseous or liquid state in its natural reservoir. The Petroleum was classified by hydrocarbon resource , chemical composition, density or API or viscosity or carbon distribution or pour point. It is derived from a series of test data that give an accurate description of petroleum quality and allow an indication of its behavior during refining.*

Petroleum products are the basic materials used for the manufacture and modern in Petroleum analysis involves not only determining the composition of the material under investigation but, more appropriately, determining the suitable petroleum for refining or the product for use. That the end product of petroleum analysis is a series of data that allow the investigator to specify the character and quality of the material under investigation. Petroleum is used mostly by volume for producing fuel oil and petrol are important "primary energy" sources. About 84% by volume of the hydrocarbons present in petroleum is converted into energy-rich fuels.

Key Words: Classification of crude oil, composition, physico-chemical characterization and Distillation.

1. INTRODUCTION

Petroleum crude is bitumen which is composed of hydrocarbon and it is a natural mixture of hydrocarbons, generally in the liquid state, that may also include compounds of sulfur, nitrogen, oxygen, and metals and other elements. The inorganic sediment and water may also be present. A crude oil product is any product that is manufactured during petroleum refining. As a result, it is not surprising that petroleum can vary in composition properties and produce wide variations in refining behavior as well as product properties. Petroleum crude oil means literally rock oil and refers to hydrocarbons that occur widely in the sedimentary rocks in the form of gases, liquids, semisolids, or solids. In chemical point of view, petroleum is an extremely complex mixture of hydrocarbon compounds, usually with minor amounts of nitrogen-, oxygen-, and sulfur-containing compounds as well as trace amounts of metal-containing compounds. The high energy density of crude oil, easy transportability and relative abundance, oil has become the world's most important source of energy since the mid-1950's. Petroleum is also the raw material for many chemical products, including pharmaceuticals, solvents, fertilisers , pesticides and plastics.

2. CHEMICAL COMPOSITION OF CRUDE OIL

The petroleum crude also exhibits a wide variations in composition and properties, and these variations not only occur in petroleum from different fields but may also be manifested in petroleum taken from different production depths in the same well. The mixture of hydrocarbons is highly complex. Paraffinic, naphthenic, and aromatic structures can occur in the same molecule, and the complexity increases with the boiling range of the petroleum crude fraction.

Petroleum is a mixture of a very large number of different hydrocarbon and non-hydrocarbon molecules. Each petroleum crude variety has a unique mixture of molecules, which define its physical and chemical properties. Hydrocarbon component and Non hydrocarbon content The Hydrocarbon component composed of paraffin, naphthenic, aromatic or asphaltic. That is Normal and branched alkane series, Cycloalkanes, Aromatic series, Asphalts, Asphaltene & resins.

The Non- hydrocarbon component there are infinite mixtures of hydrocarbon compounds that are from crude oil , sulphur, nitrogen, metals nickel vanadium and oxygen are usually present. These impurities are removed during refining. Sulphur is the most abundant atomic constituent of crude oils. The sulphur is associated with only with carbon and hydrogen, while in the heavier fractions is intercorporated in large polycyclic molecules that contain nitrogen and oxygen.

The oxygen content of crude oil is usually less than 2% by weight and is present as part of the heavier hydrocarbon component in most cases. For this reason the heavier oil contain more oxygen.

Nitrogen is present in almost all crude oils , usually it is less than 0.1% by weight.

3. CLASSIFICATION OF CRUDE OIL

Petroleum crude oil is referred to generically as a fossil energy resource and is further classified as a hydrocarbon resource, coal and oil shale kerogen have also been included

in this classification. However, the petroleum crude is classified based by the raw crude by the in other words oil is classified with geographic region. The classification of petroleum crude oil is derived from the density of the raw petroleum (API gravity) and its various non- hydrocarbon components (especially sulphur), is then added to the geographic designation. End result of all this classification that helps to determine the price of a specific barrel of crude as well as how much demand there is for that particular oil. Also the crude oil is classified on the basis of these three:

- On the basis of Density
- On the basis of compound type
- Bsed on content of sturates, Asphaltenes, Rasins, Parafins and Naphthenes.

4. PHYSICO-CHEMICAL CHARACTERISATION OF CRUDE OIL

- **Color:** Color of crude oil is transmitted light varies from yellow to red. Some very dark oil is opaque. Higher the specific gravity draker oil. Not all crude oil black-higher quality oils can be golden colour.
- **Odour:** Crude oil having larger proportion of aromaticcompounts gives pleasant odour. The paraffin and naphthene based oil, the odour agreeable while oil having amount of complex heavier HCs, with Sulphur , Nitrogen and Oxygen component gives disagreeable one.
- **Water Content:** Water content of crude oil is important in the refining or transfer of crude oils. Water ansd sediments content of crude oil is significant because it can cause corrosion of equipment and problems in processing.

A test is tested and heated under reflux condition with water –immiscible solvent which co distils with the water in the sample. Condensed solvent and water are continuously in a trap. The water settles in the graduate section of the trough and the solvent returns to the distillation flask.

Water content can be calculated by using:
Volume of water in % (V/V) = (A-B)/C*100
Volume of water in % (V/V) = (A-B)/ (M/D)*100
Mass % (M/M) = (A-B)/M*100

Where,

A= ml of water in trap
B= ml of solvent blank
C= ml of test sample
M=mass of test sample in grams
D= density of sample g/ml

As above mentioned the water content of crude oil is important in the refining purchase, or transfer of crude oils. Waters displaces crude which costs money. Water and sediments content of crude oil is significant because it can cause corrosion of equipment and problems in processing. Due to presence of water, crude oil invariably causes behavior during distillation because water suddenly changes to steam when temperature reaches more than 100°C for lubricating oils, presence of moisture content could lead to premature corrosion and wearing, an increase in the load resulting in diminished lubrication and premature plugging of filters, impedance in the effect of additives and undesirable support.

Demulsifiers are often known as emulsion breakers, are a class of specialty chemicals used to separate emulsions. For example, water in oil. These are mainly used in the processing of crude oil, which is typically produced along with significant quantities of saline water. This water must be removed from crude oil prior to refining. The majority of water and salt are not as much removed, significant corrosion problems can occur in the refining process. deleterious bacterial growth.

The available demulsifier formations are typically a mixture of two to four different chemistries. The solvents such as **xylene, heavy aromatic naphtha (HAN). Isopropanol, methanol, 2-ethylhexanol or diesel.**

- **Density:** The density of substance or crude oil is the weight of the given volume. It is mass of liquid per unit volume at 15 degree C AND 101.352KPa with standard unit measurement being kilogram per cubic meter.

5. DISTILLATION CHARACTERSTICS OF CRUDE OIL

For distillation, international standard method IP 123 experiment is used which was the apparatus used for the distillation consist of a flask of 100 ml capacity and a condenser of uniform glass tube with an outer water jacket. The lowest end of the tube is bent downward so that its lowest point touches the graduated receiver. A shield is provided surrounding the flask and source of heat. The source of heat is an electric heater capable of distilling the sample at a specific rate.

The IP 441 method is a international standard specifies a method for determination of the pour point of the petroleum products. A other procedure suitable for the determination of the lower pour point of fuel oils, heavy lubricants base stock.

Asphaltene are molecular substance that is found in crude oil along with resins, aromatic hydrocarbon and alkenes.

Asphaltene composed of primary carbon hydrogen nitrogen oxygen and sulphur as well as trace amount of vanadium and nickel. Carbon-hydrogen ratio in asphaltene is C:H= 1:2.2.

Operationally, asphaltene is insoluble in n-heptane (C7H12) and soluble in toluene.

We can measure asphaltene content by standard method IP 143 which is the quantity of the sample is dissolved in n-heptanes and the insoluble material, consisting of asphaltene and waxy substance is separated under hot reflux with n-heptanes. The asphaltene are isolated by extraction with toluene.

The paraffin wax and naphthenic hydrocarbon that are prasent in petroleum crude . Hydrocarbon component of wax can exist in various states of hydrocarbon depending upon their temperature and pressure . The crystal will form when the wax freezes . The paraffin wax is known as For calculation for Percentage of Wax

% of wax = (W2/W1) x100

W1= weight of 210+ residue from distillation

W2= weight of wax content macro crystalline wax.

6. COMPOSITIONAL ANALYSIS OF CRUDE OIL-SARA ANALYSIS

For compositional analysis ofcrude oil-sara analysis and characterisation of oils based on fractionation, whereby a heavy oil sample is separated into smaller fractions, with each fraction, having a different composition, fractionation is based on the solubility of hydrocarbon component in various solvents used in this test. Each fraction consists of solubility class containing a range of different molecular-weighted species. In this method, crude oil is fractionated in four solubility classes, referred to collectively as SARA: It Saturates aromatic, resins and asphaltenes. Iso and cyclo-paraffins are generally saturates . The aromatics, resins and asphaltene forms a continuum of molecules with increasing molecular weight. Asphaltene may also contain metals such as nickel and vanadium.

1.1 Column chromatography

Column chromatography separations are based on dipolar interaction of molecule with solid support by partitioning of molecule between support and solvent. In practice, silica column chromatography elutes most non-polar molecule first, most polar last. Different species may be selectively eluted with increasing polarity of solvents, e.g. petroleum ether, toluene, and methanol.

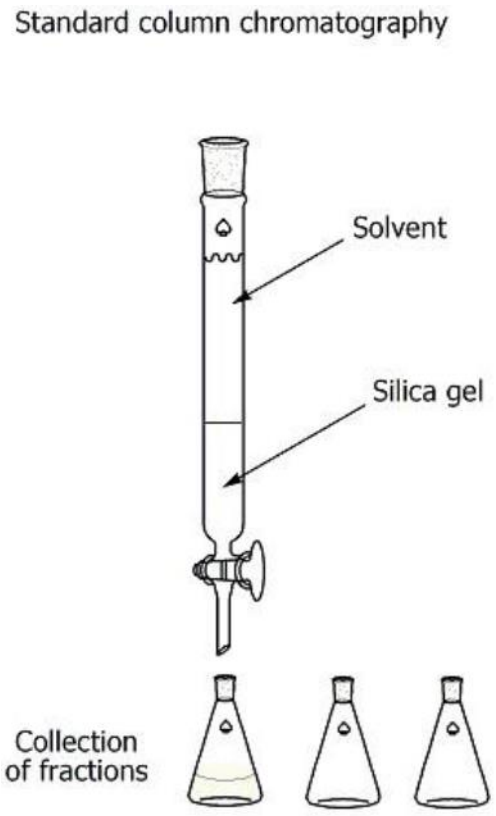

Fig1: Colomn Chromatography

S (Saturate) = (100-asphaltene %) x % of saturate/100

A(Aromatic) = (100-asphaltene %) x % 0f aromatic/100

R(Resins)= (100-asphaltene %) x % of resins/100

A(Asphaltene)= Asphaltene %

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