|| Volume 6 || Issue 6 || June 2021 || ISSN (Online) 2456-0774
INTERNATIONAL JOURNAL OF ADVANCE SCIENTIFIC RESEARCH
AND ENGINEERING TRENDS

PHYSICO-CHEMICAL STUDIES OF CRUDE OIL OF WESTERN ONSHORE

Foka Tagne Jeanlin[1], Tcheuffa Dansi Larissa[2], Jinal Patel[3] & Ashish Nagar[4]

Student, Department of Petrochemical Technology PIAS, Parul University, Vadodara, India.[1,2,3]

Professor Department of Petrochemical Technology PIAS, Parul University, Vadodara, India.[4]

jeanlin.foka@yahoo.com, tcheuffalarissa2@gmail.com, jnpatel7898@gmail.com, drashishnagar@gmail.com.

Abstract: Crude oil is a naturally occurring, yellowish-black liquid found in geological formation beneath the earth's surface. Crude oil is a complex mixture made up of hydrocarbons which mainly consist of carbon (C) and hydrogen (H) along with heteroatomic chemical constituents, comprising of sulphur, oxygen, nitrogen and metals such as Vanadium, nickel, iron and copper. Crude oil is characterized by some chemical and physical properties which play important role in oil field. In the exploration and production of crude oil, these properties are of paramount importance in decision making during production and transportation of Crude oil. In this paper, important physicochemical properties of Crude oil collected from Western onshore field of India were studied. The parameters such as Water content, Density, Specific gravity, API gravity, Pour point, Distillation, Asphaltene content, Wax content, Melting and Congealing point of Wax and Smoke point have been studied.

Keywords: *Crude oil, Pour Point, Wax & Asphaltene*

I INTRODUCTION

Crude oil is a fossil fuel, meaning that it has been created by the decomposition of organic matter from animals and plants. It is formed from the remains of tiny sea plants and animals that died millions of years ago. It is a naturally, occurring liquid found beneath the earth's surface that can be refined into fuel. In addition, these properties differ from one field to another depending on the type, depth, and location of the underground deposit and the geology of the area. The chemical and physical properties of Crude oil vary widely. Thus, the analytical study of the physico-chemical properties of crude oil is essential.

II PHYSICO-CHEMICAL PROPERTIES OF CRUDE OIL

The physical properties of crude oils are the quantitatively measurable characteristics of crude oils. They vary according to the composition of the oil, the relative abundance of the groups of hydrocarbons, and essentially depend on reservoir temperatures and pressures.

1. Water content:

Figure 1 : Dean and Stark Method for determination of water content.

The water in the crude oil sample is vaporized by boiling solvent, then condensed and collected in a calibrated trap. The amount of water collected in the trap is the water content present in the crude oil sample. The water content was determined by Dean and Stark method.

- **Demulsification process**.

After the Water content determination, the crude oil was having high quantity of water. Therefore, there is a necessity to dry that oil before others analysis. Demulsification is the breaking of a crude oil emulsion into oil and water phase by using demulsifier. Demulsifier solution of optimum dose was added to the crude oil sample, heated and the water was separated through a separating funnel.

Figure 2 : Demulsification process

2. Density, Specific gravity and API Gravity determination

Density is the ratio between the mass of the fluid per unit volume. In general, these varies with pressure and temperature. It is measured by hydrometer.

Specific gravity is defined as the ratio of the weight of a volume of the liquid to the weight of an equal volume of water at the same temperature.

The American Petroleum Institute (API) has adopted a scale, which is referred as the API scale. The nature of the crude oil

(light oil, medium density oil or heavy oil) is concluded by API gravity which is calculated as follows

$$\text{API} = \frac{141.5}{\text{Specific gravity}} - 131.5$$

Equation 1 API Gravity equation.

3. Pour point

Pour point of crude oil or refining product is the lowest temperature at which oil will cease to flow.

For the determination of Pour point, the sample of the crude oil is first heated above the cloud point followed by cooling the specimen at about 9°C above the expected Pour point. After every 3°C, the tube was taken out of the bath to check the flow. The temperature at which it ceased to flow for a minimum time of 5 seconds was noted as the cease to flow temperature of the equivalent concentration. Therefore, the equivalent pour point was noted as the no flow temperature plus (+) 3°C.

4. Distillation

Distillation process is simply the separation of this crude oil into different fractions. This method is used for measuring the Initial Boiling point and boiling point of each fraction. The crude oil is assembled in the distillation column and as the temperature column rises, the **crude oil** separates itself into different components, called "fractions." The fractions are then captured separately. The temperature at which the first drop of distillate fraction collected is reported as Initial Boiling Point (IBP).

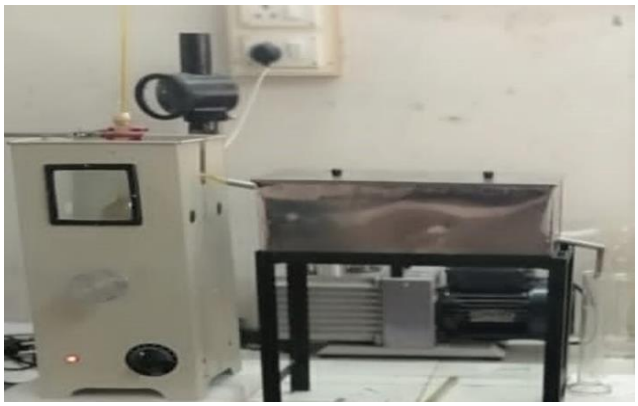

Figure 3 : Distillation apparatus

5. Asphaltene Content

Asphaltene is a heavy fraction of crude oil that has different structure and molecular Makeup which makes it one of the most complex components of the crude oil.

For Asphaltene determination, 210°C residue of the distillation sample is refluxed in n-Hexane it for approximately 2 hours and kept in dark (over night) to facilitate asphaltene precipitation. On filtration the filtrate obtained is called Maltene (kept for wax determination). Further the residue is dissolved in hot Toluene and Asphaltene is obtained.

Figure 4 : Determination of Asphaltene content

6. Paraffin wax content

Wax is an organic compound. Paraffin wax consist of straight chain saturated hydrocarbon with carbons ranging from C_{18} to C_{36}. Maltene is filtered through hot silica along with the wash of hot n-Hexane. The filtrate collected in kept in deep freezer at -20º C (overnight) after the addition of Acetone for wax precipitation. The wax crystals are collected by the filtration.

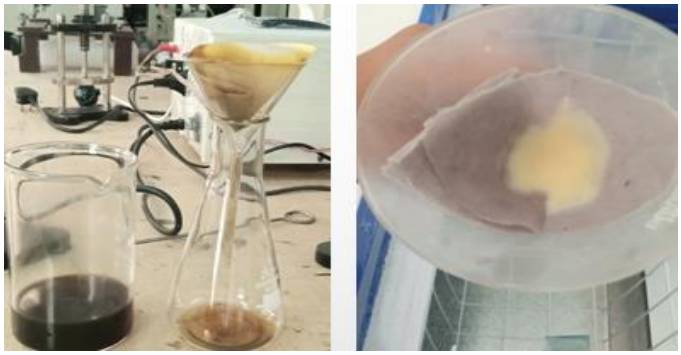

Figure 5 : Determination of Wax content

7. Melting point and Congealing point of wax

Melting point of wax is determined by recording the temperature at which a drop of the sample falls from the bulb of a thermometer when heated under standard conditions.

Congealing point is the temperature at which molten wax ceases to flow. It is a wax property, which is very important to many petroleum wax consumers. Congealing point of wax of a crude oil is determined by applying a drop of molten wax to a thermometer bulb and noting the temperature at which it congeals when the thermometer is rotated under standardized cooling condition. This method is suitable for all waxes.

8. Smoke point

Smoke point is the maximum flame height in millimeters (mm) at which the oil burns without smoking when tested in a standard wick-fed lamp under specified conditions.

III RESULTS AND DISCUSSIONS

The work on the analysis of the physico-chemical characters of crude oil led us to determine the parameters such as Water content, Demulsification, Density, Specific Gravity and °API gravity, Pour point, Asphaltene content and wax content. The results of Crude oil parameters are given in Table – 1 below:

Table 1 : Results of physico-chemical parameters of crude oil

S.N.	Parameters	Results
1	Water Content (%V/V)	48
2	Density (@15°C) (g/ml)	0.8892
3	Specific Gravity (@15°C) (g/ml)	0.8896
4	API Gravity	27.66
5	Pour point (°C)	42
6	Asphaltene content (%w/w)	8.66
7	Wax content (%w/w)	4.66
8	Melting point of wax (°C)	62
9	Congealing point of wax (°C)	58
10	Smoke point (mm)	11

IV CONCLUSIONS

- During the physico-chemical analysis of the crude oil, the water content determined was 48%.
- The density and specific gravity at 15ºC were noted to be 0.8892g/ml and 0.8896g/ml respectively. The API gravity of the crude oil was 27.66
- The pour point of the crude oil was 42.
- The Asphaltene content and Wax content present in the crude oil was 8.66% and 4.66% respectively.
- The Melting point and Congealing point of the wax was determined to be 62ºC and 58ºC respectively.
- The Smoke point was observed to be 11mm.
- The parameters of crude oil studied reveal that it is a heavy crude oil with high pour point. high Asphaltene content also supports the heavy nature of crude oil.

ACKNOWLEDGEMENT

Authors would like to convey their sincere thanks to the management of Parul University for allowing to carry out the research work. Authors would like to thank to HOD, Petrochemical Technology for his constant encouragement. Authors would like to convey their gratitude to the principal of PIAS and PIT for their efforts and encouragement.

REFERENCES

1. James G. Speight,Analytcal methods and techniques applied to crude oil and petroleum products. 2476 Overland Road USA: Laramie.
2. Taniya Kar; Analysis Of Saturates, Aromatics, Resins, Asphaltenes (SARA), Water And Clays In Water -Oil Emulsion For Steam Assisted Gravity Drainage And Expanding Solven,.Office of Graduate and Professional Studies of Texas A&M Universitty, 2015.
3. Apparatus for determining of the Pour point of crude oil and petroleum products, A. N. Sokolnikov. Elsevier, 2016.
4. Qing Lui, Bo Chu, A Visual Measurement of Water Content of Crude Oil Based On Image Grayscales Accumulated Value Differences, 2019.
5. Chemical & Physical properties of Crude oil: Module N°2 and Module N°4.
6. Harry N.Giles Clifford, O. Mills, Crude Oil: Their Sampling, Analysis And Evaluation, 2nd Edition. Mayfield, Pa: Astm International Manual, 2018.