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**To find viscosity gravity constant (VGC) for a given sample of crude oil.**

**Abstract**

Viscosity of oil is resistance to internal flow. Higher the resistance to internal flow, higher the viscosity. Normally for crude oil, viscosity increases in proportion of heavier hydrocarbon increases. Viscosity also depends upon the temperature. As temperature increases, viscosity decreases. The index that connects viscosity and specific gravity is called viscosity gravity constant.

# Theoretical Background

Oil has to be transported from one place to other by pipelines. Knowledge of viscosity proves important while performing design calculations for pumping of pipelines. It is also important to calculate power requirement for fluid transport. When combined with other properties like density, it gives valuable information about crude oil. Viscosity gravity constant was proposed for this purpose. Lower the value of this constant, more paraffinic the oil. The values of viscosity gravity constant for different crude oil are

Paraffinic 0.8 to 0.83

Intermediate 0.83 to 0.88

Napthenic 0.88 to 0.98.

Various methods are available to measure viscosity. The time of flux for certain volume of liquid through a standard orifice is recorded. Here we use Saybolt universal viscometer. The unit of viscosity measured is time in seconds required for 60ml fluid to flow through orifice at given temperature (SUS).

When viscosity of crude oil is known in Saybolt universal second and specific gravity is known, viscosity gravity constant can be calculated as

VGC = [ {10 G – 1.0752 log (V-38)}/10-log (V-38)]

Where, V = SUS and G = specific gravity

# Experimental Setup

**Apparatus:** Saybolt Universal viscometer consists of oil tube, bath, 60 ml receiving flask, stop watch, thermometer, cork stopper and hydrometer to determine specific gravity.

# Procedure:

1. Oil temperature is maintained at 380C by using water bath and time is recorded for flow of 60 cc from oil cap.
2. Three readings are taken and average is found out
3. Specific gravity is measured by hydrometer.

# Observations:

Time required to measure 60 CC flow = V = 255\_ seconds. Specific gravity = G = \_ 0.836

VGC = [ {10 G – 1.0752 log (V-38)}/10-log (V-38)]

# Result:

Viscosity Gravity constant for given sample of crude oil is = 0.763 .

# Conclusion:

The given sample has \_Close to Paraffinic base.

# References

* B.K. Bhaskara Rao, *Modern Petroleum Refining Processes*, 5th Ed, Oxford and IBH Publishing Co. Pvt. Ltd, 2007, pp. 99

# Questions

1. What is the use of determination of VGC of crude oil?
2. What are the different types of viscosities? And give their units?
3. What are the different ranges of VGC and give their crude oil base?

# Answers:

1. Use of Determination of VGC (Volume Growth Coefficient) of Crude Oil:

The determination of the Volume Growth Coefficient (VGC) of crude oil is essential for understanding how the volume of crude oil changes with variations in temperature and pressure. VGC is typically used for the following purposes:

Oil Reservoir Engineering: VGC data helps reservoir engineers predict the behavior of crude oil in underground reservoirs as they experience changes in temperature and pressure. This information is crucial for optimizing oil recovery strategies.

Pipeline and Transportation: Knowing the VGC of crude oil is important for designing pipelines and transportation systems. It helps in calculating how the volume of oil will change during transportation due to temperature and pressure variations, which is necessary for accurate volume measurements and efficient transportation.

Refining and Processing: In the refining industry, VGC data is used to estimate how crude oil properties change at different process stages and under varying conditions. This knowledge aids in refining optimization and product yield predictions.

1. Different Types of Viscosities and Their Units:

There are several types of viscosity, each with its own units. Some common types of viscosity include:

Dynamic Viscosity (Absolute Viscosity): Dynamic viscosity measures a fluid's resistance to flow when subjected to an external force. It is commonly denoted by the symbol η (eta) and is measured in units of Pascal-seconds (Pa·s) in the International System of Units (SI) or Poise

(P) in the CGS system.

Kinematic Viscosity: Kinematic viscosity is the ratio of dynamic viscosity to density and measures a fluid's resistance to flow relative to its density. It is denoted by the symbol ν (nu) and is typically expressed in units of square meters per second (m²/s) in SI or centistokes (cSt) in the CGS system.

Saybolt Viscosity: Saybolt viscosity measures the time it takes for a fixed volume of fluid to flow through a standard orifice at a specific temperature. It is often measured in Saybolt Universal Seconds (SUS) or Saybolt Furol Seconds (SSU).

Engler Viscosity: Engler viscosity is a measure of viscosity used for petroleum products. It is expressed as a ratio of the time taken by a fixed volume of fluid to flow through an Engler

viscometer compared to the time taken by the same volume of water to flow through the same viscometer. It is a dimensionless quantity.

1. Different Ranges of VGC and Their Crude Oil Bases:

The Volume Growth Coefficient (VGC) of crude oil can vary depending on the specific characteristics of the oil and the temperature and pressure conditions. There is no fixed range for VGC, as it is specific to the crude oil being analyzed. Crude oils from different sources and reservoirs can have varying VGC values.

Typically, VGC is determined experimentally by measuring the change in volume of a given quantity of crude oil as it undergoes temperature and pressure variations. The specific values and ranges for VGC will depend on the particular crude oil and reservoir conditions under consideration. Therefore, VGC values are determined on a case-by-case basis for each crude oil sample and reservoir.