

MODULE-2

Evaluation of crude oil properties and design of crude oil distillation column.

Q1: Define Viscosity Index (VI). ?

A1: Viscosity Index (VI): Used to characterize a Lube oil and provides the effect of change of temperature on the viscosity of any oil. High VI lube oils are desired. It is defined by

$$VI = (L-U) \times 100 / (L-H)$$

U = kinematic viscosity at 40°C of the oil whose VI is to be calculated.

L = kinematic viscosity at 40°C of the oil whose 0 VI.

H = kinematic viscosity at 40°C of the oil whose 100 VI.

Q2: What are different additives, their function and composition?

A2:

Additive	Function	Composition
Anti-knock compounds	To improve octane quality	Lead alkyls such as tetraethyl lead and tetra methyl lead along with scavengers ethylene dibromide and ethylene dichloride
Anti-icing additives	To minimize engine stalling and power loss due to ice formation in carburetors and fuel lines	Freezing point depressants such as alcohols (ethanol or iso propanol) and glycols (hexylene glycol and di propylene glycol)
Anti-oxidants	To minimize gum formation	Phenylene diamine and alkyl

	and improve storage stability.	phenol compounds.
Metal deactivators	To prevent catalysis of oxidation processes by deactivating metalions such as copper.	N,N-disalicylidene-1,2-propanediamine.

Q3: What is the composition of kerosene oil?

A3: Kerosines are distillate fraction of crude oil in the boiling range Of 150-250⁰C. There are various types of hydrocarbon present in kerosines like paraffin, naphthenes, aromatics, and non-hydrocarbons containing sulphur, nitrogen, oxygen, and metals. In the hydrocarbon tendency to smoke decrease in the order Aromatics>Naphthenes>Isoparaffins>Paraffins. Kerosene is treated with sulphur dioxide to decrease aromatic content.

Q4: What is the significance of cloud point and pour point?

A4: Cloud point generally determined for products that are transparent in a 40-mm thick layer and have cloud point below 49⁰C. It gives a rough idea of the temperature above which the oil can be safely handled without any fear of congealing or clogging. Pour point is a well-established test to estimate the temperature at which a sample of oil becomes sufficiently solid to prevent its movement by pumping.

Q5: What is ASTM distillation?

A5: It is a batch distillation with one equilibrium stage, no reflux and minimum separation of the components.

- ASTM method D86 (atm. Press.): Gasoline, Kerosene, gas oil and similar light and middle distillates.
- ASTM method D1160 (max. temp. 400⁰C, min.1mmHg): For heavy petroleum fractions which tend to decompose at atm. Pressure

Q6: What is TBP distillation?

A6: Distillation characteristics of a crude are assessed by performing a preliminary distillation called 'True Boiling Point' analysis(TBP).

It is performed in columns with 15 theoretical plates and a reflux ratio of 5. Operation at 760mm Hg for BP below 400 °C. for lighter fractions. For higher boiling point fractions, the distillation is conducted at even 0.5mm Hg. Degree of separation for a TBP distillation test is much higher than those of the ASTM distillation test, its IBP lower and EP higher than ASTM.

$TBP = a (ASTM D86)^b$ where 'a' and 'b' are constants varying with percent of liquid sample distilled.

Q7: What is ASTM gap and TBP overlap?

A7: ASTM gap: Diff. between 5% B.P of heavy and 95% B.P. of preceding cut.

TBP overlap: Diff. between FBP and IBP of successive fractions

Q8: What is overflash?

A8: It is a portion of total vapor leaving the flash zone boiling above the nearest side draw fraction but never included in that fraction. Increase in over-flash decreases the side draw temperatures from the second draw onwards.

Q9: What are the different type of reflux used in distillation column?

A9: Overhead reflux: Part of light naphtha returned to column

Pump around reflux: Liquid withdrawn at a point below a side stream tray that is cooled by the cold crude feed and then returned to the column a few trays above the draw tray.

Pump back reflux: In this arrangement reflux is provided at regular intervals .