

# Crude Oil Analysis

## -- Determining the Properties of Crude Oil



### Summary

Through crude oil analysis, we determine the physical and chemical properties of crude oil and gas condensate produced from a geological formation several thousand meters underground. These analytical data are used for identifying the output layer, estimating the sedimentary environment and the origin of the organic matter from the source rocks, evaluating for crude oil processing methods, and checking the quality of oil for commercial sale and modeling of the reservoir.

### Density



Hydrometer

Classification	Density <sup>15°C</sup> (g/cm <sup>3</sup> )	API Gravity
Extra Light	$\rho < 0.8017$	$39.0 < \rho$
Light	0.8017~0.829	38.9~34.0
Medium	0.830~0.903	33.9~30.0
Heavy	0.904~0.965	29.9~26.0
Extra Heavy	$0.966 < \rho$	$\rho < 26.0$

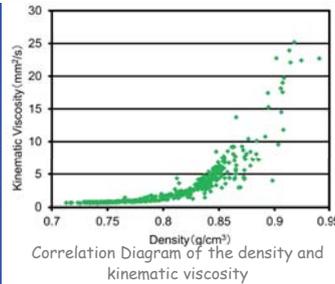
Classification table by crude oil density

Crude oil density, the density value at the surface level of the liquid, is measured with a hydrometer at room conditions (temperature and pressure). Crude oil is classified into five categories based on the measured density (API gravity).

### Kinematic Viscosity



Ubbelohde Viscometer



Kinematic viscosity is calculated based on the time it takes for the crude oil to pass through an Ubbelohde viscometer. Usually, the kinematic viscosity and density show a positive correlation.

### Pour Point & Cloud Point



Automatic pour point, cloud point tester

The pour point is the temperature at which the crude oil no longer flows. The cloud point is the temperature at which the crude oil is hazy. The pour point tends to be higher in heavier crude oil.

### Sulfur Content



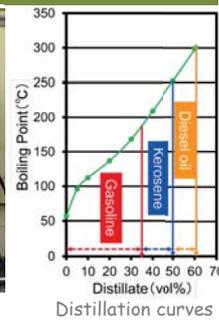
Sulfur Content Analyzer

Sulfur in crude oil is calculated based on the intensity of the fluorescent X-rays generated from the sulfur content of a sample compared to that of a standard sample. Sulfur content will be higher in heavier crude oil.

### Distillation Test



Automatic Distillation Tester



In a distillation test, the liquefied volume of steam generated at each temperature by heating the crude oil in a flask is estimated, and a distillation curve is obtained from the measured temperature (boiling point) and the amount of liquid. Crude oil can be separated into petroleum products using the differences between these boiling points.

### Components



Distillation gas chromatograph

The components of crude oil are analyzed using gas chromatography and are qualified and quantified as saturated hydrocarbon components (C3-120).

### What Can Crude Oil Analyses Tell Us ?

#### Exploration

- Information about the characteristics of the source rock. For example,
  - The degradation environment (Low density: high temperature; high density: microbial degradation, etc.) of the crude oil
  - The depositional environment of the source rock (High sulfur: Marine)
  - The origin of the organic matter (High wax: land; low wax: marine)



#### Development & Production

- This information is used in the selection of enhanced oil recovery methods, the evaluation of processing equipment, reservoir fluid modeling, and prediction of production behavior. For example,
  - The assessment of standards for separating machines.



#### Sale

- Information about the quality of commercial oil. For example,
  - The presence of impurities (sulfur, moisture, etc.)
  - Petroleum product yields.
  - Selection of taxable volatile oil.



### Key Points

Crude oil properties are estimated from crude oil analysis and are used for exploration, development, production and sales of crude oil as follows:

- Density : Used in crude oil classification, weight and volume conversion.
- Kinematic Viscosity : An important property that indicates liquidity. Used to calculate flow rate calculations in pipelines and reservoir fluid behavior.
- Pour point & cloud point : Pour point is the minimum temperature of flow, and cloud point is the temperature at which wax begins to precipitate.
- Sulfur Content : Sulfur causes air pollution and pipe quality decline and corrosion. Used in quality control and evaluation of the depositional environment of source rocks.
- Distillation Test : Used to estimate the components of crude oil based on differences in boiling points.
- Components : Crude oil consists of multiple hydrocarbons; its components differ by reservoir and are used in reservoir fluid modeling.