

Course Outline

- Introduction to crude oil.
- Composition and classification of crude oil.
- Testing and evaluation of crude oil.
- *Pretreatment and distillation of crude oil.*
- Products from crude oil.

Processing Operations in a Petroleum Refinery

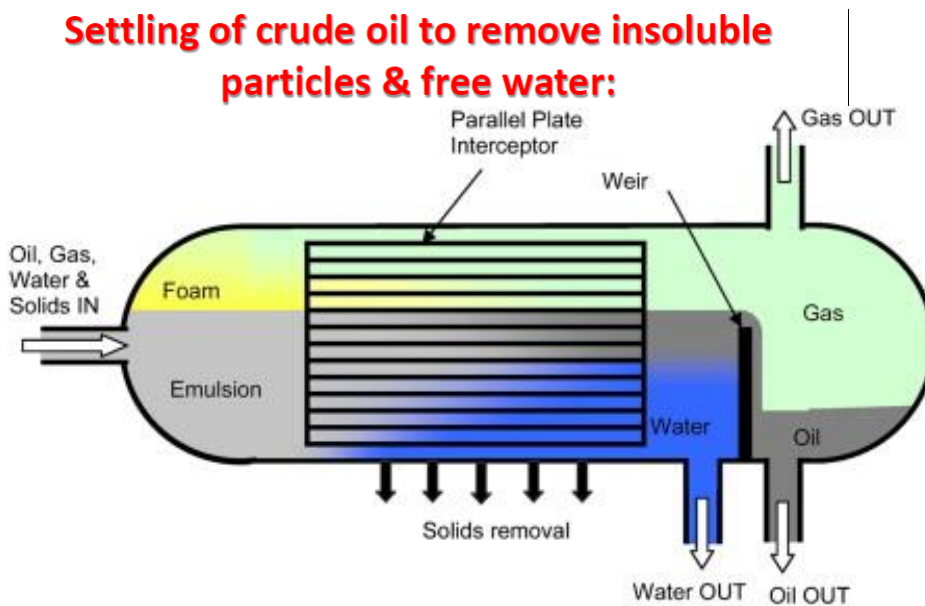
Crude Oil Receiving

In a refinery, crude oil is received and stored in a floating roof tank. The roof is made to avoid loss of hydrocarbon vapors of dissolved hydrocarbon gases and low boiling fractions present in crude oil.



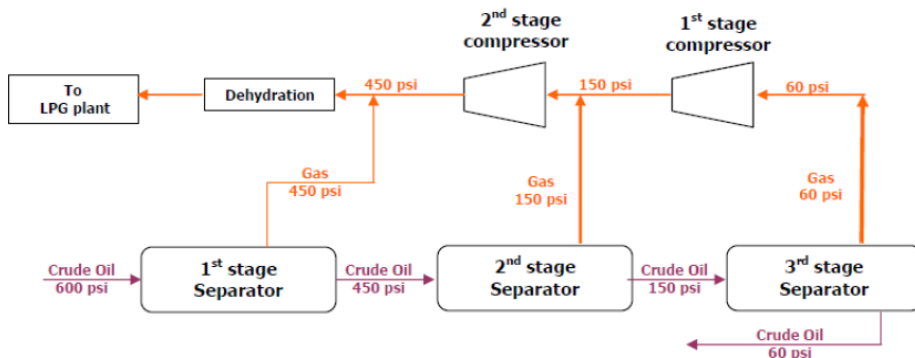
Floating roof tanks

Settling of crude oil to remove insoluble particles & free water:



Degassing of crude oil:

Before oil treatment begins, we must first remove the gas and free water from the well stream. This is essential in order to reduce the size of the oil-treating equipment.



Desalting of Crude Oils

Crude oil often contains **water**, **inorganic salts**, **suspended solids**, and **water-soluble trace metals**. As a first step in the petroleum refining process, to reduce corrosion, plugging, and fouling of equipment and to prevent poisoning the catalysts in processing units, these contaminants must be removed by desalting (dehydration).

Desalting Process

The process is accomplished through the following steps:

Water washing: Water is mixed with the incoming crude oil through a mixing valve. The water dissolves salt crystals and the mixing distributes the salts into the water, uniformly producing very tiny droplets.

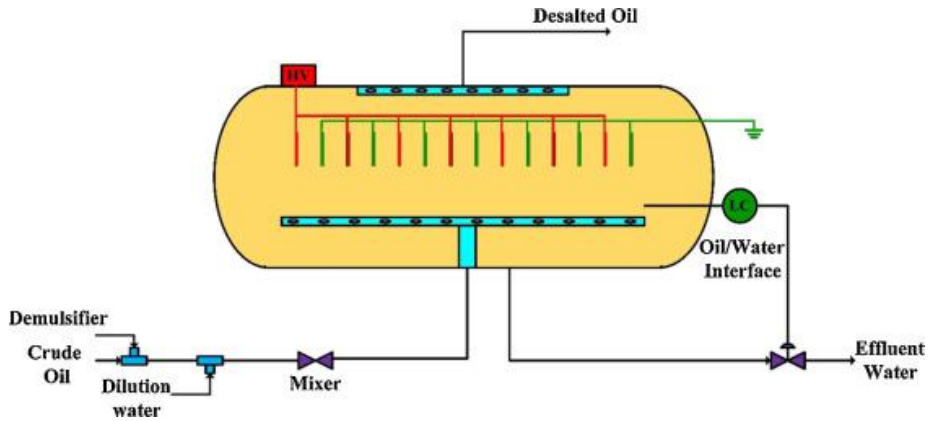
Demulsifying agents are added at this stage to aide in breaking the emulsion by removing the asphaltenes from the surface of the droplets.

Desalting Process

Heating: The crude oil temperature should be in the range of 48.9–54.4°C since the water–oil separation is affected by the viscosity and density of the oil.

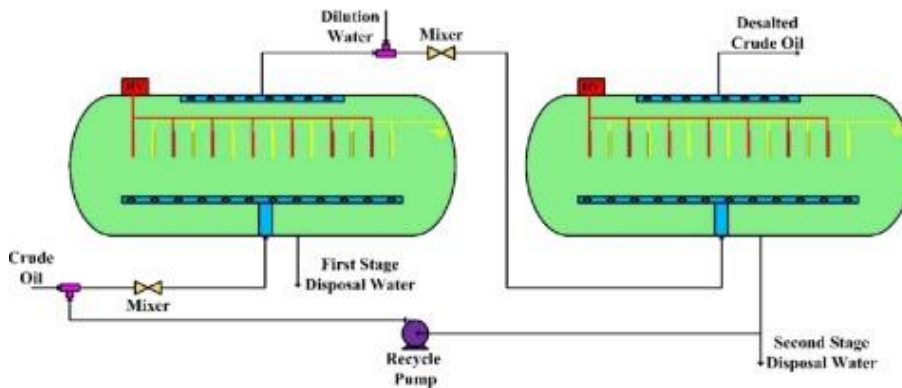
Coalescence: The water droplets are fine and do not settle by gravity. Coalescence produces larger drops that can be settled by gravity. This is accomplished through an electrostatic electric field between two electrodes. The electric field ionises the water droplets and orients them so that they are attracted to each other.

Desalting Process



Single-stage desalting systems

Desalting Process

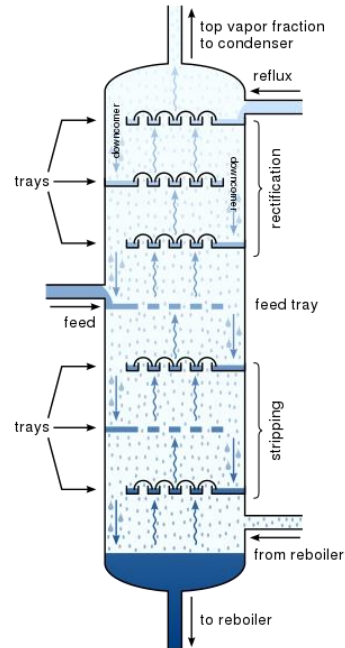


Double-stage desalting systems

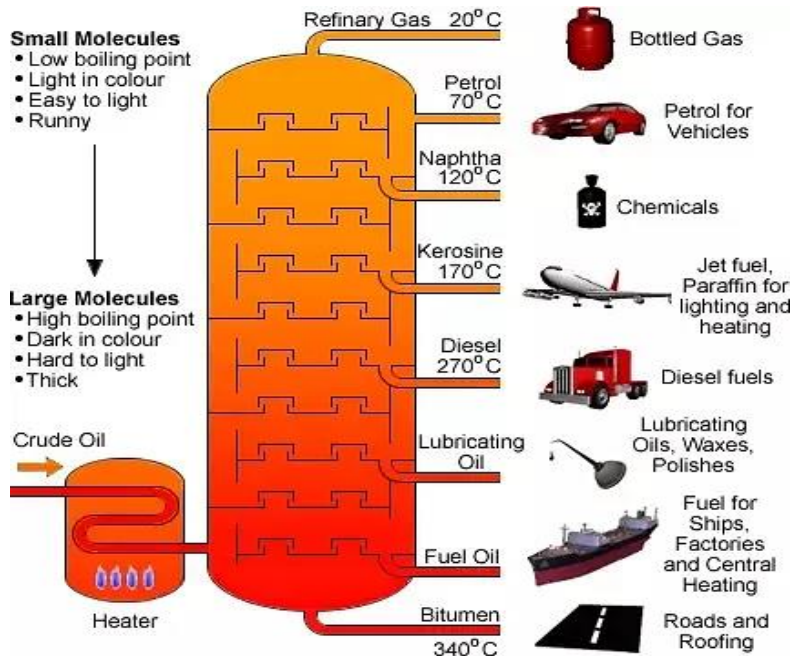
Single desalter achieves 90% salt removal. However, 99% salt removal is possible with two-stage desalters

Schematic Diagram of Distillation Column

The liquid mixture that is to be processed is known as the **feed** and this is introduced usually somewhere near the middle of the column to a **tray** known as the **feed tray**. The feed tray divides the column into a top (**enriching** or **rectification**) section and a bottom (**stripping**) section. The feed flows down the column where it is collected at the bottom in the re-boiler.

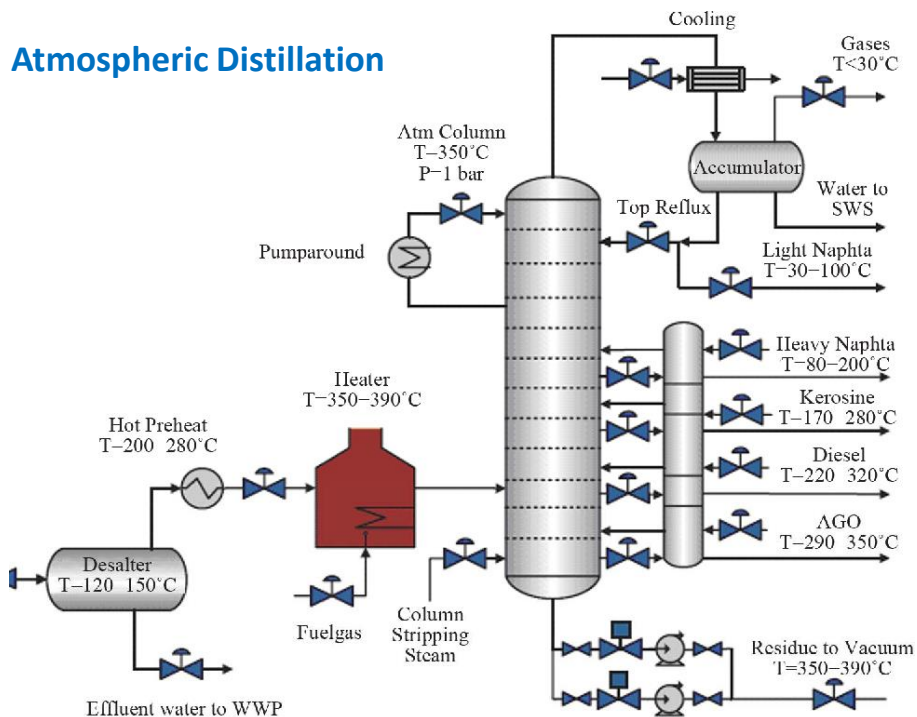


Distillation of Crude Oil



1-Atmospheric distillation:

- Atmospheric distillation is **the first and most fundamental step in the refining process**. The primary purpose of the atmospheric distillation tower is to separate crude oil into its components .
- **Fractions of crude oil such as lighter gases (C1-C4), gasoline, naphtha, kerosene, fuel oil, diesel etc. are separated in the atmospheric distillation column.**
- The after taking out these lighter hydrocarbon cuts, heavy residue remaining at the bottom of the atmospheric distillation column needs to be refined. These heavy hydrocarbon residues are sent to a Vacuum Distillation .



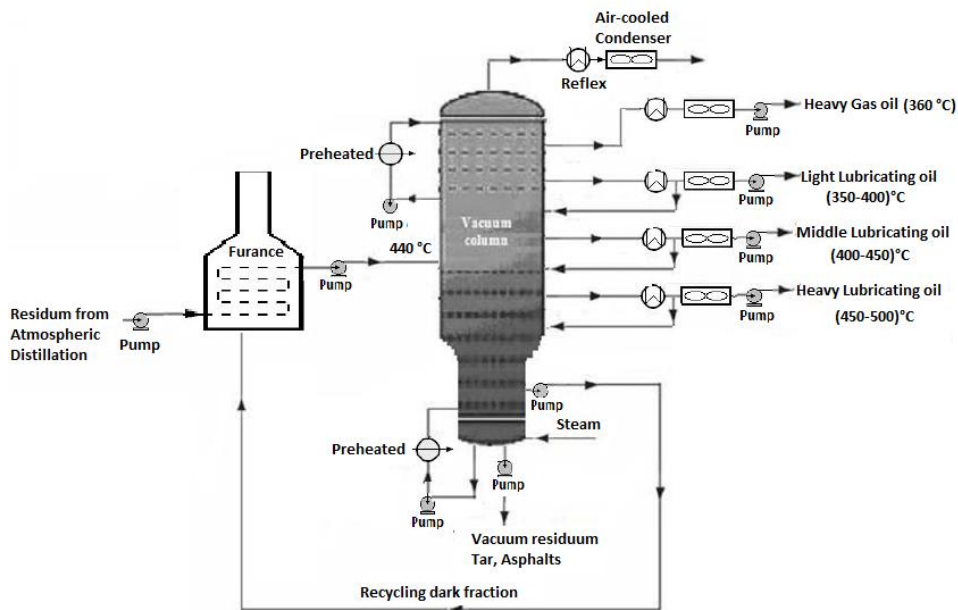
2-Vacuum Distillation:

Vacuum distillation increases the amount of the middle distillates and produces lubricating oil base stocks and asphalt. The feed to the unit is the residue from atmospheric distillation.

In vacuum distillation, reduced pressures are applied to avoid cracking long-chain hydrocarbons present in the feed.

The feed is first preheated by exchange with the products, charged to the vacuum unit heater, and then passed to the vacuum tower in an atmosphere of superheated steam. Using superheated steam is important: it decreases the partial pressure of the hydrocarbons and reduces coke formation in the furnace tubes.

Vacuum Distillation



**Atmospheric
Distillation Tower**



**Vacuum
Distillation Tower**

