



Republic of Iraq
Ministry of Higher Education
and Scientific Research
Al-Mustaqbal University College
Chemical Engineering and Petroleum Industries
Department

Subject: Fuel Technology
2nd Class
Lecture 7

Crude Oil-Distillation

The process of distillation is the most common method adopted for separating the constituents of crude oil into compounds or groups of compounds having industrial uses.

Crude oil consists of a complex mixture of hydro-carbons widely differing in boiling points. Distillation is done to separate the crude oil into the basic fractions like motor gasoline kerosene, gas oil and fuel oil.

1. Atmospheric Distillation

Crude distillation unit (CDU) is the first and most fundamental step in the refining process, also known as topping unit, or atmospheric distillation unit. The primary purpose of the atmospheric distillation tower is **to separate crude oil into its components (or distillation cuts, distillation fractions)** for further processing by other processing units.

Various steps in atmospheric crude oil distillation are:

- Preheating of Desalted crude
- Furnace
- Distillation
- Stabilization of Naphtha

Before entering the column distillation, desalted crude oil pass through a network of pre-heat exchangers in order to heat it initially with hot material drawn from the bottom of the distillation tower **to raise its temperature up to 450°F** and then to a heating furnace, which brings the temperature up to about 650°F. This part of process is essential because the carbon will be deposited inside the pipes and equipment through which it flows when the oil gets much hotter.

The hot crude oil enters the column distillation and most of it vaporizes. Unvaporized heavy oil cuts and residue will drop to the bottom of the column, where it is drawn off. Inside the tower distillation column, there are the so-called trays (Figure 5.1 below), **which are working mainly in the separation of crude oil to light the required derivatives.** These trays permit the vapors from below to pass from it and contact with the condensed liquid on top of the tray that provides excellent contact between vapor and liquid. Condensed liquid flows down through a pipe to the hotter tray below, where the higher temperature causes re-evaporation. A given molecule evaporates and condenses many times before finally leaving the tower. Products are collected from the top, bottom and side of the column.

A portion of the condensed overhead liquid product from a distillation tower that is returned to the upper part of the tower, this **reflux plays a major role in controlling temperature at the top of the tower and further enhance separation.**

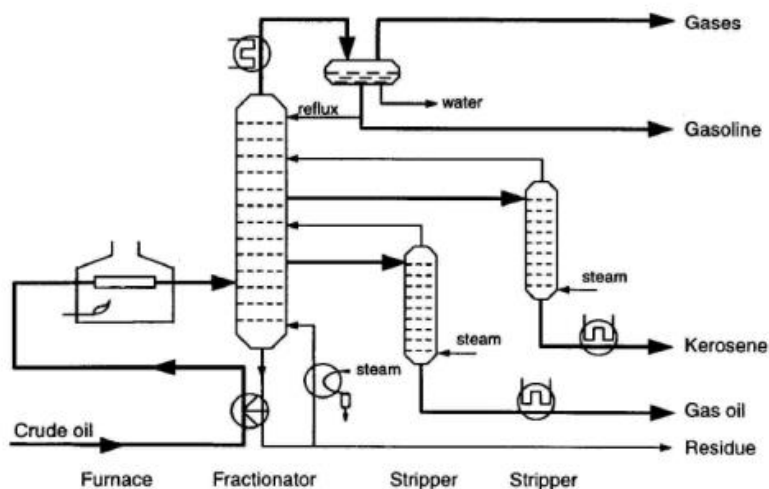


Figure 7.1: Atmospheric Distillation

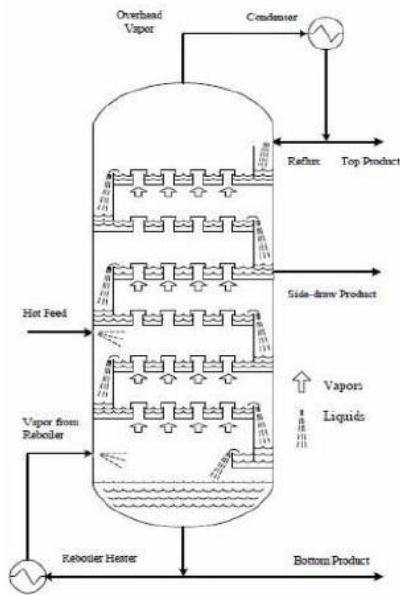


Figure 7.2: Distillation column with trays

Products from Crude distillation unit(CDU):

Figure 7.3 show various streams from atmospheric distillation column:

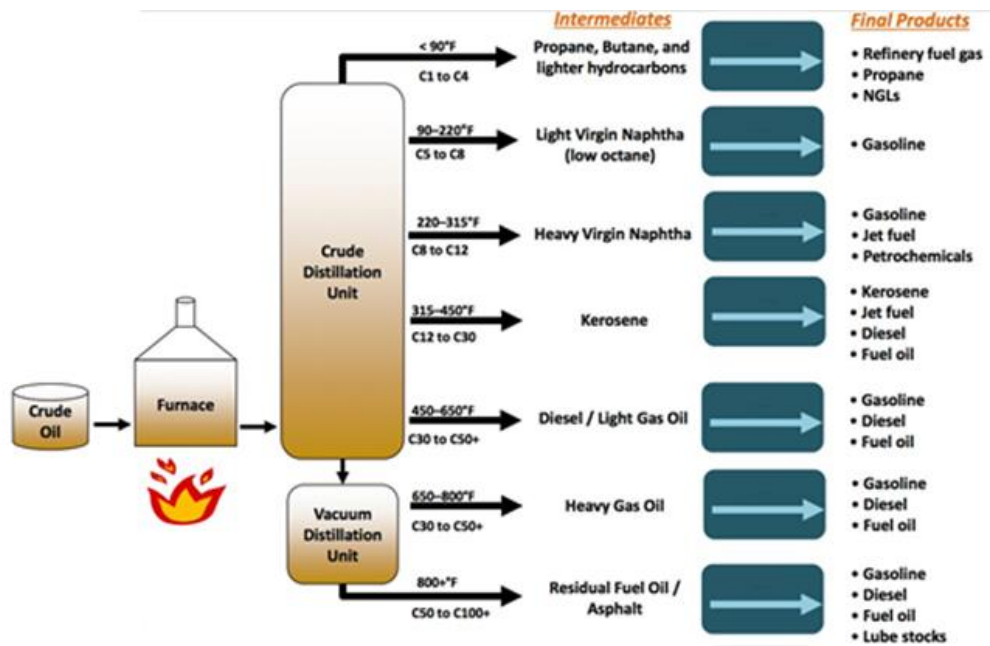


Figure 7.3 Products from Crude distillation unit.

2. Vacuum Distillation Column

The residue from an atmospheric distillation tower can be sent to a vacuum distillation tower, which recovers additional liquid.

Reduced crude oil is very heavy compared to crude oil distilling under pressure requires high temperature. Distillation under vacuum permits fractionation at lower temperature which avoid cracking of crude oil and coking of the furnace tube. These materials are therefore distilled under vacuum because the boiling temperature decreases with a lowering of the pressure.

Operating pressure of vacuum column:

- About 90-95 mm Hg at the top and
- About 135-140 mm Hg at the bottom

The main products from this unit are:

- 1- Heavy gas oil
- 2- Lubricant
- 3- Asphalt or vacuum residue (B.P > 1000F)