



Al-Mustaqbal University

College of Engineering and Engineering Technologies

**Department of Chemical Engineering and Petroleum
Industries**

Name of the substance: Chemicals from petroleum

Lecture number: First

Lecture title : Introduction (Part 1)

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1.Raw Material

Petroleum : The word petroleum originated from the Latin words, Petra, meaning rock and oleum ‘meaning oil. Literally it means ‘Rock Oil,’ and can also be defined as a non-renewable fossil fuel or oil that is found underground. This is any naturally-occurring flammable mixture of hydrocarbons found in geological formations such as rock strata . Technically, the term petroleum refers to describe any solid, liquid or gaseous hydrocarbons. It’s also known as ‘crude oil’ or ‘mineral oil.

Crude oil, commonly known as petroleum, is a liquid found within the Earth comprised of hydrocarbons, organic compounds and small amounts of metal.

Crude oil is composed of hydrocarbons, which are mainly hydrogen (about 13% by weight) and carbon (about 85%). Other elements such as nitrogen (about 0.5%), sulfur (0.5%), oxygen (1%), and metals such as iron, nickel, and copper (less than 0.1%) can also be mixed in with the hydrocarbons in small amounts .

Although it is often called "black gold," crude oil can vary in color from black to yellow depending on its hydrocarbon composition.

Differences Between Crude Oil ,Petroleum Products And Petroleum :

Crude oil- Mixture of hydrocarbons existing as liquid in natural underground reservoirs and remain liquid during extraction .Petroleum products- Produced from the processing of crude oil at petroleum refineries and extraction of liquid hydrocarbons at natural gas processing plants .Petroleum- refers to the broad category that includes both crude oil and petroleum products .

Occurrence of Petroleum

Petroleum occurs in the earth's crust, in all possible states and varies in color from light brown to dark brown or black, exhibiting luminescence in some cases. It is a mixture of various hydrocarbons, of homologous series namely paraffins, naphthenes and aromatics .

The final result is a black viscous product of composition:

Carbon	80 to 89%
Hydrogen	12 to 14%
Nitrogen	0.3 to 1 %
Sulphur	0.3 to 3%
Oxygen	2 to 3%



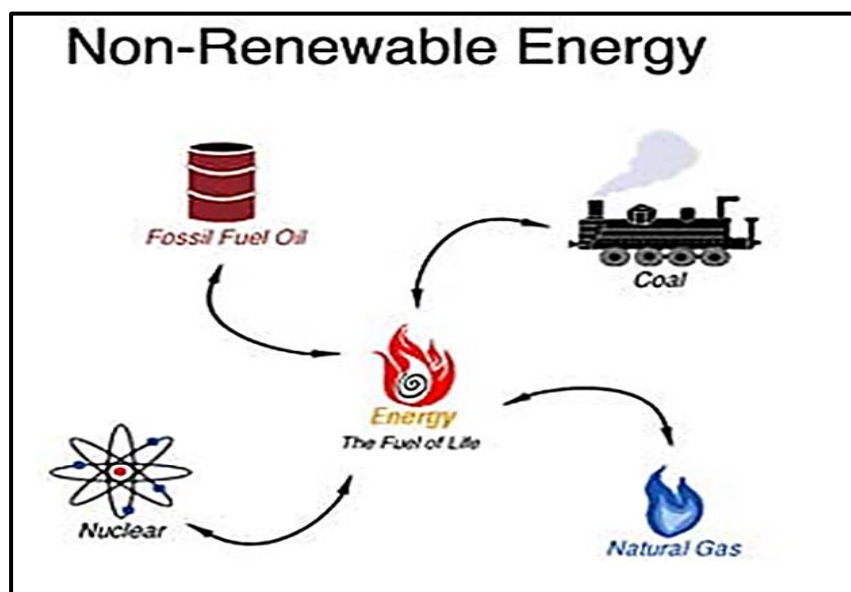
Crude Oil Volume Unit:

The standard volume unit for crude oil measurement, the 42-gallon barrel ("bbl"), dates back to the 1860s, when Pennsylvania producers actually stored and transported petroleum in wooden barrels .In countries that use the SI or "metric" system, oil volumes may be measured in metric tons.In Europe crude oil is measured in terms of weight and expressed in metric tons ("mt"), where one mt equals 2,204 lb .



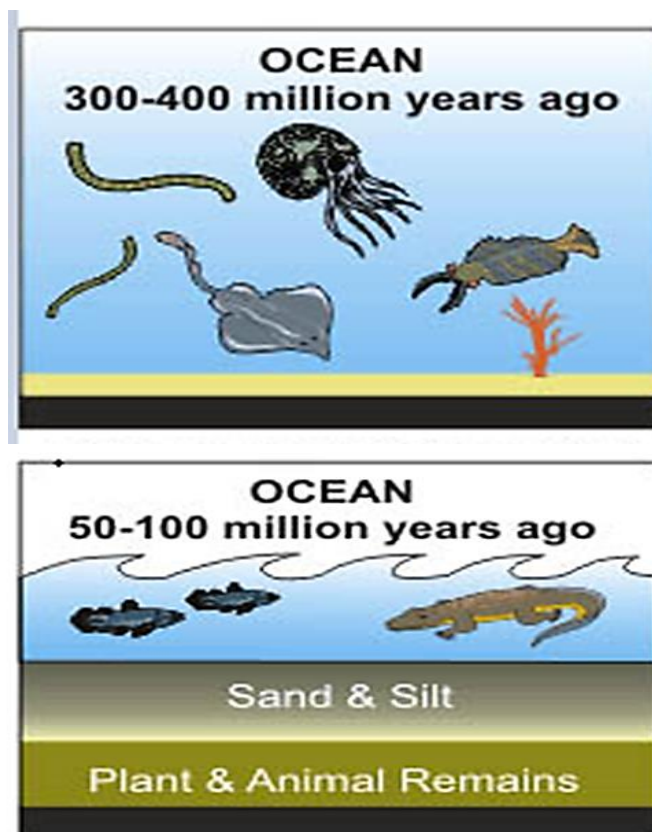
Crude Oil Facts:

- Crude oil is a naturally occurring fossil fuel - meaning it comes from the remains of dead organisms
- Crude oil is made up of a mixture of hydrocarbons - hydrogen and carbon atoms.
- It exists in liquid form in underground reservoirs in the tiny spaces within sedimentary rocks. Or it can be found near the surface in oil sands.
- It is often found alongside natural gas and saline water.
- It is non-renewable because it takes millions of years to form



Crude Oil Formation :

- Crude oil is formed from the remains of dead organisms (diatoms) such as algae and zooplankton that existed millions of years ago in a marine environment.
- These organisms were the dominant forms of life on earth at the time
- As they lived these organisms absorbed energy from the sun and stored it as carbon molecules within their bodies. Once they died their remains sank to the bottom of the oceans or riverbeds and were buried in layers of sand, mud and rock.
- Over millions of years, the remains were buried deeper and deeper under more sediment and organic materials.
- The enormous pressure, high temperatures, and lack of oxygen transformed the organic matter into a waxy substance called kerogen.



Uses the Crude Oil :

- To be of use to us, the crude oil must be “fractionated” into its various hydrocarbons. This is done at the refinery.
- Oil can be used in many different products, and this is because of its composition of many different hydrocarbons of different sizes, which are individually useful in different ways due to their different properties .
- The purpose of a refinery is to separate and purify these different components .
- Most refinery products can be grouped into three classes: Light distillates (liquefied petroleum gas, naphtha, and gasoline), middle distillates (kerosene and diesel), and heavy distillates (fuel oil, lubricating oil, waxes, and tar).



2.Characterization

Crude Oil Properties:

Crude petroleum is very complex and, except for the low-boiling components, no attempt is made by the refiner to analyze for the pure components contained in the crude oil. Relatively simple analytical tests are run on the crude and the results of these are used with empirical correlations to evaluate the crude oils as feedstocks for the particular refinery. Each crude is compared with the other feedstocks available and, based upon the operating cost and product realization, is assigned a value. The more useful properties are discussed.

Important: Analysis of crude oil composition provides important information that impacts on the recovery, handling, and transportation of hydrocarbons. Crude characterization also provides data in the analysis of geochemistry of the source of origin.



Crude oil characterization by optical methods is usually difficult because of its dark color; however, those characterizations are crucial because they give information that can affect some analysis procedures. Ultraviolet-visible (UV-vis) spectroscopy is a simple and practical technique that allows the characterization of crude oil through dilution in solvents.

Chemical Classification of Petroleum:

Physical properties and composition of crude oil provide critical information for the optimum operation of a petroleum refinery. This information does not only help predict the physical behavior of crude oil in refinery units, but also gives insight into its chemical composition. Therefore, the physical properties can be related to chemical properties of crude oil and its fractions and the characteristics of the resulting refinery products. The most important properties of crude include density, viscosity, boiling point distribution, pour point, and the concentration of various contaminants.

- 1- Specific, API Gravity
- 2- Viscosity
- 3- Flash Point
- 4- Cloud and Pour Points
- 5- Aniline Point and Diesel Index
- 6- Octane , Cetane number