Ministry of Higher Education and Scientific Research Al-Mustaqbal University College

Department of Chemical Engineering and petroleum Industrials

Properties of crude oil

2nd Stage

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Crude oil Refining

Distillation (True Boiling Point test TBP)

A standard laboratory technique used to predict the refining qualities of crude petroleum; gives distillation cuts for gasoline, kerosene, distillate (diesel) fuel, etc.

The distillation tests give an indication of the types of products and the quality of the products that can be obtained from petroleum.

The tests are used to compare different petroleum types through the yield and quality of the residuum fraction.

The boiling range gives information on the composition, the properties, and the behavior of petroleum and derived products during storage and use.

Volatility is the major determinant of the tendency of hydrocarbon mixtures to produce potentially explosive vapors.

The mainly products of crude oil distillation	
Product	**Boiling range °C**
Gas	< 15.5
Gasoline (light naphtha)	15.5 - 149
Kerosene (medium naphtha)	149 - 232
Gas oil	232 – 343
Light vacuum gas oil	343 – 371
Heavy vacuum gas oil	371 – 556
Residuum	> 566

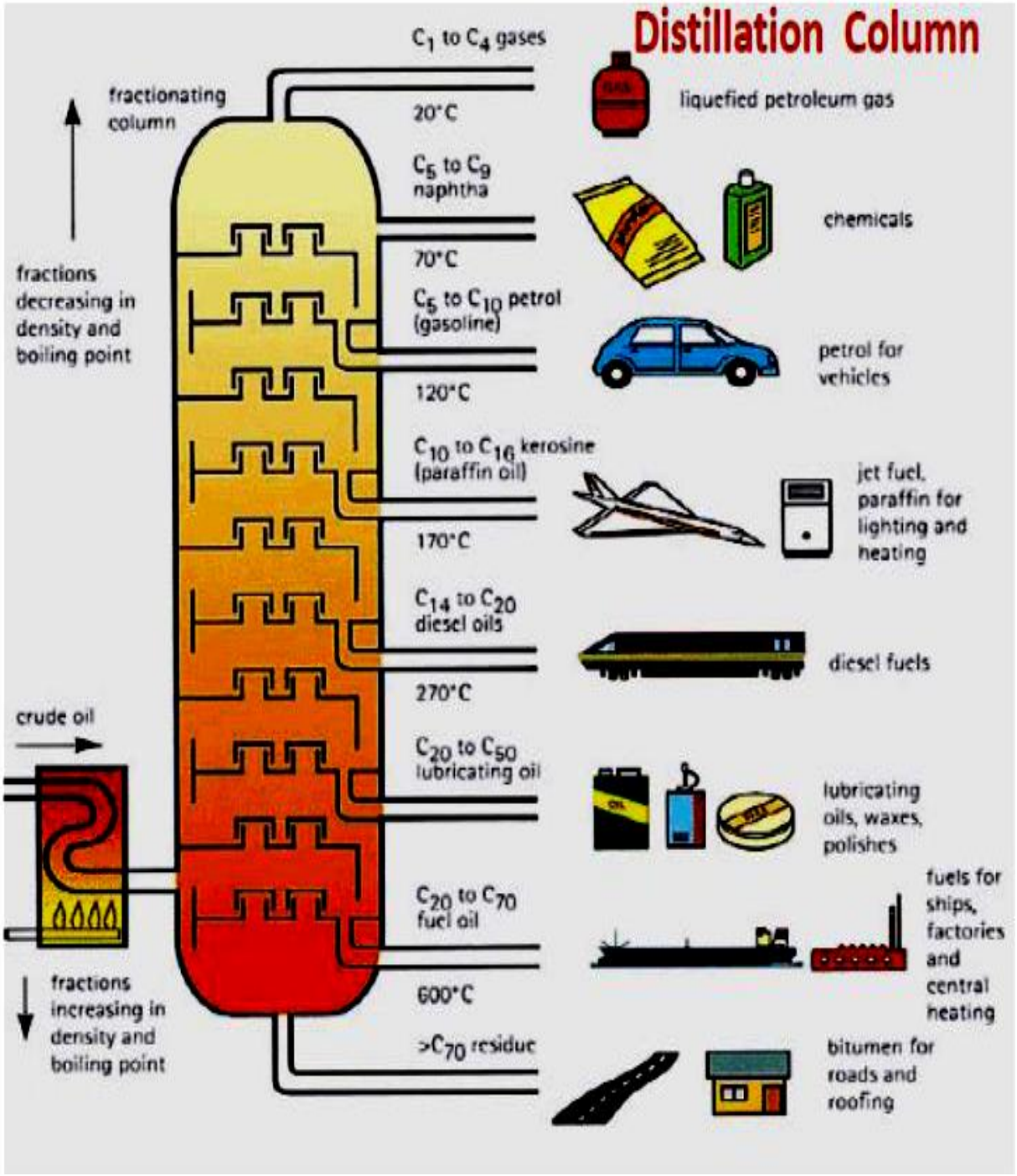

Distillation Column
C_1 to C_4 gases
liquefied petroleum gas
fractionating column
20°C
C_5 to C_9 naphtha
chemicals
70°C
C_5 to C_{10} petrol (gasoline)
fractions decreasing in density and boiling point
petrol for vehicles
120°C
C_{10} to C_{16} kerosine (paraffin oil)
jet fuel, paraffin for lighting and heating
170°C
C_{14} to C_{20} diesel oils
diesel fuels
270°C
crude oil
C_{20} to C_{50} lubricating oil
lubricating oils, waxes, polishes
C_{20} to C_{70} fuel oil
fuels for ships, factories and central heating
fractions increasing in density and boiling point
600°C
>C_{70} residue
bitumen for roads and roofing

Table 4.1. General Summary of Product Types and Distillation Range

Product	Lower Carbon Limit	Upper Carbon Limit	Lower Boiling Point °C	Upper Boiling Point °C	Lower Boiling Point °F	Upper Boiling Point °F
Refinery gas	C_1	C_4	−161	−1	−259	31
Liquefied petroleum gas	C_3	C_4	−42	−1	−44	31
Naphtha	C_5	C_{17}	36	302	97	575
Gasoline	C_4	C_{12}	−1	216	31	421
Kerosene/diesel fuel	C_8	C_{18}	126	258	302	575
Aviation turbine fuel	C_8	C_{16}	126	287	302	548
Fuel oil	C_{12}	$>C_{20}$	216	421	>343	>649
Lubricating oil	$>C_{20}$		>343		>649	
Wax	C_{17}	$>C_{20}$	302	>343	575	>649
Asphalt	$>C_{20}$		>343		>649	
Coke	$>C_{50}$*		>1000*		>1832*	

Octane Number

The *octane number* is a measure of the knocking characteristics of a fuel in a laboratory gasoline engine.

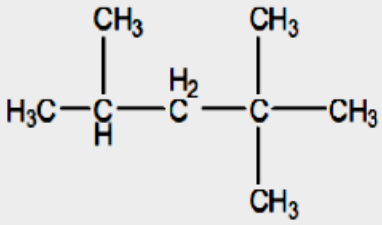
Knocking is explosion caused by its premature burning in the combustion chamber.

We determine the octane number of a fuel by measuring its knocking value compared to the knocking of a mixture of n-heptane and isooctane or 2-2-4-trimethylpentane (224TMP).

A mixture of 30% heptane and 70% isooctane has an octane number of 70.

The octane number of *n*-heptane is 0 while for iso-octane is100, by definition.

n-heptane $CH_3CH_2CH_2CH_2CH_2CH_2CH_3$ is quite low in its resistance to knock ⇒ octane number = 0



is quite high in its resistance to knock ⇒ octane number = 100

iso octane

The *cetane number* is a measurement of the combustion quality of diesel fuel during compression ignition. It is a significant expression of diesel fuel.

In short, the higher the Cetane number the more easily the fuel will combust in a compression setting.

Normal modern highway diesels run best with a fuel rated cetane number between 45 and 55.

The optical method for determining cetane requires the use of an industry standard test engine equipped with accepted instrumentation and operated under specific conditions.