

Petroleum Refining Process

Three major types of refining operations that are performed to refine the oil into finished products include the following three major steps.

1. Separation (Physical)
2. Conversion (Thermal and Chemical)
3. Treating

Although these three processes are the most commonly used operations for refining petroleum, each of the three steps have many more divisions beginning from initial separation of simple fractions from crude oil to removing nearly all unwanted impurities to enhance their potential applications.

1. Separation (Physical)

Removal of sand and water first / Separation of Crude Oil.

Heating at atmospheric pressure upto 400 °C.

Separation of fractions based on the difference in their boiling points by atmospheric distillation

Vapors of different fractions of oil rise (50 m) and are separated at different temperatures

Gases come out of the top most part where the temperature is lesser

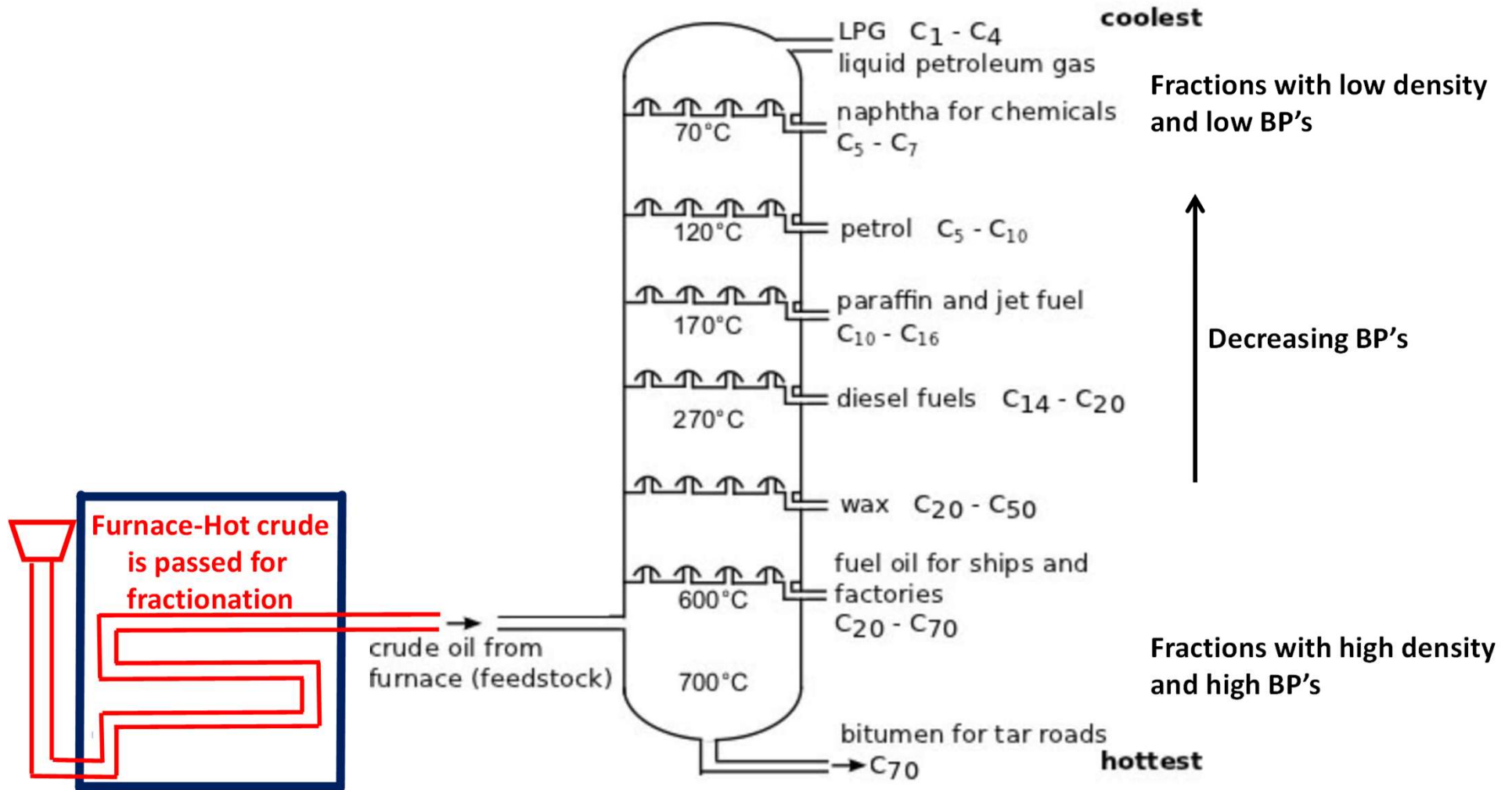
Liquids fractions condense as they rise and cool

Collector trays fixed at different heights of the column separate and collect various liquids

Heavy residual materials remain at the bottom and are treated for second distillation

This second distillation process separates diesel and heavy oils from the non-volatile solids

Bubble Cap Fractionating Column



Main Goal of Petroleum Refining Process Products

The process of refining of petroleum or crude oil is carried out in refineries to transform them into multiple useful products.

They may be in gaseous, liquids, wax/grease and solid forms.

Hence, the main goal of refining is to produce useful products for fuels, power generation, transportation & intermediates for thousands of other products.

1. Low molecular weight gases including LPG (Liquified Petroleum gas)
2. Petrol or gasoline (mainly used extensively for vehicles), Kerosene, Jet Fuel, Diesel Oil (used extensively for heavy vehicles)
3. Other heavy fuel Oils, Lubricants, grease, Paraffin Wax (Viscous oils/semisolid)
4. Asphalt / Bitumen and Tar (Solids)

Fractions Obtained from Petroleum Refining Process

No	Fraction Name / Type	Distillation Temperature	Applications	Carbon Number
1	Gases	Below 20 °C	Fuels	C1 – C4
2	Petroleum Ether	20 – 60 °C	Solvents	C5 – C6
3	Ligroin (Light Naphtha)	60 – 100 °C	Solvents	C6 – C7
4	Natural Gasoline (Petroleum/Pentanes)	40 – 205 °C	Motor Fuel	C5 – C10, Cyclic alkanes
5	Kerosene (Paraffin Oil) (Middle distillates)	175 – 325 °C Less volatile	Lighting, jet / rocket fuel and cooking	C12 – C18, Aromatics
6	Gas Oil / Red Diesel	>275 °C	Fuel Oil, heating, machines	C12 and higher

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7	Lubricating Oil	Non-volatile Liquids	Lubricant, Reducing friction, wear and tear in mechanical components	C16 – C20, Long chain attached with cyclics
8	Asphalt / Petroleum Coke, Fuel grade Pet Coke	Non-volatile Solids & Low Ash Content	For pharmaceuticals, roads, steel, lime, and energy, bituminous waterproofing, power generation, cement, brick & glass production	C18 – C22
9	Paraffin Wax (Hard wax)	Solids	Candle, Wax Paper, Polishes, cosmetic, spa	C20 – C30
10	Residue (Asphaltic Bitumen)	Solids	Asphalt, Tar	C30 – C40 and above

Smaller and Larger Fractions Properties

- Low boiling point, light in color, easy to ignite/light, low density (runny liquids), mostly used for fuels are properties of small molecules obtained from cracking process
- High boiling point, darker in color, difficult to ignite/light, thick liquid or semisolid, mostly used for other applications or further cracked are the properties of large molecules obtained as end of cracking process