SNS COLLEGE OF TECHNOLOGY
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Liquid fuel petroleum- Manufacture of synthetic petrol

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Introduction

Liquid fuel – Petroleum

- Petroleum or crude oil is naturally occurring liquid fuel
- It is a dark brown or black coloured viscous oil found deep in earth's crust.
- The oil is usually floating over a brine solution and above the oil, natural gas is present
- Crude oil is a mixture of paraffinic, olefin and aromatic hydrocarbons with small amounts of organic compounds like N, O and S.

Types of Petroleum

1. **Paraffinic – Base type crude oil**

It contains saturated hydrocarbons from CH_4 to $C_{35}H_{72}$ with a smaller amount of naphthenes and aromatics.

2. **Naphthenic or Asphaltic Base type crude oil**

It contains cycloparaffins or naphthenes with a smaller amount of paraffins and aromatics.

3. **Mixed Base type crude oil**

It contains both paraffinic and asphaltic hydrocarbons

Refining of Petroleum or crude oil

- The crude oil is obtained from the earth is a mixture of oil, water and unwanted impurities
- The crude oil is subjected to fractional distillation
- During fractional distillation, the crude oil is separated into various fractions.

Refining of Petroleum

- The process involves removing impurities
- separation the crude oil into various fractions
- The fractions have different boiling points

Refining of Petroleum or crude oil

Separation of water (Cottrell's process)

- The crude oil from oil wells is an extremely stable emulsion of oil and salt water
- The crude oil is allowed to flow between two highly charged electrodes
- colloidal water droplets combine to form large drops which is then separated out from the oil.

Removal of harmful sulphur compounds

- Sulphur compounds are removed by treating the crude oil with copper oxide
- The copper sulphide formed is separated out by filtration.

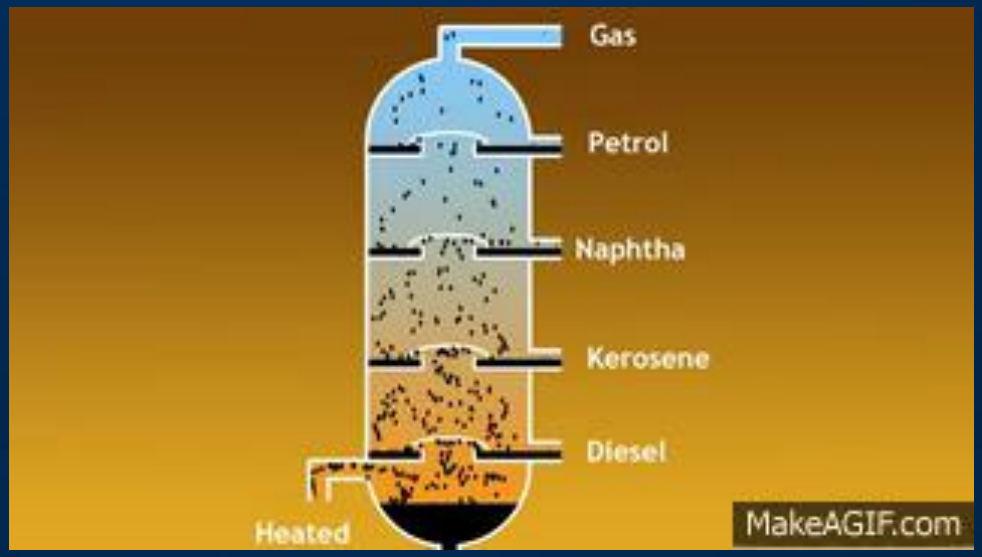
Refining of Petroleum or crude oil

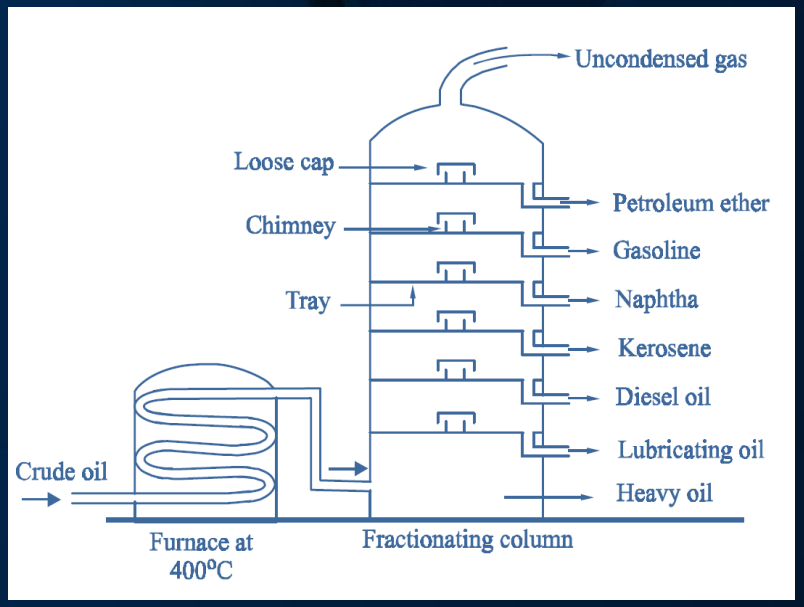
Fractional Distillation

- The purified crude oil is heated to about 400ºC in an iron retort
- The oil gets vaporized
- The hot vapours are then passed into the bottom of a " fractionating column".
- The fractionating column is a tall cylindrical tower containing a number of horizontal stainless steel trays at short distances
- Each tray is provided with small chimney covered with a loose cap
- The fractionating column is a tall cylindrical tower containing a number of horizontal stainless steel trays at short distances

Refining of Petroleum or crude oil

Fractional distillation of crude petroleum





Refining of Petroleum or crude oil

- When the vapours of the oil go up in the fractionating column they become cooler and get condensed at different trays.

- The fractions having higher boiling points condense at low trays
- The fractions having lower boiling points condense at higher trays
- The gasoline obtained by this fractional distillation is called straight-run gasoline
- Various fractions obtained at different trays is given in the following table

Fractional distillation – fractions , compositions and uses

S. No	Name of the fraction	Boiling Range ºC	Range of C-Atoms	Uses
1	Uncondensed gases	Below 30	C_1 - C_4	As a fuel under the name of LPG
2	Petroleum ether	30 - 70	C_5 – C_7	As a solvent
3	Gasoline or petrol	40 - 120	C_5 – C_7	Fuel for IC engines
4	Naphtha or solvent spirit	120-180	C_9 – C_{10}	As a solvent and dry cleaning
5	Kerosene oil	180-250	C_{10} – C_{16}	Fuels for stoves and jet engines
6	Diesel oil	250-320	C_{15} – C_{18}	Diesel engine fuel
7	Heavy oil	320-400	C_{17}– C_{30}	Fuel for ships and for production of gasoline by cracking

Refraction of heavy oil – Fractions and use

S.No	Name of the Fraction	Uses
1	Lubricating oils	As lubricants
2	Petroleum jelly or vaseline	Used in medicines and cosmetics
3	Grease	Used as lubricant
4	Paraffin wax	Used in candles, boot polishes
5	Pitch at above 400ºC	Used for making roads, water proof roofing etc.

Synthetic petrol

- The gasoline, obtained from the fractional distillation of crude petroleum oil is called straight run petrol
- The amount of straight run gasoline is not enough to meet the requirement of the present community
- Hence, we are in need of finding out a method of synthesizing petrol.

Manufacture of synthetic petrol

Coal contains about 4.5% hydrogen compared to about 18% in petroleum. So, coal is a hydrogen deficient compound.

Synthetic petrol

- When coal is heated with hydrogen to high temperature under high pressure, it is converted to gasoline
- The preparation of liquid fuels from solid coal is called hydrogenation of coal or synthetic

Hydrogenation of coal is Bergius process (or direct method).

Bergius Process

- Finely powdered coal is made into a paste with heavy oil and a catalyst powder
- Catalyst used is tin or nickel oleate
- The paste is pumped along with hydrogen gas into the converter where the paste is heated to 400 - 450ºC.

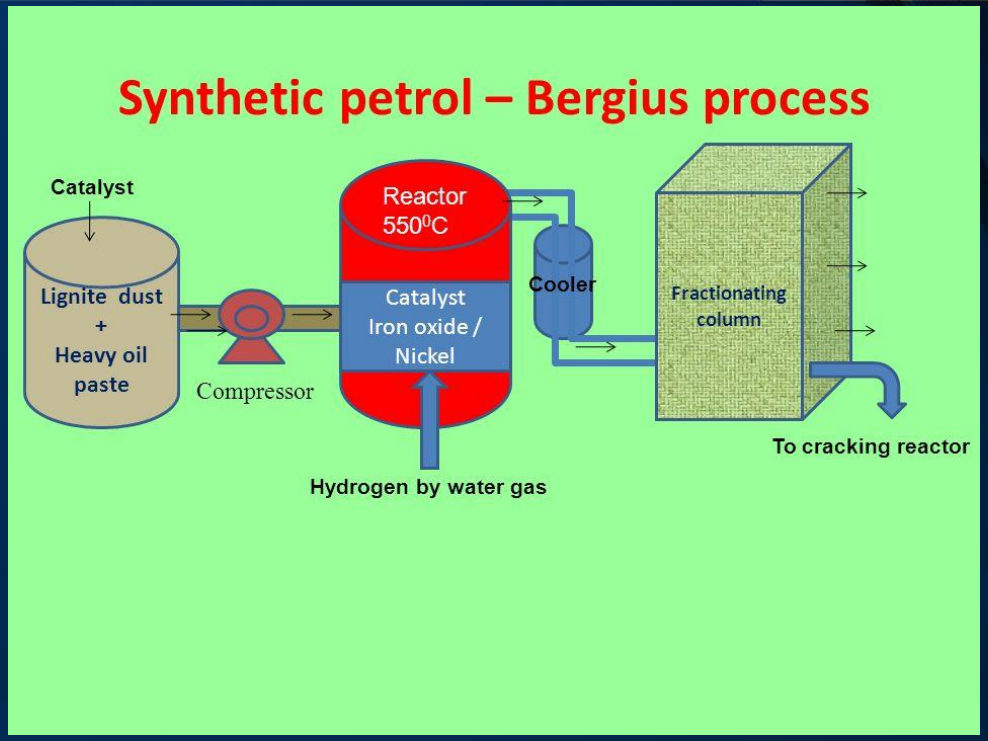
Manufacture of Synthetic petrol

- During this process hydrogen combines with coal to form saturated higher hydrocarbons
- The hydrocarbons undergo decomposition at higher temperature to yield mixture of lower hydrocarbons
- The mixture is led to a condenser, where the crude oil is obtained.

The crude oil is then fractionated to yield

1) Gasoline
2) Middle oil
3) Heavy oil

Manufacture of Synthetic petrol



BERGIUS PROCESS

https://www.youtube.com/watch?v=XUzpG1-rJLA

Manufacture of Synthetic petrol

- The middle oil is further hydrogenated in vapour phase to yield more gasoline
- The heavy oil is recycled for making paste with fresh coal dust
- The yield of gasoline is about 60% of the coal used.

Purification of Petrol (or) Gasoline

- Gasoline has some undesirable impurities like unsaturated olefins, colouring matters, sulphur compounds
- The unsaturated olefins get oxidised and polymerised there by causing gum and sludge formation on storing

Manufacture of Synthetic petrol

- Unsaturated olefins and colouring matter are removed by using adsorbent like Kieselguhr, fuller's earth.

- Sulphur containing petrol is known as sour spirit
- The process of desulphurisation of petrol is called sweetening of petrol


THANK YOU