

## Petroleum

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Petroleum or crude oil (Petro-rock, oleum-oil) is a dark greenish-brown, viscous oil found deep in earth crust. It is composed mainly of various hydrocarbons (like-straight chain paraffins, cycloparaffins or naphthalene, olefins and aromatics). together with small amounts of organic compounds containing O, N & S.

Gasoline or Petrol :- it is obtained (fractional distillation) between  $40-120^{\circ}\text{C}$  and is a mixture of hydrocarbons such as  $\text{C}_5\text{H}_{12}$  (Pentane) to  $\text{C}_8\text{H}_{18}$  (Octane). Its calorific value is about  $11,250 \text{ kcal/kg}$  and used as fuel for I.C engines.

OF all the fractions obtained by fractional distillation of petroleum, gasoline has the largest demand as a motor fuel, but the yield of this fraction is only 20% of the crude oil. Also the quality of so called straight chain gasoline is not high, moreover there is a surplus of heavier petroleum fractions.

(2) **Fischer-Tropsch method** : Water gas ( $\text{CO} + \text{H}_2$ ), produced by passing steam over heated coke, is mixed with hydrogen. The gas is purified by passing through  $\text{Fe}_2\text{O}_3$  (to remove  $\text{H}_2\text{S}$ ) and then into a mixture of  $\text{Fe}_2\text{O}_3 \cdot \text{Na}_2\text{CO}_3$  (to remove organic sulphur compounds). The purified gas is compressed to 5 to 25 atm and then led through a *converter* (containing a catalyst, consisting of

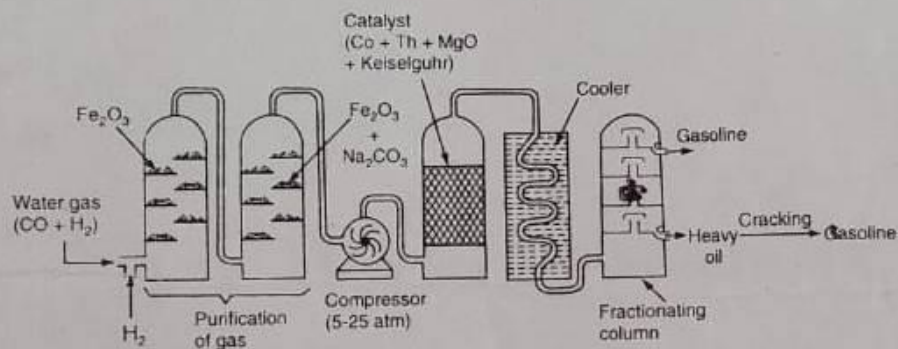
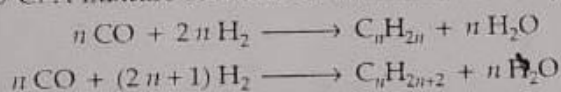


Fig. 11. Fisher-Tropsch method.

a mixture of 100 parts cobalt, 5 parts thorium, 8 parts magnesia, and 200 parts keiselguhar earth), maintained at about  $200\text{--}300^\circ\text{C}$ . A mixture of saturated and unsaturated hydrocarbons results :



The reaction is *exothermic*, so outgoing hot gaseous mixture is led to a *cooler*, where a liquid resembling *crude oil* is obtained. The crude oil thus obtained is then *fractionated* to yield : (i) gasoline, and (ii) high-boiling heavy oil. The heavy oil is reused for cracking to get more gasoline.

(3) **Bergius process** : The low ash coal is finely powdered and made into a paste with heavy oil and then a catalyst (composed of tin or nickel oleate) is incorporated. The whole is heated with hydrogen at  $450^\circ\text{C}$  and under a pressure 200–250 atm for about 1.5 hours, during which hydrogen combines with coal to form saturated hydrocarbons, which decompose at prevailing high temperature and pressure to yield low-boiling liquid hydrocarbons. The issuing gases (from the reaction vessel) are led to condenser, where a liquid resembling crude oil is obtained, which is then fractionated to get : (i) gasoline, (ii) middle oil, and (iii) heavy oil. The latter is used again for making paste with fresh coal dust. The middle oil is hydrogenated in vapour-phase in presence of a solid catalyst to yields more gasoline. The yields of gasoline is about 60% of the coal dust used.

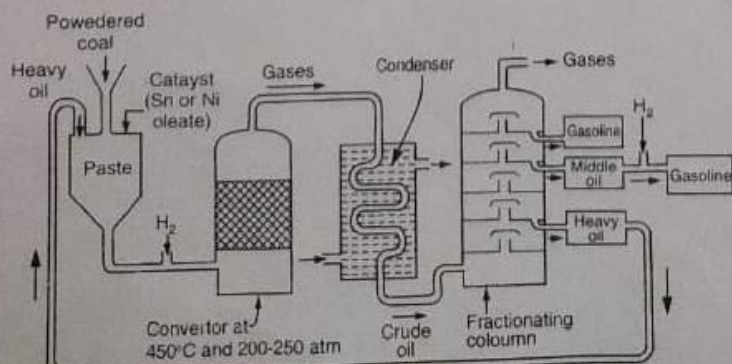


Fig. 12. Bergius process of hydrogenation of coal to gasoline.