Fuels for I C Engines

Heat energy in IC engines is produced by the burning of the fuel. Therefore selection of fuel is extremely important. Selection will depend upon the characteristics of the fuel. Selection of the fuel will affect the

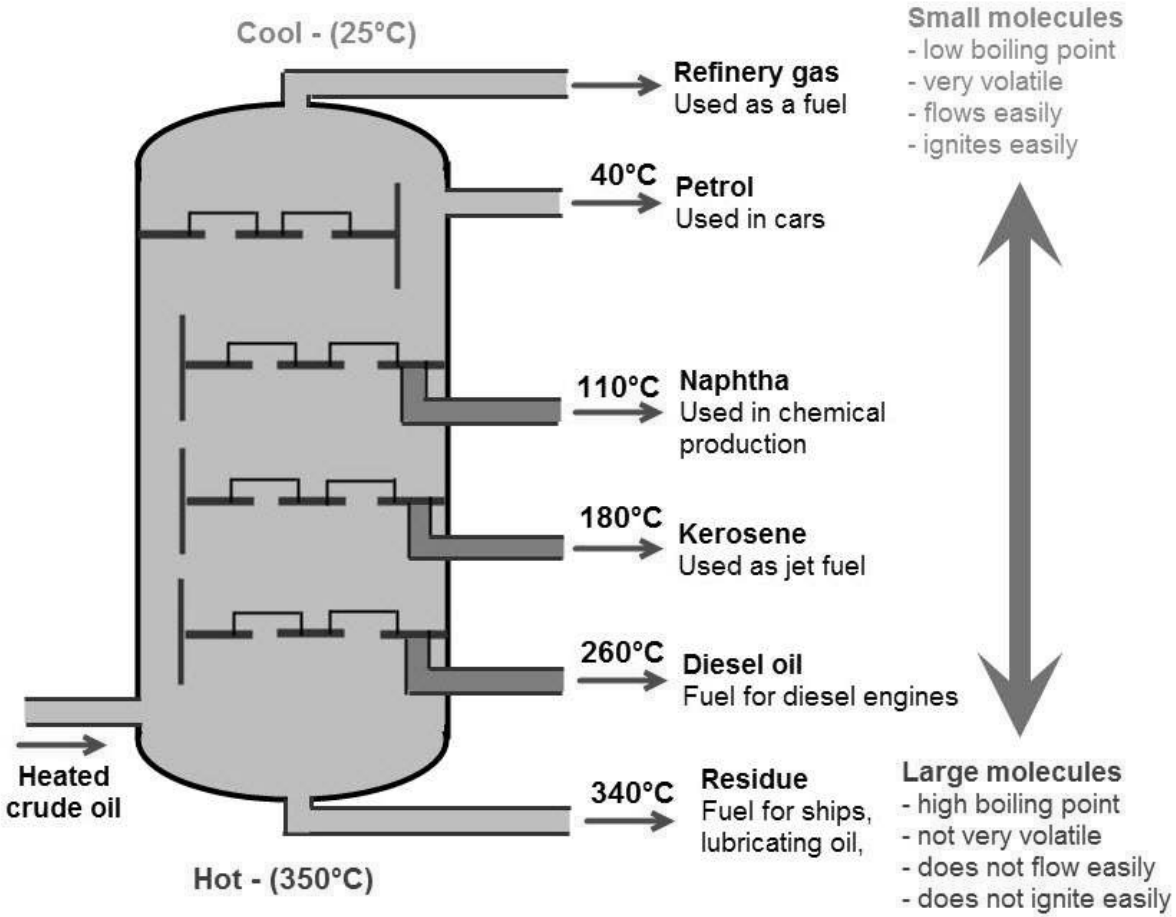
- ❑ design,
- ❑ durability (life) and
- ❑ thermal efficiency of the internal combustion engine.

Selection of fuel will also depend on the atmospheric pollution capability.

I C Engine fuel properties

- Good combustion qualities
- High energy density
- High thermal stability
- Low deposit forming tendencies
- Compatibility with engine hardware
- Good fire safety
- Low toxicity
- Low pollution
- Cheap and easily available

Petroleum or crude oil is a complex mixture of hydrocarbons and other chemicals such as Sulphur, Nitrogen, Water and Sand.



https://www.edplace.com/worksheet_info/science/keystage4/year10/topic/1277/7598/fractional-distillation

Chemical structure of petroleum

Hydrocarbon family	General formula	Molecular structure	Saturated / Unsaturated	Stability	Example
Parafin	C_nH_{2n+2}	Chain	Saturated	Stable	Butane
Olefin	C_nH_{2n}	Chain	Unsaturated	Unstable	Hexene, Butadiene
Napthene	C_nH_{2n}	Ring	Saturated	Stable	Cyclo propane, Cyclo butane
Aromatic	C_nH_{2n-6}	Ring	Highly unsaturated	Most unstable	Benzene, Toluene

Requirements of an Ideal Gasoline

- ❑ Easily vaporise
- ❑ Knock resistant
- ❑ Not pre-ignite easily
- ❑ Easy to handle
- ❑ Cheap and easily available
- ❑ High calorific value
- ❑ Not form gum and varnish

Characteristics of S I Engine Fuels

Important Qualities of S.I. Fuels

1. **Volatility:**

The ability of a liquid to change to vapor is known as VOLATILITY.

The rate of vaporization increases as the temperature increases and as the pressure decreases.

Volatility is directly related to liquid vapor pressure. At a given temperature, a substance with higher vapor pressure vaporizes more readily than a substance with a lower vapor pressure.

Characteristics of S I Engine Fuels

Front-end volatility

The various components of different molecular weights will vaporize at different temperatures, small molecular weights boiling at low temperature and larger molecular weights at higher temperature.

A small percentage of components that vaporize (boil) at low temperature is needed to assure the starting of a cold engine; fuel must vaporize before it can burn.

High front end volatility supports

- ✓ Cold starting

Too high front end volatility causes

- ➢ Low volumetric efficiency
- ➢ Vapor lock (too lean mixture is supplied to the engine)

Sulphur Content:

The gasoline should contain only a permissible amount of sulphur.

Because sulphur forms corrosive compounds that may corrode the engine parts.

Also, it causes odour and poor explosion characteristic.

Maximum sulphur content = 0.25% by weight.

Pour Point:

Temperature at which the fluidity ceases.

Important only when the engine is to be used at low temperatures.

Below pour point temperature gravity feeding from reservoir to the engine is not possible.

Pour point of fuel should be 5 to 7°C below the operating temperature

Flash point:

Flash point is the lowest temperature of a sample at which the fuel vapour starts to ignite when in contact with a flame (ignition source). For gasoline it is 25 ̊C, diesel fuel 35 ̊C and heavy diesel 65 ̊C

Gum deposits:

Gasoline with unsaturated HCs forms gum in the engine during storage,

Paraffin, Naphthene and Aromatic HCs also form some gum

Causes operating difficulties, sticking valves and piston rings, deposits in the intake manifold, clogging in carburettor jets etc

Ash content:

Should be minimum as it increases engine wear and reduces calorific value.

Viscosity:

Must be optimum, any excess of viscosity results in bad atomisation.

Anti knock quality:

Highest octane number,

- higher compression may be used,
- improves thermal efficiency and power output.