INDUSTRIAL CHEMISTRY.

FUEL GASES :-

Fuels are combustible substances which are burnt to produce heat energy.

CALORIFIC VALUE OF FUELS :-

The calorific value of a fuel is the quanity of heat produced by a given mass of fuel on complete combustion. In the SI system it is measured in Kilojoules per Kilogram. In CGS units it is in calories per gram. The calorific value is an important criteria of all fuels.

The following are requisites of a good fuels :-

* It should have high heat content i.e., high calorific value. The calorific value of a fuel is the heat evolved in kilojoules when one kilogram of the fuel is burnt
* It should not produce undesirable by-products, ash, smoke etc.,

* It should be cheap.

There are three type of fuels. They are :-

* Solid fuels.

Eg:- wood, coal, coke, charcoal, cowdung cake etc.,

* Liquid fuels.

Eg:- kerosene, alcohol, petroleum etc.,

* Gaseous fuels :-

Eg:- Natural gas, water gas, producer gas, Oil gas etc.,

Advantage of gaseous fuels over liquid and Solid fuels :-

Of the three types of fuels, gaseous fuels are the best. It is because,

1) They can be readily lighted
2) They do not leave ash.
3) They do not produce smoke
4) They can easily flow through pipes and tubes.
5) They can have high calorific value.

Water gas :-

A mixture of carbon monoxide and hydrogen is known as water gas. The calorific value is about 13100 KJ m^{-3}.

Composition :-

Carbon monoxide - 40-50%

Hydrogen. - 44-50%

Carbon dioxide - 3-7%

Nitrogen. - 4-5%

Preparation :-

It is prepared by sending steam over white hot coke or coal.

$C + H_2O \longrightarrow H_2 + CO$ $\quad \Delta H = 29$ K.cal.

$C + 2H_2O \longrightarrow 2H_2 + CO$ $\quad \Delta H = 19$ K.cal.

Uses :-

* It is used for welding purposes.
* It is a source of Industrial hydrogen.

* It is used in the manufacture of methyl alcohal and for making Carbureted water gas.

* It is used in the manufacture of Synthetic petrol.

Semiwater gas :-

A mixture of air and steam in appropriate proportions is passed over red. hot carbon the whole of the heat generated can be used. The heat liberated by the combustion of carbon maintains the temperature necessary for the formation of water gas by action of steam on carbon. we get a mixture of water gas and Producer gas. This mixture is called. Semiwater gas.

composition :-

Nitrogen	–	55%.
Hydrogen	–	15%.
methane	–	2%.
Carbon monoxide	–	30%.
Carbon dioxide	–	10%.

gaseous hydrocarbons obtained by cracking petroleum oils. Thus carburetted water gas is water gas is water gas containing hydrocarbons.

uses :-

* It is used as industrial fuel.
* It is used for heating and lighting purposes.

Producer Gas :-

Composition :-

Carbon monoxide - 35%
Nitrogen - 65%
Hydrogen - 2-5%.

rest percentange of methane and carbon monoxide.

It is a mixture of carbon monoxide and nitrogen. It is obtained by burning coke etc, in a limited supply of air. Carbon is first oxidised to CO_2 which is then reduced to CO.

$C + O_2 \longrightarrow CO_2$ $\Delta H = -97$ K.cals (i)

$CO_2 + C \longrightarrow 2CO$ $\Delta H = +39$ K.cals (ii)

Reaction (i) is exothermic while (ii) is endothermic. So there is a net loss of about 58 K.cals. So the gas is prepared on the spot and used while it is still hot.

It is poisonous in nature, heavier than air and insoluble in water. It is a non supporter of combustion though combustible itself. It has a lower calorific value is about 4500 KJm^{-3}. The temperature of its flame is low yet it is the cheapest, Another advantage is that any type of solid fuel can be employed.

uses :-

* As a cheap industrial fuel.
* As a substitute for Petrol in motor engines.
* It is used to metallurgical operations
* it is used for lighting purposes.

Difference between water gas and producer gas

		Water gas	Producer gas
1)	Composition	40-50% CO 45-50% H_2 3-7% CO_2 4-5% N_2	35% CO 65% N_2
2)	Calorific value	High	Low
3)	Cost	costlier	Cheaper

LPG (Liquified Petroleum Gas)

Liquified petroleum gases are composed of those hydrocarbons which are gaseous at normal atmospheric pressure but may be condensed to liquids at normal temperature by the application of moderate pressure. These hydrocarbons are propane, propylene, normal butane, isobutane and butylene. Commercial LPG invariably consists of mixture of two or more of these hydrocarbons.

The LPG marketed by Indian Oil corporation is called Indane.

Indane :-

Indane is the trade name of commercial butane and butane - propane mixture marketed by Indian oil corporation.

commercial butane contain about 15% propane and 85% butane.

Butane - propane mixture contains 50% butane and 50% propane. Like all L.P. gases, Indane is stored in containers as a liquid but is generally drawn and used as a gas, Indan is manufactured at Koyali, Guwahati, Barauni and Chennai.

uses :-

It is the best domestic fuel.

Gobar Gas :-

Gobar gas is the fuel obtained by the fermentation of a mixture of cattle dung and water, inside a circular

pit in the absence of air. The bacteria in the dung bring about the fermentation. A gobar gas plant is a device to convert cattle dung and other organic water into bio-gas and a good quality of manure. Gobar gas mainly consists of methane and little ethane.

The bio-gas produced by the gobar gas plant is clean and odourless and can be transported wherever needed. The gobar gas is more economical than dung cake

* It is used for domestic fuels
* It is used for lighting purposes
* It is used to run stationary diesel engines
* Gobar gas is safe to use since it is less likely to cause an explosion

Natural Gas :-

Natural gas is mixture of gaseous hydrocarbons, mainly methane. The composition of natural gas varies with the source. It consists chiefly the first six alkenes. It has the calorific value of about 3160 kJm^{-3} Natural gas occurs in association with or without petroleum. The gas available wells mainly situated in the oil producing regions. The gas is carried by a network of pipe lines from the field to the factory or wherever needed.

Composition :-

methane	- 85%.
propane	- 4%.
other higher alkanes	- 1.5%.
Ethane	- 8%.
Butane	- 1.5%.

uses :-

* It is an excellent fuel.
* The gas is carried by the network of pipelines from the filed to the factory

of wherever needed.

* It is low cost.

* It is one of the most valuable natural resources on the world.