



## 19CH101 – ENGINEERING CHEMISTRY

### Unit-4

### FUELS AND COMBUSTION

#### GASEOUS FUELS

Natural gas is always found above the oil in the oil wells. It is also called Marsh gas. It consists of methane and other saturated hydrocarbons. The average composition of natural gas is as follows :

Its calorific value varies from 12,000 to 14,000 kcal/m<sup>3</sup>.

Constituents	Percentage(%)
Methane	88.5
Ethane	5.5
Propane	4
Butane	1.5
Pentane	0.5

If natural gas contains lower hydrocarbons like methane and ethane it is called lean or dry gas. In the natural gas contains higher hydrocarbons like propane, butane along with methane it is called rich or wet gas.

#### Uses

1. It is used as a domestic and industrial fuel.
2. It is used as a raw material for the manufacture of carbon black and hydrogen.
3. It is also used for the generation of electricity by using it in fuel cells.

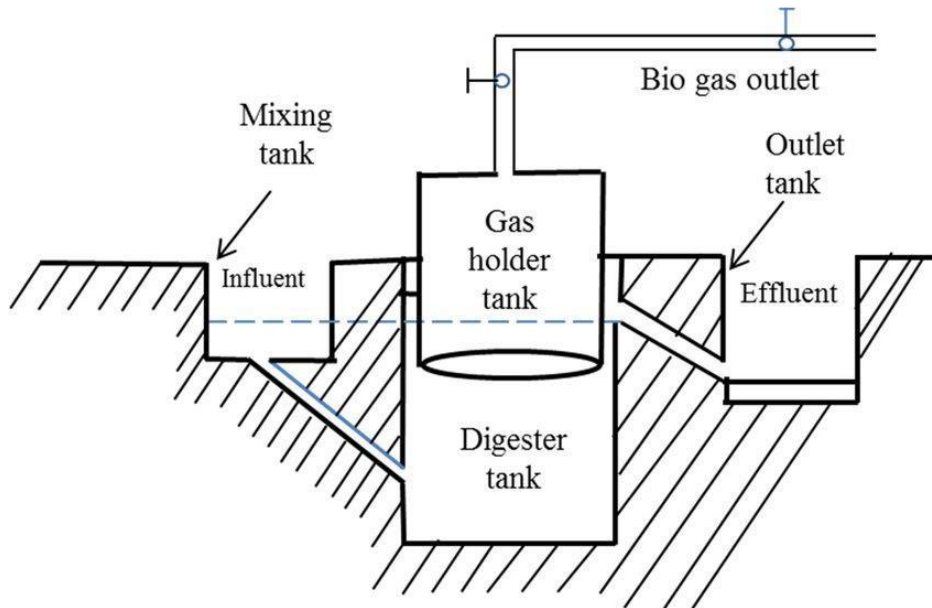
#### BIOGAS

These gases generally produced by the fermentation of bio wastes, sewage wastes etc., by anaerobic bacteria.

For example, natural gas is a Biogas, which results after a long periodic decay of animal and vegetable matters buried inside the earth.

The cheapest and easily obtainable biogas is Gobar gas, which is produced by anaerobic fermentation of cattle dung. The biogas is burnt to raise steam, which can drive turbines to produce electricity.





### Gobar Gas

- i) It is essentially methane.
- ii) Its Calorific Value is 5400 kcal/m<sup>3</sup>.
- iii) Its average composition is CH<sub>4</sub> = 60 % CO<sub>2</sub> = 30 % H<sub>2</sub> = 10 %

It is obtained by fermentation of Gobar (dung) in absence of air. In a typical Gobar gas plant, the dung in the form of slurry is introduced into a brick - lined well called fermentation well. An inverted drum is placed air tightly on the well.

It acts as gasholder and it can be moved up and down with the help of pulleys.

Formation of gas starts in a week. The optimum temperature for this fermentation is 34 - 48o C. As the gas starts collecting in the drum, the drum begins to rise and float. The gas is taken out from the exit provided at the top of the drum. It is used as a domestic fuel in villages. It is used for domestic heating and small pump running.



## LIQUIFIED PETROLEUM GAS

It is a mixture of propane and butane.

It is obtained as one of the top fractions in the fractional distillation of petroleum. It is easily liquified and so can be economically stored and transported in cylinders.

### Composition

Its approximate composition is n-Butane = 70 % Isobutane = 17 % n-Propane = 11 % Butylene and Ethane = rest.

### Calorific Value

Its Calorific Value is 27,000 kcals/m<sup>3</sup> .

### Uses

- i. It is used as a fuel for domestic cooking.
- ii. Used for heating industrial furnaces.
- iii. Used as an alternate for Gasoline in automobiles.

## COMBUSTION

Combustion is an exothermic chemical reaction, which is accompanied by development of heat and light at a rapid rate, temperature rises considerably. For example, combustion of carbon in oxygen:



For proper combustion, the substance must be brought to its kindling (or) ignition temperature, which may be defined as the minimum temperature at which the substance ignites and burns without further addition of heat from outside.



### **Factors affecting the rate of combustion**

The rate of combustion depends on the following factors:

1. The concentration of the fuel and air.
2. The nature of the combustible substance
3. The temperature
4. With increase in pressure or surface area of the fuel the rate of combustion can be increased.
5. It increases with an increase in pressure of air.
6. It increases with preheating of fuel and air.