



19CH101– ENGINEERING CHEMISTRY

Unit-4 FUELS AND COMBUSTION

CALORIFIC VALUE

It is the most important characteristic property of any fuel. Calorific value may be defined as “the amount of heat liberated by the complete combustion of a unit mass of a fuel”.

The quantity of heat can be measured by the following units.

- i. Calorie
- ii. Kilocalorie
- iii. British thermal units
- iv. Centigrade heat units

Calorie

The amount of the heat required to raise the temperature of 1gm of water through 1OC (15 to 16 OC)

HIGHER AND LOWER CALORIFIC VALUE

i) Gross (or) High Calorific Value (GCV or HCV)

The total heat generated when a unit quantity of fuel is completely burnt and the products of combustion are cooled to room temperature.

For example, when a fuel containing hydrogen is burnt, it under goes combustion and will be converted to steam. If the combustion product is cooled to room temperature, the steam gets condensed into water and the latent heat is evolved. Therefore the latent heat of combustion of condensation of ‘steam’ so liberated is included in gross calorific value

Dulong’s formula (Theoretical calculation)

Dulong’s formula for the theoretical calculation of calorific value is

$$\text{GCV (or) HCV} = 1/100(8080 C + 34500[H-O/8] + 2240 S)\text{kcal/kg}$$

where, C, H, O & S represent the % of the corresponding elements in the fuel.



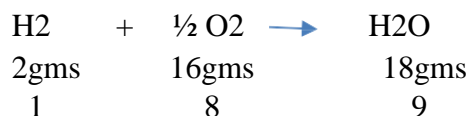
It is based on the assumption that the calorific values of C, H & S are found to be 8080, 34500 and 2240 kcal, when 1 kg of the fuel is burnt completely. However, all the oxygen in the fuel is assumed to be present in combination with hydrogen in the ratio H : O as 1 : 8 by weight. So the surplus hydrogen available for combustion is $8 O H ..$

ii) Net (or) Lower Calorific Value (NCV or LCV)

The net heat produced when a unit quantity of fuel is completely burnt and the products of combustion are allowed to escape.

NCV = GCV – Latent heat of condensation of steam produced 1 part by weight of H₂ produces 9 parts by weight of H₂O as follows.

The latent heat of steam is 587 cal/gm



Thus,

$$\text{NCV} = \text{GCV} - 9/100H \times 587 \text{ kcal/kg}$$

$$\text{NCV} = \text{GCV} - 0.09H \times 587 \text{ kcal/kg}$$

where ,

H = % of H₂ in the fuel