Requirements of a Good Fuel

Fuel:

The various types of fuels like liquid, solid and gaseous fuels are available for firing in boilers, furnaces and other combustion equipment. The selection of right type of fuel depends on various factors such as availability, storage, handling, pollution and landed cost of fuel.

The knowledge of the fuel properties helps in selecting the right fuel for the right purpose and efficient use of the fuel.

Fuel is a combustible substance, containing carbon as a main constituent, which on proper burning gives large amount of heat, which can be used economically for domestic and industrial purpose.

Fuel: any material that can be burned to release thermal energy. Most familiar fuels are hydrocarbons and are denoted by the general formula of C_nH_m. For example octane is C_8H_{18}

Fuel is defined as any materials which when burnt will produce heat.

Example 1:

Wood, charcoal, coal, kerosene, petrol, diesel, producer gas, oil gas etc. During the process of combustion, carbon, hydrogen, etc., combine with oxygen with a liberation of heat.

The combustion reaction can be explained as

$C + O_2$ ..... $CO_2 + 94$ kcals

$2H_2 + O_2$ ..... $2H_2O + 68.5$ kcals

The calorific value of a fuel depends mainly on the amount of Carbon and Hydrogen.

A good fuel should have the following characteristics:

o High calorific value.

o Moderate ignition temperature.

o Low contents of non-combustible matters.

o Low moisture content.

o Free from objectionable and harmful gases like CO, SOx, H2S.

o Moderate velocity of combustion.

o Combustion should be controllable.

o Easy to transport and readily available at low cost.

Classification of Fuels:

Classification of fuels is based on two factors.

1. **Occurrence** (and preparation).

2. The **state of aggregation.**

On the basis of occurrence, The fuels are further divided into two types:

A. Natural or primary fuels: - These are found in nature such as Wood, peat, coal, petroleum, natural gas etc.

B. Artificial or secondary fuels: - These are prepared artificially from the primary fuels.

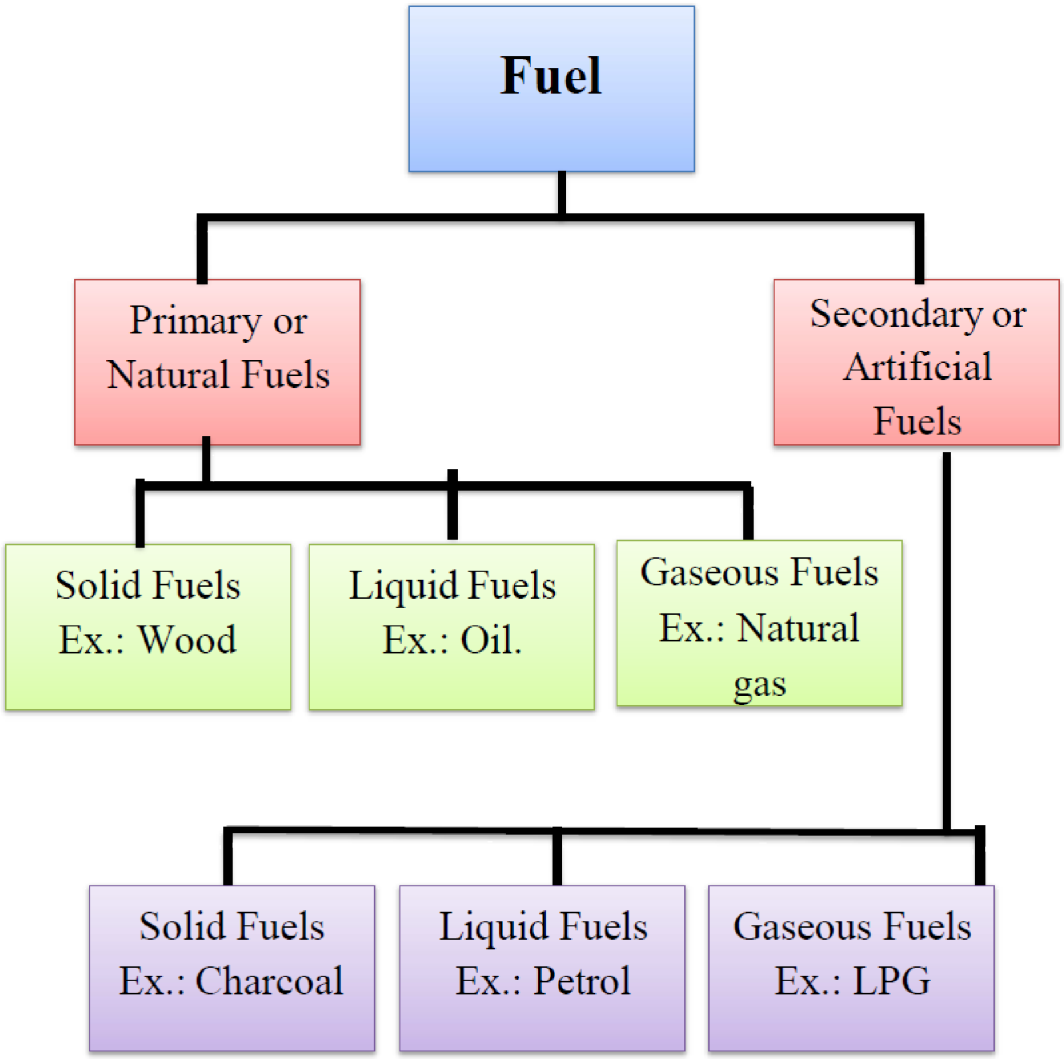
Example 2: Charcoal, coke, kerosene, diesel, petrol, coal gas, oil gas, producer gas, blast Furnace gas etc.

Fuels are classified into:

(i) Primary or Natural fuels - These are found in nature.

(ii) Secondary or Artificial fuels - These are derived from primary fuels.

Primary and secondary fuels may also be divided into 3 classes namely solid, liquid and gaseous fuels.



Characteristics of a good fuel:

1. The fuel should be easily available.
2. It should be dry and should have less moisture content. Dry fuel increases its calorific value.
3. It should be cheap, easily transportable and has high calorific value.
4. It must have moderate ignition temperature and should leave less ash after combustion.
5. The combustion speed of

a good fuel should be moderate.

6. It should not burn spontaneously to avoid fire hazards.
7. Its handling should be easy and should not give poisonous gases after combustion.
8. The combustion of a good fuel should not be explosive.

The **second classification** is based upon their **state of aggregation** like:

a) Solid fuels;

b) Liquid fuels and

c) Gaseous fuels.

1. Solid fuels:

Various kinds of solid fuels are: wood, coal including bituminous coal, peat, lignite, anthracite, etc …. Which represents "Natural Solid Fuels".

Wood: *Can be burnt easily and gives maximum intensity of heat very quickly, but is not suitable for boilers because the calorific value of wood is low ranged between (3000 - 4000 Kcal/kg).*

Coal: *It is produced from vegetable matter which accumulated under the earth, when millions of years ago, was subjected to the action of pressure and heat. This condition will changed the physical and chemical properties of matter and it got converted into what is called as* ***"Coal".***

Types of coal:

1. Peat:

It consists of decayed vegetable matter mainly decomposed to water plants and mosses. It has high moisture content and should be dried before burning.

The approximate composition is:

C=60%; H=5.8%; O=33%, and Ash=1.2%

The calorific value of peat is ***3500*** *Kcal/kg.*

2. Lignite or Brown Coal:

It is brown in color, it burns with a brightly, slightly and smoky yellow flame.

The approximate composition is:

C=67%; H=5.0%; O=20%, and Ash=8.0%

The calorific value of peat is ***5000*** *Kcal/kg.*

3. Bituminous Coal:

It is soft; it consists of large amount of volatile matter and is widely used as fuel. It burns with a long yellow and smoky flame.

The approximate composition is:

C=83.5%; H=5.0%; O=5.0%, and Ash=6.5%

*The calorific value of peat is **7800** Kcal/kg.*

4. Anthracite coal:

It is black in color and burns with a short bluish flame and amount little.

The approximate composition is:

C=90%; H=3.0%; O=2.0%, and Ash=5.3%

*The calorific value of peat is **8500** Kcal/kg*

2. Liquid Fuels:

Liquid fuels include petroleum and its derivatives.

Fractional distillation of crude petroleum helps in separating it

into its various verities such as gasoline, kerosene, oil gas ,

light diesel fuels and residual oil.

Advantages of liquid fuels over solid fuels:

The main advantages of liquid oils over solid oils are:

1. *Handling of liquid fuels is easy which required less storage spaces.*
2. *Liquid fuels can be **fired easily**, and the **maximum temperature** is attained in lesser time as compared to solid fuels.*
3. *Liquid fuels leave a **very little** quantity of **ash** after burning, while the solid fuels leave a large quantity of ash after burning causing a large problems.*
4. *The combustion of liquid fuels is uniform*
5. *The combustion of liquid fuels can be easily controlled.*

Disadvantages of liquid fuels

The main disadvantages of liquid oils over solid oils are:

1. *They are costly as compared to solid fuels.*
2. *They require special type of burners for their burning*
3. *Sometimes, they give unpleasant odours.*
4. *There is a danger of explosions.*
5. *In cold climates, the oil stored in tanks, it must be heated in order to avoid stoppage of oil flow.*