

विचार संगम

भारतीय दर्शन, विज्ञान, साहित्य-कला और
तकनीकी के विशेष संदर्भ में

सम्पादक

डॉ. दिनेश चन्द्र शर्मा

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FUELS-PATHWAY TO SUSTAINABLE DEVELOPMENT

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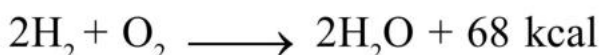
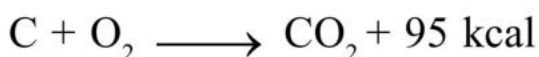
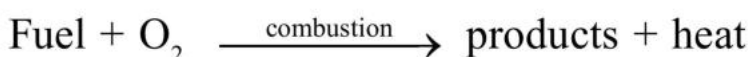
Introduction

A fuel is a combustible substance which produces heat. The heat can be produced either by combustion or by nuclear fission or fusion. The fuels which produce heat on combustion are called 'fuels' and those which produce heat by fission or fusion are called 'nuclear fuels'

Thus fuel can be defined as- "A substance which is capable of releasing large amount of heat on combustion is known as fuel." The heat produced can be used for various domestic and industrial purposes.

Elements producing heat in fuel are carbon, hydrogen, sulphur, phosphorous. Carbon and hydrogen are the most important heat producing elements.

Combustion-It is a process of burning fuel in presence of air or oxygen. In this process carbon and hydrogen react with oxygen and liberate heat. The energy is released due to rearrangement of valency electrons in these atoms, resulting in formation of CO, and H₂O. These reactions are exothermic and heat released is difference in the energy of reactant and product.



Calorific value of fuel depends mainly on carbon and hydrogen.

CLASSIFICATION OF FUEL

(A) Fuels have been classified in four general classes

(i) Fossil fuel-Derived from fossils and found in earth's crust.

eg- coal, petroleum etc.

(ii) By product fuel-Co-product of some regular manufacturing
eg- coke oven gas

(iii) Chemical fuel-Normally not used in conventional process
eg-ammonium nitrate, fluorine.

(iv) Nuclear fuel-Which release heat by fission or fusion eg-
uranium, fusion of deuterium and tritium.

(B) Classification on the basis of state of aggregation-

(1) Solid Wood, coal, coke etc.

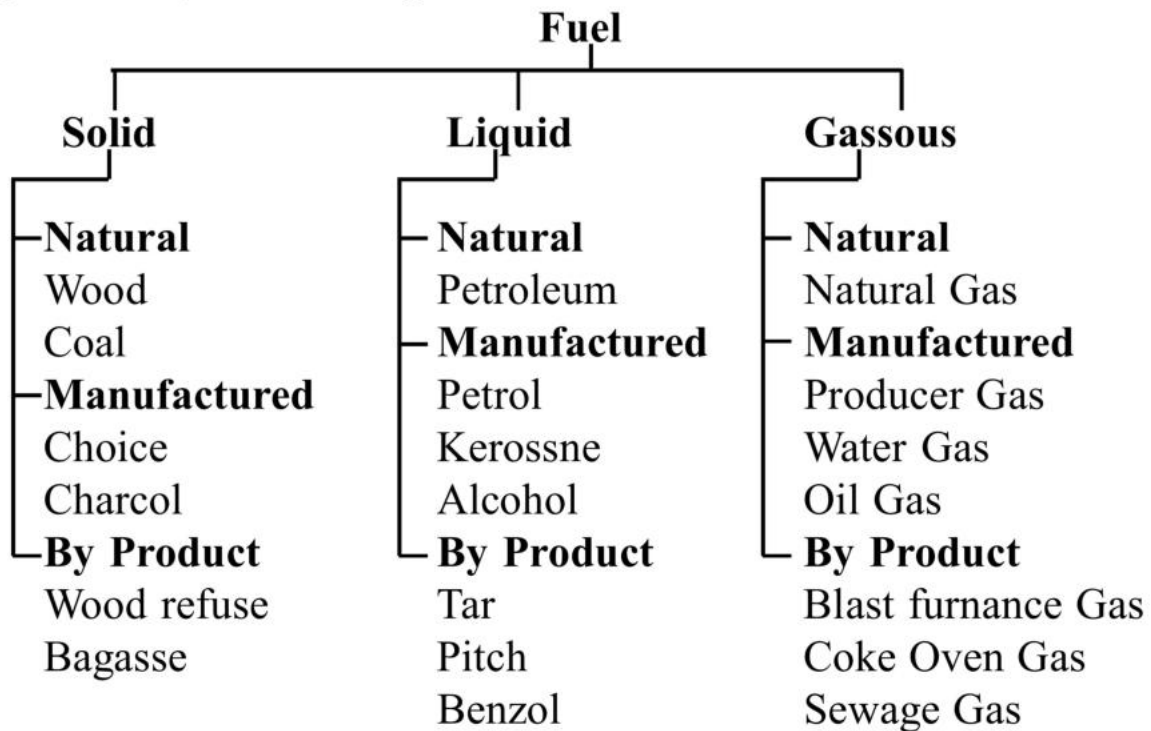
(2) Liquid Petroleum, Kerosene, diesel etc.

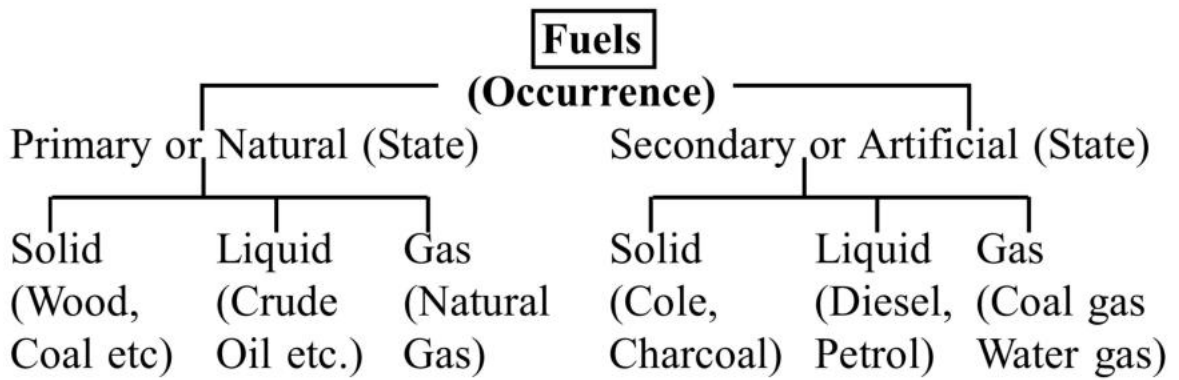
(3) Gases-Natural gas, coal gas, oil gas, producer gas etc.

(C) Classification on the basis of state of occurrence

(1) Primary or natural fuel-Those which occur in nature eg-
coal, wood, natural gas etc

(2) Secondary fuel-Those which are derived from primary fuel.
eg kerosene, coke oven gas.





S.No.	Solid Fuels	Liquid Fuels	Gaseous Fuels
1.	It is cheap and easily available	More costly	Costly, except natural gas
2.	Difficult to store, transport and handle	It is easy to store and transport, usually in closed containers	Stored in long leak proof containers can be distributed through pipe lines, can be liquified and bottled (LPG)
3.	Combustion is slow, but once initiated difficult to stop and control	combustion is fast, but easily controllable	Combustion is fast and efficient
4.	Least risk of fire hazards	Greater risk of fire hazards	Very high risk of fire hazards because they are highly inflammable
5.	Disposal of ash possess a big problem. However ash can be used with cement	Leave no ash contents	Leave no ash contents
6.	Considerable labour is involved in storage and transportation	Lesser handling cost is required	Lesser handling cost is required
7.	Burns in large excess of air	Burns in small excess of air	Burns in small excess of air

Solid Fuel

Solid fuels are easy to transport and conveniently stored without any risk of spontaneous explosion. Production cost of these fuel is low and have moderate ignition temperature. However solid fuel require excess air for complete combustion and possess low calorific value as compared to liquid or gaseous fuels. Example Wood, Coal etc

Liquid Fuels

Liquid fuels are used in industrial as well as in domestic fields. These are used in internal combustion engines and heat generation in oven and furnaces. The main source of liquid fuel is Petroleum. Its calorific value is 40,000 kJ/kg.

Advantages:

- (i) They have higher calorific value per unit mass than solid fuels
- (ii) They burn without forming dust ash clinkers etc.
- (iii) They are easy to transport through pipes.
They require less amount of air for complete combustion.
- (iv) They can be used as internal combustion fuels,
- (v) They require less volume for storage as compared to solid and gaseous fuels.
- (vi) They are clean in use and economic in labour.
- (vii) Combustion can be started or stopped at any time resulting in economic use of fuel.

However, they are highly inflammable and give unpleasant odour during incomplete combustion

The cost of liquid fuel is relatively much higher as compared to solid fuels. There is a greater risk of fire hazards, particularly in case of highly inflammable and volatile liquid fuel.

Gaseous Fuels

Gaseous fuels are being used as industrial as well as domestic fuels due to the following advantages

- (i) Gaseous fuels are clean, smokeless and ashless.
- (ii) These are easy to store and transport through pipe lines from the source of production
- (iii) The rate of combustion can be easily controlled.
- (iv) The important chemical-by-products are obtained from gaseous fuels.

(v) Excess of air needed in the combustion of gases is much less than that of required for liquid or solid fuels.

(vi) The rate of combustion is high and hence a higher temperature can be attained.

(vii) More uniform heating is possible due to equal movement of gases in all the parts of heating vessel.

(viii) Many of the gases have high calorific value.

(ix) Heat from the hot flue gases can be used in pre heating of gaseous fuel and thus, a higher temperature can be achieved with better economy

The main disadvantages of the gaseous fuels are:

(a) Requirement of large storage volume.

(b) Fire hazards due to high inflammability of gases.

GASEOUS FUEL

Gaseous fuels are those which are burnt in gaseous state in air or oxygen to give heat.

Advantages of Gaseous fuel

1. Gaseous fuel are free from mineral impurities.
2. They have consistency in quality.
3. They burn with efficiency i.e. complete combustion is possible.
4. They are clean to use.
5. They burn without any smoke and are ashless.
6. They burn instantaneously and thus rate of burning can be easily controlled.
7. On industrial scale, a gas handling system is the least costly.

Important gaseous fuel:

(A) On the basis of occurrence

- (i) Primary fuels-Natural gas, methane from coal mines.
- (ii) Secondary fuel Gobar gas, coal gas, oil gas, producer gas, water gas etc.

(B) On the basis of calorific value

(i) Rich gas-If calorific value is $> 4000 \text{ Kcal/Nm}^3$. eg- Hydrocarbon gases, coal gas.

(ii) Lean gas-If calorific value is $< 1500 \text{ Kcal/Nm}^3$. eg-Producer gas, blast furnace gas.

