

**Republic of Iraq
Ministry of Higher Education
and Scientific Research
Al-Mustaqbal University College
Chemical Engineering and Petroleum Industries Department**



Subject: Combustion engineering

3rd Class

Lecture six

Solid Fuels

Solid fuel refers to various types of solid material that are used as fuel to produce energy and provide heating usually released through combustion . Solid fuels include wood , charcoal, peat, coal and pellets made from wood and other grains. Solid fuels have been used by humanity for many years to create fire. Coal was the fuel source which enabled the industrial revolution, from firing furnaces, to running steam engines. Wood was also extensively used to run steam locomotives. Both peat and coal are still used in electricity generation today.

The use of some solid fuels (e.g. coal) is restricted or prohibited in some urban areas, due to unsafe levels of toxic emissions. The use of other solid fuels such as wood is increasing as heating technology and the availability of good quality fuel improves. In some areas, smokeless coal is often the only solid fuel used. In Ireland, peat briquettes are used as smokeless fuel. They are also used to start a coal fire.

wood

wood may be burned directly as a fuel or it may be converted into charcoal or producer gas .the principal chemical component of wood are cellulose and lingo cellulose .The major non inflammable component is water which contains 25%-50% .Ash is very small usually less than 0.6% the calorific value of pure of pure cellulose is 16 MJ/Kg .the formation of wood in nature is an endothermic process absorbing approximately 21MJ/Kg this is liberated during combustion

combustion characteristics of wood

- 1-Easily ignited and burnt below 50% moisture.
- 2-Does not burn readily in large pieces of layers of semi fused ash forming on the surface
- 3-produces a long non smoky flame when burned in excess air

peat

Peat is a brown fibrous mass of partially decayed plant material that has accumulated in situ under waterlogged conditions .World resources of peat are estimated at 1200×10^8 Ptons.Moisture contains 25%water for cut peat and average values dry basis 16-20 MJ/Kg.

combustion characteristics of peat

- 1-Low C,V. and high proportion of moisture reduces furnace temperature and efficiency .
- 2-Low bulk density 350 Kg/m³ reduces capacity of furnace and increases storage and transport capacity.
- 3-friable nature causes appreciable losses on handling.

Drying of solid fuels

The drying and sorting apparatus for preparation of solid fuel and other solid materials having substantial surface moisture. Ambient air is preheated by indirect heat exchange or other unfired means sufficiently to provide heat needed by the downstream process. The air is then passed up vertically through a bed containing the solid materials, heating and fluidizing them along with the surface moisture. When in a fluidized state, the smaller/lower density particles rise to the top of the bed. At least a portion of the surface moisture on the particles is evaporated. The quantity and temperature of the air flow is sufficient to retain the evaporated surface moisture in the vapor phase. Feedstock of solid

materials is added to an intermediate location of the bed. The larger more dense fluidized particles are removed from bottom locations of the bed. The smaller less dense fluidized particles are removed from top location of the bed. The temperature and vapor holding capacity of the air leaving the bed is substantially higher than at ambient conditions. The air is again heated by indirect or unfired means downstream of the bed for reducing relative humidity of the air substantially below saturation prior to passage through a bag house for fine particle collection after which the air along with the superheated water vapor is discharged to atmosphere.