



SNS COLLEGE OF TECHNOLOGY

DEPARTMENT OF MECHANICAL ENGINEERING



19MEB203 - THERMAL ENGINEERING

UNIT 1-Fuels & Combustion

Proximate & Ultimate Analysis

Indian coal is of low grade variety and coal washing to obtain low ash metallurgical coal is unavoidable. Over 30% of coal output is consumed by railways, another similar proportion is used by industry including iron and steel works. This leaves barely 40% of coal mined for use of the power supply undertakings.

Analysis of Coal

To ascertain the commercial value of coal certain tests regarding its burning properties are performed before it is commercially marketed. Two commonly used tests are : Proximate analysis and Ultimate analysis of coal. Calorific value of coal is defined as the quantity of heat given out by burning one unit weight of coal in a calorimeter.

Proximate Analysis of Coal

This analysis of coal gives good indication about heating and burning properties of coal. The test gives the composition of coal in respect of moisture, volatile matter, ash and fixed carbon. The moisture test is performed by heating 1 gm of coal sample at 104°C to 110°C for 1 hour in an oven and finding the loss in weight. The volatile matter is determined by heating 1 gm of coal sample in a covered crucible at 950°C for 7 minutes and determining loss in weight, from which the moisture content as found from moisture test is deducted. Ash content is found by completely burning the sample of coal in a muffled furnace at 700°C to 750°C and weighing the residue. The percentage of fixed carbon is determined by difference when moisture, volatile matter and ash have been accounted for. The results of proximate analysis of most coals indicate the following broad ranges of various constituents by weight :

Moisture	3-30%
Volatile matter	3-50%
Ash	2-30%
Fixed Carbon	16-92%

The importance of volatile matter in coal is due to the fact that it largely governs the combustion which in turn governs the design of grate and combustions space used. High volatile matter is desirable in gas making, while low volatile matter for manufacturing of metallurgical coke.

The Ultimate Analysis of Coal

This analysis of coal is more precise way to find the chemical composition of coal with respect to the elements like carbon, hydrogen, oxygen, nitrogen, sulphur and ash. Since the content of carbon and hydrogen that is already combined with oxygen to form carbondioxide and water is of no value for combustion, the chemical analysis of coal alone is not enough to predict the suitability of coal for purpose of heating. However, the chemical composition is very useful in combustion calculations and in finding the composition of flue gases. For most purposes the proximate analysis of coal is quite sufficient.

The broad range in which the constituents of coal vary by weight as determined by ultimate analysis are given below :

Carbon	50-95%
Hydrogen	2.5-5%
Oxygen	2-4%
Sulphur	0.5-7%
Nitrogen	0.5-3%
Ash	2-30%