

The Lecture Contains:

- [Oxygen, Water and Ash Content of Certain Solid Fuels](#)
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- [Various Combustion Modes](#)

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Module 1: Introduction to Combustion

Lecture 4: Characterization of Solid Fuels

Oxygen, Water and Ash Content of Certain Solid Fuels

Moisture in Solid Fuel:

1. Free
2. Bound water

Fuel moisture content will affect rate of combustion and overall efficiency.

Ash: The inorganic materials, which remain as residue even after complete combustion.

Ash content affects the performance of the combustion system.

Ash content causes fouling of the boilers.

| Fuel | Oxygen (Dry, Ash-free) | Moisture (Ash-free) | Ash (Dry) |
|-----------------|------------------------|---------------------|-----------|
| Wood | 40-45% | 15-70% | 0.1-1.0% |
| Peat | 30-35% | 70-90% | 0.1-20% |
| Lignite coal | 20-25% | 20-30% | >5% |
| Bituminous coal | 3-5% | 10-5% | >5% |
| Anthracite coal | 1-2% | 2-4% | >5% |

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Characterization of Solid Fuels:

Proximate Analysis:

- Used to determine the moisture content, volatile matter, fixed carbon and ash content in the solid fuel.
- To determine water content, few grams of fuel is heated around 378 K till it attains constant weight.
- Volatile matter is determined by heating the sample at 1173 K.

Ultimate Analysis:

- Used to determine the major elemental composition of the solid fuel.
- Nitrogen content is determined by chemical method.
- Sulphur content is evaluated by burning the fuel to convert it into SO_4 followed by precipitation method. Calorific value can be determined by bomb calorimeter.

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Various Combustion Modes

- Premixed Flame** : Fuel and oxidizer are mixed before actual combustion.
Examples: Bunsen burner, LPG Stove
- Diffusion Flame** : Fuel and oxidizer are mixed in the region where chemical reaction takes place.
- Laminar and Turbulent Flames** : Based on the flow characteristics; Turbulent flow occurs in practical combustion devices.

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