Proximate Analysis of Biomass

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Abstract: One of the sustainable and renewable energy sources that doesn't produce a lot of greenhouse gas emissions is biomass. Using biomass energy effectively will aid in addressing issues brought on by the use of fossil fuels. The biomass has only issue of low calorific value. For biomass as a fuel the calorific value plays a very crucial role. Five diverse biomass species, such as dried Sugarcane Bagasse, Rice Husk, Cotton Waste, Mango leaves and Coal are represented in this context. Agricultural leftovers, coal, and sugarcane bagasse have all been identified through proximate analysis. In this we calculated (moisture, volatile matter, fixed carbon, and ash contents). Next, a number of empirical equations with linear and nonlinear terms are used. This paper also tells about the thermogravimetric analysis method.

Keywords: Biomass, Agriculture Waste, Biofuel, fossil fuels

1. INTRODUCTION

Biomass is basically a organic matter which is obtained from agricultural waste as well as municipal wastes . It includes all land- and water-based vegetation and is created when green plants use photosynthesis to transform sunlight into plant nutrients, water, and air gases. Moreover, they comprise industrial and municipal organic wastes as well as excrement from all species of life, including people and animals.

Organic material that is renewable and obtained from trees, plants, and crops as well as from municipal, industrial, and animal wastes is known as biomass. Woody and non-woody biomass can be divided into two categories. Forests, plantations, and forestry waste are the sources of woody biomass.

The biomass which can be obtained from the plants on dry-basis can be used to generate power on combustion. The best examples of this category includes agricultural waste, energy crops and wastes from households and businesses.

Most of people aren't aware about the difference in biofuel and biomass. They combine these two terms without understanding their properties. According to US and EU government definitions, it is a type of liquid fuel utilized for transportation. The Joint Research Center of the European Union uses the term "solid biofuel" and defines it as a type of organic matter which is unprocessed and also obtained biologically such as wood chips and wood pellets.

Biomass is made up of materials that have recently or now existed biological creatures. However, by-products and waste from animal farming, food processing and preparation, and home organic waste can all be used in the energy context. It is frequently used to refer to plant material.

A. Proximate Analysis

1) *Moisture Content:* The process starts with talking the biomass samples as dry basis for oven dry method.. The sample with the known weight was initially held in the oven at +105°C until the weight remained constant. The sample from the oven was then weighed (ASTM D-3173). The sample's moisture content was determined using the formula below.

$$C\% = \frac{w2 - w3}{w3 - w1} \times 100 \quad (1)$$

2) *Volatile Matter:* A lid was placed over the dried sample still in the crucible, and the muffle boiler was set to 950 + 20 °C for 7 minutes (ASTM D-3175). After cooling the crucible in the air and desiccators, it was once more weighed. Volatile matter was reported as a percentage of weight loss. Due to its high oxygen content, biomass's

volatile matter has a low LHV. The type of pyrolyzed material, as well as the pyrolysis circumstances, temperature, and heating rate, have a significant impact on the amount of volatile matter present. These factors also affect the amounts of tar that are created.

$$VM\% = \frac{W3 - W4}{W2 - W1} \times 100 \quad (2)$$

3) *Ash Content:* Without a lid, the leftover sample in the crucible was heated for 30 minutes at 700°C + 50°C in a muffle boiler (ASTM D- 3174). After this the crusible is removed and cooled The cooling is done by the air in the dessicators.. Up until a steady weight was achieved, heating, cooling. and weighing were repeated. The byproduct of combustion is ash. Ash made from biomass is naturally acidic. Wood typically has a low ash content, however some biomasses can have up to 20% bulk ash.

$$AC\% = \frac{W5 - W1}{W2 - W1} \times 100 \quad (3)$$

4) *Fixed Carbon:* The mass balance for the sample of biomass was used to determine the fixed carbon content. The quantity of non-volatile carbon left in a coal sample is expressed as fixed carbon. Instead of being measured directly, it is a computed value (ASTM method D3172-07; American Society for Testing and Material) derived from other parameters evaluated in a proximal analysis. When biomass is pyrolyzed, after devolatilization, the solid carbon that is left in the char is known as FC.

$$FC\% = 100 - \%of\,(MC + VM + AC) \quad (4)$$

B. Raw Materials:

Physical Operation: Sorting, Drying, Grinding, Screening and Weighing.

C. Standard Methods of Analysis

a). *Thermogravimetric Analysis*: Klass suggested a different approach employing thermogravimetry in order to reduce the time and costs associated with proximate analysis using ASTM standards. This process deals with the analysis of weight loss of samples with respect to temperature , is covered by ASTM Standard D7582-15 for proximate analysis of Sugarcane Bagasse, Rice Husk, Cotton Waste, Mango leaves and Coal. There are many researchers who have made the proximate analysis by using TGA method.

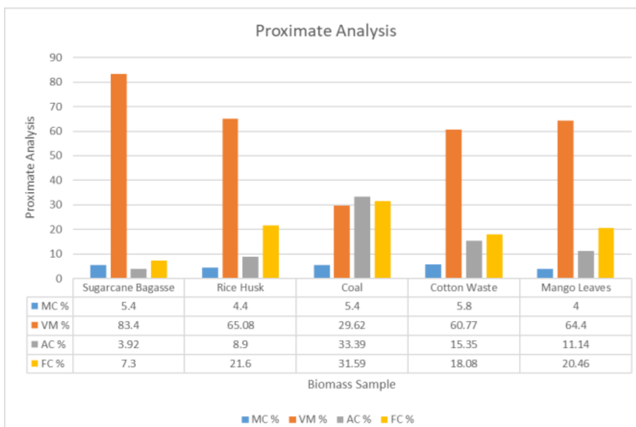
In general this process analyze the samples thermally known as thermogravimetric analysis (TGA), the mass of a sample is tracked over time as the temperature varies. This measurement offers data on both chemical and physical phenomena, including chemisorptions, thermal processes, absorption, adsorption, and desorption.

b). *ASTM Standard Method* : The American Society for Testing and Materials, currently known as ASTM International, is a global organisation that develops and disseminates voluntary consensus technical standards for a range of products, systems, and services. There are 12,575 ASTM voluntary consensus standards now in use across the globe. In labs where the loss of water after drying results in a reduction in mass, these test methodologies address the assessment of the water (moisture) content by mass of soil, rock, and similar materials, with the exception of what is indicated in 1.4, 1.5, and 1.8. According to which is most applicable, the term "material" shall refer to aggregate, rock, or soil for convenience of usage. In some disciplines, such as soil science, the water content must be determined using volume.

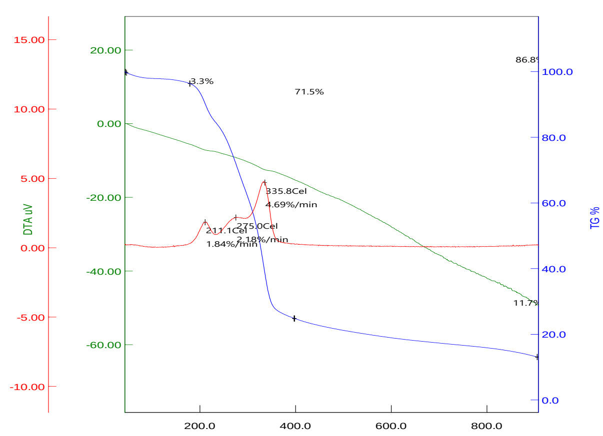
2. RESULTS & DISCUSSIONS

Comparative Study:

Sr. No	Biomass Sample	MC (%)	VM (%)	AC (%)	FC (%)
1.	**Sugarcane bagasse**	**5.4**	**83.40**	**3.90**	**7.30**
2.	**Rice Husk**	**4.4**	**65.08**	**8.9**	**21.62**
3.	**Coal**	**5.4**	**29.62**	**33.39**	**31.59**
4.	**Cotton Waste**	**5.8**	**60.77**	**15.35**	**18.08**
5.	**Mango Leaves**	**4.0**	**64.40**	**11.14**	**20.46**



GRAPH-1 PROXIMATE ANALYSIS:



GRAPH-2 TGA ANALYSIS:

1. Cotton Waste has the highest moisture content while Mango leaves has the lowest moisture content.
2. Sugarcane Bagasse has the highest volatile matter while Coal has the lowest moisture content.
3. Coal has the highest ash content while Sugarcane Bagasse has the lowest ash content.
4. Coal has the highest fixed carbon content while Sugarcane Bagasse has the lowest fixed carbon content.

3. CONCLUSION

Burning is facilitated by higher volatile matter and lower ignition temperatures. A fuel's higher heating value declines as its moisture content rises. A fuel with a high ash concentration has less volatile stuff than another fuel. Since we're talking about alternative fuel, it should be green and have no carbon emissions. Therefore, it is preferred to have as little fixed carbon as feasible. Sugarcane bagasse has been discovered to possess those qualities, making it a potential alternative fuel.

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