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Characterization of Briquette Fuel Prepared from Corn Cub

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ABSTRACT

Briquettes produced from corn cobs are a sustainable and renewable source of fuel that offer many advantages over traditional fossil fuels. Corn cobs are a by-product of the corn harvesting process and are often discarded as waste. The present work insists on effectively converting corn cobs to briquettes and comparing its properties with rice husk,coconut shell and charcoal briquettes. The process of producing briquettes from corn cobs involves grinding the cobs into a fine powder and then compressing the powder into dense, compact briquettes using a binder such as starch. The resulting briquettes are a highly efficient and clean-burning fuel that can be used in a variety of applications, including heating and cooking.The calorific value was found to be 16691 KJ/kg, 14446 KJ/kg for prepared corn cob and rice husk and 18405 KJ/kg and 11.359KJ/kg for coconut shell and charcoal briquette respectively. The burning time value were found to be 130 min, 45 min for corn cob, rice husk and 185 min and 209 min for coconut shell and charcoal briquette respectively. Among all the briquettes, it is suggested that corn cob briquette to be used.Additionally, corn cobs as a fuel source can provide economic benefits for farmers and communities, as it creates a new market for an otherwise unused waste product.

Keywords: Corn Cobs, Coconut Shell, Briquettes, Calorific Value.

I. INTRODUCTION

Energy is very essential to human livelihood and makes significant contributions to economic, social, and environmental features of human development. Non renewable energy sources such as fossil fuel, coal, and kerosene cannot be renewed and resulted in emissions of greenhouse gases (GHG), CO_2, SO_2, NO_2, etc. Renewable energy sources are so alternate and sustainable that are considered to be a preferable and better option than non-renewable energy sources. Among the renewable energy sources, biomass fuels such as fuelwood, wood charcoal, agricultural residues, and animal dung are commonly utilized for household cooking purposes. However, the extensive and improper utilization of biomass fuel for household

cooking resulted in deforestation, indoor air pollution, acute lower respiratory infections in women and children, and emission of greenhouse gases, which can be considered as a great challenge to the world, particularly in developing countries. Biomass fuels consist of firewood, forest waste, animal dung, vegetable matter, and other agricultural residues that are highly utilized by many rural and urban households for domestic use [1].

Briquetting is a process of compressing loose biomass residues into a high-densified solid block that can be used as a fuel. Briquette from agricultural waste (biomass) contributes to the energy mix [2]. The advantage of being able to transform biomass, which in its raw form has low density, low heating value, and highmoisture content, into a highly efficient fuel briquette. The briquette fuels are advantageous to handle, have ease of transport, and improve heating value than other types of biomass fuel. Briquetting improves the ultimate and proximate properties of biomass materials [12].

II. LITERATURE REVIEW

The production of briquettes from corn cobs has gained increasing attention in recent years as a sustainable and renewable fuel source [3]. Many studies have focused on the potential of corn cob briquettes as an alternative to traditional fossil fuels, as well as the economic and environmental benefits of their production and use [6]. Mohammed Aliyu *et. al.* (2020) investigated the effect of different binders on the properties of corn cob briquettes. They found that using starch as a binder resulted in higher heating values and lower ash content compared to other binders such as sawdust and molasses[9]. Patrick Mulindwa*et. al.* (2021) evaluated the performance of corn cob briquettes as a fuel source for residential heating. They found that the briquettes had similar heating properties and emissions levels compared to traditional wood fuels, indicating that corn cob briquettes couldbe a viable alternative[7]. In terms of economic feasibility. A study by Arry Y *et. al.* (2015) assessed the profitability of producing briquettes from corn cobs in Nigeria. They found that the production ofcorn cob briquettes had the potential to create new job opportunities and generate income forfarmers, while also providing a sustainable fuel source for local communities [10].

Overall, the literature suggests that corn cob briquettes have the potential to be a sustainable, eco-friendly, and economically feasible alternative to traditional fossil fuels. However, further research is needed to optimize the production process and evaluate the long-term environmental and economic impacts of their use.

III. MATERIALS AND METHODS

Corn cub, coconut shell, rice husk and charcoal are used to prepare the briquettes.

Sample Collection: Samples of corn cob were collected from farmers from Hassan and Chikkaballapura district.

Preparation of the Sample: The collected samples were dried for 4 days and then the samples were carbonized.Carbonization is the process of converting organic matter, such as wood, agricultural waste, or other biomass, into a carbon-rich solid fuel through heating in the absence of oxygen. The carbonization process in briquette production involves heating the raw material, typically sawdust or agricultural waste. During this process, the volatile compounds in the raw material are driven off, leaving behind a carbon-rich residue, or char. The resulting char is then crushed and mixed with a binder, such as starch, and formed into briquettes under high pressure. The briquettes can then be used as a fuel source for heating or cooking, and because they are made from waste materials, theyare a sustainable environmentally-friendly alternative to traditional fossil fuels [4].

Preparation of Briquettes: A cylindrical mould of in length and 7.5 cm diameter was constructed. A metal bar of 7.5 cm diameter was used in pushing the formed briquettes out of the moulding cylinder. 25g of starch and 100g of corn cub were weighed out using a triple weighing machine into a 100ml plastic basin, they were thoroughly mixed with the corn starch (the binder), the blend was then loaded into the cylinder

mould and compressed The densified briquette was pushed out of the mould with the aid of a metal bar. The same procedure was repeated and the produced briquettes were air dried for one week duration. The photograph of dried corn cub briquettes are shown in figure 1.

Calorific Value: The calorific or heating value is an important indicator of the quality of the pressed fuel briquettes. It measures the energy content of the briquettes. It is defined as the amount of heat evolved when a pressed fuel briquettes.Density: The density of the briquettes was determined using a weighing balance by taking the weight of all the briquettes samples and dimension measurement using a Vernier calliper. The photograph of measuring device for calorific value and density is shown in figure 2 and 3 respectively.

Ignition Time: Ignition time was determined (as reported by Oladeji*et.al.*) The samples were graduated in centimetres, ignited at the base and allowed to burn until it extinguished itself. The rate at which flame propagated was calculated by dividing the distance burnt by the time taken in seconds. Ignition time = *distanceburnt/totaltimetaken*

Figure 1: Dried Corn cub Briquettes ready for use.

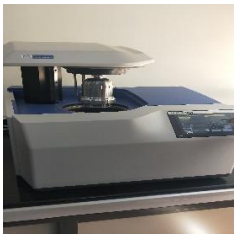

Figure 2: Oxygen bomb calorimeter C3000 isoperibol

Courtesy: Bioenergy research and quality assurance laboratory

IV. RESULT AND DISCUSSION

The briquettes are prepared using corn cub, coconut shell, rice husk and charcoal with the same mould and same size. To determine the characteristics of the briquette produced, tests have been done in "Bio-Energy Research and Quality Assurance Laboratory", Gandhi Krishi Vignan Kendra, Bangalore (GKVK).

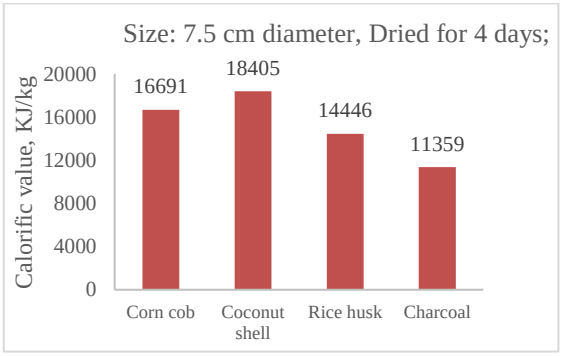

Figure 3 : Calorific value of different briquettes

The figure 3 shows the calorific value of briquettes made of corn cob, coconut coir, rice husk and charcoal. As mentioned, the calorific value was found to be 16691 KJ/kg,14446 KJ/kg for prepared corn cob and rice husk and 18405 KJ/kg and 11.359KJ/kg for coconut shell and charcoal briquette respectively[2,5]. The calorific value of fuel indicates the amount of heat content in the fuel. Higher calorific value is found to be 18445KJ/kg for coconut shell briquette,however briquettes made of corn cob is suggested, hence there is less availability of coconut shell for making briquette.

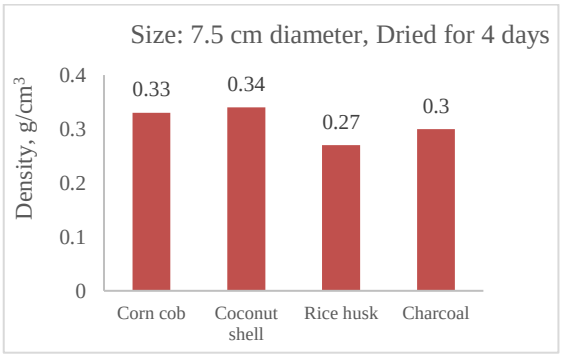

Figure 4: Density of different briquettes

The figure 4 shows the density of briquettes made of corn cob, coconut shell, rice husk and charcoal. As

mentioned the density values were found to be 0.33 and 0.27 g/cm³for prepared corn cob and rice husk and 0.34 and 0.30 g/cm³ for coconut shell and charcoal briquettes respectively. The density of corn cob is less compare to coconut shell which is appreciable.

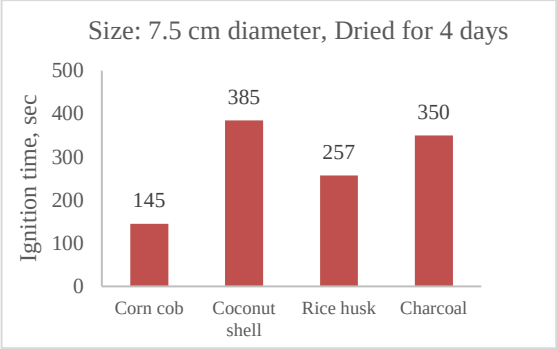

Figure 5 : Ignition time of different briquettes

The figure 5 shows the ignition time of briquettes. As mentioned the ignition time were found to be 145 sec, 257 sec for prepared corn cob and rice husk and 385 sec,350 sec for coconut shell and charcoal briquette respectively[3,5]. The corn cob is having less ignition time as compared to other fuels, hence briquettes made of corn cob is suggested for the usage.

V. CONCLUSION

The briquettes are prepared from corn cob and rice husk as per the requirement. The process of making the briquettes is similar to both of them. The calorific value was found to be 16691 KJ/kg,14446 KJ/kg for prepared corn cob and rice husk and 18405 KJ/kg and 11.359KJ/kg for coconut shell and charcoal briquette respectively. Density values were found to be0.33 and 0.27 g/cm³ for prepared corn cob andrice husk and 0.34 and 0.30 g/cm³ for coconut shell and charcoal briquettes respectively. Ignition time were found to be 145 sec, 257 sec for prepared corn cob and rice husk and 385 sec,350 sec for coconut shell and charcoal briquette respectively. The burning time value were found to be 130 min, 45 min for prepare corn cob and rice husk and 185 min and 209 min for coconut shell and charcoal briquette respectively. Among all the briquettes, it is suggested that corn cob briquette to be used.

VI. REFERENCES

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