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EVALUATION OF PROPERTIES OF BAGASSE AND ARECA SHEATH BRIQUETTES

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Keywords

Briquette, Agricultural waste, Bagasse.

Abstract

Nowadays as there is a large shortage of energy source like wood, coal, natural gases, kerosene, diesel, petrol etc. And day by day the prices of these fuels are going hike, leading to demand of energy source. Hence, production of alternative fuel becomes necessary and which in turn lead to the production of biomass fuel briquettes. Biomass Briquettes are a fast-growing product in India since it is easy to use, ecofriendly, economical and can be produced in bulk quantity to fulfil the alternative source of fuel. Biomass briquettes are made utilizing agricultural wastes such as coconut shell, areca sheath, sugarcane straw, coffee husk, rice husk, groundnut shells etc., forestry wastes such as leaves, dry woods etc. and industrial wastes such as saw dust, molasses, charcoal etc. Bio mass Briquettes have wide application in domestic and industrial purposes.

Therefore, in present work Fuel briquettes were produced using Bagasse and areca sheets mixing with different binders. Such that the low-density waste is converted into high density biomass fuels to obtain higher calorific value fuel briquette.

1. INTRODUCTION

Briquettes are a type of compressed fuel made from various organic materials, typically including biomass residues such as agricultural waste, forestry by products, or other renewable resources. They are commonly used as a substitute for traditional fuels like coal, wood, or charcoal in industrial and domestic applications.

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The process of creating briquettes involves compacting these organic materials under high pressure, often with the addition of binders or additives to help maintain their shape and improve their burning properties. The resulting briquettes are dense, solid blocks or cylindrical shapes with a uniform composition.

Briquettes offer several advantages over traditional fuels. Firstly, they are an environmentally friendly option, as they are derived from renewable resources and reduce the dependence on non-renewable fossil fuels. They contribute to waste reduction by utilizing agricultural residues and other biomass waste materials that would otherwise be discarded or left to decompose, releasing greenhouse gases. Furthermore, briquettes have a higher energy density compared to their source materials, making them more efficient and cost-effective. They have a consistent shape and size, allowing for easy handling, storage, and transportation. Additionally, briquettes produce less smoke, ash, and harmful emissions when burned, contributing to improved air quality and reduced environmental impact.

The study titled "Fabrication and Characterization of Rice Husk and Coconut Shell Charcoal-Based Bio-briquettes as Alternative Energy Source" was conducted by researchers from Padjadjaran University, Indonesia. It aimed to investigate the fabrication process and characterize the properties of bio-briquettes made from rice husk and coconut shell charcoal. The research involved multidisciplinary approaches, combining materials science and energy studies. Experimental procedures included biomass collection, carbonization, grinding, binder mixing, and briquetting. Characterization techniques encompassed proximate analysis, calorific value measurement, density and compressive strength analysis, combustion analysis, and ash analysis. The study emphasized utilizing locally available agricultural waste for sustainable energy production [2].

The study aimed to determine the optimum blend ratio for solid fuel briquettes produced by Pongamia shell (PS) and Tamarind shell (TS) with Pongamia cake (PC) as an additive. Cylindrical briquettes were produced at pressures of 100, 150, and 200 MPa and evaluated for properties such as compressed density, relaxed density, relaxation ratio, compressive strength, and shattering index. Results showed that the compressed density increased with an increase in pressure and binder percentage. The highest relaxed density was observed for S1, while the highest relaxation ratio was observed for S3 at 200 MPa. The highest shattering index was obtained for S1, 200 MPa, while the highest compressive strength was observed for S1, 200 MPa. The study concluded that the Pongamia-Tamarind briquettes with a blend ratio of S1 at 200 MPa have better characteristics [1].

M Yugandhar et al.[3] studied the properties of bio briquettes produced from palm powder and coconut coir mixture with maida and boiled starch as the binding materials. Results have shown that 50:50 ratio for palm powder and coconut coir with binder have shown better results.

Deepak K B et. al.[4] conducted experiments on biomass briquettes produced from eca sheet and leaves with paper, sawdust and coconut coir as binders obtained that the coconut leaves briquette

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with saw dust as binder shown better calorific value, but the briquettes made using areca sheet have shown considerable decrease in ash and moisture content.

Daham Shyamalee et al[5] studied the effects of different types of binders on binding of the briquettes. They used saw dust as the base material and dried cow dung, newspaper waste and wheat flour as the binding agents. Briquettes with 30% paper as binder exhibited high compressive strength while the briquette with wheat flour binder exhibited higher calorific value.

2. MATERIALS

- BAGASSE

Bagasse is the fibrous remains of sugarcane after the juice has been extracted from it. It is a byproduct of the sugar refining process and is primarily composed of cellulose, hemicellulose, and lignin. Bagasse is typically obtained from sugarcane plants, but it can also be derived from other sources, such as cornstalks or wheat straw.

- ARECA SHEATH

Areca sheath, often referred to as areca palm sheath or simply palm sheath, is a natural material derived from the dried leaf sheaths of the areca palm tree. These sheaths are the protective coverings that encase the emerging leaves or fronds of the palm tree.

- CORN STARCH

Corn starch, also known as maize starch, is a fine, powdery substance that is derived from the endosperm of corn kernels. It is a versatile food ingredient and industrial product with a wide range of application.

Composition chosen is as mentioned in table 1.

Table 1: Composition

SAMPLE NAME	BAGASSE (%)	ARECA SHEATH (%)	CORN STARCH(%)
A	40	50	10
B	50	40	10
C	45	45	10

3. METHODOLOGY

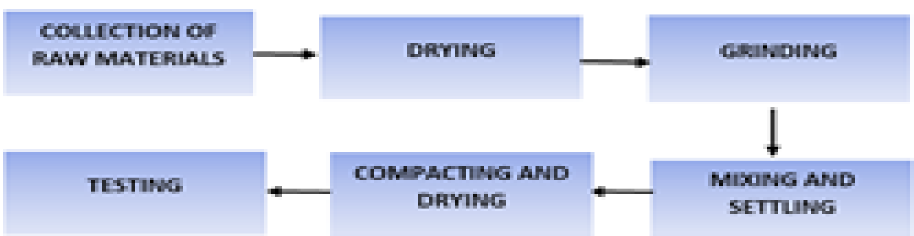

Figure 1: Methodology

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- As detailed in figure 1, initially the raw materials bagasse and areca sheath will be collected and dried.
- After drying the raw materials will be grinded and brought into powder form.
- Then the powder is mixed and allowed to settle along with the binder.
- Then the briquette is compacted and dried again.
- Finally the prepared briquettes are tested to evaluate the properties like Calorific value, Moisture content and ash content.

4. RESULTS & DISCUSSIONS

Table 2: Results obtained

SAMPLE NAME	ASH CONTENT (%)	MOISTURE CONTENT (%)	CALORIFIC VALUE (KJ/kg)
A	5.5	9.9	17434.728
B	4.5	8	17585.352
C	5.45	10.3	17510.104

From table 2, it can be noted that out of the three samples taken, sample B with 50% bagasse and 40% areca sheath has shown better characteristics with a calorific value of 17585.35kJ/kg, as content of 4.5% and moisture content of 8%. Other samples with more proportion of areca sheath have shown slightly poor calorific value and high ash and moisture contents.

5. CONCLUSION

- The ash content testing revealed that Sample A had an ash content of 5.5%, Sample B had an ash content of 4.5%, and Sample C had an ash content of 5.45%. The lower ash content indicates a higher purity of the briquettes
- Moisture content testing showed that Sample A had a moisture content of 9.9%, Sample B had a moisture content of 8%, and Sample C had a moisture content of 10.3%. Lower moisture content is desirable as it increases the calorific value of the briquettes.
- The calorific values of Sample A, Sample B, and Sample C were found to be respectively of 17434.728 kJ/kg, Sample B measuring 17585.352 kJ/kg, and Sample C having a calorific value of 17510.04 kJ/kg.

6. AUTHOR(S) CONTRIBUTION

The writers affirm that they have no connections to, or engagement with, any group or body that provides financial or non-financial assistance for the topics or resources covered in this manuscript.

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7. CONFLICTS OF INTEREST

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

8. PLAGIARISM POLICY

All authors declare that any kind of violation of plagiarism, copyright and ethical matters will take care by all authors. Journal and editors are not liable for aforesaid matters.

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