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Design & Fabrication Of Burning Block Making Machine From Agriculture Waste

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Abstract

Agricultural waste, including rice husk, sawdust, sugarcane bagasse, and other crop residues, is generated in large quantities worldwide. Improper disposal of this waste through open-field burning contributes to environmental pollution and resource wastage. This thesis focuses on the design and fabrication of a burning block making machine that converts agricultural waste into compact, eco- friendly fuel blocks. The machine operates on a mechanical compression principle, where agricultural residues are subjected to high pressure to form dense blocks with improved combustion efficiency. The primary objective is to develop a cost-effective and efficient system capable of transforming various types of agricultural waste into sustainable energy sources for domestic and small-scale industrial applications. This approach not only reduces agricultural waste but also provides an alternative to conventional fuels, supporting the global shift toward renewable energy.

The design and fabrication process involves the selection of durable materials, the development of a sturdy frame, and the assembly of mechanical components to ensure reliable operation. The performance of the burning block machine was evaluated through tests on block density, durability, and combustion efficiency. Results indicate that the machine produces consistent and robust burning blocks with a significant calorific value, making them suitable for cooking, heating, and other energy needs. This project contributes to sustainable waste management practices by offering a practical solution to convert agricultural by-products into value-added fuel. With its simple design and low operational costs, the machine is ideal for use in rural areas, promoting energy self- sufficiency and reducing dependence on fossil fuels.

Introduction

Agricultural waste is generated in significant quantities worldwide due to extensive agricultural activities. This waste includes by-products such as rice husk, sawdust, sugarcane bagasse, wheat straw, and other organic residues. Improper disposal of these materials through open-field burning or dumping leads to severe environmental issues, including air pollution, soil degradation, and greenhouse gas emissions. At the same time, there is an increasing demand for alternative energy sources to address the depletion of fossil fuels and the rising cost of conventional energy. One effective solution to these problems is the conversion of agricultural waste into usable energy forms, such as burning blocks or biomass briquettes. These compressed blocks serve as a renewable energy source for domestic and small- scale industrial applications.

The design and fabrication of a burning block making machine provide a sustainable and costeffective method to utilize agricultural waste. This machine transforms loose organic residues into dense, burnable blocks by applying mechanical compression. Such machines not only reduce waste but also offer an eco-friendly fuel alternative. This project aims to address the dual challenges of agricultural waste management and energy scarcity by developing a reliable and efficient burning block machine.

The improper disposal of agricultural waste leads to environmental pollution and the underutilization of valuable biomass resources. Traditional methods of agricultural waste disposal, such as open burning, contribute to air pollution and the loss of potential energy. Meanwhile, rural and remote areas often face energy shortages due to the limited availability of conventional fuels. There is a clear need for a practical and sustainable solution to convert agricultural waste into usable energy forms. This project seeks to design and fabricate a burning block making machine capable of compressing agricultural waste into high-density fuel blocks, providing a cleaner and more efficient alternative to conventional waste disposal and energy generation methods.

Literature Review

The development and utilization of briquetting machines for agricultural waste have been extensively studied over the past decade. Researchers have explored the design, performance, and optimization of these machines to improve efficiency and sustainability.

Karthikeyan and Kumar [1] discussed the design and development of a briquetting machine for agricultural waste. Their study highlighted the need for alternative fuel sources and demonstrated the potential of briquettes as a renewable energy source. The research focused on optimizing the compression process to enhance briquette density and combustion properties.

Patel and Sharma [2] emphasized the fabrication of biomass briquetting machines as a sustainable solution for waste management. Their study examined the mechanical properties of briquettes produced from agricultural residues and concluded that the process could significantly reduce waste while providing a renewable energy alternative.

Gupta and Singh [3] analyzed the parameters affecting the briquetting process and optimized the process for agricultural residues. They identified key factors such as moisture content, particle size, and compression pressure, which play a crucial role in determining the quality and efficiency of briquettes.

Mishra and Verma [4] conducted a performance evaluation of biomass briquetting machines, focusing on energy consumption and output efficiency. Their findings indicated that optimizing the design of mechanical components could significantly enhance the machine's performance, leading to higher production rates and better-quality briquettes.

Singh and Kumar [5] highlighted the importance of agricultural waste management through the conversion of biomass into briquettes. Their research outlined the environmental benefits of using briquettes, including the reduction of greenhouse gas emissions and minimizing the reliance on fossil fuels.

The Bureau of Indian Standards (IS: 1350 [6]) provided essential guidelines for the analysis of coal and coke, which have been adapted in various studies to assess the quality and calorific value of biomass briquettes.

Rajput [7] provided fundamental insights into the mechanical design principles necessary for the construction of briquetting machines. This textbook served as a foundational reference for understanding the mechanical components and their interactions within the machine.

Proposed System

Fig 1 Conveyor belt

The conveyor belt facilitates the movement of agricultural waste from the hopper to the compression chamber. It is made of **nylon material** for its durability, flexibility, and resistance to wear and tear. The belt size is **7 inches wide and 2 meters long**, allowing for efficient transportation of materials during the briquette-making process

Fig 2 Metal Shaft

Primary Shaft: Made of **nylon**, with dimensions of **48 mm height x 200 mm width**, it is responsible for rotating and compressing the agricultural waste.

Secondary Shaft: Metal shaft with dimensions **10 mm x 11 mm** and a **length of 275 mm**, designed to transfer mechanical power from the motor to the compression unit

Fig 3 Bearing

The machine uses **Pebdots type PT04** bearings to reduce friction and support the rotation of the shafts. These bearings are chosen for their smooth motion and ability to handle heavy loads. The bearing bush has an **inner diameter of 10 mm** and an **outer diameter of 20 mm**.

Fig 4 Hopper

The hopper serves as the input unit where agricultural waste is loaded. It is fabricated from **HR (Hard Core)** material for durability. The dimensions are **6 inches width, 8 inches**

length, and 10 inches height, allowing for a continuous and controlled feed of material into the compression chamber.

Fig 5 Crusher Motor

A **crusher motor** powers the compression and shaping of the agricultural waste into briquettes. The motor specifications are:
Power: 800 W
Voltage: 50 V
Speed: 16000 RPM
Size: 82 mm This high-speed motor provides the necessary torque to compress the raw material effectively.

Fig 6 wiper gear motor

A **wiper gear motor** is incorporated for auxiliary movements such as adjusting the material flow or regulating the compression process. This component enhances operational flexibility and automation.

Scope Of Study

Key Areas of Study:

1. **Machine Design & Development**
   Selection of **materials** for durability and efficiency.
   Mechanical design and assembly of key components (frame, hopper, motor, conveyor belt, chain drive, etc.).
   Optimization for low-cost manufacturing and maintenance.
2. **Agricultural Waste Utilization**
   Processing various organic residues like rice husk, sawdust, and sugarcane bagasse.
   Improving the density, durability, and combustion efficiency of the produced burning blocks.
3. **Performance Evaluation**
   Assessing briquette quality, including size, density, and burning time.
   Measuring power consumption and mechanical efficiency.
   Analyzing energy output and cost-effectiveness.
4. **Target Applications**
   Rural and small-scale industrial use where conventional fuels are costly or unavailable.
   Alternative waste disposal solutions to reduce environmental pollution.
5. **Limitations Considerations**
   The study is focused on small-scale applications (not for large industrial production).
   Manual operation with potential for future automation.

Conclusion

Our modified design deals with the solution of space and power consumption problem in the burning block manufacturing industries. After applying our proposed modified design of burning block making machine, we can *save the space* (which is a major problem of any manufacturing industry) & also *saves some amount power consumption* due to the use of only

one AC synchronous motor.
Modified design has the less no of components only one chain drive where conventional machine
uses three chain drives & all components are establish properly and in a sequential way so that we can get desired output regularly at a very cheaper and economical way.
Therefore we can say that due to less complexity & less maintenance in our modified design, modified machine is more effective and efficient than the conventional machine.
The modified burning block manufacturing machine has a lot of applications, It can use for making blocks from different wastes etc. According to the waste application, with making slight changes in our machine component (according to the design formulas) we can make blocks of any size.
In our modified design we mainly concentrate on the Space & Power consumption problem & we have succeeded to get our target. We have saved the space and also the power consumption but apart from the *saving of space and power consumption*, the *less complexity* and the *less maintenance* for the burning block manufacturing machine are like an icing on a cake.

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