

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 5, Issue 1, Januray 2016

Biomass Briquette System: Pollution Free Thermal Energy Resources

P.V Jadhav¹, Shashikant Dashore², Kedarnath Chaudhary³

Assoc. Professor, Department of Production Engineering, Bharati Vidyapeeth College of Engineering Pune, India¹

P.G Students, Department of mechanical Engineering, Bharati Vidyapeeth College of Engineering Pune, India^{2,3}

ABSTRACT: Biomass Briquette, a dense form of bio-fuel has gained a large popularity in poor developing countries as an alternate cooking fuel. Within a short period it has replaced traditional fuels for its availability and high acceptance in user level. In a country like India, where 67% people rely on traditional bio- fuel for energy, briquette has received an immense response. Although large volume of work has been done on developing its production process, little data is available on its physical and fuel properties and reasons behind its high acceptance. The paper consists summery of the findings gained from a research conducted on briquette in India, its physical and fuel properties and field survey on local acceptance. The idea is widely in innovation globally. One can browse “n” number of development that is being taking place regarding biomass briquettes. Our search for such development led us to conclusion that all the biomass around the world, surely there is a way of recycling, providing clean environment. Moreover, as we have seen very few have utilized bio waste, providing clean environment. We were encouraged to find the reason behind it. We decided to look into the possibilities of recycling through such wastage.

KEYWORDS: Briquette, Fuel Properties, Physical Properties.

I. INTRODUCTION

A briquette (or briquette) is a block of flammable matter used as fuel to start and maintain a fire. Common types of briquettes are charcoal briquettes and biomass briquettes. In Bangladesh biomass briquette has gained a huge popularity and covers a large portion of cooking fuel needs of rural people. Here mainly rice husk is used for producing briquettes by the process of extrusion. Rice being main food of the country, rice husk is easily available at cheap rate for briquette production which contributed significantly towards its rapid popularity.

Biomass plays a vital role in meeting local energy demand. Traditional bio-fuel is hard to collect, transport, use and store. Biomass briquette is an efficient solution to all these problems. Besides that it significantly contributes to economy by generating employment and income. It also contributes to the environment by reducing CO₂ emission and deforestation.

Briquettes can be produced with a density of 1.2 g/cm³ from loose biomass of bulk density 0.1 to 0.2 g/cm³ These can be burnt clean and therefore are eco-friendly arid also those advantages that are associated with the use of biomass are present in the briquettes [2].

Briquetting technology is yet to get a strong foothold in many developing countries because of the technical constraints involved and the lack of knowledge to adapt the technology to suit local conditions. Overcoming the many operational problems associated with this technology and ensuring the quality of the raw material used are crucial factors in determining its commercial success. In addition to this commercial aspect, the importance of this technology lies in conserving wood; a commodity extensively used in developing countries and leading to the widespread destruction of forests. The ash content of different types of biomass is an indicator of slagging behavior of the biomass [1]. Generally, the greater the ash content the greater the slagging behavior. But this does not mean that biomass with lower ash content will not show any slagging behavior. The temperature of operation, the mineral compositions of ash and their percentage combined determine the slagging behavior. If conditions are favorable, then the degree of slagging will be greater. Minerals like SiO₂ Na₂O and K₂O are more troublesome. Many authors have tried to determine the slagging

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 5, Issue 1, Januray 2016

temperature of ash but they have not been successful because of the complexity involved. Usually slagging takes place with biomass fuels containing more than 4%.



Figure 1: Different Types of Briquettes [7]

➤ **ADVANTAGES OF USING BRIQUETTES COMPARED TO OTHER SOLID FUELS**

- Biomass briquettes have a higher practical thermal value.
- Briquettes have much lower ash content (2-10% as compared to 20-40% in coal).
- Combustion is more uniform compared to coal
- Briquettes are usually produced near the consumption centers and supplies do not depend on erratic transport from long distances.
- Briquettes give much higher boiler efficiency because of low moisture and higher density.
- Briquettes are cheaper than coal.
- Oil, coal or lignite, once used, cannot be replaced.
- There is no sulfur in briquettes, thus does not pollutes the environment.

➤ **ADVANTAGES OF SETTING UP BRIQUETTES PLANT PROJECT**

- High sulfur content of oil and coal, when burnt, pollutes the environment.
- There is no fly ash when burning briquettes.
- Briquettes have consistent quality, have high burning efficiency, and are ideally sized for complete combustion.
- Combustion is more uniform compared to coal and boiler response to changes in steam requirement is faster due to higher quantity of volatile matter in briquettes.
- Compared to fire wood or loose biomass, briquettes give much higher boiler efficiency because of low moisture and higher density.
- Briquettes, are easy to store, pack and hygienic to handle.

➤ **BRIQUETTES CAN REPLACE FOLLOWING CONVENTIONAL FUELS**

- Diesel, Kerosene, Furnace oil, Lignite, Coal, Firewood

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 5, Issue 1, Januray 2016

➤ KEY FEATURES OF THE BRIQUETTES PLANT PROJECT

- Ready market
- High profitability
- Excellent growth potentiality
- Wide variety and easy availability of agro-waste from various crops.

II. DESIGN PROSPECT AND METHODS

Sometimes an image may contain text embedded on to it. Detecting and recognizing these characters can be very important, and removing these is important in the context of removing indirect advertisements, and for aesthetic reasons.

Design consists of application of scientific, principles, technical information and imagination for development of new or improvised machine or mechanism to perform a specific with maximum economy & efficiency.

Hence a careful design approach has to be adopted. The total design work has been split up into two parts;

System design

Mechanical Design

System design mainly concerns the various physical constraints and ergonomics, space requirements, arrangement of various components on main frame at system, man + machine interaction, No. of controls, position of controls, working environment of machine, chances of failure, safety, measures to be provided, servicing aids, ease of maintenance, scope of Improvement, weight of machine from ground level, total weight of machine and a lot more.

In mechanical design the components are listed down and stored on the basis of their procurement, design in two categories namely,

1. Designed Parts
2. Parts to be purchased

For designed parts detached design is done & distinctions thus obtained are compared to next highest dimensions which are readily available in market. This amplifies the assembly as well as postproduction servicing work. The various tolerances on the works are specified. The process charts are prepared and passed on to the manufacturing stage.

The parts which are to be purchased directly are selected from various catalogues & specified so that anybody can purchase the same from the retails shop with given specifications.

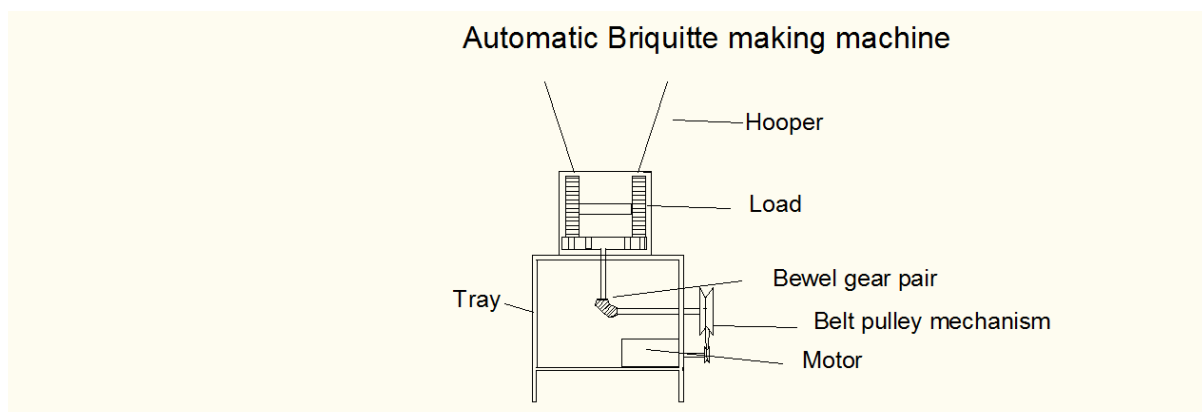


FIG 2: Schematic Diagram of Biomass Briquette Machine

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 5, Issue 1, Januray 2016

General dimension of briquettes vary slightly depending on the size of extrusion barrel and center rod. Generally external diameter varies from 58 - 60 mm; the internal diameter in generalize 20 - 22 mm and the average is 1 meter.

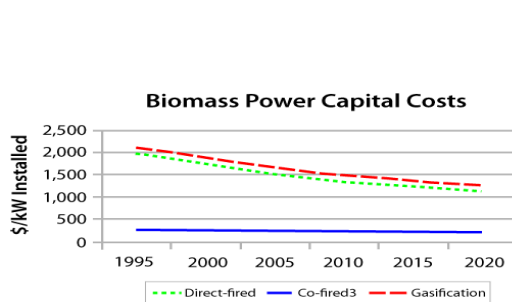


FIG 3: Biomass Power Capital Cost

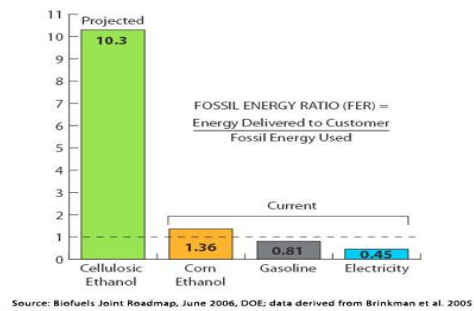


FIG 4: Bio fuel Usage

Briquette is a moderate quality fuel for cooking and other purpose. It can be ignited easily and burns with a long and steady flame, low smoke and almost no odor. It also has a high burning efficiency.

All experiments were done in atmospheric pressure and room temperature and humidity. The sample grade size was 60 (250 microns) [8].

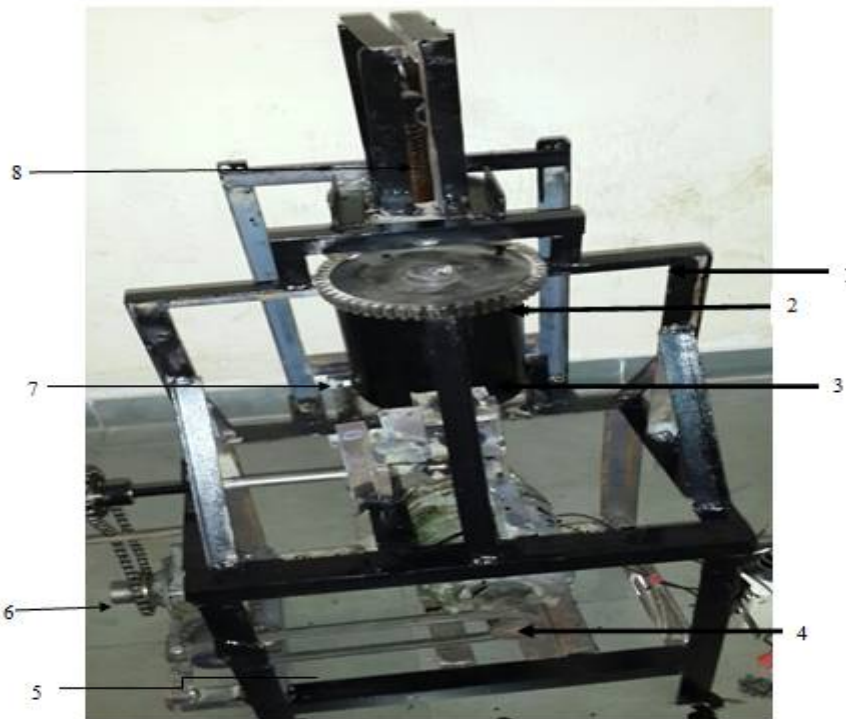


Figure 5. Bio Mass Briquette Making Machine

- | | |
|-------------------|--------------------|
| 1. Structure | 5. Belt drive |
| 2. Spur gear pair | 6. Chain drive |
| 3. Hopper | 7. Bevel gear pair |
| 4. Motor | 8. Screw press |

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 5, Issue 1, Januray 2016



FIG 6: Biomass Briquette Machine



FIG 7: Top View of Biomass Briquette Machine

III. MANUFACTURING PROCESS

This project is called biomass briquetting project and is simply a process of converting agro waste and forestry waste into biomass briquettes/bio coal. The biomass briquetting is the best renewable source of energy for healthy environment and economy. It's a complete eco-friendly project.

All materials containing lignite and cellulose are suitable for densification. Successful test have been carried out with variety of materials from saw dust, sander dust, secondary pieces of wood, tree barks and twigs, pine needles, wild grass, coffee husk, sunflower waste, rice husks, groundnut shell, almonds and cotton stalks, sugarcane bagasse, leaves and trash. The above sectors can be briquetted individually or in combination depending on their availability and blending properties. Main concept of this project is to produce the material as abio-coal, which is made from the wastages. We cannot destroy the wastage totally. But we can use it with the help of briquetting plant and produce the briquettes, which ultimately produce the energy. The use of these cheap fertilizers gives low yield as compared to the modern fertilizer available however the major quantity of press mud goes just as waste. We can use such above wastage as an input to the briquetting plant machinery to produce white coal and the non-conventional source of energy. Hence below there is glance at operation process chart which gives brief idea about the process

Firstly the agro waste is separated into several forms such as wet, dry & mixed. They are segregated in various containers. After putting into containers the waste are mixed with water in very small quantity and bunch of waste is mixed in container itself after mixing is done the process further moved piston and waste is poured into that piston. Piston is cleaned and water is poured in small quantity into piston as well as wet waste now through electrical supply motor is turned ON and supply of energy is been transferred to belt drive which is used for transmission of energy where electrical energy is converted into mechanical energy. Conversion of energy is taken place where with the help of belt drive chain drive the bevel gears are attached together and the piston is been moved. Reciprocating motion of piston is been observed and all the waste is been crushed on basis of strokes given by piston giving maximum strokes thrice all the wastes present in the piston is been crushed and no water is added into that piston hence the briquettes are obtained through Die. The die gives proper shape which is attached in the bottom of the piston and gives biomass briquette. These briquettes are dried in open air and can be used in several industries as fossil fuels.

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 5, Issue 1, Januray 2016

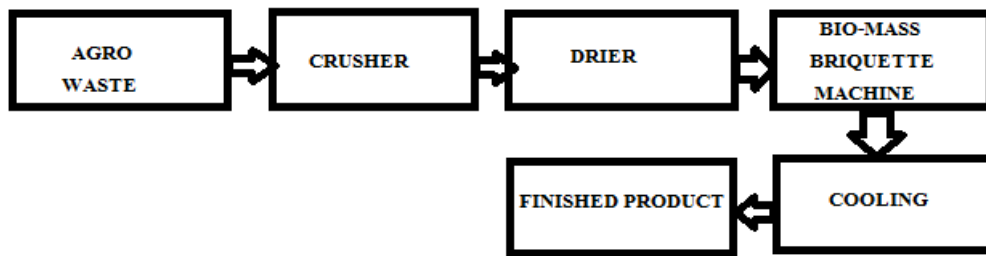


FIG 6: Production Process Flow Chat

➤ **Following Industries Can Make Maximum Use of Briquettes [5]**

- Ceramic and Refractory Industry
- Solvent Extraction Plant
- Chemical Units
- Dyeing Plants
- Milk Plant
- Brick making units
- Leather Industry
- Thermal applications

IV. FUTURE UPGRADATIONS

Our main task is to stop and minimize the carbon emission as far as possible while producing briquettes by blending with some other material in order to save the environment from toxic Sulphur pollutants. The use of biomass briquettes is strongly encouraged by issuing carbon credits. One carbon credit is equal to one free ton of carbon dioxide to be emitted into the atmosphere. India has started to replace charcoal with biomass briquettes in regards to boiler fuel, especially in the southern parts of the country because the biomass briquettes can be created domestically, depending on the availability of land. Therefore, constantly rising fuel prices will be less influential in an economy if sources of fuel can be easily produced domestically. Lehra Fuel Tech Pvt. Ltd is approved by Indian Renewable Energy Development Agency (IREDA) [3], is one of the largest briquetting machine manufacturers from Ludhiana, India.

Table 1: People (In Millions) relying on Traditional Biomass [4]

Countries	2004	2015	2030
Sub Saharan Africa	575	627	720
North Africa	4	5	5
India	740	777	782
China	480	453	394
Indonesia	156	171	180
Rest of Africa	489	521	561
Brazil	23	26	27
Rest of Latin America	60	60	58
TOTAL	2528	2640	2727

Source: Review of Wood Waste arising & management in UK (2005)

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 5, Issue 1, Januray 2016

V. CONCLUSION

Biomass briquette is a very effective bio-fuel that has appreciable physical and fuel qualities and burns with good efficiency. It's cheap rate, high availability and admirable fuel characteristics gained it high acceptance in a short time. Another reason for its quick expansion is the profit gain from its production thus more and more people are attracted to the business and raises its availability. It reduces emission and also reduces deforestation by serving as an alternative cooking fuel in rural areas. Still there is scope for development in this sector by researching for more effective ways to use bio-fuel and make it more environment and user friendly. While concluding this part, we fill quite contended in having completed the project assignment well on time. We had enormous practical experience on the manufacturing schedules of the working project model. We are therefore, happy to state that the inculcation of mechanical aptitude proved to be a very useful purpose. We are as such overwhelmingly elated in the arriving at the targeted mission.

Undoubtedly the joint venture has had all the merits of interest and zeal shown by all of us the credit goes to the healthy co-ordination of our batch colleague in bringing out a resourceful fulfilment of our assignment described by the university.

REFERENCES

- [1] "Biomass Briquetting: Technology and Practices - Introduction."_Centre for Ecological Sciences INDIAN INSTITUTE OF SCIENCE BANGALORE. Volume -10 Issue 04 Dec. 2010.
- [2]"Biomass Briquettes for Green Electricity Production."_Bionomicfuel.com. 4 May 2009. Volume-21Issue-30 Nov. 2010.
- [3]"Biomass Briquetting: Technology and Practices - Introduction."_Centre for Ecological Sciences INDIAN INSTITUTE OF SCIENCE BANGALORE. Volume-11 Dec. 2010.
- [4]"Biomass Briquette." www.gcmachines.com/net/biomassbriquettemachine.html30 Nov. 2010.
- [5]"Biomass Briquette." www.wikipedia.com March. 30 Nov. 2015.
- [6]"A Study of Biomass Briquette System" Proceedings of the International Conference of Mechanical Engineering 2011{ICME2011} volume-55 Dhaka, Bangladesh 2011
- [7] "Biomass Briquette Production" American Journal of engineering Research (AJER) Volume-04, Issue-02 pp-44-50, 2015
- [8] "An experimental Study of combustion characteristics of Low Density Biomass Briquettes" Volume-11, Issue-05 Year 2011