ISSN No:-2456-2165

Biomass Briquette: Generation of Non-Traditional Technology and Pollution Free Sources for Energy

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Abstract:- Each year thousands ton of agricultural waste is generated which one is burnt inadequately in unrestricted ways which causing air pollution. This waste is recycling and provides renewable energy sources of biomass by converting in to high density briquettes in the absence of any binder. This is especially use in area where agriculture waste generated and passable amount fresh-grass, etc. which also helpful for the farmers for additional income from agricultural waste. Briquettes is mostly used in inchoate countries / world where fuels are not as handy accessible. A briquette used in industry for boiler to produce steam.

***Keywords**:- Bio-coal, Biomass, Briquettes.*

I. INTRODUCTION

We know about importance of fuel. There is an insufficiency of non-renewable fuel, prices of those fuels is getting higher- higher day by day. Because of that there is high demand in fuel, so now people are starting too fascinated to use bio-coal briquettes. Thesis briquettes is environmentally-safe and renewable resources in country. So, we can say it is worldwide needs of briquettes to satisfy the replacement of the fountainhead of fuels.

In earlier times it was used as a substitute of the non-renewable fuels in an inappropriate way but now it is basic fuels of the different industry the briquettes complete the need and gives best outcomes at inexpensive rate than other non-renewable fuel.

Bio-coal briquettes made from the agriculture residue, woody biomass, biomass (saw dust, maize husk, etc.), etc. and which is metamorphose into hard cylinder shape. The wide ranging residues is Rice Husk, Sugarcane Bagasse, Sawdust, Wood chips, etc.

Briquettes are the only binding, mean it's composed of residue and which can give high heating capacity/ heat of combustion.

The technology to tie up waste it is called binder less technology. It doesn't need of any type of bonding material. In many inchoate countries now they are attempting the use this technology, since its low contaminating and which is convenient.

Briquettes is generally used for boilers, scalding etc. as a fuel, bio-coal which is give best outcomes.

Presently in India, industry like chemical units, others industry having thermal application, milk plant etc. using and it is observed that the briquettes is effective in industry.

Figure.-1 Biomass Briquette

Use of Briquettes in different field [2]:

Biomass briquette which is used as a fuel by industry, commercial and household sectors. Which is use in following areas like Boilers, Forges and Foundries, Brick kilns and ceramic units, residential heating, etc.

- Various industries where biomass briquettes used:

Table. 1: Various industries uses biomass briquettes

ceramic and refectory Industries	Solvent Extraction Plant
Spinning Mill	Lamination Industries
Chemical Units	Leather industries
Dyeing Plants	Milk plant
Others Ind. having thermal application	Food processing Industries
Gasifier Sys. in thermal	Vegetable plants
Textile Unit	Brick making units

II. LITERATURE SURVEY

- Different types of R/M with their calorific value[2]:

Table. 2: Different type of R/M and their calorific Value

R/M	Calorific Value
Groundnut shell	4524 k
Bagasse	4380k
Castor seed shell	3860k
Saw dust	3898k
Cotton stalks/ chips	4252k
Bamboo dust	4160k
Coffee husk	4045k
Tobacco waste	2910k
Tea waste	4237k
Paddy straw	3469k
Mustard straw	4200k
Sunflower stalk	4300k
Sugarcane	4100k
Barks wood	1270k
Forestry waste	3000k
Rice husk	3200k
Wood chips	4785k

- Different types of waste biomass & non-biomass materials which is use as a briquetting:

Figure.-2 different type of waste biomass & non-biomass material

Material	Waste Composition	Binder Used
Agricultural residue	• Rice husks, corn cobs and sugarcane bagasse. • Rice straw.	• Starch, biosolids, microalgae. • Cotton stalk.
Woody biomass	• Wood and bark • Shredded cones	• None. • None.
Fruit waste	• Mango seed. • Orange bagasse. • Durian, coconut, coffee, cacao, banana and rambutan. • Cashew press cake.	• Starch, Clay soil, Red soil' • Corn starch. • None. • Cassava starch.
Tannery solid waste	• Hair, flesh, chrome shavings and buffing dust. • Buffing dust, chrome shavings, fleshing and hair	• Cassava starch. • Cassava starch.
Human waste	• Fecal matter	• Starch, molasses, lime
Textile industry solid waste	• Biosludge, cotton residue. • Cotton waste	• None. • None.
Paper and cardboard	• Office and commercial printing paper, newsprints, and cardboard • Cardboards, magazines, newspapers, office paper, books. • Cardboards.	• None. • None. • None.
Vegetable market waste	• Cauliflower/cabbage leaves, coriander stalk and leaves, field beans and green pea pods	• None.
Furniture waste	• Wood and upholstery foam	• None.
Garden waste	• *Mesua ferrea* leaves,	• Wastepaper
Oil palm waste	• Palm kernel shell, palm fiber • Empty fruit bunch. • Palm kernel shell. • Rubber seed kernel and palm oil shell.	• Wastepaper. • Starch, asphalt. • Starch. • Starch.
Biomass and plastic waste	• Sachet water bags, polythene bags, saw dust, maize husk, coal. • Sawdust, date palm trunk, wire, printed circuit boards, automotive shredder residues.	• Starch, limestone, laterite • None.
Biomass and coal	• Sawdust and coal. • Coal fines, sawdust. • Woodchips, olive stone, anthracites, and coal	• Cassava starch • Molasses. • Starch, resin
Black liquor	• Straw pulp black liquor	• Starch.
Aquatic biomass	• Giant reed (*Arundo donax L.*) and reed (*Phragmites australis*) • Water hyacinth. • Water hyacinth.	• Loess, lime • Phytoplankton scum. • Molasses

- Briquetting Technology:

Biomass compression represents the technology for the conversion of biomass residues into fuel. The technology is also now having briquetting.

Depending on the type of equipment used, it can be categorized into 5 main types:
1. Piston press
2. Screw press
3. Roll press
4. Pelletizing
5. Low pressure/ manual press

- Briquette presses and their study outcome[7]:

Figure.-3 Study outcome of different presses

Briquette Press	Output Capacity	Briquettes' Shape and Dimension	Raw Material Used	Study Outcome
Screw extruder	• 120 kg/h	Hexagonal. 100 mm length.	• Cassava rhizome waste	• The briquettes had higher density (0.69 to 0.91 g/cm^3), compressive strength (8.51 to 14.94 kg/cm^2), Impact resistance index (153.7 to 416.7) and calorific value (21,670 to 24,367 KJ/kg).
	• 200 kg/h	Hexagonal. 50 mm length, 20 mm inner diameter	• Rubber seed kernel (RSK), Palm oil shell (POS)	• The maximum compressive load of the POS briquette was 101.11 N and the calorific value was 16.05 MJ/kg whereas the RSK briquette was 141 N for compressive load and 16.03 MJ/kg for calorific value.
Mechanical piston press	• 500 kg/h.	Cylindrical. 50 mm diameter.	• Vegetable market waste (VMW)	• The bulk densities for VMW briquettes increased substantially to 509 to 747 kg/m^3 from initial bulk densities of 44.2 to 60 kg/m^3 of dried and loose vegetable market waste. The calorific values of different VMW briquettes were in the range of 10.26 to 16.60 MJ/kg.
	• 1200 kg/h	Cylindrical. 70 mm	• Rice straw	• Briquettes were produced with high-density (1030.38–1159.22 kg/m^3), durability ranging from 71.9 to 92.3%, maximum calorific value of 15.61 MJ/kg, and minimum ash content (16.34%).
Hydraulic piston press	• Not available	Cylindrical. 50 mm diameter.	• Furniture wood waste, Foam.	• Briquettes produced from combining furniture wood waste and foam generated more heat and energy. Durability of briquette with 20% of polyurethane foam was like a common briquette of furniture wood waste.
	• Not available	Rectangular. 30 mm length, 25 mm width, 15 mm height	• Saw dust, Coal fines	• The addition of saw dust as well as molasses as a binder resulted in a briquette with a calorific value of 26 MJ/kg, fixed carbon of 76% and high compressive strength of 0.25 kN/cm^2 which is not easily shattered
Roller press	• Not available	Almond shaped. Maximum size of 31.3 mm length, 23.3 mm width, 17.9 mm depth.	• Corn stover, Switch grass	• Briquettes produced with the roll press briquetting machine had bulk densities (351 to 527 kg/m^3), durability (39% to 90%), and crushing strengths (28 to 277 N)
	• Not available	Pillow shaped. 60 mm width, 50 mm height, 30 mm depth.	• Charcoal powder	• The machine produced briquettes whose physical properties were satisfactory, regardless of the type of binder and showed adequacy for use in barbecues.

- Factors affecting Densification / Briquetting [6]:
1. Temperature and pressure
2. Moisture Content:
3. Drying:
4. Particle Size and Size reduction:

- Comparison coal and biomass characteristics source [6]:

Table. 3: Comparison between Coal and different type of biomass residue

Fuel	Density (g/cm^3)	Calorific Value (Kcal/Kg)	Ash Content %
Coal	1.3	3800-5300	20-40
Biomass Briquette From			
Bagasse	0.074	4200	4
Saw dust	1.7	4600	0.7
Ground Nutshell	1.05	4750	2
Rice husk	1.3	3700	18
Saw dust cotton	1.12	4300	8

III. MATERIAL, METHOD & FLOW DIAGRAM

- Material:

Saw dust, Bagasse, Cow manure, Chicken manure fertilizer & Groundnuts Shell.

- Method:

The briquetting process involves drying, grinding, sieving, compacting and cooling operation.

As raw material as moisture in it and which is removed by drying process in dryer, and dried material is send to the grinding process, as raw material size is larger then what it should be for making briquettes.

And if raw material is in small size or in required size for making briquettes then it is send to briquetting machine and make sure that it is has continuous flow of raw material in the press.

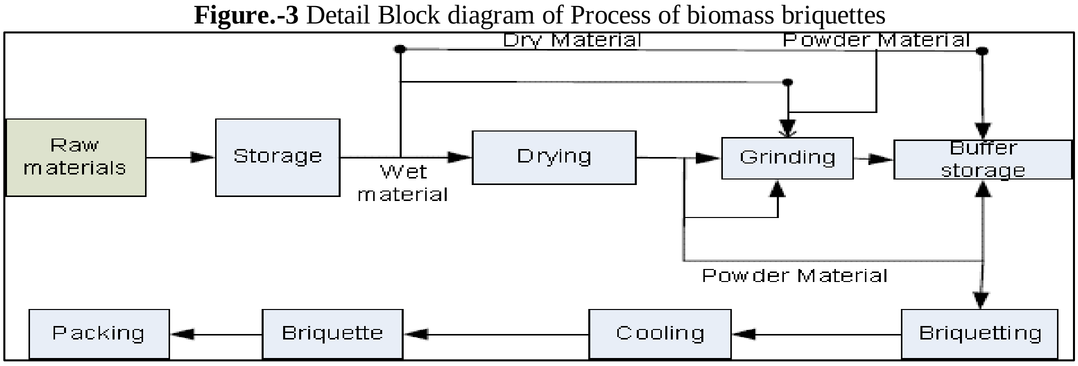
Ram in the machine continuously packs in the material through taper die.

As the briquetting machine compression increases the pressure and temperature goes high enough that lignin present in the raw material performing as natural binder which help as compaction.

Then the product is remove and cooled to have a finished product as solid fuel which can replace the non-renewable fuels.

- Flow Diagram:

Figure.-3 Detail Block diagram of Process of biomass briquettes



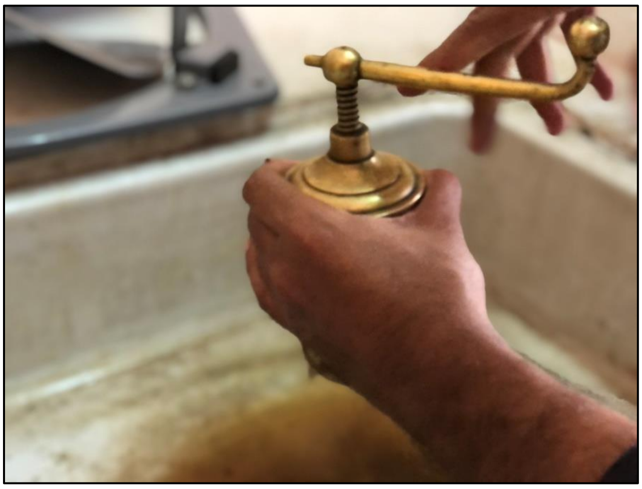
IV. PHOTOGRAPHY

1. R/M: saw dust, Bagasse, mixture of Chicken and Cow manure fertilizer and Groundnuts Shell

2. Mixture of all the R/M:

ISSN No:-2456-2165

3. Transfer the mixture of R/M in homemade type Manual Press:



4. Heating is provided with Max. Pressure

5. Removing the finished Briquettes:

6. Finished Product:

V. DIFFERENT R/M SAMPLES

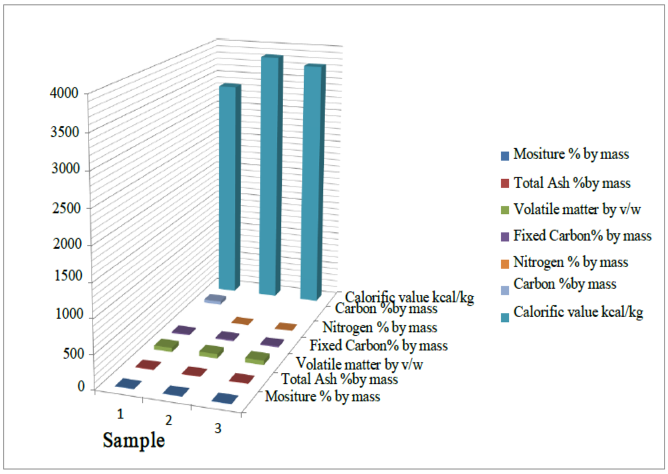
Sample-1: R/M- saw dust, Bagasse, mixture of Chicken and Cow manure fertilizer and Groundnuts shell:

Sample-2: R/M- Saw dust and Groundnuts shell:

Sample-3: R/M- Mix. Of Saw dust:

VI. RESULT

	Sample 1	Sample 2	Sample 3
Moisture % by mass	6.88	6.18	6.8
Total Ash %by mass	9.52	7.2	8.3
Volatile matter by v/w	63.2	65.23	66.3
Fixed Carbon% by mass	20.22	21.39	18.3
Calorific value kcal/kg	3694	3842	3742
Nitrogen % by mass		0.83	0.53
Carbon %by mass	51.06		



VII. CONCLUSION

Choice of an appropriate biomass residue is important to produced good quality briquettes. Most important is availability of the residue in large quantities. R/M preparation prior to densification is also important in producing good quality briquettes. Particle sizes of 6-8 mm with 10-20% powdery components give the best result and this ensures a smooth briquetting process.

Briquettes produced were found to have a good handling property which makes them transportable over long distance without disintegrating. This will therefore be a better way of fashioning an energy system that will not only be sustainable for the society but will relatively be equitable on the long term.

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