DESIGN AND FABRICATION OF SEMI AUTOMATIC FUEL BRIQUETTING MACHINE

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Abstract

Energy consumption in the rural sector of India, particularly is in the form of petroleum-based fuels, and now a days the utilization of these fuels has been increased rapidly .Such an increase in the fuel consumption will have a serious effect on all economic and domestic activity, particularly in the vast rural areas. As the usage of the fossil fuels have increased so much and it effects adversely on the health of every individual. Burning the fossil fuels such as wood, coal, kerosene gives off smoke and releases other harmful gases. In order to minimize theses effects an alternate cooking fuel is needed and one of the solutions is ***Fuel -Briquetting****.*

Fuel Briquette can be made from any kind of organic waste, which is easily available the organic waste can be made into briquettes by mixing it with a thick solution of paper pulp. This mixture is then poured into a screw press to remove water and make them into solid pieces/briquettes. These briquettes can be dried and used as an alternative cooking fuel.

Briquettes to produce from banana peels and saw dust are also going to be used through their compaction ratios and also to get the value of utilized heat produced. The study focuses on the design of briquetting machine and development of briquettes produced from banana peels and saw dust, as banana peel got high calorific value this has been used as one of the constituent in the fuel briquette produced. A production level type of briquetting machine is designed but low in cost is efficient and could be developed to transform agro-waste into fuel briquettes

Key Words : Fuel, Fossil fuels,BioMass,Fuel Briquette, Cooking Fuel Key Words : Fuel, Fossil fuels,BioMass,Fuel Briquette, Cooking Fuel

1.INTRODUCTION: Biomass Briquetting is the process of converting low bulk density agro waste into high density fuel. These are good replacements for conventional cooking fuels, economical and eco-friendly and utilize materials that constitute solid waste. India is reaching out to fuel-starved rural/urban communities and individuals to transfer the simple skills for making fuel briquettes from agricultural, municipal, industrial and domestic waste to people in remote areas to meet their cooking fuel needs and for livelihood support from selling the briquettes. This project is a rare example of how simple, innovative technologies and techniques can offer remarkably effective solutions to critical, day-to-day problems of underprivileged people, while protecting the environment.

A manual Briquetting Machine, single person operated can produce about 5 to 6 to 8 Kg of briquettes per day/per shift. A family of 4 persons requires about 0.5 to 0.75 kg of briquettes daily to meet their cooking needs. A day's operation of briquetting machine can produce more than a week's fuel requirement easily. It also helps in Solid Waste Management by reducing the volume to be sent to land-fills, where it is presently burnt or buried without proper care and serve as an ongoing source of income to help people satisfy their basic needs, but also introduce & produce alternative environment friendly burning fuel to heat homes and cook food.

Materials used in the fuel briquette making : The fuel briquettes are made out of loose raw materials like rice husk, saw dust, coir pitch, groundnut-shell, coffee husk, sugar cane which are abundantly available, into a compressed form to increase its specific weight, thus increasing the fuel efficiency (Combustion Efficiency) as compared to its loose condition without using any Binders.

The materials that we are using are saw dust and rice husk with binding material (paper) . As they are mostly available in cities which can be properly used in making briquetts .

Fuel Briquettes are used to replace conventional fuels like coal , firewood in heating .

-Briquettes do not emit smoke with sulfur or phosphorus and also fly ash. Hence no need of pollution controls equipment.

Fig 1: Types of Materials used for fuel Briquetting

1.1 Flowchart of the Biomass Briquetting

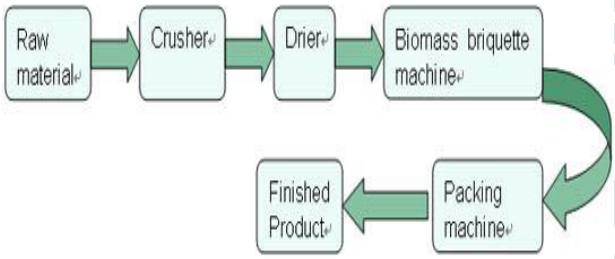

Fig 2: Stepwise Sequence of Production of Fuel Briquettes From Agricultural, Domestic & Industrial Waste Materials

- Shred waste paper into smaller pieces to be soaked overnight (should be soaked 36 to 48 hrs for best effect) in water. Please note that this paper should not contain any pins, paper clips etc
- Cut the grass, leaves and sugarcane bagasse in small pieces about one cm and dry in plastic buckets so as to protect this material from the wind.
- Soak the small pieces of grass, Leaves and sugarcane bagasse in water, overnight.
- Once soaked overnight, use this material to make pulp for briquettes. The pulp will be made by using a special tool or wooden hammers.
- Weigh saw dust and remove all thick sticks. Spread a 4 inch thick layer of saw dust on a plastic sheet.
- Use a sufficient amount of water while stirring the pulp (material soaked all night and then made into pulp).
- Pour the pulp on the layer of saw dust. Cover the saw dust layer as if making a pizza with toppings.
- Mix the pulp and the saw dust well – either by walking on it with rubber boots or with your hands.
- Collect mixed saw dust and paper pulp in the center to make a pyramid. Cover the pyramid with paper pulp and walk on it.
- Be sure to mix the saw dust with the paper pulp well, this will form the base for briquettes.

- Put the mixture in drums or buckets, add water to the drum and stir and mix the pulpy solution well.
- Put this pulp into the press to make a briquette. Operate the press as shown to make briquettes.
- Dry the briquettes in the sun on a plastic sheet or on rods.

1.2 A sample fuel briquette

Fig 3: Fuel Briquetting made of Saw Dust

2.PRIMARY OBJECTIVES :

- Semi-Automation of fuel briquetting machine.
- Increase the production rate.
- Reduce the production time.

2.1 Methodology

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A semi-automatic Briquetting Machine, single person operated can produce about 5 to 6 to 8 Kg of briquettes per day/per shift. A family of 4 persons requires about 0.5 to 0.75 kg of briquettes daily to meet their cooking needs. A day's operation of briquetting machine can produce more than a week's fuel requirement easily. It also helps in Solid Waste Management by reducing the volume to be sent to land-fills, where it is presently burnt or buried without proper care.

3. Design Of Briquette Press: The 3D model of the machine is designed using Solid Works Software.

Fig. 4 Fuel briquetting machine

3.1Parts of the machine :

1. Base plate

2.Ramming plate

3.Moulding plate

4.Stand

5.Casing

6.Pneumatic cylinder setup

7.Pneumatic cylinder

3.2Parts Detailing Solid Works Model

1.Base Plate

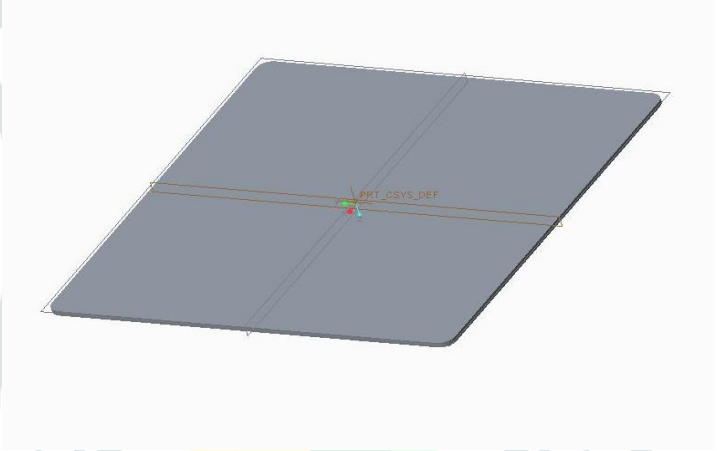
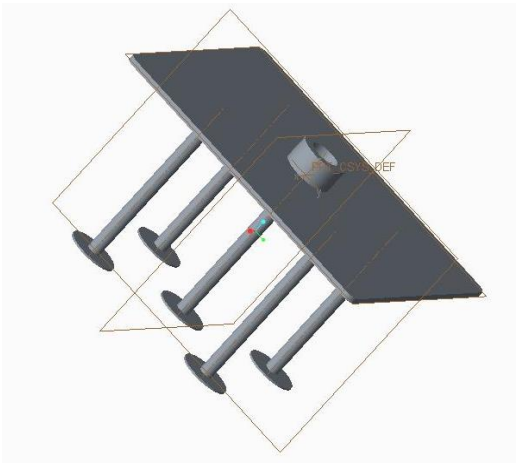


Fig5.:Base Plate

2.Stand

Fig6 :Stand



3.Ramming Plate

Fig 7: Ramming Plate 1

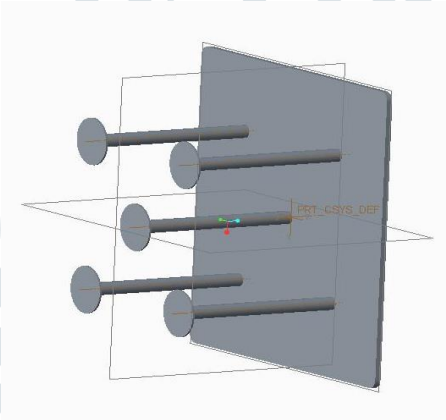


Fig8 : Ramming Plate 2

5.Moulding Plate

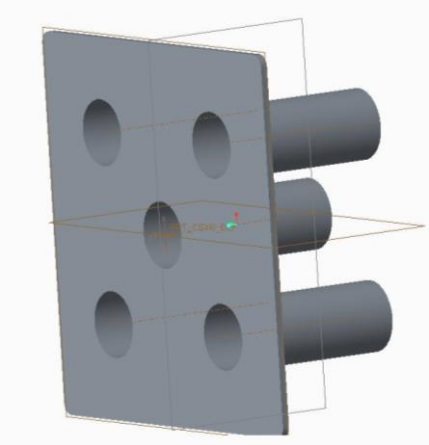


Fig9 :Moulding Plate

4. ANALYSIS:

Structrual Solution

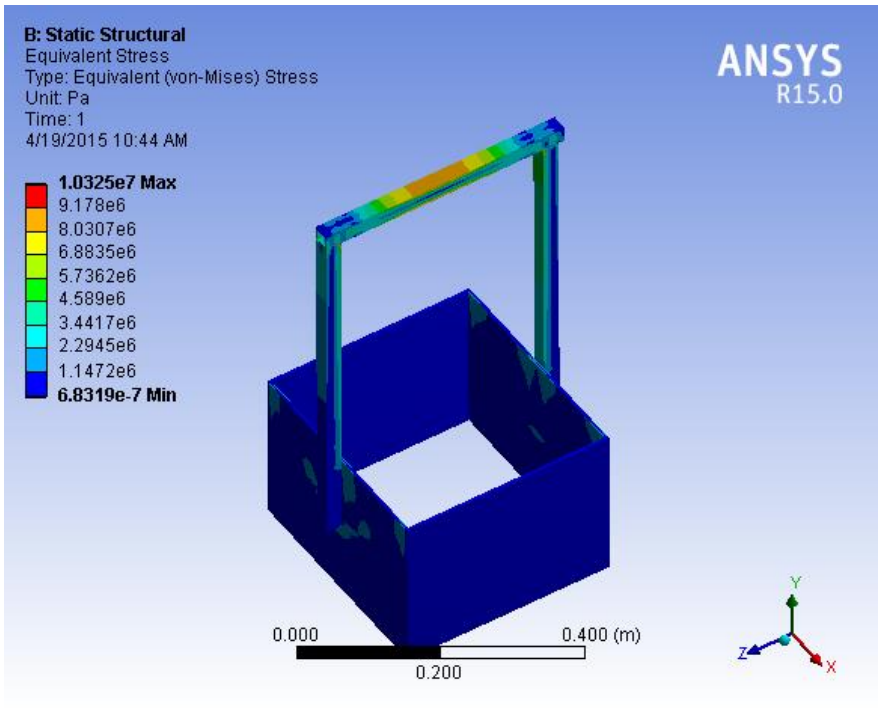


Fig 10: Structrual Analysis

Nodal Solution

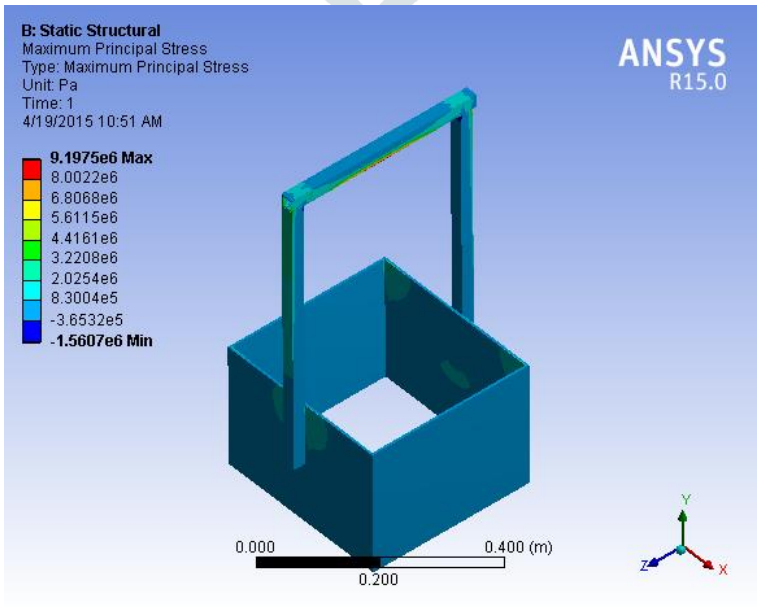


Fig 10: Nodal Solution

Deformation Plot

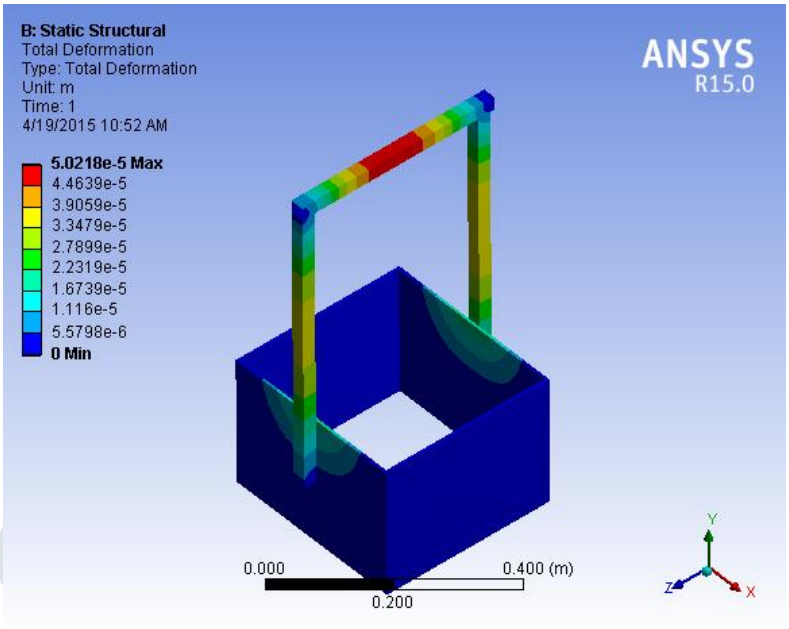


Fig:11 : Deformation Plot

5.Fabricated Semi Automatic

Fuel Briquetting Machine

Fig 12. Fuel briquetting machine

5.RESULTS

MATERIALS USED IN BRIQUETTES		INDIVIDUAL PERCENTAGES OF USED MATERIALS		BURNING TIME	CALORIFIC VALUE	POLLUTANT PERCENTAGES IN SMOKE LIBERATED ON BURNING				ASH CONTENT
I	II	I	II	in secs	Kcal/ Kg	%C	%H	%N	%O	gms/unitgms
Paper	Saw dust	20	80	364 (6min4sec)	4523	52.28	5.20	0.47	40.85	14/270
Paper	Sugar cane	30	70	384 (6min24 sec)	3950	39.75	5.55	0.17	46.82	38/280
Paper	Dry leaves	30	70	250 (4min10 sec)	4256	45.95	5.40	2.76	39.17	16/270
Methi	Saw dust	10	90	390 (6min30 sec)	4625	51.9	4.8	0.39	41.20	16/286
Methi	Sugar cane	10	90	396 (6min36 sec)	4095	40.55	5.38	0.21	45.62	28/275

From the above table Calorific value, Pollutant percentages and Ash content of fuel briquettes are known.

5.1Calorific value of the briquettes:

After the briquettes are free undesirable moisture, it is analysed in a bomb calorimeter which gave the following result.

Parameters

I. Proximate analysis result

Moisture content 11.40%

Volatile matter(ARB) 54.85%

Ash content(ARB) 19.43%

Fixed carbon(ARB) 14.32%

II. Ultimate analysis(ARB)

1. Carbon 38.40%
2. Hydrogen 2.06%
3. Nitrogen 1.42%
4. Oxygen 27.23%
5. Sulphur 0.05%

6.	Phosphorous	0.01%
7.	Moisture content	11.40%
8.	Ash content	19.43%
III.	Gross calorific value (ARB)	3264 k.cal/kg

6.CONCLUSIONS:

- A fuel briquetting machine made up of mild steel has been fabricated which can produce five briquettes in one cycle. .
- As it is made of mild steel the machine is more rigid and durable , greatrer force could be applied. Since the machine produces five briquettes at a time , there has a been a tremendous increase in productivity.
- Manual labour cost was reduced .There by it can be said that it is a feasible, sustainable fuel briquetting machine.
- Two types of briquettes have been formed i.e
- used engine oil and sawdust
- Paper and banana peels
- Tea and sawdust
- If paper availability is there than it is better to go for paper and sawdust fuel briquettes
- The amount of emission that are released using tea and sawdust are least in terms of percentage of hydrogen.
- Where as percentage of carbon emission is less in paper and banana peels fuel briquettes. The ash content is least in sawdust and paper fuel briquettes .
- With respect to burning time it is preferable to utilize sawdust and engine oil.
- Further work can be carried out by using other combinations of briquettes materials.

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