

# Development of Human Powered Biomass Briquette Making Press

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**Abstract:** Energy consumption is increasing day by day. Fossil fuels have maximum share in the source of energy. Since the fossil fuels are getting depleted day by day, alternate to fossil fuel is need of time. Waste biomass which is easily available nearby if used after proper processing can be an alternate solution for to coal at domestic level. This paper focuses on the development of human powered briquette making press which is portable and having very low cost. Also study is extended to investigate the calorific values.

**Keywords:** biomass, briquette, fossil fuel, human powered press.

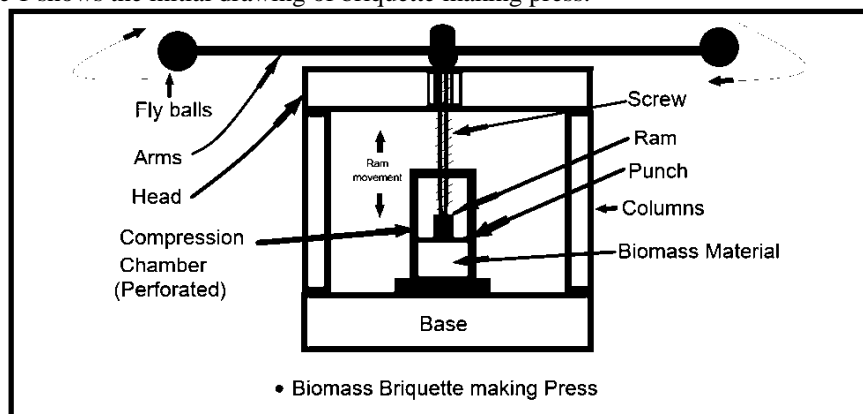
## I. INTRODUCTION

Energy consumption all over the world is increasing day by day. In 2017 total energy consumption of India was 933.934 Mtoe (Tonne of oil equivalent) (1 toe = 11.63 megawatt-hour) which is increased by 4.24% compared to 2016 [1]. Out of total 933.934 Mtoe, 44% of total energy is obtained from coal [1]. Continuous demand of coal is observed over the years. In 2016-17, 841.56 Million Tonnes of coal was supplied which further increased to 908.40 Million Tonnes for 2017-18 [2]. Usage of biomass can compensate demand of coal upto small extent. Gulmohar, Cassia Tora [3] and sugarcane bagasse, soybean husk [4] are good source for biomass generation. Briquetting is the process of conversion of low bulk density agro-residues into high density and energy concentrated biomass which can be used as solid fuel. In this process, raw materials gathered are crushed and dried in form of fine powder and then compressed into briquette in order to burn longer and make transportation of the goods easier. This paper deals with the development of human powered biomass briquette making press.

Various types of briquette making machines are available in the market which are operated with the help of electrical power. In this paper briquette making press operated by human power is discussed so as to use in rural areas where human power is preferred over electricity because of cost parameter which is very simple in construction and easily affordable to poor families.

### Design of Briquette Making Press

Figure 1 shows the initial drawing of briquette making press.



**Figure 1 Initial drawing of briquette making press**

Following are the various parts and its dimensions of briquette making press. Dimensions of various parts are calculated as per design data book.

- Bottom Frame: It is made up of hollow rectangular channel made up of Mild steel. It acts as a foundation of the press. It also provide stability to the press.
- Vertical Frame: It is also made up of hollow rectangular channel made up of Mild steel. It is mounted on bottom frame. Main pressing is mounted on it.
- Screw rod: Threaded screw is the main acting member of the press. It passes through the head nut which has internal threads and also acts as a bearing for screw rod.

- Hollow pipe: It is an MS pipe attached at one end of the screw rod, the main function of it being the rotation of screw with increased rotational force due to increased momentum.
- Guide: The guide is made up of MS channel and MS pipe assembly the main function of it is to guide the screw punch assembly with minimum deflection.
- Compression Chamber: Compression chamber is made of perforated MS pipe. The perforations are given to the pipe using a 2 mm drill; the compression chamber is fixed on a certain position by two MS strips which are welded to it and the columns.
- Wooden Block- The wooden block placed on the base of the press also acts as the bed of the press. The purpose behind selecting wooden block as one of the part of the press is its higher compressibility and cost effectiveness plus zero maintenance.

**Table 1 Specification of various parts of briquette making press**

Sr. No.	Part	Dimension	Material
1	Bottom Frame	61cm × 61cm	Mild Steel
2	Vertical Frame	61cm × 71cm	Mild Steel
3	Screw rod	Punch diameter=9.3cm Punch Thickness=1.5cm Ram length=5cm Screw thread length=53cm Screw Diameter=5cm	
4	Hollow pipe	Diameter = 4cm Length = 105cm	Mild Steel
5	Guide	Diameter=6cm height=10cm Collar thickness=3.5cm Collar length=15cm Collar breadth=10cm	Mild Steel
6	Compression Chamber	height=12cm internaldiameter = 9.5cm outerdiameter= 10cm	Mild Steel
7	Wooden Block	height=17cm diameter=18cm	Wood



**Figure 2 Briquette Making Press**

## II. ASSEMBLY & WORKING

The wooden block is mounted on the base of the press, the compression chamber gets in contact with the block with least clearance. MS plate is sandwiched between the block and the chamber to have flawless delivery of the briquette. The horizontal MS strips holding the compression chamber at one place make a firm assembly consisting of the chamber and the wooden block. The biomass material pulp is poured in the chambers

up to the brim. The punch is then lowered by rotating the arm. The punch is self-adjusting. It goes inside the chamber while performing pressing action as the operator applies rotational force on the arm. As the compressive force goes high the water is sieved out of the compression chamber through perforations. As the punch goes further inside up to a dead zone (a zone where maximum force has been applied by the operator and no further pressing action is allowed by the pressed material), a lock up point is reached. The arm is rotated in opposite direction and the punch is brought a little up to release the pressure on the briquette inside. The wooden block is then pulled off by means of a door handle fixed on it. Now a metal tray is held underneath the chamber and the arm is rotated further down to push the briquette out of the chamber. The briquette as it comes out of the chamber is collected by the operator on the tray. It is then shifted to next process of drying. Drying could be done using an oven or it could be as simple and cheap as sun drying.

### III. BRIQUETTE TESTING

Briquette produced are tested by proximate analysis which consists of determination of moisture, ash, volatile matter, and fixed carbon contents. It was carried out on samples by standard method. Also gross calorific value (GCV) and fuel burning rate is determined. The details of these analyses are as follows;

**Table 1 Results of proximate analysis**

Material	Moisture	Ash	Volatile Matter	Fixed Carbon	GCV (kcal/kg)	Fuel burning rate (g/min)
Sugarcane bagasse	12.39%	3.01%	79.07%	5.53%	3800	0.6850
Soybean Husk	11.30%	7.82%	73.96%	6.92%	3225	0.7862

#### Cost Analysis

Total Cost of the human powered briquette making press including all is INR 3500 only which is minimum compared any kind of briquette making machine available in market. Total cost of the briquette produced from this press by using sugarcane bagasse is found to be approximately Rs. 5/kg which also includes crushing of sugarcane bagasse and binding material etc.

### IV. CONCLUSION

The main objective of this work is to fabricate a low cost portable human powered briquette making press, which can be used in rural areas to produce briquettes with waste materials and use these briquettes in their daily domestic works like cooking. So this work helps in waste management and also provides a way to reduce the use of fossil fuels which in turn reduces pollution. Rate of production can be increased by increasing number of cylinders. Here only sugarcane bagasse is used for briquette making. Other waste biomass material can also be used for briquette making. This press can also be used at remote places where electricity is not available.

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