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# Design and Development of Municipal Solid Waste Briquette Making Machine

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**Abstract -** *Municipal waste is not in suitable form for gasification process or storage of solid waste and therefore it has to dried, shredded or disintegrated and compacted into suitable compact form – briquette. As the municipal waste is full of inorganic materials and therefore briquettes are not compact. It is very important to determine the technological parameters and influences which can influence the final quality of briquettes. In this contribution the main differences between briquettes produced on mechanical press and hydraulic press are described. The description includes different aspects like manufacturing of briquette making and design of briquette making machine.*

***Key Words*: Briquettes ,Density, Bio Mass, Moisture, Economical.**

## 1. INTRODUCTION

Waste management is a necessary process for the protection of the environment and health of the population. Solid waste can create significant health problems and very unpleasant living environmental conditions. If the problem is not correctly approached it may lead to breeding sites for insects, pests, snakes and rats that increase the likelihood of disease transmission. The more comfortable human life is paid by excessive energy increase in all its form. The reserves of non-renewable energy source (coal, oil, natural gas) are not limit less and they are gradually getting exhausted for that their price continually increases. Over the recent years the problem of environment is pollution, sustainability and safety which insist for the development of power generation systems which are techno economically viable, sustainable and safe. In this context researches has been carried out on alternative fuel resource including nuclear, solar, geothermal, wind, tidal and biomass based. Biomass can be defined as "all renewable organic matter including plant material, whether grown on land or water, animal products and manure, food processing and forestry by- product; To overcome this problem, the solid wastes which are combustible can be used as a fuel and fed into the combustion chamber in the form of compressed bricks for production of steam.

A briquette is a block of compressed coal, biomass or charcoal dust that is used as fuel. Briquetting is a high pressure process which can be done at elevated temperature or at ambient temperature depending on the technology one applies. In some briquetting techniques, the materials are compressed with or without addition of adhesive.

### 1.1 Existing biomass briquetting technique

Lignin and cellulose are the two major compounds of biomass. Lignin distributed among cellulose determines the structure strength of biomass. Lignin is a non- crystallized aromatic polymer with no fixed

melting point. If heated to 200–300°C, lignin starts to be soft, melted and liquefied. If pressure is applied in this case, lignin will glue cellulose together, which is solidified and briquetted after cooling down.

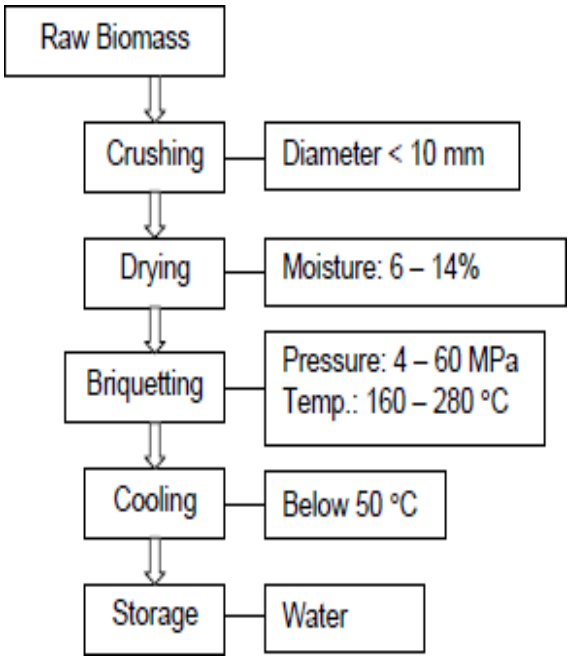


**Fig-1:** The Existing Biomass Briquetting Technique.

### 1.2 Briquetting process

Briquetting is densification or compaction of residues into a product of higher density than the raw materials. It can be used either for heat generation in households and small scale home industries, or even for power generation in large industries (Kaliyan and Morey, 2008). The fuel briquettes produce depends on the locally available materials which may be sugarcane bag asse, charcoal dust, coffee husks, gum Arabica, tree leaves, water hyacinth, rice husks, sawdust and other wood residues or agricultural by-products (Rous seta et al., 2011). In China agricultural by-products like rice straw and rice bran are used in briquette production (Chou et al., 2009), maize cobs in Thailand (Wilaipon, 2007) and coffee husks in Brazil (Felfli etal., 2010). Briquettes could serve as compliments to firewood and charcoal for domestic cooking and agro-industrial operations, if produced at low cost and made conveniently accessible (Wilaipon, 2008).Briquettes are held together by a binding agent or "binder". This binding material can be any partially decomposed fibrous organic material, to release the fiber necessary to physically hold the briquette together. Various advantages and disadvantages have been experienced throughout the world.

### 1.3 Characteristics of the Briquettes

The main purpose of briquetting material is to reduce the volume and thereby increasing the energy density. When densification takes place, there are two quality aspects that need to be considered, firstly, the briquette has to remain in solid form until it has served its purpose (handling characteristics). Secondly, the briquette has to perform well as a fuel (fuel characteristics).

The energy characteristics are other important issues when describing and comparing briquettes with other fuels. The energy characteristics describe how the briquette act and what it produces when burned. The calorific value of briquettes is an important measure of the amount of energy released from every briquette when burned. Briquettes are normally priced by weight, but still, the calorific value is the most important factor in determining the competitiveness of the fuel. The calorific value varies with ash content and moisture content. Different ash and moisture contents in briquettes result in different calorific values.

Normally, the ash content of wood briquettes is about 0.7%. The resulting calorific value is 17-18KJ/kg.

## 2. METHODOLOGY

In this we shall be discussing the design and fabrication of Briquetting making machine using the CAD tool.

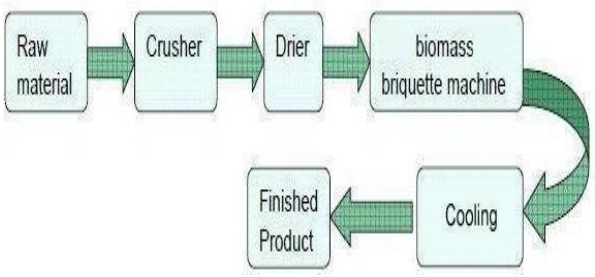


**Fig-2 :** Flow chart shows the fabrication of briquetting process.

- **Collecting solid waste from the municipalities**-The solid wastes from the municipalities are collected and dumped into the containers of segregator.
- **Segregation of wastes**-With the help of segregator, the wastes is segregated based on their density due to reciprocating motion of container. The materials which are of higher density will get settled backwards and materials with lower density will move forward and collected.
- **Conveying of segregated waste**-The segregated wastes (combustible waste) is passed into the crusher through conveyor.
- **Crushing**-The waste through the conveyor are dumped into the crusher due to crushing action they get crushed into the smaller size particles which are fair enough to make briquettes.
- **Mixing**- Crushed particles are mixed with paper pulp or cow dung in definite proportion which acts as binder and also helps in combustion afterwards the mixture is passed into the rammer.
- **Briquette making**-Due to compressing action, the crushed particles get compressed into high density briquettes.

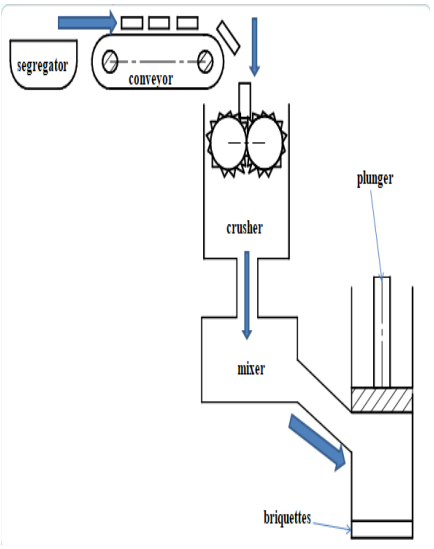


**Fig 2.1-** Shows the working flow chart of Briquetting process.

### 2.1 Design of Municipal Solid Waste Briquette Making Machine.

The below figure 2.2 shows the dimension of the briquette making machine which is designed using the cad tool.

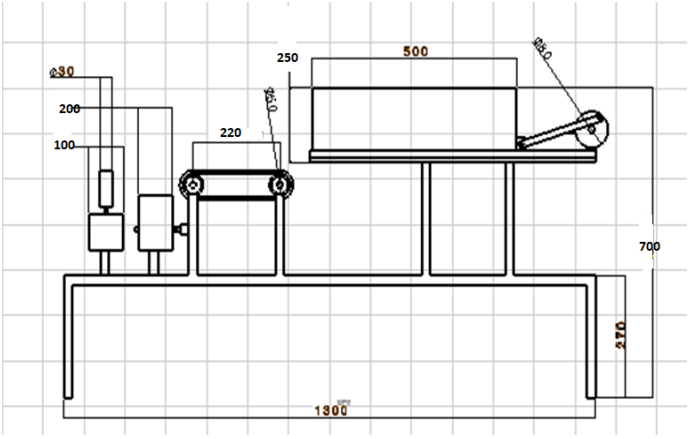


**Fig 2.2-** Shows the dimension of briquette machine.

A set of cad model has been designed and developed for easy fabrication of the briquette making machine , the cad models are shown below.

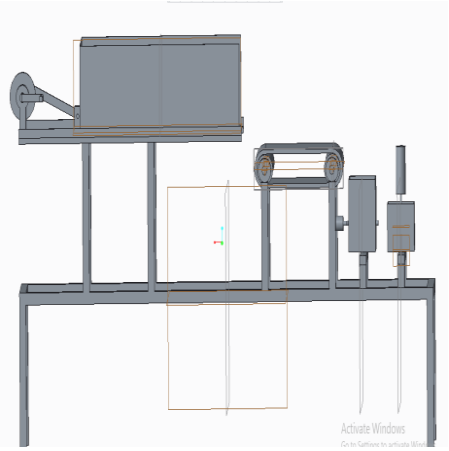

**Fig 2.3-Front view of the model.**

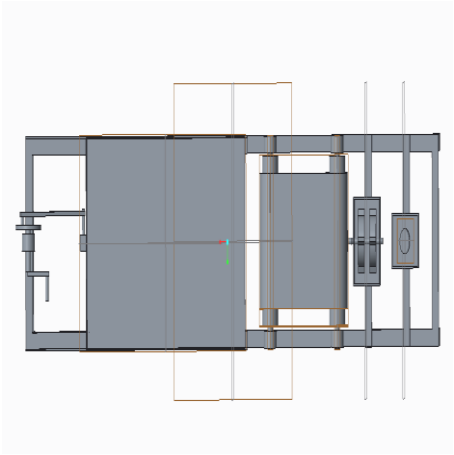

**Fig 2.4-Top view of the model.**

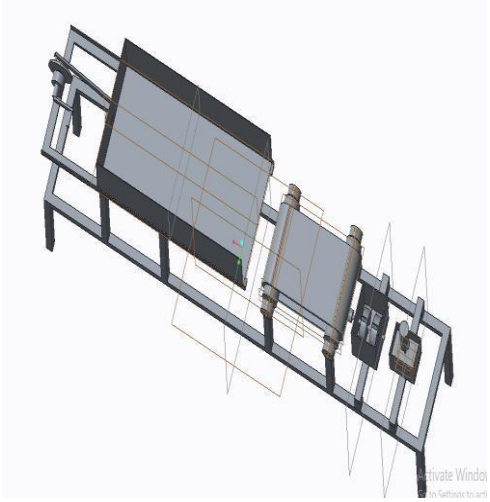

**Fig 2.5- Isometric view of model.**

With the help of cad modeling the briquette making machine is developed and for the next stage we shall work on the fabrication of the briquette making machine with the suitable material which can beused to fabrication .

Various parameters has to be analyzed for material selection for the machine as it has to withstand high compression force and it should be economical.

## 2.2 Finding the density of the waste briquette

Diameter of vessel (d) =16cm Height of vessel (h) = 18cm

Volume of vessel, $v = \pi r^2 h$ = 3.14*8²*18

= 3619.11 cm³.

Height of mass compressed $h_1$=11.5cm. Volume of mass compressed, $v = \pi r^2 h_1$

= 3.14*8²*11.5

= 2311.04 cm³.

Mass of compressed mass, m = 220gm.

= 0.220kg

Density of solid waste $\rho = m/v$

= 0.220/ (2311.04*$10^{-3}$)

$\rho$ = 0.09519 Kg/m³

**Fig-2.6:** Shows the dry solid waste in a box.

## 3. CONCLUSION :

The problems for solid waste management can be found by making of solid briquette . In this paper we have designed a solid waste briquette making machine with the help of CAD tool for clear understanding. The actual dimension of the machine has been given and a analytical calculation has been shown to find the density of the solid briquette .by using the machine we can reduce the area required for the deposition of solid waste , and this solid briquette can be used as fuel for burning .

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