Automated Briquetting Machine for Bio Coal Manufacturing

Mr. Swapnil Babarao Khadatkar, Mr. Dilip Gangwani

***Abstract*— This paper report is to design and manufacturing a prototype of an automated briquetting machine which is able to prepare a coal cake made from the agricultural waste products such as Saw dust, Wheat straw, Bajra cobs, Forest leaves, etc. The machine comprises of two major parts, first one is crushing chamber where raw material is converted into fine powder and In the second circular section of a machine where screw conveyor carries material forward and compression of material is carried out. The compressed material is comes out through a fixed die used to shape the final product.**

***Index Terms*—Briquetting machine, Biomass briquettes, Bio coal, White coal, Hammer mill crushing.**

I. INTRODUCTION

Bio coal is a form of fuel produced by drying chopped wood over a fire. Biomass Briquetting is the process of converting low bulk density biomass into high density and energy concentrated fuel briquettes. Biomass Briquetting machines are of various sizes which converts biomass into solid fuels.

Briquettes are ready substitute of Coal/wood in industrial boiler and brick kiln for thermal application. Biomass briquettes are Non-conventional Source of energy, Renewable in nature, Eco friendly, non-polluting and economical. Process of converting biomass to solid fuel is also non-polluting. No addition of any binder / chemicals is required so it is 100 % natural.

The processing of a material into briquette pieces having a uniform geometrical shape and practically identical weight. Briquetting creates additional raw material resource from fine material, primarily fuels and ores, the use of which would otherwise be insufficient or difficult, it also makes it possible to use waste product, such as dust slag, the usefulness of briquetting is judged by economic factors.

Depending on the material to be processed, briquetting may be done with binders at medium pressure (10-50Mn/m2) or without binder at high pressure (100-200mn/m2).In order to produce briquettes of high quality, the material used must meet specific requirement for fractional composition, moisture content, temperature and the like.

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II. LITERATURE REVIEW

The technology of briquetting has progressed through development and introduction of new processes and intermediate stages, new binders, and new equipment, both for the production of a high-quality smokeless fuel for household use and for the manufacture of a fuel for continuous coking processes; the latter is designed to broaden the raw material base and improve the economy of the coke industry.

The world production of coal briquettes amounts to approximately 110 million tons a year, of which briquettes made from brown coal account for 85 percent. In 1968 the USSR produced approximately 8 million tons of coal briquettes (70 percent from brown coal) and approximately 7 million tons of peat briquettes.

III. COMPOSITION AND PRODUCTION

Biomass briquettes, mostly made of green waste and other organic materials, are commonly used for electricity generation, heat, and cooking fuel. These compressed compounds contain various organic materials, including rice husk, bagasse, ground nut shells, municipal solid waste, and agricultural waste. The composition of the briquettes varies by area due to the availability of raw materials. The raw materials are gathered and compressed into briquette in order to burn longer and make transportation of the goods easier. These briquettes are very different from charcoal because they do not have large concentrations of carbonaceous substances and added materials. Compared to fossil fuels, the briquettes produce low net total greenhouse gas emissions because the materials used are already a part of the carbon cycle. One of the most common variables of the biomass briquette production process is the way the biomass is dried out. Manufacturers can use Torre faction, carbonization, or varying degrees of pyrolysis. Researchers concluded that Torre faction and carbonization are the most efficient forms of drying out biomass, but the use of the briquette determines which method should be used.

Compaction is another factor affecting production. Some materials burn more efficiently if compacted at low pressures, such as corn Stover grind. Other materials such as wheat and barley-straw require high amounts of pressure to produce heat. There are also different press technologies that can be used.

A piston press is used to create solid briquettes for a wide array of purposes. Screw extrusion is used to compact biomass into loose, homogeneous briquettes that are substituted for coal in co-firing. This technology creates a toroidal, or doughnut-like, briquette. The hole in the center

of the briquette allows for a larger surface area, creating a higher combustion rate.

IV. Compared To Coal

The use of biomass briquettes has been steadily increasing as industries realize the benefits of decreasing pollution through the use of biomass briquettes. Briquettes provide higher calorific value per dollar than coal when used for firing industrial boilers. Along with higher calorific value, biomass briquettes on average saved 30–40% of boiler fuel cost. But other sources suggest that co-firing is more expensive due to the widespread availability of coal and its low cost. However, in the long run, briquettes can only limit the use of coal to a small extent, but it is increasingly being pursued by industries and factories all over the world. Both raw materials can be produced or mined domestically in the United States, creating a fuel source that is free from foreign dependence and less polluting than raw fossil fuel incineration. Environmentally, the use of biomass briquettes produces much fewer greenhouse gases, specifically, 13.8% to 41.7% CO2 and NO_X. There was also a reduction from 11.1% to 38.5% in SO2 emissions when compared to coal from three different leading producers, EKCC Coal, Decanter Coal, and Alden Coal. Biomass briquettes are also fairly resistant to water degradation, an improvement over the difficulties encountered with the burning of wet coal. However, the briquettes are best used only as a supplement to coal. The use of co-firing creates an energy that is not as high as pure coal, but emits fewer pollutants and cuts down on the release of previously sequestered carbon. The continuous release of carbon and other greenhouse gasses into the atmosphere leads to an increase in global temperatures. The use of co-firing does not stop this process but decreases the relative emissions of coal power plants.

V. Designing Methodology

The construction and working is very simple as there are only two operations are carried out as follows:

1) Milling and

2) Compressing

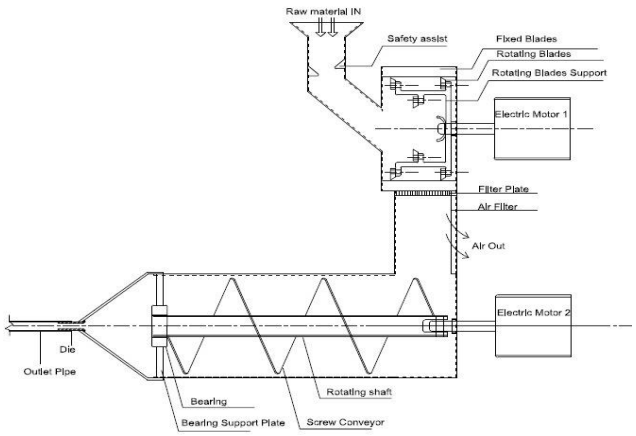

Fig.5.1: General Arrangement for Briquetting Machine

For crushing purpose there is one Hammer mill is attached comprises of Grinding Inserts, Rotor Blade, Baffle plates driven by electric motor having Rotor speed up to 2000-2500 rpm 50 Hz, which cuts the straws and make a fine powder up to 80um which is dropped down by gravitational force and powder comes out through bottom sieve, this bottom sieve maintains the uniform geometry of powder and connected it with the filter hose which allow the air to passed away and avoid the back pressure produce by the hammer mill, Generate optimize air passage, leads to cooling of material, the graphical representation of powder making technique is shown as;

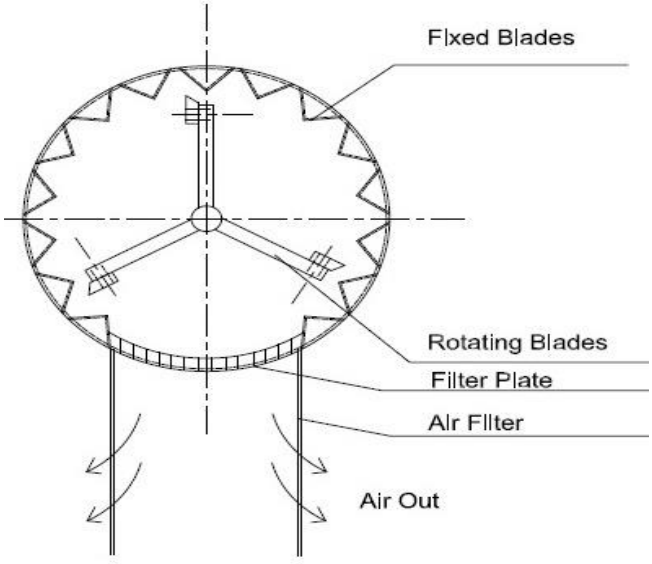

Fig.5.2: representation of hammer mill

Once the powder comes out then it enters into the second major portion of the machine which is a Screw conveyor, represented as;

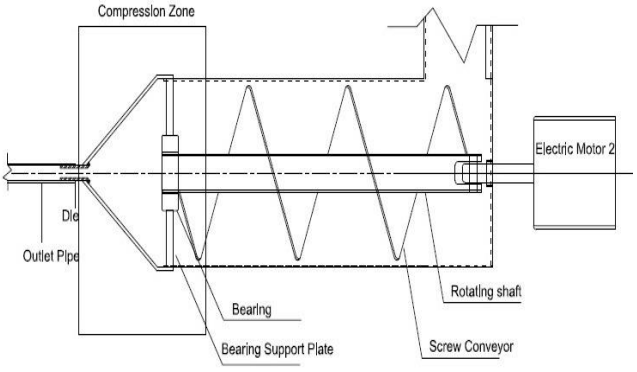

Fig.5.3: Representation of conveyor and compressing zone.

It functions to carry forward the powder towards a compressing zone allowing uniform flow of material and when the material reaches the zone the compression is taken place as the material continues to come there and because of a lot of quantity of material gathered together results into the compression of material and bind together itself and these compressed material comes out by means of an fixed die. The purpose of this die is to shape the product and to provide an outlet for the product. Once this comes out the final product is ready to use for various domestic and industrial purposes.

VI. Safety Arrangement

There is a safety assist provided at the very initial stage of the designing of the machine as follows:

Fig.6.1: Safety Assist of Machine

The primary purpose is to avoid direct contact with the machine component or moving parts of the machine. For this reason an arrangement is done which doesn't allow the human interaction, initially while inserting the straws or raw material into the machine there are much more chances of getting hands pull by the rotor and getting injuries hence to avoid these an zigzag type of dome is prepared which is beneficial in avoiding this but also provide some reliability to the machine such as:

1) Uniform flow of material

2) Constant and reproducible condition

3) Prevent material overload

4) Avoid overheating

5) Ensure constant thermal balance

This results in gentle grinding process also.

VII. Conclusion

This Paper is Highly Concentrated on development of the overall mechanism for the manufacturing of the bio coal using the waste product which can be created in the agricultural farms every year. The sole purpose for this concept is to use these waste products and create a non-conventional energy source. The practical use of this mechanism may retain to sound production of the coal briquettes which will be used in domestic purpose or may be in Industrial sector with confine additives. This mechanism is in concept stage, the results will be testified with the practical approach of the machine & Identifying the barriers, that can be overcome through the well define design and its calculations.

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