Fabrication of Briquette Preparing Machine

Gokul L S[1] Nilavarassan G B[2] Prasanth N[3] Venkatesh M[4]
[1]Assistant Professor [2,3,4]UG Scholar
[1,2,3,4]Department of Mechanical Engineering
[1,2,3,4]Bannari Amman Institute of Technology, Sathyamangalam, Tamil Nadu, India

Abstract— Briquette is compressed form of waste materials like dry leaves, saw dust and paper. It can be used as a fuel in various applications. Compressing the waste material will increase the burning time, which leads to high calorific value and low ash content compared to the raw materials. Thus, the emission of carbon monoxide also is reduced. Briquette is formed by using compression of raw materials using Pneumatic system. Pneumatic is a part of modern mechatronics system, which focuses on automation. Pneumatic system provides more accuracy of dimensions of briquette. More quantity of briquette can be prepared by using pneumatic system. The standard pneumatic system operates at 10 bar pressure, which helps double acting cylinder actuate. The proposed model comprises of pneumatic double acting cylinder, solenoid valve, hollow cylinder and piston. Actuation of double acting cylinder will help compression of raw material into briquette. The briquette made is dried using sunlight for two days, which reduce moisture content and can be used as a fuel.

Keywords: Briquette, Calorific Value, Pneumatic Actuation

I. INTRODUCTION

A. *Briquette*

A briquette is a packed block of coal dust or other flammable biomass material like charcoal, sawdust, wood chips, peat, or paper utilized for fuel and fuel to light a fire. The term comes from the French language and is identified with block. Biomass briquettes are produced using rural waste and are a trade for non-renewable energy sources like oil or coal, and can be utilized to warm boilers in plants, and furthermore have applications in agricultural nations.

Biomass briquettes are a sustainable wellspring of energy and try not to add fossil carbon to the environment. Various organizations in India have changed from heater oil to biomass briquettes to save costs on kettle energizes. The utilization of biomass briquettes is transcendent in the southern part of India, where coal and oil are being supplanted by biomass briquettes. Various units in Maharashtra (India) are additionally utilizing biomass briquettes as evaporator fuel. Utilization of biomass briquettes can acquire Carbon Credits for diminishing emanations in the air. Lanxess India and a couple of other huge organizations are apparently utilizing biomass briquettes for procuring Carbon Credits by exchanging their heater fuel. Biomass briquettes likewise offer more calorific benefit/kg and save around 30-40 percent of fuel costs.

A famous biomass briquette arising in created nations takes a waste produce like sawdust, packs it and afterward expels it to make a reconstituted log that can supplant kindling. The regular lignin in the wood tough situations the particles of wood together to shape a strong. Consuming a wood briquette is definitely more productive than consuming kindling. Dampness substance of a briquette can be just about as low as 4%, while green kindling might be pretty much as high as 65%.

B. *Types of Briquettes:*

1) *Coal briquette*

Coal briquettes have for quite some time been delivered as a method for spending 'little coal', the finely broken coal definitely created during the mining cycle. Something else, this is hard to consume as it is both difficult to organize satisfactory wind stream through a fire of these little pieces, additionally it would in general be drawn up and out of the stack by the draft, giving obvious dark smoke.

An exclusive brand of briquettes from the South Wales coalfield was Phenacite, created by Powell Duffryn. Phenacite utilized the accompanying blend,

- Bituminous coal, 25%
- Steam coal, 45%
- Dry steam coal, 22%
- Pitch, 8%

2) *Charcoal briquettes*

A few briquettes are compacted and dried earthy coloured coal expelled into hard squares. This is a typical strategy for low position coals. They are regularly dried to 12-18% dampness, and are basically utilized in family and industry. Charcoal briquettes sold for preparing food can include:

- Wood charcoal (fuel)
- Lignite coal (fuel)
- Anthracite coal (fuel)
- Limestone (debris colorant)
- Borax (discharge specialist)
- Sodium nitrate (catalyst)
- Sawdust
- Chaff (rice debris and nut waste)

3) *Paper briquettes*

Paper briquettes are the side-effect of a briquettor, which packs destroyed paper material into a little round and hollow structure. Briquettor are frequently sold as extra frameworks to existing disintegrator or rotating blade factory destroying frameworks. The NSA has a greatest molecule size guideline for destroyed paper material that is gone through a disintegrator or rotational blade factory, which commonly doesn't surpass 1/8" square. This implies that material leaving a disintegrator is the proper size for pressure into paper briquettes, rather than strip-cut shredders which produce long pieces of paper.

II. ASSEMBLY AND DETAILED DRAWING OF COMPONENTS

A. Briquetting machine

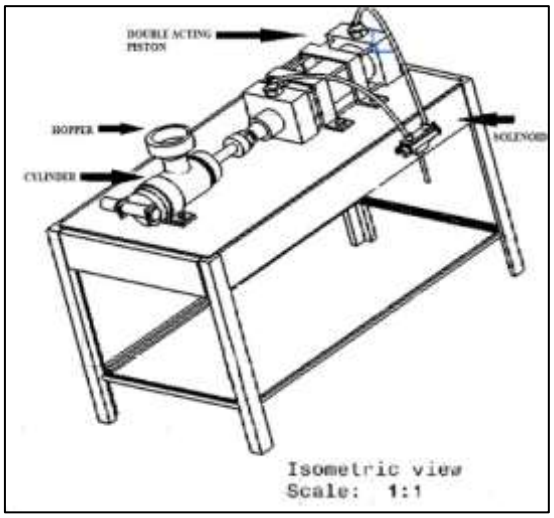

Fig. 1: Briquetting machine

B. Assembly Drawing

The fig-2 represents the assembly drawing of briquetting machine in front,left, and top view.

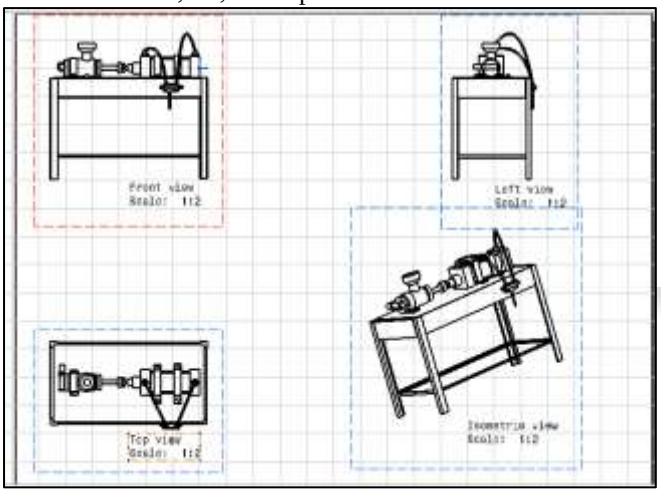

Fig. 2: Assembly Drawing

C. Pneumatic Circuit

The figure -3.3 represents the pneumaticcircuit diagram of actuating mechanism of the briquetting machine.

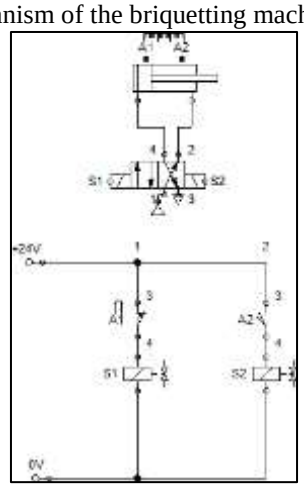

Fig. 3: Pneumatic circuit

III. DETAILED DRAWING OFBRIQUETTING MACHINE

A. Double Acting Cylinder

The figure-4 represents the detaileddrawing of double acting cylinder. This is the base structure that is in movement and the stresses acting on it that is contained bya cylinder.
Dimensions & Materials;

- Dimension = 3.5 cm
- Length = 10 cm

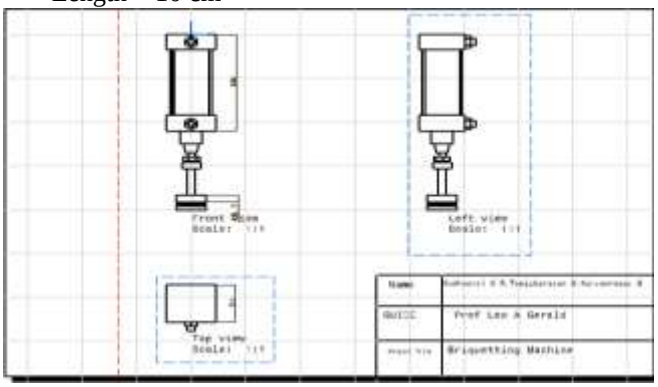

Fig. 4: Double acting cylinder

B. Cylinder

The figure -5 represents the detailed drawing of cylinder. This is the main part ofthe machine where the piston moves inside. Dimensions & Materials Diameter = 5 cm Length = 15 cm Material = Aluminium

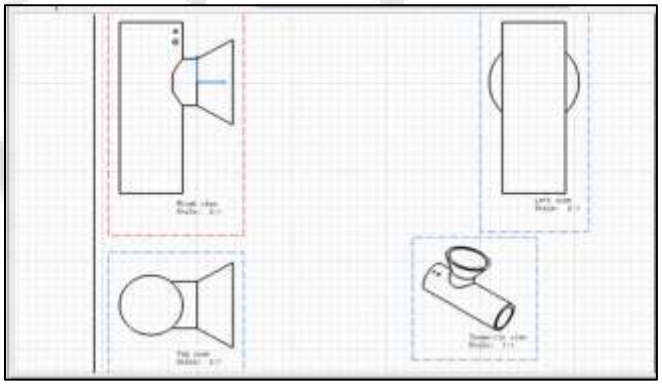

Fig. 5: Cylinder

IV. DESIGN CALCULATIONS

A. Piston and Cylinder calculations

Diameter= 5cm
Area of Cylinder = $\pi/4 \times (d^2)$
= 19.625 cm^2
Pressure = 10 bar
Force acting on piston = Pressure x Area
= 10 x 19.625
= 196.25 N
Mass = 0.1kg Height=3 cm Volume of cylinder = $\pi \times r^2 \times h$
= 3.14 x 6.25 x3
= 58.85 cm^3
Density = Mass/ Volume
= 0.1/ 58.85
=169 Kg/cm^3

V. PROPOSED IDEA AND WORKING METHODOLOGY

A. Piston Press DensificationTechnology:

Briquetting is one of the densification technologies for converting biomass wastesinto solid and convenient fuel. The mechanical piston presses are usually applied for production which ranges from 2to 25 kg/ h. The mechanical piston press is driven by pneumatic circuit where double acting piston used for piston front and backmovement and this can be achieved by solenoid. Comparing with the hydraulic press, the mechanical piston press has alonger working life and gives a better investment return.

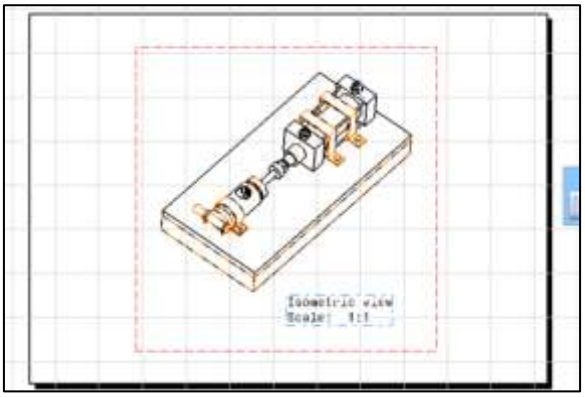

Fig. 6: Piston press technology

B. Process of Making Briquette

Generally, the paper is chopped into small tiny pieces and it is soaked in water for two days. Because it would break it down further into strands of cellulose, a type of organic plant material and the resulting mixture formed into a pulp or slurry. So that the binding conditions of paper are improved in this process. The pressure range which we are using to make briquette is 10 bar which is sufficient and we confirmed it through journals.

C. Working

The motive the project is to make use of waste products like paper, saw dust and dry leaves. Waste paper is collected and soaked in water. Saw dust and dry leaves are made into very fine grains. These wastes are mixed and can be used as raw material.

The apparatus consists of Pneumatic double acting cylinder, which helps to actuate. At the head of double acting cylinder, a piston setup is made, which helps to compress raw material into briquette. The piston is concentrically placed to the double acting cylinder, so that the piston can actuate within the cylinder. Pneumatic double acting cylinder is connected to solenoid valve, by which the direction of actuation can be controlled. It is powered by compressed air with pressure of 10Pa. The cylinder and double acting cylinder are fixed to the base horizontally. In between metal base and cylinder setup, there is plywood, which supports the entire setup. At the end of the cylinder, there is closed metal dummy made of mild steel. The dummy is supported by a metal piece and it is fixed to base, to support the cylinder against high pressure. The metal piece is fixed with the base by using nut and bolt. By removing metal support, we can take briquette from the cylinder. At is the top of the cylinder, there is whole from which raw material can be filled in the cylinder. The solenoid valve is connected to 230-volt Ac supply. There will be one input and two outputs at double acting cylinder. While turning on the solenoid valve, air flows towards outwards the cylinder, leads to extension of pistons. The extension of piston will compress the raw material Which turning off the solenoid valve, air flow towards in inwards the cylinder, leads to contraction of piston to its original position. So that the raw materials can be filled in the cylinder. Then the cycle repeats 10 to 15 times, in order compress low denser raw material into higher density product. At the end, metal dummy can be removed and briquette can be collected.

VI. ADVANTAGES

- They have higher calorific value compared with other materials that are used as a source for heat energy.
- They have less ash content so it is pollution free.
- Leftovers from the paper recycling and nature wastes such as leaves and stem of a plant can be used.
- The machine is light in weight and also portable.
- Mechanism is simple so it is not a difficult process
- Less cost compared with other briquetting machines in market.
- It will produce 6-7 briquettes per hour.

VII. RESULTS AND DISCUSSION

Thus, the Briquette obtained is characterized by calorific and ash content test. The obtained briquette has high calorific value and low ash content compared to raw material used for making briquette. The following graph clearly explains the calorific value and ash content of briquette.

SAMPLE(200 gm)	CALORIFIC VALUE (k cal)	ASH CONTENT
PAPER	4200	6.8
SAW DUST	4380	3.6
DRYLEAVES	4456	14.5
BRIQUETTE	5002	4.7

Table - 1. Ash Content and Calorific Value Table

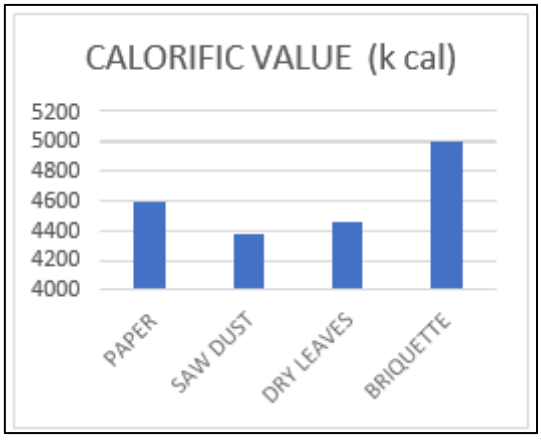

Fig. 7: Calorific value graph

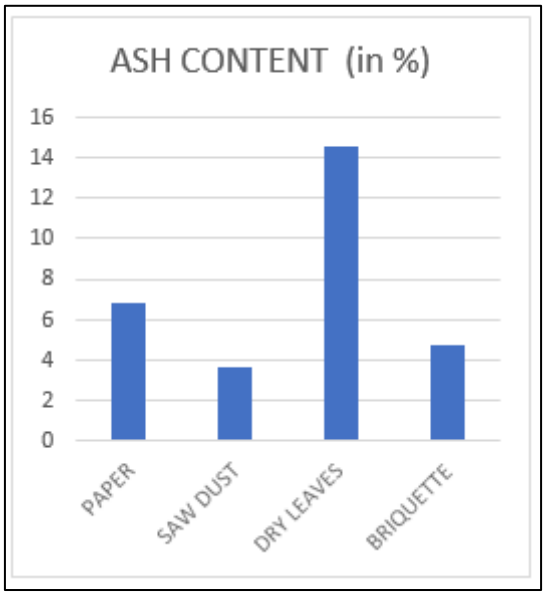

Fig. 8: Ash Content graph

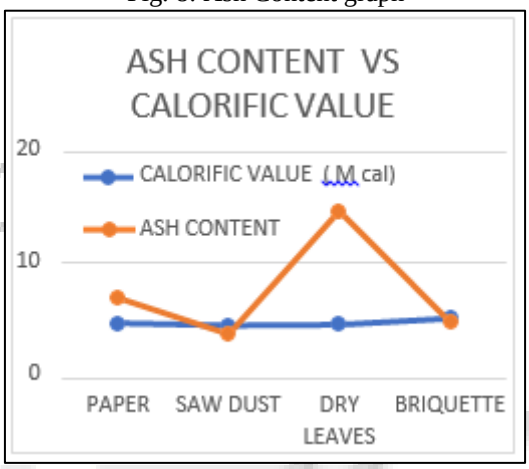

Fig. 9: Ash content vs calorific value Graph

VIII. CONCLUSION AND FUTURE SCOPE

Briquette is formed by using compression of raw materials using Pneumatic system. Pneumatic is a part of modern mechatronics system, which focuses on automation. Pneumatic system provides more accuracy of dimensions of briquette. More quantity of briquette can be prepared by using pneumatic system. Thus, the project has come up with a briquetting machine of compact size. At the same time, it is manufactured at low cost and also easy to operate. The time required in the conventional process is high and lot of human effort is need which we are going to eliminate by automating the process in future.

The briquette prepared by pneumatic system is limited to pressure of 10 bar. In future project can be upgraded to work with 100 bar pressure so that briquette formed is used as fuel for power plant.

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