Fabrication of Biomass Pellet Burner
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Abstract—The use of renewable energy sources is becoming increasingly necessary, if we are to achieve the changes required to address the impacts of global warming. Biomass is the most common form of renewable energy, widely used in the third world but until recently, less so in the Western world. Latterly much attention has been focused on identifying suitable biomass species, which can provide high-energy outputs, to replace conventional fossil fuel energy sources. So we used pellets which can be made from biomass. Pellets are biofuels made from compressed organic matter or biomass. Pellets can be made from any one of five general categories of biomass: industrial waste and co-products, food waste, agricultural residues, energy crops, and virgin lumber. The pelletization of biomass consists of a series of unit operations: drying, size reduction, densifying, cooling, screening, and warehousing. The main purpose of the project is to reduce greenhouse gas emission through the creation and introduction of innovative elements in the biomass processing and heat production. We are fabricating a device which is an alternative to domestic burner and small scale industrial burner. By using Biomass Pellet burner, We have to replace Oil/Gas burners, to save 30–80% of the fuel Cost, Energy Saving, Environment protection. A Biomass Pellet burner based on new design concept so that all biomass burning particle to find a solution to CNG, petroleum and all other conventional energy sources. The pellet burner is an eco-friendly heat generation technology, designed to convert furnace oil, diesel or gas based systems into a biomass-based system which is economical, carbon neutral, clean and sustainable. A biomass pellet burner consist of Hopper, Blower, Grate, Combustion Chamber and ashpit, etc. Biomass Pellet burner is Energy - efficient, It has high thermal efficiency, stable and reliable performance, less smoke, easy operation, low investment and running cost. It is light in weight and freely movable.

It is a perfect alternative to the costly diesel, wood and gas based system. Biomass pellet burner is equipped with manual control mechanism to work according to the system requirement. Biomass pellet burners are newly biomass combustion devices, which adopt new scientific research, integrate advanced combustion technologies.

They are the best substitutes of combustion equipments for electric boilers, oil burning boilers, gas-fired boilers and coal-fired boilers. Biomass pellet burner is widely used in various heat energy industries, such as boiler, die-casting machine, industrial furnace, incinerator, smelting furnace, drying equipment, drying plant, painting equipment and asphalt heating equipment etc.

II. PROBLEM IDENTIFICATION

The older burners are consumes more times and created more pollution. These is because of the small size of blower i.e. if blower size is small then the discharged of air to the combustion chamber is low by which air supply is reduces. And if the discharge of air is reduces then it causes incomplete combustion of pellet which causes pollution by creating carbon monoxide.

In the olden burner there was manual feeding of the pellets, due to which again increase the times for heating purpose. The older burner are heavy in weight due to which it causes problem at the time of transportation.

III. OBJECTIVE

1) By using Biomass pellet burner, we are using pellets as the substitute for oil and gases. Our aim is to replace Oil/Gas burners by using Biomass pellet burner as fuel with low cost as compared to fuels such as kerosene, L.P.G, natural gas, wood, Coal.

2) Main objective of our project is to reduce greenhouse gas emission through creation by introduction of biomass pellets, and also carbon emission is very less as compared to other fuels.

3) No pollution and high efficient environmental protection, burn reproducible biomass fuel, realize the sustainable use of energy.
IV. PELLETS

Pellet fuels are biofuels made from compressed organic matter or biomass. Pellets can be made from any one of five general categories of biomass: industrial waste and co-products, food waste, agricultural residues, energy crops, and virgin lumber.

Biomass pellets are the most common type of pellet fuel and are generally made from compacted sawdust and related industrial wastes from the milling of lumber, manufacture of wood products and furniture, and construction. Other industrial waste sources include empty fruit bunches, palm kernel shells, coconut shells, and tree tops and branches discarded during logging operations. So-called “black pellets” are made of biomass, refined to resemble hard coal and were developed to be used in existing coal-fired power plants.

Pellets are produced by compressing the wood material which has first passed through a hammer mill to provide a uniform dough-like mass. This mass is fed to a press, where it is squeezed through a die having holes of the size required (normally 6 mm diameter, sometimes 8 mm or larger). The high pressure of the press causes the temperature of the wood to increase greatly, and the lignin plasticizes slightly, forming a natural “glue” that holds the pellet together as it cools.

Pellets are categorized by their heating value, moisture and ash content, and dimensions. They can be used as fuels for power generation, commercial or residential heating, and cooking. Pellets are extremely dense and can be produced with a low moisture content that allows them to be burned with a very high combustion efficiency.

A. Characteristics of pellets:

Pellet quality depends both on physical, chemical and mechanical properties of biomass (as a raw material) and pelletizing variables (such as pressure, temperature, etc.). Moisture, bulk density and durability are three of the main properties to evaluate densified products.

- Moisture must be low in pellets. High moisture levels imply that combustion heat is partially used to evaporate water from the biofuel, whereas for dry biofuels the whole heat is used for the right purpose. Lower moisture contents allow higher flame temperatures (with better temperature gradient and heat transfer, and enabling the completion of combustion), and shorter residence times in the combustion chamber. The results obtained for this parameter were similar, changing depending on the moisture of the raw material, the drying process and operating conditions of the equipment.

- As far as bulk density is concerned, it is the main quality indicator for pellets, along with size distribution, moisture and compression strength during the process.

- Durability is related to the effectiveness of densification. Pellets should endure different efforts during shipping, loading and transportation to the final destination.

B. Types of Pellets:

The different types of pellets are shown in figure.

- Corn Straw Pellet: These straw pellet is made up of Corn so called as Corn Straw Pellet.
- Wheat Straw Pellet: These straw pellet is made up of Wheat so called as Wheat Straw Pellet.
- Rice Straw Pellet: These straw pellet is made up of Rice so called as Rice Straw Pellet.
- Cotton Straw Pellet: These straw pellet is made up of Cotton so called as Cotton Straw Pellet.
- Peanut Shell Straw Pellet: These straw pellet is made up of Peanut Shell so called as Peanut Shell Straw Pellet.
- Branch Straw Pellet: These straw pellet is made up of Branch so called as Branch Straw Pellet.
- Wood Saw Dust Straw Pellet: These straw pellet is made up of Wood Saw Dust so called as Wood Saw Dust Straw Pellet.
- Scobes Straw Pellet: These straw pellet is made up of Scobes so called as Scobes Straw Pellet.

C. Features of Pellets:

- Cost Effective: Customers can significantly lower their energy cost through use of pellets.
- Sustainable and Eco-friendly: Use of biomass pellets reduces emissions through utilization of biomass replaces and replacement to conventional fossil fuels.
- Efficient: Their uniform shape and size ensures that pellets offer remarkable consistency and burning efficiency. Biomass pellets have low moisture, ash content which further add to their performance.
- Safe: Pellets are absolutely safe to use and store as there is no risk of fire hazards.
- Less smoke produce: It produce less smoke as compared to other fossil fuels, as well as clean and hygienic working environment.
- Easily available: Pellets are manufactured locally in anywhere. Thus, unlike imported fuels such as diesel and LPG, there is no fear of shortages, stock-outs and undue price fluctuations.
- Convenient pack-size: Biomass pellets are easily available in 25 kg bags for small commercial, industrial and residential use. We can supply pellets in bulk quantities for large scale industrial requirements.

Fig. 1:
D. Design of Pellet Burner:

Fig. 2:

V. CONSTRUCTION AND WORKING

- The biomass pallet burner is made up of the four main parts. It includes the blower, hopper, combustion chamber and ashpit.
- Blower is used to supply pressurized air below the grate where the pallets are burned.
- The hopper is connected to the upper parts of the biomass pallet burner from where the biomass pallets are fed. It consists of an automatic pallet feeder system which helps to maintain a desired quantity of pellets in a combustion chamber.
- When the desired level of pellets in combustion chamber is reached then the hopper is closed by means of lever mechanism.
- Similarly when the level of plates on grate falls below the desired level for combustion then additional pellets are supplied to the required level for proper combustion of pellets.
- Ashpit is used to collect the ash from burner grate. When the pellets are burned on the grate, then ash of the burned products falls on the ashpit.
- When the ash collector is completely filled with the ash we can remove the ash collector and dispose it to wastage tank.

VI. FEATURES AND BENEFITS OF PELLETS BURNER

- Energy-efficient: The pellet burner takes biomass pellets as the energy source, the cost is decreased by 30%-60% compared to the fuel oil or gas.
- High thermal efficiency: With boiling type half gasification combustion and tangent spiral-flow type air distribution design, the fuel can burn completely, and the combustion ratio can reach higher than 90%.
- Stable and reliable performance: The equipment is running under micro pressure state, it won’t appear tempering or flame-lifting phenomenon.
- Low carbon and pro-environment: It realizes the sustainable use of energy by using the biomass energy, with low emissions of smoke dust, sulphur, nitrogen and carbon dioxide.
- Low investment and running cost: The biomass burner is with reasonable design, it costs little money when used for boiler reforming.
- Labor Saving: The pellet burner is with automatic gravity based feeding design, easy to operate, one person can finish the operation.
- Hot water utilization: There are two types of biomass pellet burner, water-cooling type and air-cooling type. As for the water-cooling structure, it can generate hot water for life or industry use.

VII. APPLICATION

Biomass pellet burner is widely used in

- Kitchen equipment: It can be use as a domestic application.
- Heater: It can be use for thermal comfort for human at cold places.
- Agricultural use: It can be use in green house plant.
- Industries: It should be use in smithy operation
- It can be use in rural area.

VIII. FUTURE SCOPE

In future, we can use in household works & in industries in large scale. We can use it in furnace for melting the metal in industry. It is use in boiler work on biomass fuel with maximum efficiency. It can be used for preparing meals in large amount.

REFERENCES

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