A Review on Briquetting Machine for Agriwaste

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Abstract— This study was that every year millions of tons of agricultural wastes are generated in the country. Briquettes produced from agro residues are fairly good substitute for coal, lignite and fire wood. Briquettes have high specific density (1200-1450 kg/m3) compare to 60 to 180 kg/m3 of loose agro residues. Loading / unloading, transportation and storage costs of agro residues are drastically reduced if they are counted in the form of briquettes. Formation of briquettes at the very site of its production stops air pollution to a large extent. In this paper an attempt is made to design and fabricate briquetting machine for any kind of agriwaste in any season. Effect of moisture content in agro residues and binders used have been studied on briquettes density power consumption / kg of briquette produces calorific value / kg of briquette. Thermal efficiency of chulha (local stove) using prepared briquette was obtained to be 5%.

Key words: Briquettes, Agricultural Residues, Agriwaste, Binder, Biomass, Calorific Values Briquette Density

I. INTRODUCTION

Agricultural wastes are waste from farming, forestry, horticulture and other farm operations. There is a rapid increase in the volume and types of agricultural wastes due to intensive agriculture in the wake of population growth and improved living standards, which are now becoming a major problem as rotten waste biomass emits methane and leach-ate. Open burning of these wastes by farmers usually generates carbon dioxide (CO2) and other local pollutants (UNDP, 1982). Most agricultural solid wastes are generated by the rearing of animals, and harvesting and processing of crops. These wastes take the form of residual stalks, straw, leaves, roots, husk, nut or seed shells, waste wood and animal husbandry waste.

These wastes are managed through the processes of collection, storage and disposal in form of biomass. If not managed properly, agricultural waste from farm operations can pollute the environment and even degrade both surface and underground water as they contain a lot of nitrates which can reduce the ability of these resources to support aquatic life and serve for human and animal consumption (www.HaweeRiver Water Coalition.com, 2010).

Fig. 1: Selected Raw Materials Tested for Briquette Production

In order to manage these waste agricultural biomass by converting them into useful material resource, considerable efforts have been made by many Governments and private entities but there are still major gaps to be filled (UNDP 1982). Also, there is a lack of awareness and capacity to divert most of the waste for useful materials, energy recovery and wealth. This could reduce the costs for waste disposal and would generate the revenue from the sale of the recovered materials and energy.

Due to the present world's energy crisis and its related environmental issues as well as increasing trend of fossil fuel prices, renewable energy source is an essential matter. Biomass briquettes are a renewable source of energy and they avoid adding fossil carbon to the atmosphere. They are made from agricultural waste and are a replacement for fossil fuels, and can be used to heat boilers in manufacturing plants, and also have applications in developing countries.

Fig. 2: Pine Needles processed before for Briquette Production

To survive in competitive environment, biomass briquette entrepreneurs should be provided an appropriate technology which helps to reduce production cost and time, and improve productivity. Huge quantities of agro-residues are produced after the harvest by many of the developing countries but they are used inefficiently causing extensive pollution to the environment. The major residues are rice-husk [1], coffee husk, coir pith, jute sticks, bagasse, groundnut shells, mustard stalks and cotton stalks [2, 3].Saw dust, a milling residue is also available in huge quantity in India. Problems associated with the utilization of these residues are for transportation, storage and handling. The direct burning of loose agro residues in conventional grates is associated with very low thermal efficiency and widespread air pollution. In addition, a large percentage of no burnt carbonaceous ash has to be disposed of. Briquetting of agro-residues at the very site of its production can solve these pollution problems with the advantage of making use of them as a source of nonconventional energy.

II. CONCEPT

Figure shows the conceptual diagram of the agriwaste briquette making machine. In this machine operator will press the foot lever by using the foot. That foot force will transmit

towards ratchet through the intermediate linkage that will convert the foot pressure into the rotation of shaft by using the ratchet mechanism.

On same shaft at opposite side small sprocket of chain drive will be mounted which will rotate the other shaft by using the chain drive. The second shaft will be mounted on quarterly threaded shaft which will convert the rotation of shaft in vertical motion of other shaft.

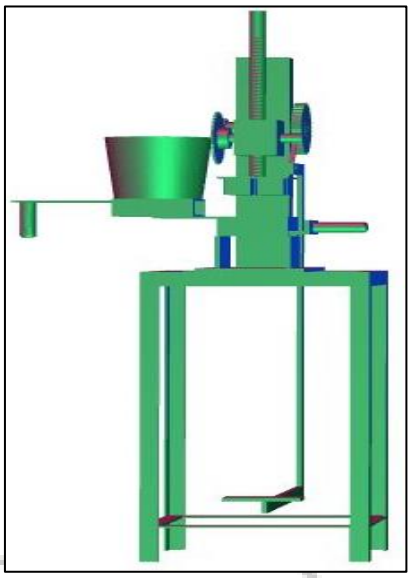

Fig. 3: Conceptual Diagram of Agriwaste Briquette Making Machine

That vertical motion will create the pressure on the die by using punch for creating the briquette.

III. LITERATURE REVIEW

A. "Investigation into Viability of Briquettes from Different Agricultural Residues as Alternatives to Wood and Kerosene Fuels"

1) Oladeji, J.T.

The use of wood is increasing on daily basis especially in the less technologically developed countries of the world. Heavy reliance on wood for domestic cooking would lead to deforestation or desertification. The present work identified biomass briquettes as viable alternatives or supplements to wood and petroleum based fuels for domestic and industrial cottage applications in Nigeria. Two sets of briquettes (one from cassava starch and the second from glue) were produced from each of the four selected residues. Briquettes from each set from the four residues were used to boil a measured quantity of water and temperatures were taken at various time intervals with the aid of mercury-in-glass-thermometer, which was inserted through a hole drilled on the cover of the pot. A stop clock was used to time the boiling process and readings were taken every two minutes interval until the water boils. Results of briquettes produced with glue as binding agent were compared with those mixed with starch. Firewood and kerosene were also used to boil the same quantity of water. Results of boiling test showed that it took 28 minutes for rice husk binder with starch and glue to boil the water, while the sawdust briquettes binder with glue and starch raised the temperature of water to boiling point in 26 and 28 minutes respectively. It took melon shell briquettes binder with glue and starch 22 and 24 minutes respectively to boil the water, while the time used by cassava peel briquettes binder with glue and starch to boil the same quantity of water were 20 and 22 minutes respectively. Using firewood, the water boiled in 18 minutes, while kerosene boiled the same quantity of water in 14 minutes. The results had shown that biomass briquettes are good substitutes for firewood and kerosene. Of all the four biomass briquettes examined, briquettes from cassava peel and melon shells appear more efficient.

B. "Assessment of the Performance of a Disc Actuated Briquette Production Machine Developed At the National Cereals Research Institute, Badeggi"

1) AgidiGbabo [1], A. N. Efomah [2], S. A. Alake [3]

A briquetting machine to utilize agricultural waste products as raw material was designed, fabricated and tested. The machine was developed in order to be utilized by cottage factories to produce briquettes for both domestic and industrial use as source of heat energy. The machine mainly comprised of a hopper, compaction chamber, compression lever mechanism and the main frame. The machine was tested by using it to produce briquettes from sugarcane bagasse produced directly from a cane juice expeller, rice husk and sawdust under the same conditions of binder concentrations at different levels. The samples were analyzed for combustion properties (volatile matter, ash content, fixed carbon and heating value), Bulk density and compressive strengths. Result showed that Sugarcane bagasse and rice husks had higher volatile matter and lower fixed carbon compared to sawdust. The volatile matter and fixed carbon were 80% and 12% for sugarcane bagasse briquette and 79.8% volatile matter and 11.2% fixed carbon for rice husk at 10% binder concentration. The bulk density, 2.1kg/m3 of the bagasse briquettes was less than that of the rice husk and sawdust briquettes which were 3.6kg/m3 and 3.2kg/m3 respectively at 10% binder concentration. The compressive strength of all the briquettes were almost the same with the highest values ranging from 0.9KN/m2 (for sugarcane bagasse briquette) to 1.2KN/m2 for rice husk briquette at 40% binder concentration. The machine was found suitable to be used in producing briquettes from sugarcane bagasse since it had higher volatile matter and lower fixed carbon which are good quality characteristics required from combustible materials meant for the production of heat energy for both domestic and industrial uses.

C. "Community-Based Energy Briquette Production from Urban Organic Waste Atkahawa Soweto Informal Settlement, Nairobi"

1) Mary Njenga [1], Nancy Karanja [2], Gordon Prain [3], John Malii [4], Patrick Munyao [5], KuriaGathuru [6], Beatrice Mwasi [7].

Solid waste management presents a major challenge for many municipal authorities in Sub-Saharan African cities, where rapid growth, social and cultural change, widespread poverty, inadequate and weak local enforcement capacity and limited financial resources all contribute to environmental degradation and waste disposal challenges. Nairobi, the capital city of Kenya, generates over 2000 tonnes of solid waste daily and only 40% is collected and disposed. The city experiences a high level of poverty and unemployment among the poor who constitute over 60% of the population. Many youths living in the informal settlements are highly affected by lack of jobs in the formal sector and to address

their plight, they have come up with initiatives to address poverty and unemployment as well as environmental burdens and insecurity in their neighborhoods through recycling waste resources. One major problem that the urban poor in cities of Sub-Saharan Africa have to contend with is inaccessibility of affordable cooking fuel, and it has been shown from numerous studies that the majority of people depend on charcoal for cooking. The residents of Kahawa Soweto village are no exception to this challenge and so Soweto Youth in Action (SOYIA) youth group, in collaboration with Urban Harvest and Kenya Green Towns Partnership Association (Green Towns), developed an action research initiative on making fuel briquettes from urban solid waste generated from the neighborhood and environs with the objective of generating income and providing employment while contributing to environmental management. In the course of the project TERRA NUOVA, the private sector and the University of Nairobi joined the partnership to provide specified technical expertise. This action research project was the follow-up to a larger study on solid waste management carried out in 2003-2004 by Urban Harvest and partners where SOYIA youth group was one of the CBOs that played a key role to the success of that project.

D. "Design and Development of a Compact Screw-Press Biomass Briquetting Machine for Productivity Improvement and Cost Reduction"

1) Teerapot Wessapan [1], Nisakorn Somsuk [2], Theerapong Borirak [3]

This paper presents a design and development of a compact screw-press briquetting machine which combines three functions including crushing, mixing and briquetting in a single unit. By eliminating individual machines, the great savings in space, material handling and worker, and the improved efficiency can be realized. This technology also helps to reduce cost and production time, and improve productivity, and eventually lead to be able to survive in competitive environments. This paper also presents characterizing property of the briquettes produced by the developed machine. Finally, a cost analysis for the compact briquetting machine is presented.

E. "Biomass Briquetting of Agricultural, Forest Residues and Herb Wastes in Nepal"

1) G. R. Shakya [1], I.Shakya [2], M. Augustus Leon [3]

The large quantities of agricultural residues produced in developing countries can play a significant role in meeting their energy demand. However, the abundant quantities of agricultural wastes and forest residues are neither managed effectively nor utilized efficiently. In the case of Nepal these shortcomings are observed even in the management and utilization of wastes from medicinal herbs and aromatic plants. The biomass wastes can be upgraded into a more convenient fuel by briquetting. Recognizing this, the Royal Nepal Academy of Science and Technology (RONAST) has been conducting research and development activities in the field of biomass briquetting since 1997. The academy has been successful in producing biomass briquettes from alternate raw materials besides rice husk. Problems associated with the high cost and wearing of screw have also been addressed. Realizing the role of appropriate cooking devices, RONAST has developed new briquette burning devices and modified traditional stoves for firing biomass briquettes. This paper highlights the findings related with the briquetting of alternative raw materials like pine needles, ban Mara, wood shavings, aromatic and medicinal herbs, plastic waste etc. It also discusses about a new cost effective technique of fabricating the screw used in the heated-die screw-press briquetting machine, and its performance. Lastly the paper provides an insight to the user's perception of briquettes as domestic fuel.

F. "Developing Agricultural Raw Materials for Wealth Creation in Nigeria"

1) Peter Azikiwe Onwualu

The world economy is experiencing an in-depth change in structure, marked by the widening phenomenon of globalization. This change bears new hopes, throws daunting challenges and presents real dangers for the Less Developed Countries (LDCs). It is a known fact that many of the LDCs are generously endowed with vast natural resources, but in the emerging global economy, the wealth of a nation is no longer determined by mere possession of natural resources, but largely by the human resource capabilities, whose role include acting upon the natural resources to enable the society derive full benefit from such endowments. This is because endowments of a nation with natural resources does not necessarily make a nation rich, it makes the nation only potentially rich and a nation can remain potentially rich on a permanent basis, whilst a country that is not generously endowed with natural resources can become very rich by making use of the quality of its human resources. The ability to transform the natural resources into products which are acceptable and globally competitive defines the wealth of a nation. In realizing the importance of economic growth and development to the well-being of the citizenry, the present administration of President Yar'Adua emphasizes the need to expand the productive base of the economy for increased Gross Domestic Product (GDP) as well as achieving the lofty objectives of the Seven-point agenda and the Vision 20-2020 for the overall national economic growth and development.

G. "Conversion of Waste Plastic into Solid Briquette in Combination with Biomass"

1) Mitun Chandra Bhoumick [1], Niloy Chandra Sarker [2], Md. Mahmudul Hasan [3], Bishaw Kanti Roy [4]

Every year millions of tons of agricultural wastes are generated in the country. The percentage of Plastic waste is also increasing in the Municipal Solid Waste management system. These Biomasses or Agricultural wastes can be used as energy source directly. The problem is the energy efficiency and environmental pollution. Meanwhile waste plastics are recycled and a major portion of it goes to land filling. As plastics possess high fuel value, these can be combined with biomasses to prepare solid briquette. This current study looks to develop a good composition of Briquette which comprises of conventional Biomasses and Plastic waste. The total work is carried out in three segments; (i) Preparing a Lab grade Thermal Piston Press for Plastic-Biomass Briquette Manufacturing, (ii) Sample preparation with various proportion of Biomass and Waste Plastic, and (iii) Characterization of the prepared sample. From the study it is seen that the fuel value of Biomass Briquette increases with mixing of plastics, which minimizes water absorption and friability, increases storage capacity and strength. The characterization of Plastic-Biomass Briquette shows that with

the addition of 10% waste plastic the calorific increases 40% by margin and doubles the compressive strength.

H. "Design & Fabrication of Briquetting Machine for Saw Dust"

1) Dr. Pushpa Jha [1] , Mr. Pramod Yadav [2]

Briquettes produced from agro-residues are fairly good substitute for coal, lignite and firewood. Briquettes have high specific density (1200-1450 kg/m3) compared to 60 to 180 kg/m3 of loose agro-residues. Loading/unloading, transportation and storage costs of agro residues are drastically reduced if they are converted in the form of briquettes. Formation of briquettes at the very site of its production stops air pollution to a large extent. In this paper an attempt is made to design and fabricate briquetting machine for saw dust. The machine has been designed to produce briquette at the rate of 7kg/hr. Effect of moisture content in agro-residues and binders used have been studied on briquette density, power consumption/kg of briquette produced and calorific value/kg of briquette. Thermal efficiency of chulha (local stove) using prepared briquette was obtained to be 5%.

IV. RESEARCH METHODOLOGY

The various steps that will be followed to achieve the objective in this project are:

- Study of Agriwaste.
- Study of Machine Available In Market.
- Study of New Mechanism.
- Design of Briquette.
- Design of Machine.
- CAD Model.
- Result & conclusion.

The approach will be Design, Modelling, Fabrication and Testing of the machine.

V. CONCLUSION

The main conclusion will be drawn find out whether it is possible to automate a skilled manual process which would avoid worker fatigue. Also the future scope is developing the generalized machine for any shape, size and category of agriwaste.

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