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Briquetting – A Waste Management Technology

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***Abstract*—Waste management is the process of treating solid wastes and offers variety of solutions for recycling items that belongs to trash. It is about how waste is used as valuable resource. Energy from waste management is a proven renewable energy technology that recovers energy from waste. Briquetting is one of the promising waste management technologies for converting biomass in to solid fuel with high calorific value. In this paper the issues related to briquetting such as wear and tear of die and screw, power consumption, safety and environmental issues need to be addressed to make briquetting a productive process.**

***Index Terms*— Waste management, Agricultural Waste, Briquetting, Alternate Energy.**

I. INTRODUCTION

Briquetting is one of the waste management technologies to produce homogenous uniformly sized pieces from bulk density waste. It is commonly used as fuel. Briquetting is made by using biomass material such asdry leaves, ground nutshells, coffee husk, rice husk etc. In most of the applications the biomass is compressed to a solid mass using die and punch technology.

The biomass is the third prime renewable energy in the creation. The primary renewable energy currently provides about 1250 million tonnes supplying energy [1,2]. The renewable source of energy based on biomass was utilized to fulfil world's 14 per cent of energy. The utilization of the remains from agricultural sector as primary or secondary source of energy is considerably attractive [3,6]. It is widely accepted that renewable energy seems to be one of the promising energy resources and shall play a major role in the foreseeing years.

The plenty of biomass is available due to vast agricultural production in world, in particular India, Srilanka, Indonesia, Bangladesh, China, Nepal, Philippines, Thailand, and Bhutan.An overall potential of 17000MW of power generation through the use of various types of biomass materials has been estimated [1, 3].Common aspects which are important for the development of briquetting are the demand for wood and wood products particularly charcoal, which is the fuel of choice in many urban areas. Deforestation is an actual or potential problem for supply of biomass. The supply of a substitute for fuel wood in the household sector has emerged as a policy priority in many developing countries [4,5,6].

Nowadays briquetting technology plays an important role in the utilization of agro wastes for higher calorific value and high energy utilization mainly in urban areas [9,11]. It is also an additional technology for improving the efficiency of biomass fuel. Briquetting process is the compaction of residues into a product of higherdensity than the original raw material.

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II. Biomass Briquetting Industry

In 19th century the biomass under enemy control the global energy supply with a 70% share [10]. The biomass energy sources, woodfuels are the most projecting. By rapid increase in fossil fuel use, the share of biomass in total energy degenerated steadily through substitution by coal in the nineteenth century and laterby refined oil and gas during the twentieth century. In the face of its declining share in energy, global consumption of wood energy has continued to grow. Throughout 1974 to 1994, global wood consumption for energy grew yearly by over 2 percent rate. Presently, the biomass sources contribute 14% of global liveliness and 38% of energy in developing countries [6].

III. The Briquetting System

Due to their assorted nature, biomass materials possess inherently low bulk densities, and uneven and worrying characteristics thus, it is difficult to efficiently handle large quantities of most feed stocks. The process of compaction of residues into a product of higher density than the original raw material is known as briquetting process (Fig.1). Densification has produced a great deal of curiosity in developing countries all over the world lately as a technique for upgrading of residues as energy sources. Converting residues into a densified form has the following advantages are like the process increases the net calorific value per unit volume, densified product is easy to transport and store[7,8],The process helps to solve the problem of residue disposal, The fuel produced is uniform in size and quality.

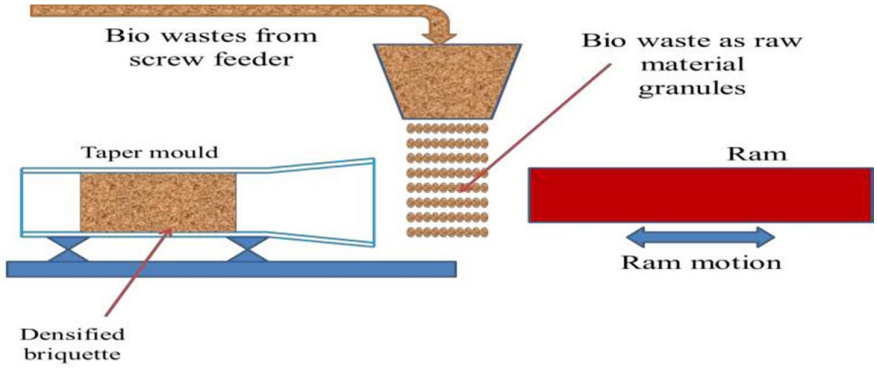
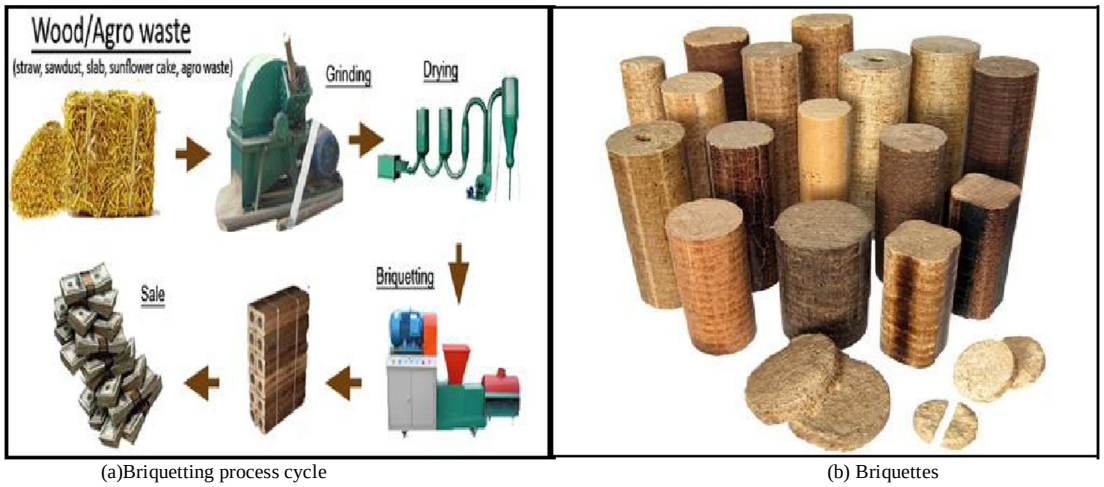


Fig 1: Biomass briquetting process (AGICO Briquette press)



(a)Briquetting process cycle (b) Briquettes

Fig. 1 :Briquetting process

Fig. 1 shows the outline of briquette making process in which the first step is to cut the biomass material into small pieces followed by drying, preheating and finally fed through the punch and diewhere theraw material is squeezed and compacted in the taper mould as shown in Fig. 1(a). The densified briquettes are compacted

to a desired shape and size as shown in Fig.1(b). There are many technical challenges involved in the fabrication process with respect the briquettes and machine parts [10]. The common problem in the process is wear and tear of the machine elements. This was due to rapid motion of ram reciprocation and thermal stresses and strain in the taper mould because of heat generated between the process of compaction and due to friction between the mating parts. There by after some time, the taper mould and ram are subjected to high wear and were failed in a short time. This was the serious problem that was faced by the many briquetting industries.

IV. Briquetting Methods

There are mainly three popularly used methods for briquetting namely; (a)die and punch technology (b) Screw technology (c) Hydraulic press-based technology.

A. Die and punch technology

In the die and punch technology, the biomass is placed into a die by a reciprocating ram with a very high pressure thereby compressing the mass to obtain a compacted product. The technology having a lesser relative motion between the ram and the biomass and hence, the wear of the ram is considerably less. It is the most money-making technology currently offered by the Indian market.

B. Screw technology

It is widely applied process for the compaction of low bulk density waste to convert it in to a solid form. The material to be pressed between the screw and barrel and propelled by the rotating screw in a direction parallel to the axis. The compression effect can be achieved for example by decreasing the clearance between the screw and the cage or by reducing the length of the screw flight in the axial movement. The screw is subjected to wear and tear.

C. Hydraulic press-based technology

This process consists of first compacting the biomass in the vertical direction and then again in the horizontal direction. This technology can agree to take raw material with moisture content and allows a speed for the die and punch process [12]. Additional, the relative movement of the material within the die is only for a limited length, the wear and tear of the machine will be lower than those currently available machines in the Indian market.

V. Problem Associated With Briquetting

A. Wear and tear of tooling

In briquetting process, a punch and die isused for compacting the biomass. The common problem encountered in briquetting process is the wear and tear of the punch and die due to the abrasive nature of biomass [5]. High carbon high chromium material with a hardness of 60 HRC is used as material for die and punch [6]. The life of punch and die is around 70 to 100 hours based on the type of biomass used. As the life of the die is very short, it calls for frequent change of die and punch leading to down-time of press there by decrease in productivity. Before manufacturing process, the preheating of raw material is required due to decrease the wear and tear of tooling. Even using [7], the most abrasive raw material, the screw life increased from 20 minutes to 31 by using tungsten carbide coating on the screw [6,10].

B. Rebuilding cost of screw

The rebuilding cost of screw to increase the life of the screw to the required level as obtained in manufacturing process with a different raw material. The different alloys used, for increasing life of the screw obtained [12]. Even using rice husk, the most abrasive raw material, the screw life increased from 20 minutes to 31 hours by grinding and preheating the raw material. The alloy (tungsten carbide) is coated on the screw. It increases the life of the screw and reduce the maintenance cost and increase the production process. [7,8].

C. Operational issues

In manufacturing industry, the operation, maintenance and monitoring of the machines are the main important to be concentrated are regular maintenance of machines. The replacement of the worn-out parts at

regular intervals, change the lubricating oil daily, to increase the life the parts, to decrease the wear and tear of tooling [9].and also reduce the maintaince cost of machines.

D. Safety and environment

The safety and environment is an important role in briquetting industry [9]. Some of the safety issues are: (a) Danger of fire in drier system, (b) Dust pollution of the lubricated parts of the machine, (c) Air pollution in the shed.

VI. Conclusion

This technique briquetting is not complex or highly sophisticated operating conditions. Briquetting is one of the promising waste management technologies for converting biomass in to a compact and useful fuel with high calorific value. The major problems that need to be addressed are the wear and tear of tool, environmental problems, operational problems and safety issues in order to make briquetting as an economically viable technology.

References

[1] Daham Shyamalee , A.D.U.S. Amarasinghe, N.S. Senanayaka 2-Evaluation of different binding materials in forming biomass briquettes with saw dust- International Journal of Scientific and Research Publications, V-5, Issue 3, March 2015 1 ISSN 2250-3153

[2] Yaman, M. S. ahan, H. Haykiri-ac¸ S. K, bayrak-Production of fuel briquettes from olive refuse andpaper mill waste -www.elsevier.comrlocaterfuproc-Fuel Processing Technology 68 (2000), 23–31

[3] Yuhazri, M.Y., Haeryip Sihombing, Umar Nirmal, Saijod Lau and Phongsakorn Prak Tom. Solid fuel from empty fruit bunch fiber and wastepaper's part 1: heat released from combustion test-global engineers & technologists review- www.getview.orgGlobal Engineers & Technologist Review, Vol.2 No.1 (2012)

[4] Stephen J Mitchual1, Kwasi Frimpong-Mensah and Nicholas A Darkwa-Effect of species, particle size and compactingpressure on relaxed density and compressivestrength of fuel briquettes-. International Journal of Energy and Environmental Engineering, (2013).

[5] Olorunnisola department of agricultural & environmental engineering University of Ibadan, Nigeria -production of fuel briquettes from waste paper and coconut husk admixtures Agricultural Engineering International: the CIGR Ejournal. Manuscript EE 06 006. Vol. IX. February, (2007)

[6] Manoj Kumar Sharma, Gohil Priyank, Nakita Sharma - Biomass Briquette Production: A Propagation of Non-Convention Technology and Future of Pollution Free Thermal Energy Sources - American journal of engineering research, volume-04, pp-44-50 (2015)

[7] W.S. Hulscher, Fao-Rwedp, Bangkok-biomass/wood energy resources: commercial prospects for wood-based technologies

[8] Krizan, M. Matus, Soos, j, Kers, P. peetsalu, Kask and Menind -Briquetting of municipal solid waste by different technologies in order to evaluate its quality and properties-Agronomy Research Biosystem Engineering, Issue 1, 115-123, 2011

[9] Zhao Fang, Zhang Ya-zhuo, Xu Zheng, Li li, Zhang Shuang. Standardized processes of biomass briquetting densifi cation fuel-College of Materials Science and Technology, Beijing Forestry University, Beijing 100083, P. R. China© Beijing Forestry University and Springer-Verlag Berlin Heidelberg For. Stud. China, 2012, 14(1): 80–84DOI 10.1007/s11632-012-0110-9

[10] Grover & S. K. Mishra-of the International workshop on biomass briquetting-regional wood energy development programme in Asia gcp/ras/154/net-of the international workshop on biomass briquetting new Delhi, India (3-6 April 1995), RWEDP report no.23

[11] Wajeeha Saleem, Ayesha Zulfiqar, Muneeba Tahir, Fatima Asif, Ghazala Yaqub -Latest technologies of municipal solid waste management in developed and developing countries: A reviewInternational Journal of Advanced Science and Research V-1, pp-22-29 Issue 10; October 2016; Page No. 22-29

[12] Shreya shukla1, savitavyas-study of biomass briquettes, factors affecting its performance and technologies based on briquettes-IOSR Journal of Environmental Science, Toxicology and Food Technology, V-9, pp-37-44(Nov. 2015), PP 37-44www.iosrjournals.org