Veera Prathap Bolishetti, et. al. International Journal of Engineering Research and Applications
www.ijera.com
ISSN: 2248-9622, Vol. 11, Issue 8, (Series-II) August 2021, pp. 38-40

RESEARCH ARTICLE OPEN ACCESS

Waste to Wealth a Sustainable Processing of Municipal Solid Waste

Veera Prathap Bolishetti, Bhavani R*
Department of Civil Engineering, JNTU Anatapur, A.P, India.
Corresponding Author: Prof. Bhavani.R
Professor and Controller of Examinations, JNTUA, A.P, India

ABSTRACT:
The management of municipal solid waste is an alarming problem. An ever-increasing population and rapid pace of urbanization, the country is facing a huge challenge of waste management. Solid waste biomass to high-density briquettes is a potential solution to solid waste problems as well as to a high dependence on fuel wood in developing countries like India. Present study deals with the attempt of potential of converting garden waste and vegetable waste to briquettes using waste paper as a binder. Briquettes were produced with a manual briquette press after the processing base wastes. The waste and binder composition ratio tested at 90:10; 85:15; 80:20 and 75:25. The moisture content, densities and cooking efficiency of the briquettes were determined. It was concluded that garden waste could be best to convert into good-quality briquettes.

Date of Submission: 24-07-2021 Date of Acceptance: 09-08-2021

I. INTRODUCTION:

The volume of municipal solid waste (MSW) generated from residential, commercial and institutional locations is increasing due to population growth and the ‘‘throw away’’ culture that persists throughout much of the world. The ability of landfills to handle our waste is limited due to the space required and resulting pollutions to soil, water, and air. According to a US EPA (Environmental Protection Agency) report in 2011, total MSW generation was 250 million tons in 2010 and only 34% of waste was recycled over the same period in the US. Although 12% of trash was converted through waste-to-energy (WTE) operations, around 54% MSW was still going to landfill without any treatment (1,2).

In India, the volume of municipal solid waste is projected to rise from the present 62 million tonnes to about 150 million tonnes by 2030. Indiscriminate dumping of garbage at the current rate without appropriate scientific treatment, would impose huge requirement of landfill area per year. This necessitates the importance of scientific solid waste management in today’s context. The continuous disposal of municipal into the landfill may have adverse effect on the environment to future generations (5).

Energy crisis is the one of the main challenges facing by the developing world. In addition, due to the increasing use of fossil fuels to supplement the energy demand, there has been shocking increase in the climate change and global warming. Use of alternative sources of energy is being measured to supplement the energy demand and also to help in mitigating the environmental problems. However, research problems related to targeted use of alternative sources of energy still desires to be addressed. Several methods based on alternative sources of energy have come up(3, 4). A number of studies point to the fact that feed stocks of municipal solid waste (MSW) origin have potential for briquetting.

Biomass comes from several sources which includes Wood from natural forests and woodlands, Forestry plantations, Forestry residues, Agricultural residues such as straw, stover, cane trash and green agricultural wastes, Agro-industrial wastes, such as sugarcane bagasse and rice husk, Animal wastes, Industrial wastes, such as black liquor from paper manufacturing, Sewage, Municipal solid wastes (MSW) and Food processing wastes. Natural biodegradation releases methane which is a greenhouse gas. Hence, the waste conversion into a by-product could act as an energy resources as well as reduces the methane generation. Biomass waste such as dry leaves, dead branches, dry grass, vegetable, paper etc. are disposed of by first shredding it to suitable size followed by mixing with the slurry of the biogas digester. This mixture is feedstock for briquette, which is utilized as fuel for cooking (3). These briquettes can also being utilized in gasifier for production of syngas which can be

utilized in gas engine for generation of electricity. The ash produced from burning of briquette can be mixed with cement and water in an appropriate proportion for production of bricks, which is used for construction work.

II. MATERIAL AND METHODS

2.1 Study Area: The Greater Hyderabad Municipal Corporation (GHMC) is the civic body that oversees Hyderabad, the capital and largest city of the Indian state of Telangana. It is the local government for the cities of Hyderabad and Secunderabad. It is one of the largest municipal corporations in India with a population of 7.9 million and an area of 650 km². The Greater Hyderabad Municipal Corporation categorized into Six zones in 2019 (south, east, north, north east, west and central zones) that is of 30 circles and 150 wards. Samples collected from landfill site of GHMC, Telangana.

2.2 Briquette Preparation: The waste materials selected were garden, vegetable waste and paper waste. The garden and vegetable waste was collected and sun-dried for 10 days. The dried biomass was manually pulverized. Each of the portions was mixed with waste paper which had been turned to pulp to serve as a binder in the following waste and binder composition ratios 90:10; 85:15; 80:20 and 75:25. The paper and vegetable waste materials were thoroughly mixed and then hand fed into the manual briquetting press and compacted at an average pressure of 3.5 MPa using a hydraulic jack equipped with a pressure gauge. The briquettes were allowed to dry for about 2 weeks.

2.3 Moisture Content Determination: The moisture content of the vegetable waste was determined by measuring their fresh weight and dry weight. The percentage difference between these two weights gave an estimate of the moisture content of the waste materials. The moisture content (dry basis) of the briquettes was determined using the oven-dry method.

2.4 Density Determination: The bulk density of the vegetable waste was determined by weighing the materials in an open top rectangular carton box with standard volume. True densities of the biomass and briquettes (dry basis) were determined using the mass and volume relationship.

III. RESULTS AND DISCUSSION:

Sometimes the briquetting material does not have suitable composition from good adhesion binding. Then mixing the binding agent into the shredded MSW can be used and a binder should be combustible. The briquette density value is influenced not only by material composition but also by type of briquetting process. Briquettes produced on mechanical press have higher density than briquettes produced on hydraulic press. The Standards for these solid biofuels determine that briquettes should have density over 1.12kg dm^{-3}.

3.1 Moisture Content and Densities of Briquettes:

The moisture content of the dry loose vegetable waste materials were 44.0% and 11.0% for paper respectively. The moisture content of the briquettes ranged from 2.94% to 8.50%. There was a significant difference among the percentage moisture content of the composition.

The bulk density of the vegetable (0.228 g/cm^3) was slightly higher than that of the paper (0.224 g/cm^3). The densities of briquettes ranged from 0.79 g/cm^3 to 0.96 g/cm^3. There was also no observable trend in variation of densities with an increase in the amount of paper used as binder for briquettes.

3.2 Water-Boiling Test:

The ignition time ranged from 0.34min to 4.42min. An increase in ignitability with decrease in paper concentration was observed. Boiling time ranged from 9.35min to 32.42min, while the burning rate was between 1.84g/min and 4.96g/min. The burning rates for all briquette types decreased with the increase in percentage of paper used as binder.

IV. CONCLUSIONS:

1. Municipal waste can be briquetted by using pre-treatment technology (drying and mixing with the binder).
2. Material composition has great influence on the final quality of the produced briquettes.
3. Also, the briquettes produced had relatively high ignitability (0.34–4.42min), fair cooking efficiency judging from the duration each took to boil water (9.35–32.42min), and burning rates that can suit various purposes (1.84–4.96min).

REFERENCES:

[1]. JeongIn Gug, David Cacciola, Margaret J. Sobkowicz, Processing and properties of a solid energy fuel from municipal solid waste (MSW) and recycled plastics, Waste Management xxx (2014), http://dx.doi.org/10.1016/j.wasman.2014.09.031

[2]. US EPA, 2011a. Municipal Solid Waste Generation, Recycling, and Disposal in the United States: Facts and Figures for 2010. USEPA (United States Environmental Protection Agency), Washington, DC, 20460.

[3]. Olugbemiro M. Akande, Abel O. Olorunnisola, Potential of Briquetting as aWaste-Management Option for Handling Market-Generated Vegetable, Waste in Port Harcourt, Nigeria, Recycling 2018, 3, 11; doi:10.3390/recycling3020011
[4]. Pratham Arora Andrew F.A. Hoadley Sanjay M. Mahajani Anuradda Ganesh. Compartment model for a dual fluidized bed biomass gasifier. Chemical Engineering Research and Design (2016) http://dx.doi.org/10.1016/j.cherd.2016.10.025 .
[5]. Ministry of Science & Technology, Sustainable Processing of Municipal Solid Waste: Waste to Wealth, India, https://pib.gov.in/PressReleasePage.aspx?PRID=1667099.
[6]. Moni, M.N.Z.; Sulaiman, S.A.; Raja, Y.S.; Karunamurthy, K.; Inayat, M.; Bou-Rabee, M.A. Investigation of the relationship between moisture content and density of selected Malaysian biomass. J. Mech. Eng. Sci. 2016, 10, 2112–2126.
[7]. P. Križan1, M. Matúš, L. Šooš, J. Kers, P. Peetsalu, Ü. Kask and A. Menind, Briquetting of municipal solid waste by different technologies in order to evaluate its quality and properties, *Agronomy Research* Biosystem Engineering Special Issue 1, 115-123, 2011.
[8]. JeongIn Gug, David Cacciola, Margaret J. Sobkowicz, Processing and properties of a solid energy fuel from municipal solid waste (MSW) and recycled plastics, Waste Management xxx (2014) xxx–xxx.
[9]. Anita Shrestha and Ramesh M. Singh, Energy Recovery from Municipal Solid Waste by Briquetting Process: Evaluation of Physical and Combustion Properties of the Fuel, Nepal Journal of Science and Technology 12 (2011) 238-241.
[10]. Asad Iqbal, Xiaoming Liu, Guang-Hao Chen, Municipal solidwaste: Reviewof best practices in application of life cycle assessment and sustainable management techniques, Science of the Total Environment 729 (2020) 138622.

Veera Prathap Bolishetti. "Waste to Wealth a Sustainable Processing of Municipal Solid Waste." *International Journal of Engineering Research and Applications (IJERA)*, vol.11 (8), 2021, pp 38-40.