European Journal of Molecular & Clinical Medicine
ISSN 2515-8260 Volume 7, Issue 3, 2020

Feasibility Study on Decentralised Gasifier Based Incinerator In Villupuram Municipal

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1.ABSTRACT

Waste to energy conversion is the current tend in disposing municipal solid waste. This solve dual problem, one Is the effective disposal of solid waste with safe norms of pollution control board and another one is to generate substantial amount of power either in the form of thermal or electrical. Total disposal of solid waste in the villupuram district amounts to 150 TPD. As per the pollution control board there are five category of waste such as Municipal solid waste, Bio medical waste,E-waste,Hazourdous waste and plastic waste. In villupuram district the current practice of handling the municipal waste is to collect, dump and compost the waste to form it as manure. This is the time consuming process which will delay in disposal and wastes that are accumulated over period of time. This issue is taken forward by this project to have a communal based incinerator using gasification which is appended by the RDF (Refused derived fuel) production and effective Tar management. In addition to it bio degradable waste can be converted into natural fertilizer with the aid of the residual heat emanated. As per the guidelines of NITI Ayog and National Green tribunal, This project combines both suggestions. One is to decentralizing waste management and having separate compartment for the composting of degradable waste.

2. KEY WORDS:

WTE, RDF, Municipal solid waste,Gassifier, Incinerator

3. INTRODUCTION

The per capita waste generation in the rural area in India is 500 gms at an average and 700 gms in urban area. The total population is 34 Lakhs. This will lead to a drastic situation to handle municipal waste. More over land fill at villupuram causes pollution and disturb the ambient air quality .In addition the land fill area is exhausted lead to a concern in search of new land fill sites.

NITI AYOG suggested that bio gas and composting is not the sustainable solution for municipal solid waste management also suggested that it can be burnt to produce energy.NITI AYOG highlighted that due to the economic consideration Pyrolysis and Plasma techniques are not suitable for disposing the waste. There are four different Waste to heat energy plant in India but due to lack of funds few plants are

not being operated and one plant is shut down due to lack of technology. More over the Nation Green Tribunal imposed ban on burning compostable fraction. They suggested that decentralized solid waste management and non-degradable waste can be sent to WTE plants and degradable wastes can be made compost. As of now only five WTE units are there in India. Few units are not at a running condition due to the lack of fund and technology. [1]Thermal destruction of wastes containing polychlorinated naphthalene in an industrial waste incinerator carried out by Takashi Yamamoto et al "Springer-Verlag Berlin Heidelberg 2016 For a variety of waste plastic mixture, current research focuses on the mutual effect between various substances in the pyrolysis process. [2] Chowlu et al. (2009) internationally, gasification technology of MSW is relatively mature in Europe and United States and other developed countries.Shakthivel et al [11] utilized cow dung to run an IC Engine. **Switzerland SA Company** has developed thermoselect gasifier and built plastic waste treatment plant in Germany. **MTCI Company of USA** has successfully developed multiple models of fluidized bed waste gasifier using indirect heating gasification technology and the gasification temperature is generally 700°C. EPA has developed **Torrax technology**, the UUC Company has developed **Purox technology**, and German has developed FLK technology and so on.

4. PILOT STUDY

A pilot study is performed titled House hold incinerator. The household incinerator consists of two compartments one is for organic compartment and another one is for in organic compartment. The inorganic wastages are handled in inorganic compartment. It is based on both the Incineration and Decomposition techniques. Here, the household inorganic waste materials are crushed by the crusher and heated it using the electrical heating filament (glow plug) and convert into micro particles. The organic wastes are handled by organic compartment, in which the vegetable wastages in the home are poured. These wastages are crushed and feed on the plastic tray with sand bed and maintain the moisture level for decomposition process to takes place. Then, the sand bed can be taken out and feed to plants as fertilizers. Initially, the decomposition will be slow as a fresh new device, after some series of decomposition process. There will be increase in speed of decomposition process. The main work of this compartment is to increases the decomposition process and helps to make natural fertilizers for gardening. Both these compartments will combine handle the household wastages.

4.1 METHODOLOGY

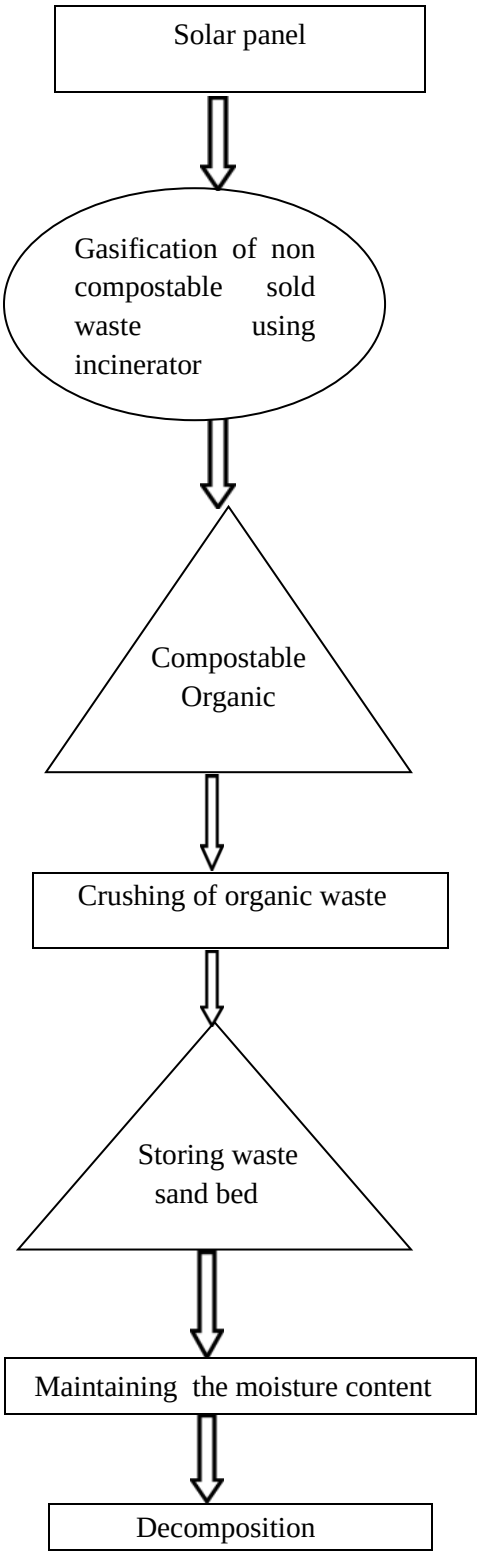

Fig 4.1: process flow of pilot study

4.2 COMPONENT SPECIFICATION

Table 4.1 Component specification

SI.NO	COMPONENTS NAME	QUANTITY	MATERIAL SPECIFICATION
1.	Arduino nano	1	UNO 328
2.	Soil moisture sensor	1	-
3.	Power module	1	LM2596
4.	Servo motor	1	SG90
5.	Metal gear motor	1	10KG torque
6.	Solar panel	1	12v 6w
7.	Push back switch	2	-
8.	Battery	1	12v7A
9.	Pump motor	1	-
10.	Outer casing sheets	6	Acrylic material
11.	Hopper	1	Foam sheets
12.	Shaft	1	Iron rod
13.	Crusher blade	13	Sheet metals
14.	LCD display	1	16x2
15.	Potentiometer	1	10k
16.	Power switch	1	8A

4.3 OPERATION:

Basically, household waste incinerator consists of two compartments. one is for treating plastic wastes and another one is for converting organic wastes into useful fertilizers. Pipe shaped heating element is used for treating plastic wastes. The plastic wastes are fed into heating element through hopper

in a batchwise manner. The heating element can generate heat upto 350 degree celsius and convert the plastic wastes into molten state. The gases releasing from heating element is filtered with help of filtering unit. The treating plastic wastes can be converted into different shapes with the help of MS plates placed below the heating element. These organic wates are converted into fertilizers by sensing the soil moisture by moisture sensor. The miniature pump is used to induce moisture in the sandbed by sensing the moisture level. Hence, the household waste incinerator is used to incinerate the plastic wastes and convert the organic wastes into fertilizers.

4.4 FINAL ASSEMBLY

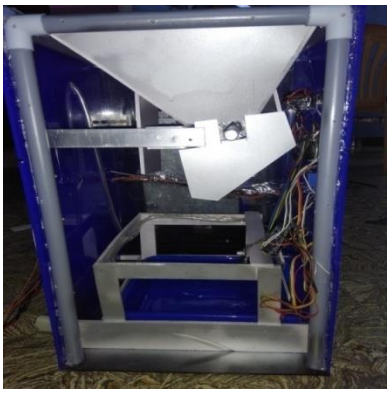

Fig 4.2 Side View

Fig 4.3 Front View

5. CONCLUSION FROM PILOT STUDY

It is concluded that the household incinerator is useful in handling the household wastes. It has separate compostable and non compostable wastes handling compartment. It performs based on both the incineration and decomposition techniques. It is user friendly product. It reduces the wastage

accumulation and also reduces the pollution in decentralized manner. Inorganic household wastes can be easily managed and convert it into ash. The organic compartment is very useful in handling organic wastes. It is also useful in making the organic fertilizer. It converts the organic wastes into useful product as fertilizer. This can be used for enriching the plant growth in natural way. The time taking for making the fertilizer will get reduced. This is due to the maintenance of moisture level of sand bed. So, the combination of both the organic and inorganic compartments is very useful in handling most of the household wastes. Due to the managing of wastage at home level, reduces the work of handling larger amount of wastes accumulation. So that, the pollution level will get reduce.

6. PROPOSED METHOD OF DECENTRALISED GASIFIER BASED INCINERATOR:

[3]Characterization of on municipal solid waste in India as per the study conducted by CPCB and NEERI (2005) biodegradables make up 47.4% of the MSW stream. Metals and glass make up only about 1% each of the MSW stream because of their high potential for recycling. The inerts—street sweepings, drain silt, and construction and demolition (C&D) debris—make up 25% of the MSW stream as the street sweepings, drain silt, and construction and demolition debris eventually find their way into municipal solid waste.

The combustion characteristic of MSW also depends on moisture contents [4].Optimum moisture is to be maintained to have an efficient burning of municipal solid. [5] Since mere incineration of combined compostable and non compostable waste produces pollutants like dioxins. [6]Diversion in handling solid waste is mandatory to avoid pollution. [7] [9]Gassification is the suitable and economical way of disposing MSW. Either down draft and updraft gasifier with scrubber can be used.

From the pilot study it is proposed Decentralized gasifier based incinerator which has the same motive of handling compostable and non compostable waste separately, Utilized solar based nichrome heater with controlled amount of oxygen to gasify the non compostable solid waste. Flue gas which is collected in separate chamber and can be circulated it through the condenser unit to derive refuse derived fuel (RDF)[8] This RDF can be commercialized. The solid residues collected at the bottom of the incinerator can pelletized. Heat from the condenser unit is utilized to maintain required environment for composting the degradable solid waste. This compost can be used as manure. [10]

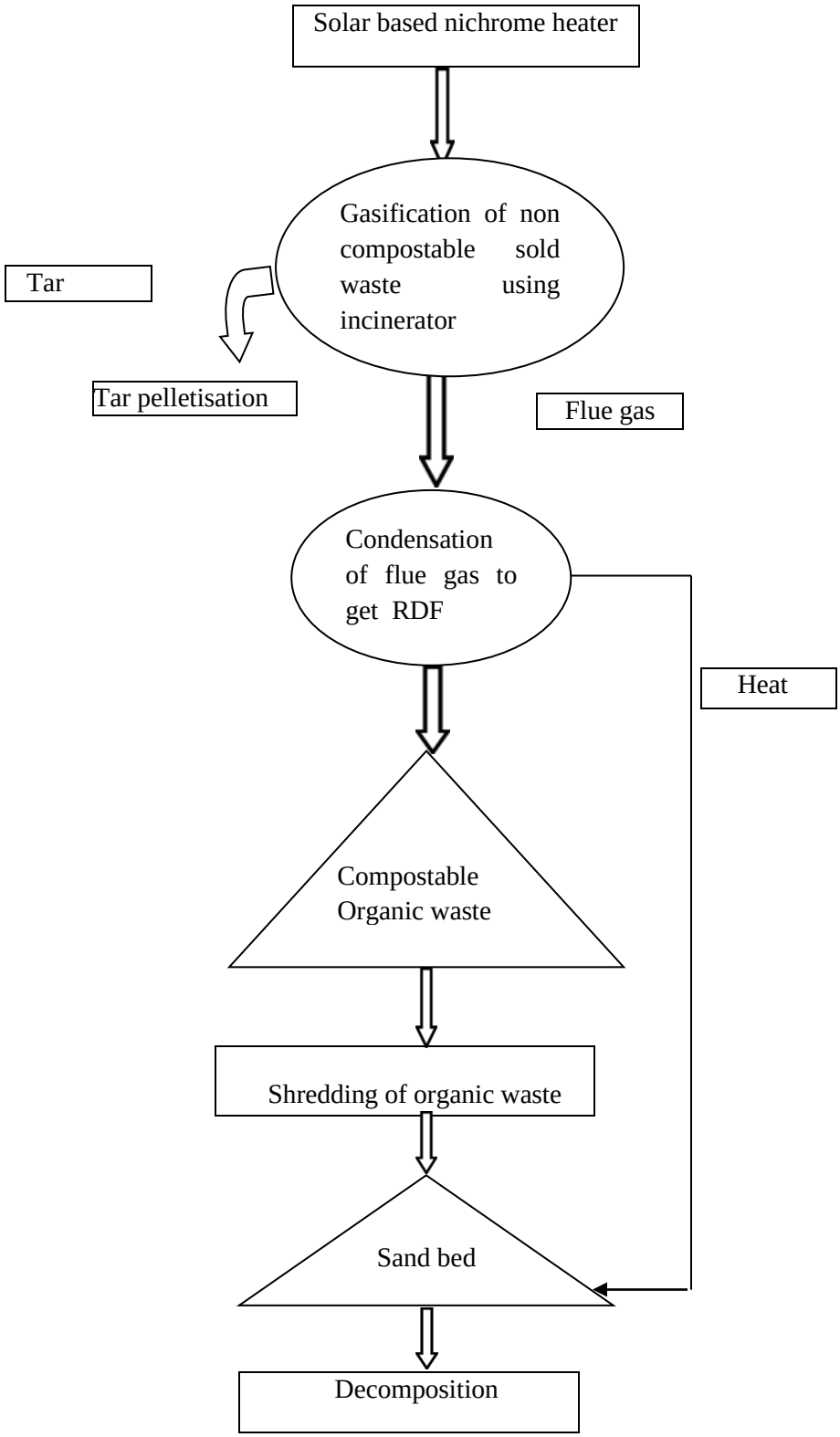

Fig 4.1: process flow of pilot study

7. CONCLUSION

Finally it is concluded that decentralized gasification based incinerator could be the effective solution of disposing municipal solids. This provides three benefits, One is reducing the total volume of solid waste by 80 to 90 % , Second Effective conversion of compostable waste into natural fertilizer and the third is commercialization of RDF (Refuse derived fuel) and pelletized Tar. Moreover decentralized incineration provides an economic solution of solid disposal.In villupuram districts 10 communal plants can be installed at capacity of 15 TPD.

8. REFERENCE

[1] Woodard & Curran, "Industrial Waste Treatment Handbook"', Second Edition (2006)

[2] Thermal destruction of wastes containing polychlorinated naphthalene in an industrial waste incinerator carried out by Takashi Yamamoto et al "Springer-Verlag Berlin Heidelberg 2016

[3] Swatch Bharat mission, Municipal solid waste management Manual Part II.

[4] Liang, L., et al. (2008). "Experimental study on effects of moisture content on combustion characteristics of simulated municipal solid wastes in a fixed bed." Bioresour. Technol., 99(15), 7238–7246.

[5] Zhang, Y. (2004). "Municipal solid waste incineration technology and control of dioxins emission." Ind. Boiler, 5, 1–7.

[6] Royal Haskoning DHV (2014) Municipal Solid Waste Diversion and Beneficiation Opportunities at Nelson Mandela Bay Metro Municipality – Feasibility study final report.

[7] Arena, U. (2012). "Process and technological aspects of municipal solid waste gasification. A review." Waste Management., 32(4), 625–639

[8] Wu, J., Wen, W., Wang, B., and Chen, C. (1989). "An influence of RDF properties on carbonization and gasification." J. Tongji Univ., 17(1), 113–122.

[9] Wu, W., Ma, Q., and Li, R. (2010). "Comparative analysis of state-of-the-art technology for waste treatment." Municipal Admin. Technol., 1, 18–21

[10] The decomposition process earth-kind® landscaping". aggie-horticulture.tamu.edu. retrieved 2017-02-05.

[11] M. Sakthivel et al," Performance Test on Single Cylinder IC Engine by Using Cow Dunk as a Biogas", International Journal of Emerging Technology and Advanced Engineering, 2016, Volume 6, 273-277