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ENERGY RECOVERY OF MUNICIPAL SOLID WASTE BY THERMAL PROCESS

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ABSTRACT: *Success of solid waste management system is directly related to disposal efficiency. It is decided upon how much of the total dumped waste is finally disposed properly. It is clear that we are not disposing municipal solid waste as per internationally accepted scientific procedures and there is no state level solid waste management policy. Studies show that the most beneficial of disposal is Advanced Thermal Treatment method (thermo select gasification). Hydrogen from Syn gas is required in market and methane gas is used to produce electricity and also used for vehicle fuel, in further use of methane as chemical solvent, paint. The main product is Syn gas (CH4, CO, H). The Syn gas emission separation process can be done by gas analysis process.*

Keywords – Advanced Thermal Treatment Process, Gasification, Solid waste management

1. INTRODUCTION

Human activity create waste, and the way these waste are handled, stored, collected and disposed of, which can pose risk to the environment and do the public health. Where intense human activities concentrate, such as in urban centers, appropriate and safe solid waste management (SWM) are of at most importance to allow health living conditions for the population. In Chennai, Rapidly increase in volume and types of solid and hazardous waste as a result of continuous economic growth, urbanization and industrialization, is becoming a burgeoning problem for national and local governments to ensure effective and sustainable management of waste. This fact as been acknowledged by most government, however many municipalities are struggling to provide even the most basic services. Typically one to two thirds of the solid waste generate is not collected (WORLD RESOURCE INSTITUTE, et al., 1996). Solid waste (SW) generation in Chennai, the fourth largest metropolitan city in India, as increased from 600 to 3500 tons per day with in 20 years. All the municipal areas have identified disposal sites for scientific disposal of solid waste. A common land of extent 50 Acres has been purchased for Alandur, Pallavaram and Tambaram Municipalities at a cost of Rs.l 13.28crore at Venkatamangalam village for developing the same as modernized Compost yard bringing the segregated wastes for the purpose. Our study area is Tambaram and Pallavapuram, it can produce 220 tonnes per day of solid waste. In respect of the panchayat areas are concerned, only in thickly built-up areas, collection is carried out and disposal made in compost yards that are located in close proximity. In these less dense areas the solid waste collection and disposal is very limited, meeting its present requirements.

2. OBJECTIVES

- To reduce the large quantity of waste in landfilling.
- Reduce the greenhouse gas emission and capable of diverting around 90% waste from land fill.
- Process of disposal time will be less.
- To control land pollution and water pollution.
- To protecting environment from hazardous gas.
- To producing electricity from syngas.
- Economical process compared to other thermal process.
- To maximize waste conversion to high heating value fuel gases, mainly CO, CO2 and CH4.

3. EXTSTING TECHNOLOGIES

3.1 THERMAL PROCESS

- Incineration.
- Pyrolysis.
- Plasma Gasification.
- Thermo Select Process.

3.2 BIOLOGICAL PROCESS

- Aerobic Composting.
- Anaerobic Composting.
- Bio-methanation.

4. TECHNOLOGY PREFERRED

4.1 ADVANCED THERMAL TREATMENT GASIFICATION

Gasification can be seen as between pyrolysis and combustion in that it involves the partial oxidation of a substance. This means that oxygen is added but the amounts are not sufficient to allow the fuel to be completely oxidized and full combustion to occur. The temperatures employed are typically above 700^{O}C. The process is largely exothermic but some heat may be required to initialize and sustain the gasification process. The main product is a syngas, which contains carbon monoxide, hydrogen and methane. Typically, the gas generated from gasification will have a net calorific value (NCV) of 4 - 10 MJ, Nm3. The other main product produced by gasification is a solid residue of non-combustible materials (ash) which contains a relatively 1ow leve1 of carbon.

5. NEED FOR GASIFICATION

- Gasification is an alternative to traditional combustion plants as it is possible to generate more efficient electricity in small plants and thereby reduce the fuel input.

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- The gasification can be used for the management of all type of waste, both hazardous and non-hazardous waste.
- Gasification is a reliable and clean energy technology that can turn biomass or any material containing carbon into synthetic gas.
- This gas can then be used in a gas engine for the production of electricity and heat.
- A gasification plant significantly reduces the environmental impact compared to traditional technologies.
- Syngas can be burned in a boiler to generate steam which may be used for power generation or industrial heating.
- Syngas can be used as a fuel in a dedicated gas engine.
- Syngas after reforming, may be suitable for use in a gas turbine.
- Syngas can also be used as a chemical feedstock.

6. REFUSB DERIVED FUBL (RDF)

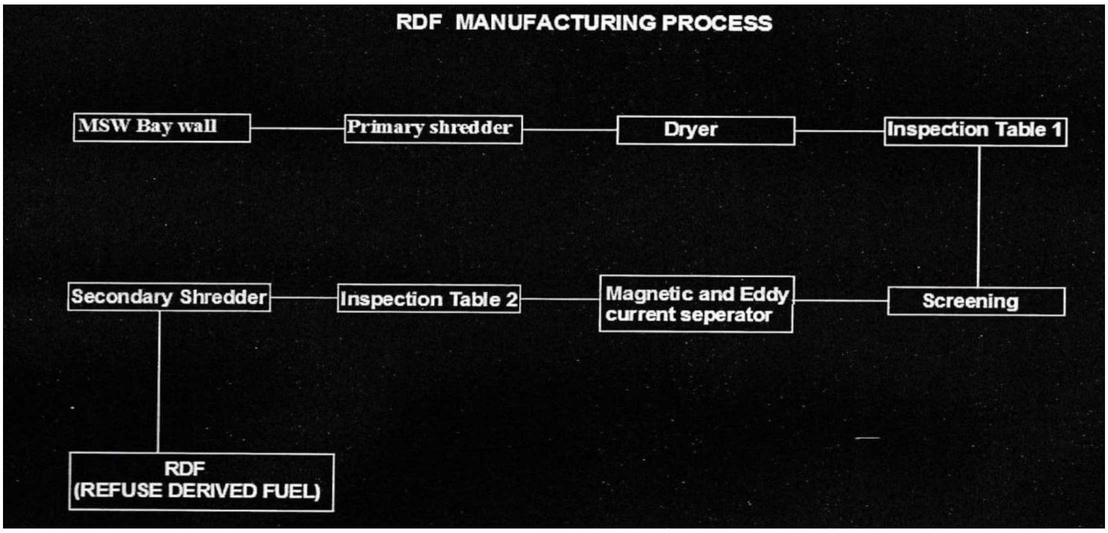
Refuse-derived fuel (RDF) is a fuel produced by shredding and dehydrating solid waste (MSW) with a Waste converter technology. RDF consists largely of combustible components of municipal waste such as plastics and biodegradable waste. RDF processing facilities are normally located rear a source of MSW and, while an optional combustion facility is normally close to the processing facility, it may also be located at a remote Location.

- Substantial reduction in the total quantity of waste depending upon the waste composition and the adopted technology.
- Significant reduction in environmental pollution.
- Improvement in the quality of residual waste.
- Reduction in the demand for land for waste disposal.
- Reduction in transport cost, as garbage is not required to be carried to a faraway place for dumping.
- Improved commercial viability of the waste disposal project from the sale of energy/products.

7. GASIFIER

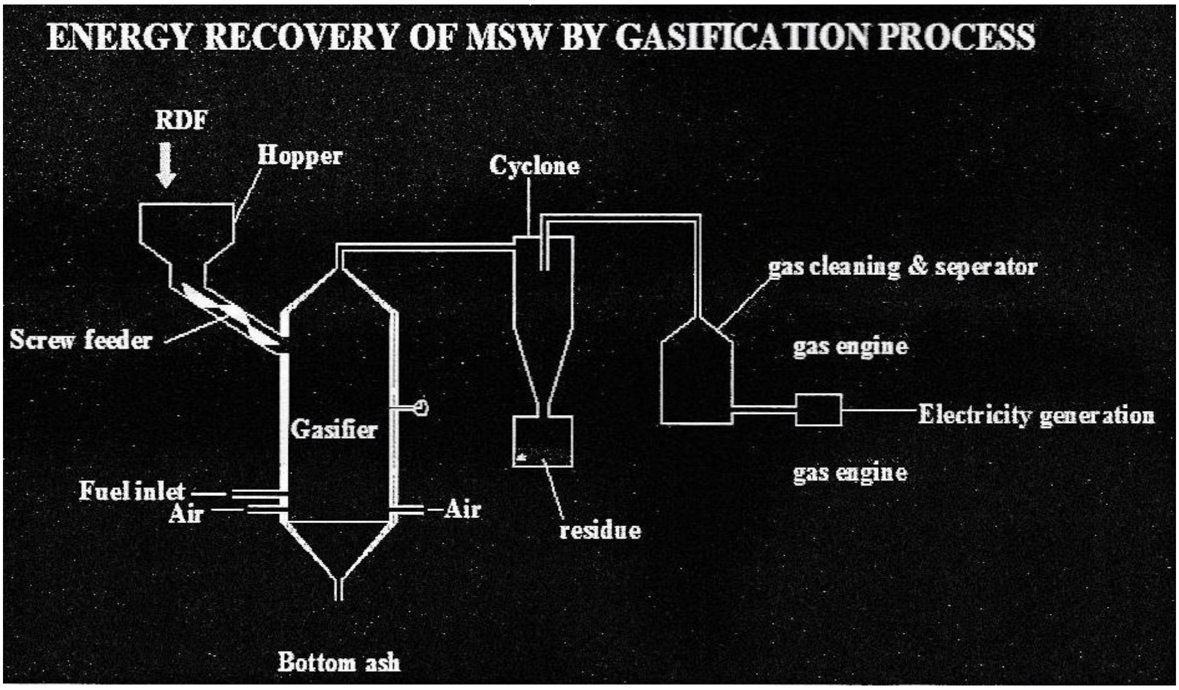
- The waste is leading from screw feeding gasifier. It is made up of mild steel in cylindrical shape of structure and the bottom portion of gasifier is conical shape, for the purpose of ash removal and fuel inletting.
- And the bottom portion to have providing air inlet (partial air).
- The hole of air inlet pipe is 2.5 cm. the cylindrical cell thickness is 5 mm, height of gasifier is 1-52 cm, inner diameter is 52 cm and outer diameter is 70 cm.
- In between gap is providing brick lining and outer of brick lining is providing glass wool to resisting temperature in 3 cm thickness.
- One end of the top corner is inlet for waste materials feeding and other end of top is outlet taken for gas collection.

- In mid portion of qasifier to make a hole for initial starting to induction of flame then the hole is closed during the burning process.



8. PROCESS OF GASIFICATION

- Initially, the firing process is started using LPG gas and the fire is set through the inspection.
- When the pressure using of LPG gas pressure of $3kg/cm^2$ raise the flame height and pressure.
- This process is carried on 4 to 6 hrs for getting high temperature and volume process.
- The fire clay brick is used to raise and maintain the temperature rapidly and outer of fire clay bricks providing glass wool for resting the temperature.
- Then provides 5mm thickness outer mildsteel.
- The range between temperatures is $1500\text{-}1700^{O}C$. Then the resisting the temperature and the thickness of glass wool is2.5cm in two layers.
- During the firing process, the RDF material is fed into the hopper manually. Then the RDF is reaching the screw feeder.
- The screw feeder is connecting in electric motor. The rpm of motor is 600 depend on the pulley diameter.
- When the RDF material is falling on the burner, that time burning process is occurred.
- The burning of RDF in higher temperature to get by product of syngas and ash. The product of syngas contents more in CO2. Because the optimum temperature is not attained.
- When the optimum temperature is attained, the byproduct of gas is fire and blinking.
- The output gas is entering to the cyclone. This gas is mixed with particulate matter and the gas is entering the cyclone to removing the particles automatically and settles in bottom of storage.
- The output gas is getting from the top of the cyclone. This gas is taking too fired.



9. CONCLUSION

There is no single recipe for waste management. However, there are a few golden rules: keep it simple and advanced step by step. It is better not to apply the most advanced technology there are too many redundant waste plant worldwide. Studies show that the most beneficial of disposal is **Advanced Thermal Treatment** method (thermo select gasification). It is clear that we are not disposing municipal solid waste as per internationally accepted scientific procedures and there is no state level solid waste management policy. When assessing a waste project the value of the number of jobs created should be included; this may be important to demonstrate economic viable. Likewise, environmental cost should be taken into consideration.

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