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Design of Sanitary Landfill Site and Incineration Unit for Municipal Solid Waste Management

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Abstract:** The gradual depression of natural resources with increase in energy prices, there is processing need to converse energy in environment and repair activities, and to adopt methodologies that would be benefitted to the environment. Municipal solid waste is one of the major area of concern all over the world. In developing country like India, there is rapid increase in municipal solid waste due to urbanization and population growth. The management of waste become an acute problem due to enhanced economic activities and rapid Urbanization. Municipal solid waste management is one of the most neglected aspects of India due to these environmental hazards and unhealthy conditions problems are formed. This project deals with the study of the municipal solid waste management and precautions to be taken and proposal for developing the municipal solid waste management. The main problems of the MSW is collection and disposal of the waste. So that in this case study the problems are find out and precautions are given. This study consists of the details of the municipal solid waste management and methodologies to be preferred, problems and proposal for development of the collection and disposal of Municipal solid waste.
***Keyword:** Municipal solid waste, Incinerator, Sanitary Landfill.*

I. INTRODUCTION

Solid Waste Management reduces or eliminates the adverse impact on the environment & human health. A number of processes are involved in effectively managing waste for a municipality. These include monitoring, collection, transport, processing, recycling and disposal. The quantum of waste generated varies mainly due to different lifestyles, which is directly proportional to socio economic status of the urban population. In metro cities in India, an individual produces an average of 0.8 kg/ waste/ person daily. The total municipal solid waste (MSW) generated in urban India has been estimated at68.8 million tons per year (TPY) (0.573 million metric tonnes per day (MMT/d) in the year 2008). The average collection efficiency of MSW ranges from 22% to 60%. MSW typically contains 51% organic waste, 17% recyclables, 11% hazardous and 21% inert waste. However, about 40% of all MSW is not collected at all and hence lies littered in the city/town and finds its way to nearby drains and water bodies, causing choking as well as pollution of surface water. Unsegregated waste collection and transportation leads to dumping in the open, which generates leachate and gaseous emissions besides causing nuisance in the surrounding environment. Leachate contaminates the groundwater as well as surface water in the vicinity and gaseous emissions contribute to global warming.

II. LITERATURE REVIEW

From past 10 years many research works were carried out on solid waste management about their implementation and improvements. New investigations, methods, equipment's were effectively used.

A. "Landfill area estimation based on integrated waste disposal options and solid waste forecasting using modified ANFIS model", by Mohammed K. Youne's, et al, Vol. 04, 2015.

This paper deals with the study area and data collection optimization of the inputs and development of MANFIS, estimation of waste disposal area. Solid waste prediction has crucial for sustainable solid waste management. The collection of accurate waste data records was challenging in developing countries. This research has minimize the land requirements for solid waste disposal.

B. "Incineration process for solid waste management and effective utilization of by products", by Pooja G. Nidon, Vol. 04, 2017.

This paper deals with the Incineration process, waste management, Incineration methods, control of Air pollution from Incinerators. The major problem facing in Municipal solid waste management was the disposal of solid waste. Here they study about a low cost incinerator can be constructed and to utilize the byproducts obtained effectively, the byproducts of incineration which are released into the atmosphere which causes acid rain, infectious diseases and waste of heat energy. The attempt was made to utilize these byproducts effectively for the welfare of living beings.

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C. "Environmental friendly ways to generate renewable energy from municipal solid waste", by Jaya Rawat, et al, Procedia environmental sciences35, 2016.

This paper deals with technologies for municipal solid waste conversions which includes plastic waste, gasification, pyrolsis, generation of fuel. The technologies used for handling MSW which treat plastic to convert fuel oil by gasification, pyrolysis, conversions. The useful products like liquid fuels, chemicals and power are being generated through these processes. Systematic planning of municipal waste collection, segregation and processing them with suitable technologies can help us in development of clean atmosphere with a lot of employment generations in the society at all levels.

D. "Municipal solid waste management in India", by AtriPamnani, MekaSrinivasarao, 2014.

This paper deals with Municipal solid waste management.. In developing country like India, there has been rapid increase in municipal solid waste due to urbanization and population growth. Optimization studies were carried out to explore the feasibility of integrated waste management through clustering of small towns and their surrounding villages for better MSWM. This paper gives current scenario of India with respect to municipal solid waste quantity, quality and its management.

III. METHODOLOGY

A. Sanitary Landfilling

Sanitary landfill is the method of controlled disposal of municipal solid waste on land by several layer. A final top soil cover is placed, compacted and graded and various forms of vegetation maybe placed in order to reclaim otherwise useless lands, to fill declivities to levels convent for building parks, golf courses, or other suitable public projects.

B. Estimation of Landfill Capacity, Landfill Height, Landfillarea

1) Current Waste generation per year=W (tons per year)
2) Estimated rate of increase (or decrease)of waste generation per year = x (percent) (use rate of population growth where waste generation growth rate estimates not available)
3) Proposed life of landfill (in year= n(years)Waste generation after n year=W $(1 + x/100)^n$ (tons per year)
4) Total waste generation in n years (T) in tons

   $T = 1/2\,[W + W\,(1 + x/100)^n]\,n$ (tons)
5) Total volume of waste in n years (V_w) (on the assumption of 0.85 t/cm. m density of waste)

   $V_w = T/0.85$ (cu. m.)
6) Total volume of daily cover in n years (V_{dc}) (on the basis of 15 cm soil cover on top and sides for lift height of 1.5 to 2m)

   $V_{dc} = 0.1\, V_w$ (cu.m.)

C. Incineration

Incineration is the treatment of waste material by combustion of organic substances present in the waste materials. It converts the waste material into heat, flue gas and ash. Heat which is in major percentage can be used to generate electric power. Flue gases contain traces of nitrogen, carbon dioxide and sulphur dioxide. Nitrogen produced can be used as fertilizers to increase the productivity of crops, carbon dioxide can be used as fire extinguishers and sulphur once extracted from sulphur dioxide can be used in dental treatment. Ash is obtained in the form of solid lumps which can be used for construction purposes.

D. Incinerator Design

1) *Incinerator Internal Sizing Requirements:* This volume is a function of the total heat released per hour from the burning refuse. The internal volume requirement excludes the ash pit and can be evaluated. $Vi_{min} = Q_{thr} / 258{,}750\ w/m^3$
2) *Chamber Sizing:* Chamber sizing is based on heat release. There is a limit to the quantity of heat that can be released in a particular furnace chamber. Heat release is the amount of heat generated when combustible material burns. The furnace volume must be large enough to allow release of the heat generated by the anticipated waste and the supplemental fuel. V □□□ r^2 (*L*)
3) *Incinerator Residence Time:* Residence time means the length of time that the combustion gas is exposed to the combustion temperature in an incinerator. This is an important criterion in the design of waste incinerators, and it is calculated at the typically mandated 990 or 1100C. t = v/q

4) *Turbulence and Mixing:* In order to achieve high combustion efficiency in incinerators, it is particularly important to achieve good mixing between the primary combustion products (primarily CO and organics) and a stoichiometric excess secondary combustion air. Re = VD / K

IV. RESULTS AND DISCUSSION

Collection of data from the selected ward, analyzing the solid waste quantity and methods carried out by the ward to recyle and reduce the waste.

A. *Design of Sanitary Landfill For Hemmigepura Ward – 198*

1) Current Waste Generation Per Day = 20t
2) Estimated Waste Generation After 12 Years = 31t
3) Total Waste Generation in 12Years=111.7 x 10^3tons
4) Maximum Landfill Height = 5m
5) 4:1 side slope for the above-ground portion of the landfill.
6) 2:1 side slope for the below-ground portion of the landfill.
7) Final size of landfill = 210 m x 420m
8) LANDFILLPHASES
9) Active life of landfill = 12years
10) Plan area of one cell on the basis of 1.0m lift of each cell =9 x 16 m
11) Size of sedimentation tank = 10 x 4 x0.5 m

B. *Incinerator Design*

1) Incinerator internal sizing requirements
   Vi_{min} = 1.18 m^3
2) Chamber sizing
   r = 1.92 m
3) Incinerator residence time
   t = 0.69 sec
4) Turbulence and mixing
   Re = 5,37,214

Design values are shown in below table.

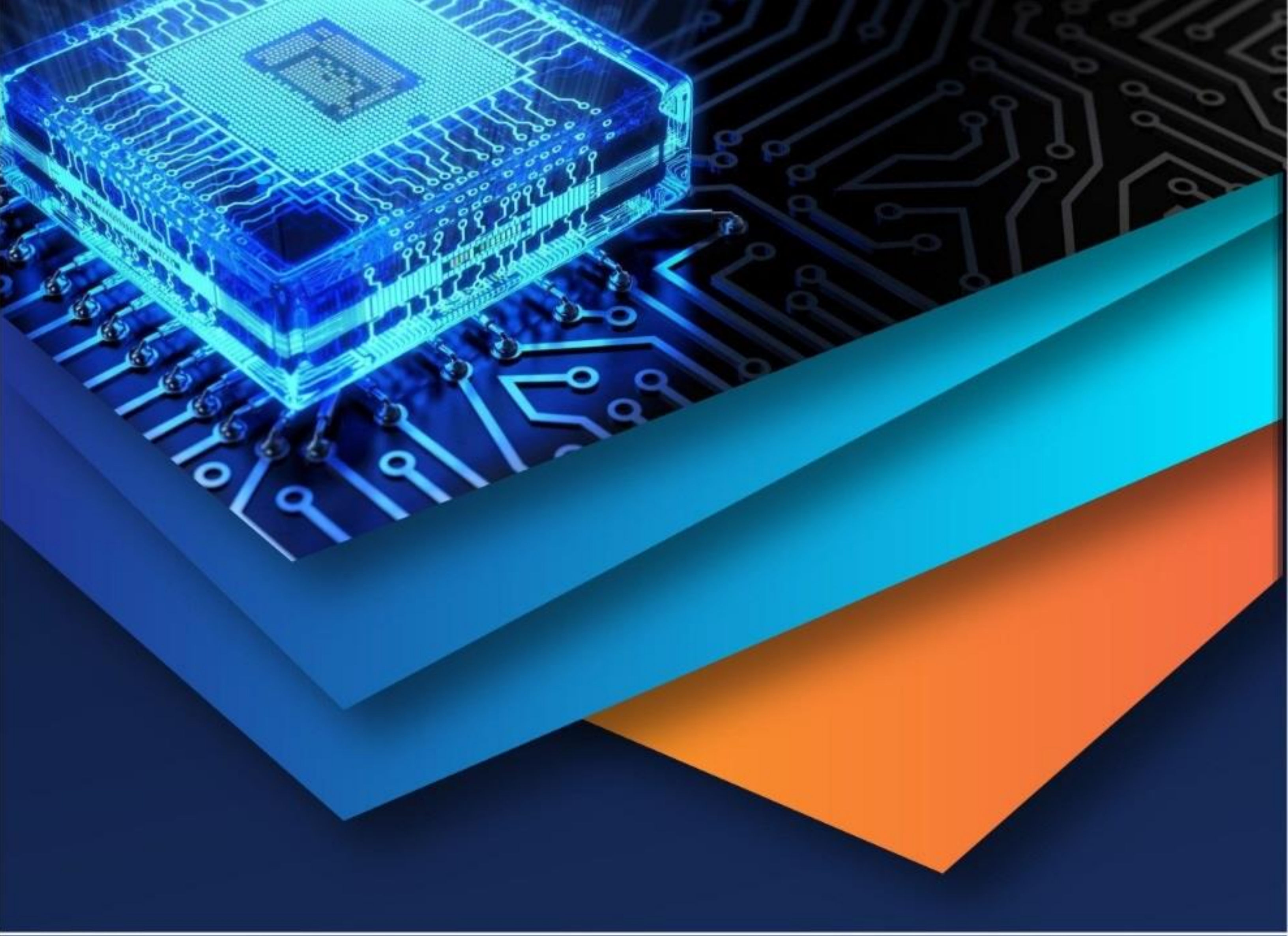
Heat generated	1,101,471.85 MJ
Incinerator residence time	0.69 seconds
Incinerator volume	1.18 m^3
Incinerator bed length	2.1 m
Incinerator width	0.8 m
Incinerator height	0.7 m
Reynolds number, Re	5,37,214
Flame temperature, T	1600 c

V. CONCLUSION

Study and design of different Solid waste disposal systems at the proposed site suggests that landfill gases released can be recovered and can be used as an alternatively source of energy. Logistics arrangement should be made for separate collection of different kinds of solid waste especially, household hazardous waste and municipal biomedical waste, from generation to final disposal. There is a requirement to establish more dry waste collection centres for enhancing the recycling efficiency. The waste collected from drain cleaning and street sweeping should not be mixed with organic waste to maintain the quality of the organic manure. Optimization studies should be carried out to explore the feasibility of integrated waste management through clustering of small towns and their surrounding villages for better MSWM. Optimized sanitary land fill and incinerator design has been done for efficient solid waste management.

REFERENCES

[1] "Municipal solid waste collection and disposal in Bengaluru city-A review", by Pavan and Balakrishna H.B , IJERT, VOL. 03, Issue 7, 2014.
[2] Bangalore Mahangara Palika, Solid waste landfill site development office, Bengaluru.
[3] "Landfill area estimation based on integrated waste disposal options and solid waste forecasting using modified ANFIS model", by Mohammad K. Younes, Z.M. Nopiah, N.E. Ahmad Basri, H. Basri, Mohammed F.M. Abushammala, Mohammed Y. Younes, (IRJET), Vol. 04, 2015.
[4] "Incineration process for solid waste management and effective utilization of by products", by Pooja G. Nidon (IRJET), Vol. 04, 2017.
[5] "Environmental friendly ways to generate renewable energy from municipal solid waste", Jaya Rawat, Srinivasulu Kaalva, Vivek Rathore, D.T. Gokak, Sanjay Bhargava, Procedia environmental sciences35, 2016.
[6] "Municipal solid waste management in India", by AtriPamnani, MekaSrinivasarao, (IJCIET), 2014.



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