International
Journal
Of Advanced Research in Engineering & Management (IJAREM)
ISSN: 2456-2033 || PP. 16-22

The feasibility of incineration on Solid Waste Management in Puducherry –A Case Study

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Abstract: The paper presents a case study focused on waste generation, the feasibility of incineration on Solid Waste Management in Puducherry. Municipal Solid Waste (MSW) is one of the curses for generation and later causing pollution to the environment along with other sources of pollution, especially in developing countries. with improper management plans, starting from collection of waste to dumping in the site, the problems due to MSW will be aggravated many times in the form of contaminating the surrounding soil, land, air and water (both surface as well as groundwater) in years to come. The present research pointed out current MSW in Puducherry and projected population, characterization of soil profile at Karuvadikuppam and Kurumbapet dumping sites. The study reveal that the establishment of incineration plant used for reducing of solid waste in Puducherry territory.

Keywords: Feasibility, MSW, Pollution, Waste, Puducherry

I. Introduction

The system of disposal of municipal solid waste adopted by different municipalities in India is the open dumping in low lying areas in the outskirts of the cities or on some land specially embarked for this purpose. With pressure on land and with growing urbanization such areas becoming more and rarer. The growth of the towns also poses problems regarding continued use of these disposal sites. Mechanical composting has so far been rarely used but in some municipal areas, composting by natural process is being adopted. Incineration or scientific land filling is not much practiced anywhere in India. As in other Cities of India, disposal of Municipal Solid Waste (MSW) poses greater challenges to the Government of Puducherry. It is estimated that 600 TPD of MSW are generated in Puducherry urban areas. Currently, it is being collected, transported and disposed at Kurumbapet dumping yard since 2010.These practices attract lot of public and academicians objection in view of open dumping of MSW, obnoxious odor and flies menace etc. It also poses great risk of ground water contamination due to percolation. Finding a scientific solution to the MSW disposal problem is prime consideration of the Government as it is connected with public health issues.

As per the collected data from Municipal Solid Waste (Management and Handling amend) Rules, 2000,solid waste disposal methods prearranged includes different methods like composting, anaerobic digestion vermin composting, and incineration.Puducherry Government explored the possibilities of adopting composting through Coimbatore and Vellore Model. Reportedly, two factors are attributing constraint to implement the same in Puducherry viz. (i) Poor source segregation (ii) Mingling of plastic wastes with MSW.

Puducherry has been rated as second city in India having highest per capita income next to New Delhi. Thus per capita waste generation is also proportionally higher than the national average. It has been expected that per capita solid waste generation in Puducherry is about 500gm.And almost 500 Tons of MSW is being generated currently. With the projected population as 800,186 in the year 2020, it is estimated that 16000 tons of MSW would be generated in the year 2020.Currently; it is being collected, transported and disposed at Kurumbapet a dumping yard without any scientific processing. These practices attract lot of public and academicians objection in view of open dumping of MSW and obnoxious odor and flies formation. This practice also poses great risk of ground water contamination due to percolation. It is assessed that nearly 21 diseases occur from improper disposal of MSW in our country.

The urbanization and tourism are one of the foremost income generations for Puducherry; random disposal of MSW gives horrible face to the coastal city. In order to shelter the public health and environment, it is necessity of the hour to discover a suitable method for MSW disposal. After evaluation different options available for MSW disposal and assessing different factors like geography, topography, availability land, climatic condition, calorific value of MSW, etc.The study area is the district of Puducherry which is the first

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most immensely colossal among the four regions. It has an area of 293 km2 located between latitudes 11 ^{o}.46$^{'}$ N and 12^{o}.03$^{'}$ N and longitudes 79 ^{o}. 36$^{'}$ E and 79 ^{o}.53$^{'}$ E. It is located along the Coramandal coast of India, being constrained on its east by the Bay of Bengal and on the other three sides by the Cuddalore district of Tamil Nadu State (shown in Figure.1).

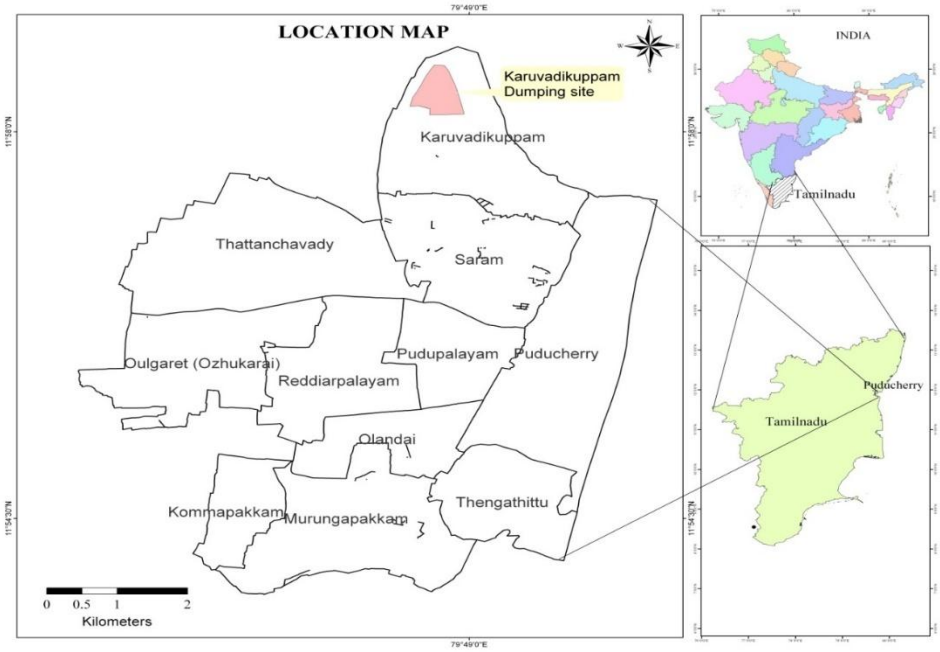

Figure.1.Study area

II. Literature Review

Organized Retail Penetration in India is low that is only 5% as compared to other countries such as US **Rao and Shantaram et al., (1995)** studied the groundwater pollution from solid waste dumps at Hyderabad and found that groundwater is not suitable for drinking purpose

Douglas and Haith, 1998 The economic and environmental impacts of municipal solid waste management are dictated by the masses and volumes of materials moving through the various components of the municipal solid waste**.**

Khurshid et al.,(1998) analysed the effect of waste disposal on water quality which revealed that the concentration of trace elements exceeded the maximum permissible limit prescribed by World Health Organization.

Krishna et al., (2005) analyzed the effect of solid waste leachate on lateritic soil and concluded that leachate modified the soil chemical properties.

Chandrasekar and Ayyappan (2006) calculated the impact of municipal solid waste dumping on groundwater quality and accomplished that higher amount of contamination was observed in the water samples within 500m from the dumping site and were not suitable for drinking purpose.

Viraraghavan and Curtis (1990) discussed factors like topography and capacity of sanitary landfills, possibility of surface and groundwater pollution by leachates, hazards from gases formed during decomposition in selecting sanitary landfill sites.

A study was conducted by **Ishizaka and Tanaka (2003)** to resolve the conflicts between residents and the municipality for the selection of site for a solid waste treatment and disposal facility.

Sasao (2004) examined public preferences on sitting landfills. He focused on possible negative effects of a hypothetical landfill sitting on residents who are assumed to live around the landfill.

Padmaja et al., (2006) identified solid waste disposal site in Hyderabad city using analytical hierarchy process and GIS.

III. RESEARCH METHODOLOGY

The research methodology followed in the study is explained below:

3.1. Objectives of the Study

To study current MSW disposal in Puducherry
To understand the current and projected population for better solid waste management
To prepare soil profile of Kurumapet and Karuvadikuppam villages
To propose feasibility of incineration on Solid Waste Management in Puducherry

3.2. Scope of the Study

The worsening solid waste disposal situation in Puducherry has attracted attention among the populace. High profile government officials including Ministers of territory and even the presidency have expressed concern about the deplorable solid waste situation in Puducherry.Uncontrolled open dumps are reservoirs of high public health hazards because of improper site management which directly endanger the health of the people living near to, or on the site.The public may be affected by the contamination of their drinking water, by soil contamination passed on to the aquatic and terrestrial food chain and through the spreading of diseases. However, none of these studies has investigated the issue of solid waste disposal in sufficient detail to create adequate understanding of the problem even though it remains one of the most visible and scary problems in the urban areas. In view of the above, this study can be justified on the grounds of incineration of solid waste best method of reducing zero waste that it will further understanding of the solid waste problem affecting in Puducherry and provide a useful starting point for addressing an otherwise intractable problem.The study will also contribute to both the theory and practice of urban solid waste management in developing countries generally.

3.4 Sources of Data

The various solid waste datas like quantity of waste generated, number of dust bin location, population, soil profile of dumping site collected from Municipality of Puducherry.

3.5 Tools for Data Analysis

The collection of different solid waste details and disposal site information collected .In addition to that various database entered into SPSS software. The statistical analysis of population versus solid waste generation calculated. The population studies carried out by the most important method like Arithmetic Method, Incremental Method is project the population.

IV. Analysis & Interpretation

The total waste generation of the Puducherry is estimated based on projected urban population of Puducherry Population is estimated by Arithmetic Mean Method and Incremental method. However incremental method is taken into consideration since this method projects higher value than the other. The population projection through Arithmetic Method, Incremental Methodstatics for Puducherry Urban area is presented in Table 1.and figure.1. The general projection of population and solid waste generation are shown in Table.2. and figure.2.

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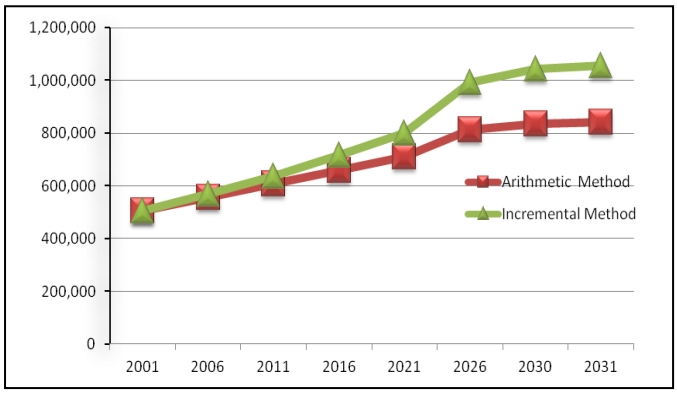
Table I: Population Projection- statistics

Year	Arithmetic Method	Incremental Method
2001	505,959	505,959
2006	556,952	568,234
2011	607,945	638,030
2016	658,939	715,347
2021	709,932	800,186
2026	811,918	992,427
2030	836,394	1,043,257
2031	842,514	1,055,965

Figure.1. Population Projection (2001-2031)



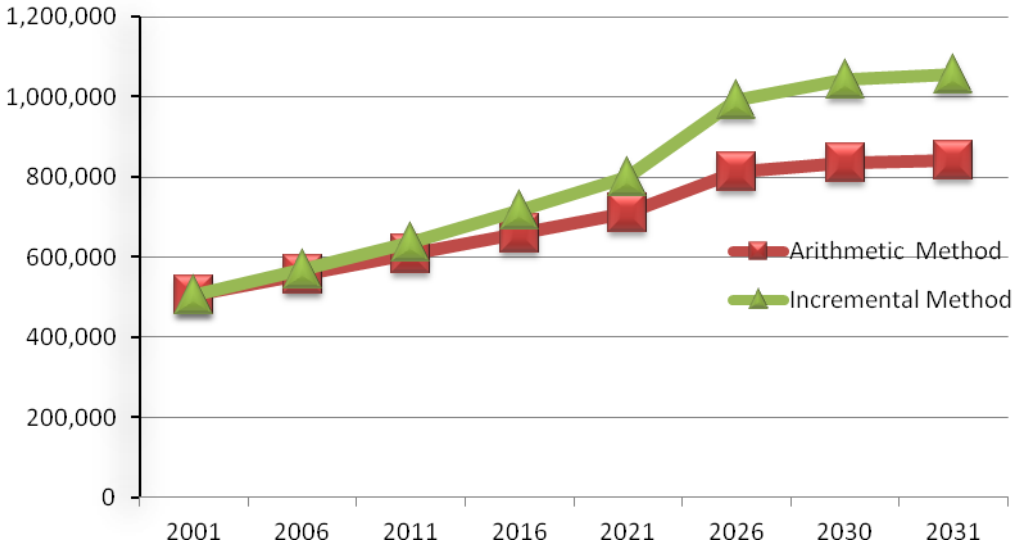
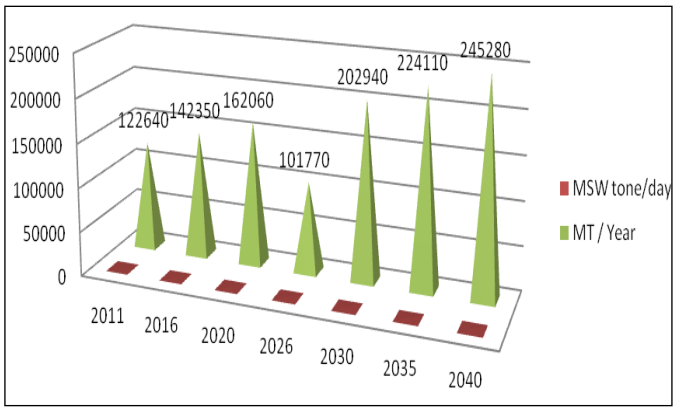


Table II: Population Projection **& MSW**

S.No	Year	MSW tone/day	MT / Year
1	2011	336	122640
2	2016	390	142350
3	2020	444	162060
4	2026	498	101770
5	2030	556	202940
6	2035	614	224110
7	2040	672	245280

Figure.2 MSW & Population



The below table 3 shows the approximate numbers of tractor trailers which are used every day for the Garbage disposal. Almost each tractor trailer is utilized for two operation /trips per day and can carry two tones of garbage.

Table III: Collection and Transportation of MSW in Puducherry

Municipality/ Commune	Number of Tractors	Number of trips/day	Approximate Wt/trip/t	Number of Dustbins
Puducherry	68	2	2	532
Oulgaret	72	2	2	213
Villianur	17	2	2	111
Ariankuppam	6	2	2	68
Bahoor	7	2	2	81
Nettapakkam	14	2	2	90
Mannadipet	6	2	2	41

Existing solid waste disposal system

The collected mixed waste is transported to Kurumbapet dumping area by truck and dumped on open land without any processing. It causes obnoxious odor and fly formation. The Rag picker collects usable materials. They also Involves in burning of waste to collect the valuable materials. The wastes from the transit points located in the municipality are being transferred to the disposal yard through mini trucks and light commercial vehicles. Currently 500 TPD of mixed MSW are collected from Puducherry Urban area. The source of solid waste generation is given in Table 4.Among the various sources; solid waste generation is expected to be high in residential areas.

Table IV: MSW source and % of total

S.No	Waste Source	**% of Total**
1	Residential	68
2	Commercial	14
3	Restaurants/Hotel	11
4	Market	04
5	Hospital	03
	Total	100

This problem results in public agitation against dumping of MSW in this site. Ground water contamination in the area also has been reported due to leaching from the dumping site. In a nut shell, the existing practice poses greater challenges to the public health, environment and aesthetic value of the city.Figure.3.showing the dumping site at Kurumbapet and Karuvadikuppam villages.

In the study area of Karuvadikupam Litho logical Description (Figure.4.) shows depth up to 3 m.Top soil reddish colour clay sands medium to fine grained angular to sub angular,3m to 8m Reddish colour sands stone ,medium to fine grained angular to sub rounded ,mixed with clay pieces and latterite , 8m to 14m Reddish colour sands stone ,medium to fine grained mixed with minor intercalations of clay,14mto 17m Red sand, coarse to medium grained angular to sub rounded with minor intercalations of clay,17m to 26m Red sand, fine to medium grained angular to sub rounded 26 to 30m, Red sand, coarse to medium grained angular to sub rounded with minor intercalations of clay 30 to 31m Red sand, coarse to very coarse grained angular to sub rounded. The soil Formation is Cuddalore sandstone..Kurumbapet area Lithological Description (Figure.5.) shows also up to 140m Cuddalore sandstone in the split-up details are up to 13.00m Sand, Light brown to Yellowish brown, fine grained to coarse grained, angular quartz grains, with clay in bottom.13to 20m Clay,

black, plastic, sticky 20 to 30m Sand and clay, sand coarse grained, angular black.30 to 60m Clay, black, hard, plastic sticky with sand 60to 140m Sandstone, with gravel and clay, dark grey to light brown. Coarse to very coarse grained

Figure.3.Dumping site at Kurumbapet and Karuvadikuppam

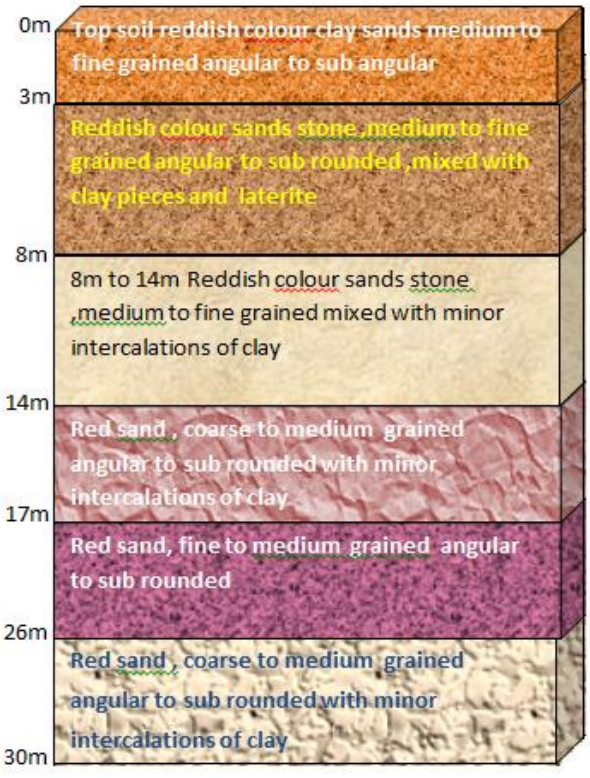


Figure.4. Lithological Description Karuvadikuppam

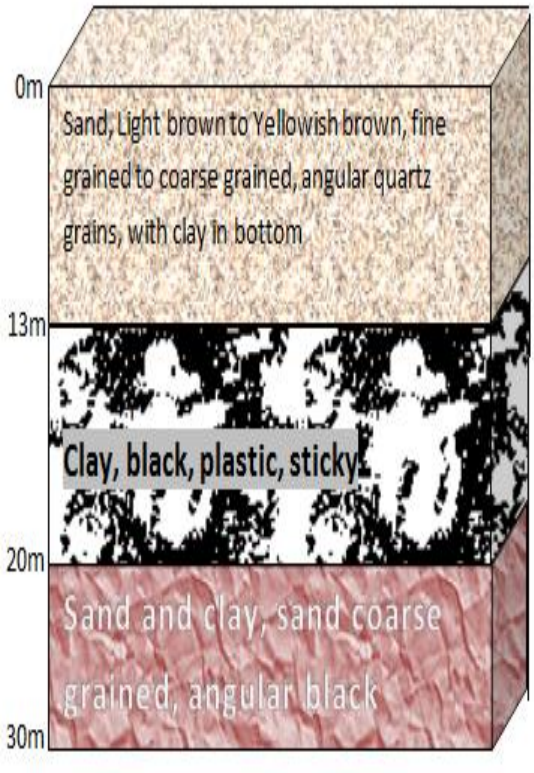


Figure.5. Lithological Description Kurumbapet

Merits and Demerits of the Existing MSW disposal system

Open dumping, composting and sanitary land filling are three methods being adopted for MSW disposal. The merits and demerits are summarized below

Open Dumping

Merits	**Demerits**
Inexpensive	Health-hazard, insects, rodents, odor, etc.
Instant disposal	Air pollution
Release of Methane	Ugly look
	Ground water contamination and run off

Composting

Merits	**Demerits**
Wealth from waste	Takes longer duration
Concentration of Nutrients	Release green house gases
Easier to transport	Require larger land
Composting kills parasites	Need to control rainfall runoff from the composting area
Usable in organic systems	Generate odor

Sanitary Land filling

Merits	**Demerits**
Accommodate huge quantity	Larger land area is required
Instant disposal	Cost intensive
Leachate can be collected	Odour
Longer duration	Methane formation

V. Conclusion

This research indicates the of incineration on Solid Waste Management is crucial for the subsequent system planning of solid waste management in Puducherry. Most importantly this incineration on Solid Waste process one hand does leave amazing results in managing and handling the Municipal Solid Waste on the other hand it is successfully being implemented in Timarpur-Okhla, Waste incineration project in New Delhi.So this case would be best fit for the managing of solid waste in Puducherry. It is generating revenue to the government and end results ultimately which solves a major issue of handling and managing the municipal solid waste.Successful implementation can put a city from troubles concerning unhealthy livelihood of people in the city and quality of living could be developed automated.

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