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A Study On Urban Solid Waste Management In South India

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ABSTRACT

Man and environment are closely intertwined with each other and are expected to maintain a balance or equilibrium with the nature. But our environment is getting worse day by day. With increased urbanization, economic development and improved living standards in cities increase the amount and complexity of solid waste. Consequently, waste management has become a key issue needing to be addressed. But management of municipal solid waste continues to remain one of the most neglected areas of urban development in India. Despite the municipal agencies spend such heavy expenditure; the present level of service in many urban areas is so low that there is a threat to the public health in particular and the environmental quality in general. The present paper is based on the study to find out the problems and prospects of municipal solid waste in Karaikudi, one of the important municipalities in Tamil Nadu. The outline of existing situation of solid waste management system, problems associated with the system and the future requirement to handle the up growing situation are discussed in the study area by the selected 100 households. The secondary data were collected from Karaikudi municipal office. A survey questionnaire and observation techniques have been used to collect primary data. The study reveals that almost 85 percent of the municipal solid waste is collected daily and transported to disposal site (Rastha). But it has problem and deficiencies including lack of required equipment and labour force for collection and disposal of waste and due to lack of awareness, segregation of waste by the respondents is not efficient.

Keywords: Environment, Karaikudi Municipality, Municipal Solid Waste Management

1. INTRODUCTION

Karaikudi is a growing town in Sivagangai district of Tamil Nadu. The Trichy-Rameswaram Highway passes through Karaikudi. Earlier, Karaikudi was a small village in Ramanathapuram district. Now it becomes a Special Grade Municipality from 2013 onwards. The total area of this municipality is about 13.75 $km^{2.}$ Like many other small cities in India, Karaikudi is growing in terms of its living quality. New roads, apartments and underground drainage are being built to renovate the town, and other improvements are going on. It is part of the area commonly referred to as "Chettinad". This town is not an exception in solid waste management which is a universal problem for any growing towns or cities in India. Over the years the city has grown significantly both in population and in density, which put pressure on the resources of the city, which in turn has contributed to an exponential increase in the generation of solid waste to a level which goes beyond the ability to manage. The quantity of solid waste produced in the Karaikudi city comes mainly from the residential area and commercial area. Disposal of this increasing quantity of solid

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waste becomes a major challenge for Karaikudi Municipality with its limited resources. Karaikudi city generates about 47 tons solid waste per day. The wastes are disposed in most unscientific way on to the land thereby posing threat to environment and public health. The Municipal Solid Waste Rules were put in place in 2000 but the enforcement has been poor. Against this background the current paper attempts to draw an inference on waste formed and its management at Karaikudi Municipality, Sivagangai District in Tamil Nadu.

2. OBJECTIVES OF THE STUDY

- To find out the present practices of managing solid waste by the municipality.
- To suggest measures towards managing solid waste.

METHODOLOGY

The study is based on both primary and secondary data. Study was conducted in Karaikudi Municipality in Sivagangai District. Hundred households were randomly selected for the purpose. The primary data was collected by using a structured questionnaire from the households and the secondary data was collected from the Karaikudi municipal office. As of 2015, the town had a population of 1, 06,793 and had a total of 30,865 households. Karaikudi is a developing urban center in the backward Sivagangai District in Tamil Nadu.

PRESENT PRACTICE OF SOLID WASTE MANAGEMENT AT KARAIKUDI

The proper collection and disposal of solid waste without causing any harm to the environment is collectively termed as the solid waste management. The management of solid waste involves four steps. These are:

- Generation and Composition of Waste
- Collectio
- n of Waste
- Transportation of Waste
- Disposal of Waste

GENERATION OF WASTE

In Karaikudi, there are 36 wards are located. For sake of convenience of management of municipal solid waste, the waste generated, resources available etc. are referred to each ward and respective zonal office. The municipality performs its function as per the provisions of the Act governing the municipality in the state. The sources of waste generation from various places are given in the Table 1.

SOURCES OF WASTE GENERATION IN KARAIKUDI MUNICIPALITY

SOURCES OF WASTE GENERATION									
2015 POPULATION	NO. OF HOUSE HOLDS	NO. OF COMMERCIAL ESTABLISHMENTS	NO. OF MARRIAGE HALLS	NO. OF MARKETS	NO. OF BUS STANDS	NO. OF MUTTON STALLS	NO. OF CHICKEN STALLS	NO. OF PARKS/ GARDENS	NO. OF INDUSTRIES
1,06,793	30,865	2,865	38	2	2	43	77	4	-

Source: Municipal Office, Karaikudi-2016.

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Table 2 explains the daily waste generation and collection of municipal solid waste with per capita waste generation per day and collection efficiency. The remaining 15 percent of municipal solid wastes are not collected and left on the roadside and nearby houses.

MSW GENERATION AND COLLECTION

MUNICIPALITY	AREA (SQ.KM)	POPULATION (IN LAKHS) 2011	TOTAL MSW GENERATED DAILY (MT)	PERCAPITA GENERATION /DAY (GM)	TOTAL MSW COLLECTED/DAY (MT)	COLLECTION EFFICIENCY IN PERCENT
Karaikudi	13.75	106793	48	450	41	85

Source: Municipal Records, 2016-KKDI

TABLE NO 2

COMPOSITION OF WASTE

The composition of waste in terms of its physical characteristics will give a clear idea regarding the consumption pattern and waste disposal in an area. Higher income and economic growth will also affect the composition of wastes. Wealthier individuals consume more packaged products, which results in a higher percentage of inorganic materials – metals, plastics, glass, and textiles etc. in the waste stream. Large amount of wastes with a higher content of inorganic materials could have a significant impact on human health and the environment. A typical Solid waste comprises of biodegradable, non biodegradable and debris matter as given in Table 3 for Karaikudi town. Various studies have shown that the municipal solid waste contains a high biodegradable content. The Table 4 showed the physical composition of solid waste in the study area.

CLASSIFICATION OF WASTE

S.NO.	TYPES OF WASTE	%
1	Biodegradable	60
2	Non-bio degradable	37
3	Debris and Silt	3

Source: Municipal Records, 2016- KKDI

TABLE NO 3

PHYSICAL CHARACTERISTICS OF GARBAGE IN KARAIKUDI

S.NO.	COMPOSITION	PERCENTAGE
1	Combustible matter	81.8
2	Paper	6.4
3	Plastic	6.8
4	Rubber, leather & synthetics	2.4
5	Glass	1.8
6	Metal	0.8
Total		100

Source: Municipal Records, 2016- KKDI

TABLE NO 4

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TOTAL MANPOWER AND INFRASTRUCTURE DEPLOYED (FOR THE COLLECTION AND TRANSPORTATION OF MSW BY KMC)

Many studies on urban environment have revealed that municipal solid waste collection efficiency is a function of two major factors: manpower availability and transport capacity. The average collection efficiency for municipal solid waste in Indian cities and states is about 70 percent. (Rathi, 2006; Siddique et al., 2006; Nema, 2004; Gupta et al., 1998; Maudgal, 1995; Khan, 1994). In the study area, the activity of collection and transportation of MSW is carried out both by contract basis and Karaikudi Municipality itself. The total manpower bifurcated into the contractual labour and Karaikudi Municipality manpower and the infrastructure deployed for the collection and transportation of MSW is as follows:

MAN POWER FOR SOLID WASTE MANAGEMENT IN KARAIKUDI

DESIGNATION	AS PER NORMS	STRENGTH		SHORTFALL
		SANCTIONED	AT PRESENT AVAILABLE	
Health Officer	1	1	1	0
Asst. Health Officer	0	0	0	0
Sanitary Inspector	5	5	5	0
Sanitary Supervisor	12	12	12	0
Drivers	5	5	5	0

* Temporary workers through private agency.

Source: Municipal Office, Karaikudi-2016.

TABLE NO 5

The table 5 shows the total manpower of the municipal solid waste management in Karaikudi Municipality. Waste collection has properly managed by Karaikudi Municipality jointly with one private agency. Almost 85 percent of Karaikudi municipal solid waste is collected daily and transported to disposal yard and the rest 15 percent of municipal solid waste are not collected mainly due to short fall of sanitary workers.

The table 6 shows the sanitary workers details in Karaikudi Municipality

SWM SANITARY WORKERS DETAILS IN KARAIKUDI MUNICIPALITY

AT PRESENT AVAILABLE			REQUIRED SANITARY WORKERS	SHORTFALL	PERCENTAGE OF SHORTFALL
PERMANENT	TEMPORARY	TOTAL			
194	110	304	401	97	24.19

Source: Municipal Office, Karaikudi-2016.

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From the table 6, it is evident that out of the required 401 sanitary workers, 304 workers were available. There are 97 workers are shortfall. With this shortfall of 24.19 per cent, Karaikudi municipality manages to clear solid waste in the town.

TRANSPORT AND TRANSFER

The municipal solid waste collected from the dustbins and collection points is transported to the disposal sites using a variety of vehicles. The trucks used for transportation of MSW are generally of an open body type and are usually kept uncovered; thus during transportation, the waste tends to spill onto the road resulting in hygienic conditions. In some cities, modern hydraulic vehicles are gradually being introduced (Bhide and Shekdar, 1998; Reedy and Galab, 1998).

VEHICLES EMPLOYED FOR WASTE COLLECTION AND TRANSPORTATION IN KARAIKUDI

COMPACTOR LORRY	TIPPER LORRY	DUMPER PLACER	MINI AUTO	TOTAL
1	2	3	2	8

Source: Municipal Office, Karaikudi.

TABLE NO 7

At present, both open body type and modern hydraulic vehicles are used to collect waste in Karaikudi Municipality. Table 7 presents a summary of vehicles employed for waste collection and transportation in Karaikudi Municipality. Waste collection is through community bins and house-to-house collection. Nearly 40 percent of modern hydraulic vehicles and 60 percent of open body type vehicles are used for waste collection.

COLLECTION AND TRANSPORTATION OF SOLID WASTE IN KARAIKUDI MUNICIPALITY

DESCRIPTION	LIFTING CAPACITY (IN TONS)	NO. OF VEHICLES	NO. OF TRIPS/ DAY	TOTAL MSW LIFTING IN TONS/ DAY
Compactor Lorry	6	1	2	11
Tipper Lorry	3	2	2	8
Dumper Placer	1.5	3	5	15
Mini Lorry	2.5	2	1	5
Total		8	10	39

Source: Municipal Office, Karaikudi.

TABLE NO 8

The table 8 shows that the total collection and transportation of residential and other municipal solid waste which are carried by 8 vehicles under various category such as Compactor Lorry, Tipper Lorry, Dumper Placer Lorry and Mini Lorry. All these vehicles can lift 39 ton capacity of

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solid waste per day and remaining garbage is left out. The actual generation of solid waste per day is 48 tons and out of which 39 tons wastes disposed to dumping yard and remaining waste not cleared. Even though there is insufficient vehicles, insufficient funds and shortfall of manpower the municipal administration has done their role perfectly joined with one private agency with respect to solid waste management.

MANAGEMENT OF SOLID WASTE AT LANDFILL SITE

The waste is dumped at compost yard. The compost yard of Karaikudi municipality is located at Devakottai Rastha and has an extent of 13.70 acres, which is 4 Kms away from the town. The segregated wastes transported through dumper bin placers and other lorries are unloaded separately in the yard. To convert natural manure from degradable wastes, the works are in progress. The segregation of wet and dry waste is not carried out at the site and contract has been allotted for generation of manure.

MANAGEMENT OF BIOMEDICAL WASTE

There is provision of management of biomedical waste in Karaikudi by one private agency from Tanjore, Tamil Nadu.

COMPLIANCE OF MSW RULES 2000 BY KMC

- **Prohibition of littering**
  For stopping littering K.M.C. has provided 100 closed containers and 20 fixed open spots.
- **Final disposal at Landfill site**
  The waste is being currently dumped at the landfill site.
- **Public awareness programs**
  The Corporation has taken various programs to create awareness among the local people regarding the significance of the solid waste management, which includes the following steps: - a) Pamphlets distribution b) Creating awareness through loudspeakers c) Door to door campaign d) Media publicity.

3. PROBLEMS WITH CURRENT SOLID WASTE MANAGEMENT SYSTEM

1. GENERAL

- There is shortfall of vehicles for the total collection of waste.
- There is no initiative or co-operation forthcoming from the general public as regards the storage of waste generated from the household's every day.
- The collection is not hard and fast in the city.
- There is difference of approx 25 tons of waste between the approx.160 tons of MSW transported for disposal as vis-à-vis approx 185 tons of waste generated which remains scattered and remains in the city either in the city or in unidentified places.
- The complete waste is not collected from hotels, beer bars and community halls.
- There is no classification of waste from house-to –house collection.
- Lack of awareness and absence of comprehensive segregation of waste at source,

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resulting in large quantities of non-biodegradable waste being collected and sent to the facilities for biological processing.

- Absence of transfer stations for transferring MSW into bigger vehicles for transportation to the treatment and landfill facilities.
- Inadequate waste treatment capacity when compared to the quantum of waste generated.
- Dumping of MSW in drains, along the roads and in low-lying areas.
- Absence of policy and regulations to promote waste reuse and recycling and a favorable environment to promote manufacture of reusable material.
- Limited participation of the community in sharing the costs for SWM.

2. TRANSPORTATION OF WASTE

- There is shortfall of vehicles and waste containers but the waste stored from the handcarts is much more comparatively.
- The waste stored from the handcarts is not classified at source into biodegradable and non-biodegradable components.

3. DISPOSAL OF WASTE

- As there is no provision of processing of waste available, the waste is disposed of by land filling.
- As there is no provision of classification of waste there is malodor from the landfill site.
- As there is no provision of approach road up to land filling site the technique of disposal is not as per the norms.
- There is no provision of vermicomposting of waste.
- There is no adequate provision of water and electricity on the landfill site.
- Adequate land is not available for land filling.
- 628 nos. of organizations don't provide the biomedical waste generated.

4. FUTURE CHALLENGES

Given the population growth in Karaikudi, the key challenge for the KMC is to provide adequate MSWM services within its limited finances. MSWM services would require universal coverage since it has a direct bearing on the city's environment and citizens' heath. The requirements for collection and transportation equipment and the estimate of tipping fee for composting and landfill are based on the waste generated and in turn the projected population as set out by detailed studies. The estimated waste generation is expected to increase in future based on the population growth forecasts. While the per capita waste generation is expected to increase with economic growth. Various initiatives for segregation, recycling and reduction are proposed to be implemented.

4. PROPOSED PLAN FOR MSW MANAGEMENT BY KMC

The New MSW Master Plan should be set out in compliance with MSW Rules, 2000 and the accepted waste hierarchy principles of reduction, reuse, recovery, and disposal. For long term planning following key principles should be followed.

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- Waste minimization at source
- Waste management closest to generation
- Generator to pay for management
- Efforts for conversion of waste to energy should be made
- Addressing social and environmental aspects

KMC should implemented projects with private sector participation in collection, transportation, treatment, and disposal. MSW management staff from worker to engineer all should be made aware about necessity, their role and responsibilities as a part of their duty. They should be trained and held responsible for improper management of MSW and implementation of strategies in the area allotted to them for supervision.

5. CONCLUSIONS

The study concludes that insufficient finance, men and machine power is identified as weaknesses for efficient handling of the solid waste management in Karaikudi Municipality. In addition to that public awareness had to be taken in the effective implementation of the solid waste management system. Households have not followed the habit of segregation practices during disposal at primary level and as they are not aware of its significance. Above all, inculcating the culture of recycling the waste and using of recycled material in a proper way would solve the problem to a very great extent. The results of this study had revealed that there was a good chance of success if solid waste collection service charges were introduced. The rate of these charges should take into consideration both the ability as well as the willingness to pay.

6. RECOMMENDATIONS

- The operational efficiency of solid waste management mainly depends upon the active participation of both the municipal agency and the citizens. Therefore, to increase the operational efficiency of solid waste management the municipal authorities create public awareness programme.
- Sufficient dustbins will be provided in each and every street. And separate storage bins should be provided for both decomposable and non-decomposable waste.

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