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Estimation of Municipal Solid Waste Generation – A Case Study

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ABSTRACT

A trend of significant increase in municipal solid waste generation has been recorded worldwide. This has been found due to over population growth rate, industrialization, urbanization and economic growth. Consumerism speed has been found very high covering around more than 50% of total population since last decade due to higher economic growth, which has ultimately resulted in increased solid waste generation. Municipal solid waste generation showed different trend and a positive correlation with economic development in term of kg/capita/day solid waste generation at world scale. This paper reports the result of municipal solid waste analysis undertaken in Kovvur city. Field surveys were carried out in various activity zones that are representative samples of the city to understand the practice and identify the lacunae. The results show that the solid waste generated in the city contained more garbage (3274.5 Kg) concentration and with less concentration of polythene (44.22 Kg) and paper (47.57 Kg).

INTRODUCTION

Domestic solid waste management has emerged as a dominant urban environmental issue that has attracted academic, economic and media debates, and has over the years developed into an independent discipline. However, despite this formidable growth in content and general awareness, the waste management system in the third world city has either crumbled or is non-existent altogether. The theoretical approach to the subject identifies seven major components of the solid waste management system. These are waste generation, storage, collection, transfer, transport, processing, and disposal (Tevera *et al*, 2003).

Waste generation includes activities in which materials are identified as no longer of any value and so are either thrown away or gathered together for disposal (Theodore and Theodore, 1996). In the late 1990s, it was estimated that each person in the world generated 200 kg of solid waste per year (UNCHS, 2002) and this was forecasted to increase with the growth in population. At a more regional study by Mukuka and Masiye (2002), a similar trend was revealed that there was a quasi linear relationship between population growth and waste produced in Lusaka, Zambia. A more alarming example was also found in Indonesia's region of Jabotatek, which includes Jakarta, where population growth was fast and waste generation rate was estimated at 50,000 m/day or 7 million tons per year (Otten, 1996). The rate of increase in the quantity of waste generated in relation to the population size can only worsen urban environmental issues and planning as a whole.

In low income cities of India, it has been estimated that 15.62% of domestic waste is vegetable matter, 4.35% is paper, 0.55% is rubber and leather, 0.62% are plastics, 4.00% are rags, 0.40 % wooden paper, and 0.62% are metals (Bhatia, 2003). These figures are somehow different from the African scenario as represented by findings from Chirundu, Zambia where 10% of household waste was paper, 7% plastic, 6% metal, and 72% was food waste (Masundire and Sanyanga, 1999). Therefore, components and amounts of waste generated vary for different towns and cities. A number of determinants account for the type of waste generated. These include consumption patterns, as well as lifestyles. Masundire and Sanyanga (1999) found that Kariba and Victoria Falls had the same population size of 30,000.

Once waste is generated at the household level, it has to be handled in a manner that facilitates easy disposal. Waste handling and separation involves activities that are associated with the management of waste until they are placed in storage containers for collection (Tchobanoglous *et al*, 1993). Waste storage involves the management of wastes until the generator places them in a suitable container for collection. Storage containers include black refuse bags, hard plastic bins, skips, metal bins, informal bags, and bulk containers. Waste receptacles differ in shape, size, and materials, which they are made of. They also differ in durability; for example, metal bins have a life span of about five years and carry waste ranging from hot ash to glass.

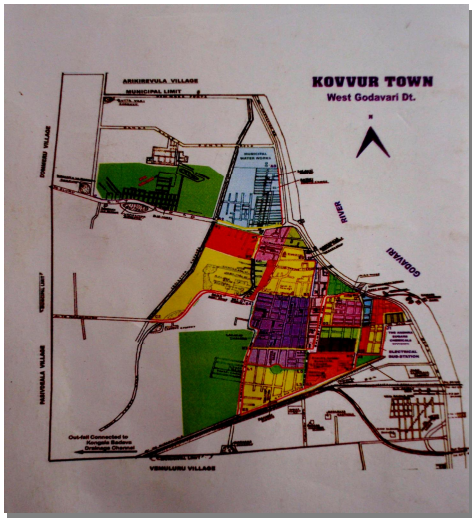
A study by Masundire and Sanyanga (1999) revealed that in areas, such as Kasane (Botswana), Livingstone (Zimbabwe), and Chirundu (Zambia) there were too few litterbins, thus, people ended up sharing bins resulting in over spilling of the bins. Lack of refuse storage containers in overcrowded towns and cities resulted in prevalence of odors, housefly infestation, and visual pollution produced by exposed and decomposed garbage.

Waste collection, transport, and transfer have also presented a number of challenges in the third world city. These range from lack of waste removal equipment, personnel, finance, and above all, lack of commitment by management. Skip vehicles, tractors, trailers, and trucks are used to collect waste. The collection system in most developing countries is grossly inadequate and local authorities are blamed for inefficient and unreliable domestic waste collection with 30-50% of domestic waste generated left uncollected (Hardoy, 1997).

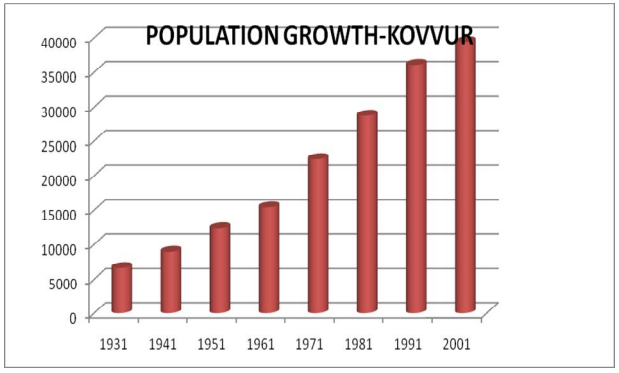
In the context of the crushing scenario observed along the entire waste management system, it became necessary that a critical review of the waste management system in the city of Kovvur be conducted with a view to unravel the dynamics of the solid waste management system at a local level. Kovvur has experienced an increase in population over the years and certainly the challenges associated with this phenomenal growth in population.

Study Area

Kovvur Municipality is a 3rd grade municipality in Andhra Pradesh State, India. It has been established as a Nagar Panchayath in the year 1965. Geographically Kovvur town lies at 81^0-43' North longitude and 17^0-00 East longitude on the bank of the river Godavari and spread over 24.56 sq.k.m. It is the Revenue divisional headquarters of West Godavari district and one of the industrial towns. The town is basically agriculturally rich because of its location in the middle of very fertile land producing huge quantities of Paddy as main crop and sugar cane, Banana as other crops. Since 1931, decade wise population mentioned as follows. The rapid growth of population was because high migration and natural growth which has been found from official records.



Currently the town had a population of 39,384 with 9,872 households as per 2001 census with a 9.15%.



The climate of the Kovvur is characterised by an oppressive season and with good seasonal rain fall. The average rain fall recorded was 2cms. The daily minimum temperature is about 18^0c. From November to February is the coolest part of the year.

METHODOLOGY

The study involved various sequential steps that are explained as follows:

1. Step 1: Study area was randomly selected including areas covering the slums, commercial and other residential zones including apartments.
2. Step 2: The selected tricycles were followed and the number of individuals filling the solid waste collection tricycles was counted along with the number of tricycles trips to complete the selected area.
3. Step 3: After completion of filling the tricycle, the filled tricycle was segregated by separating the components like paper, polythene, cloth, rubber, Iron and garbage etc.
4. Step 4: These separated wastes were weighed individually.

The same process was followed in the other selected areas.

With the data from the above steps the differences in waste quality in slums, commercial and other residential areas including apartments was known. By calculating all the values the total amount of garbage generated by the city per day and also individual components of the waste per day was known.

RESULTS

The solid waste in residential slum areas contained more garbage concentration and with less concentration of polythene and paper. When compared to the other areas the tricycle weight increased with less number of house hold waste collection and also the average value of polythene usage is also very less. This data helps to collect waste for the preparation of organic compost, because segregation process can be very easy (Table -1).

In the residential middle class and above middle class areas the number of households to fill the tricycle was more when compared to all other areas. In this area paper usage is more and next polythene and garbage. The cloth disposal is almost equal to slum areas. Segregation of solid waste in these areas is difficult, because the waste is mixed with all the paper, polythene, cloth and garbage. Once garbage mixed with paper and polythene it is difficult to segregate for recycling purpose.

The solid waste from the people residing in the apartments consists of more paper waste and less garbage, when compared to all the residential areas. In these areas major problem is dumping of their waste by packing in a polythene cover and also usage of polythene packed items. Segregation of solid

waste is so difficult for recycling purpose and also it takes requires more working time for the segregation of garbage for the preparation of organic compost (Fig-1).

In the pure commercial areas total tricycle was filled with polythene and paper only and even kg of garbage not found. Cloth waste was also found in these areas. All the waste come from this area is useful and can be recycled. Segregation process is very easy and by identifying and separating these areas we can easily manage the solid waste.

CONCLUSION

In the study of collection of waste from different types of areas it is observed that for the preparation of fine organic waste by vermin composting method it is better to collect from the slum area because according to field observation the garbage consists of no other non-putrescible matter in these areas and no prolong process of segregation was required.

Preparation of organic compost by normal dumping method, the waste from the middle and above middle class is suitable, because the waste consists of paper and other small polythene waste and with a little segregation process these are removed and by huge dumping the waste organic compost can be prepared.

The waste from the apartments required more segregation process and according to field observation very small amount of the waste is useful. The waste coming from the commercial areas almost all the waste is useful and it is all recyclable and only it consists of paper and polythene.

This study provided a basic understanding for the solid waste management. From all the observations it is understood that care should be taken in the collection process itself for the complete segregation of solid waste for the easy process of preparation of quality organic compost and also for the recycling of the non degradable waste.

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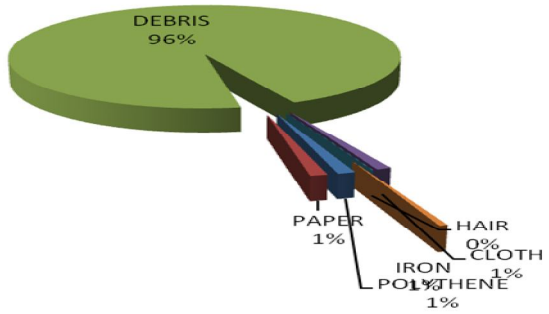

Figure – 1 Fractions od Solid Waste generated in Kovvur City

S.NO	Ward Number	Type of the Area	Total No of households/shops waste for filling the tricycle	Polythene (kg)	Paper (kg)	Cloth (kg)	Garbage (kg)	Hair (kg)	Iron scrap	Total Weight (kg)
1	2	Slum	303	1.42	1.125	1.5	161.5	0	1	166.545
2	3	Commercial	333	1.2	1.5	1.8	156	0	0	160.5
3	4	Slum	311	1.6	1.4	2.5	140	0	0.2	145.7
4	5	Residential	253	1.6	1.5	1.9	166	0.1	0.5	171.6
5	6	Residential	226	1.6	1.85	2.5	140	0.1	1.2	147.25
6	7	Apartment	290	2.5	1.9	1	155	0	1.6	162
7	8	Apartment	322	2.7	3.2	1.8	180	0.2	1.6	189.5
8	1-Rajiv colony	Slum	195	1	1.8	0.75	110	0.1	0	113.65

9	1-Sri Rama colony	Slum	194	1.5	2.1	1.1	110	0.1	1	115.8
10	9	Official	242	3	3.5	2	150	0	2	160.5
11	10	Apartment	300	3	2.8	4	170	0.1	1.3	181.2
12	11	Residential	370	2.2	2.9	3	210	0	1.5	219.6
13	12	Residential	278	2.1	2.7	3	160	0	1.4	169.2
14	13	Commercial	370	2.3	3.5	1.6	190	0	0.5	197.9
15	14	Commercial	264	1.8	3	1.3	145	0	0.7	151.8
16	15	Residential	252	2.3	2.2	2.1	146	0.2	1.2	154
17	16	Residential	230	2.2	2.4	2.2	110	0.1	0	116.9
18	17	Residential	339	3.4	3.2	3.3	180	0.12	1.4	191.42
19	18	Residential	288	2.9	1.4	3	165	0.1	1.6	174
20	19	Commercial	340	1.4	1.4	1	180	0	1.2	185
21	20	Slum	246	2.5	2.2	2.5	150	0	0.6	157.8
Total			5946	44.22	47.575	43.85	3274.5	1.22	20.5	

Table - 1 Showing the data of solid waste collected by tricycles and weight of the individual components of waste from Kovvur Municipality

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