EUROPEAN ACADEMIC RESEARCH
Vol. II, Issue 2/ May 2014

Impact Factor: 3.1 (UIF)
DRJI Value: 5.9 (B+)

ISSN 2286-4822
www.euacademic.org

Studies on Garbage Solid Waste from Residential Areas in Tirupati City, Andhra Pradesh, India

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Abstract:

Eco city Tirupati and its environs form a part of Swarnamukhi river, sub basin in Chittoor district, Andhra Pradesh, India. It is a famous Hindu pilgrim centre in India and attracting a floating population of about one lakh everyday into the city. The urban population has increased from less than 40,000 in 1947 to over half a million now. As the urban population and floating population is increasing rapidly, the solid waste generated by them is increasing many folds. Hence, the author has made an intensive surveys on garbage solid waste (pest and food contamination) from houses in Tirupati city. From 2,180 households samples were collected, analysed and interpreted in order to understand how the solid waste disposal is done in Tirupati and suggested suitable measures for effective disposal in order to maintain clean environment for the eco city Tirupati.

Key words: Ecocity, Tirupati, population, garbage, pests, clean environment

Introduction

The Tirupati Municipality lies in between longitudes 79°, 23' 10" to 79° 26' 30" E and latitudes 13° 37' 05" N to 13° 38' 40" N and it is located in survey of India map of 57 O/6 in the scale of 1:50,000 the extent of the area is determined as 16.56 km^2 and

has a residential population 2.28 lakhs with 36 wards. The world population whether living in developing or developed countries are now worried too much about wastes. Disposable areas are getting scarcer every year. Wastes are getting complex from time to time. Solid waste such as garbage from homes and industries, are probably, the most visible solution. One of the most difficult problems facing humans today is the disposal of solid wastes (Alemayehu, 2007).

Municipal solid waste constitutes a serious problem in most Indian cities. Most of the waste generated from households and commercial establishments is not collected and only a fraction of what is collected receives proper treatment or disposal. Furthermore, in all metropolitan cities and most large cities in India, about 50 to 60% of the municipal waste collected is dumped in open dumpsites (Bhide, 1984; CEE South, 1995). The rest keeps lying around in municipal bins and roadsides for several weeks to months, becoming a breeding ground for rodents, flies, mosquitoes, and disease causing germs including bacteria, molds & viruses. Furthermore, this untreated waste pollutes air, water, soil and food and adversely affects the aesthetics & sensibilities of citizens. Even in smaller cities where most of the municipal solid waste generated may be collected, it is merely dumped in the outskirts of the city without any treatment or precautionary engineering to protect air, soil and water (Krishna et al, 1996). In this context, Ministry of Environment and Forests, (MoEF) Government of India promulgated the Municipal Solid Waste (Management and Handling) Rules in 2000 mandating all municipal authorities to implement improved systems of waste management, which involves segregation of waste at source, employing the non-formal sectors like ragpickers for segregated door to door collection and treating the waste thus collected in an appropriate manner (MoEF, 2000).

Much of the solid wastes from homes offices and municipal wastes end up littering road sides, floating in lakes

and streams, and collecting in ugly dumps. When the wastes are put in to open dumps, they ruin the attractiveness of the surrounding areas and would potentially endanger the healthy environment necessary for human existence. Ecological phenomena such as water and air also attributed to improper management of solid wastes (Monroe, 1997). SWM requires among other things effective local planning and citizen participation backed by clear, integrated and comprehensive strategy towards effective and safe solid waste disposal mechanisms (Aarne*, et al*, 2002). Singh (1999) reviewed some of the indicators that give rise to environmental concern on environmental quality of urban areas. These include, solid waste management. According to him the magnitude and dimensions of indicators are as follows:

Solid Waste Management

- In larger cities, on an average, 60% of the solid waste generated is collected every day. For smaller cities, the average is 50%.
- Most solid waste collected ends up in open dumps or drainage systems, threatening both surface water and ground water quality.

Hardoy *et al.* (1992) and Benneh *et al.* (1993) presented the environmental problems in third world cities. They identified some of the problems in cities are: water scarcity and contaminated water supply, inadequate sanitation and drainage facilities, congestion of roads, improper collection and disposal of solid wastes, mosquito and fly problems, water borne diseases, respiratory diseases due to acute automobile air pollution, shortage of houses and slum formations.

The most obvious environmental damage caused by municipal solid wastes is aesthetic, the ugliness of street litter and degradation of the urban environment and beauty of the city. More serious, however, and often unrecognized, is the transfer of pollution to water, ground water. Excess packaging

is one of the major sources of solid wastes. Disposing of packaging and other solid waste is a serious problem. Some communities dispose of refuse in an open dump where the refuse is left on the ground. There open dumps are a threat to the environment and a health hazards. Rain carries materials from the dump in to water supplies. Since rats, insects, bacteria, and fungi are found in open dumps, such dumps may be source of disease (EPHTI, 2004). The present study was organized to assess the awareness of institutions and the community on the environmental impact of solid waste management practice.

There are different strategies through which municipalities can have approach the issues of solid waste collection (Andre and Cerda, 2006). One option is that the municipality undertakes the responsibility of waste collection fully, thus assuming the responsibility for the health and safety of its population. In this model, the population served is not restricted to certain types or quantities of garbage, and they are in charge of collecting the garbage as often as possible. The costs must be born on domestic, commercial and industrial users, and materials are not recycled most of the time. Another alternative is a more managed approach. The model is based on environmental precaution, and includes the separation of organic waste. The waste is treated as the responsibility of the producer because the municipality can be selective in what it collects, and materials are recycled. Strategies are implemented to minimize waste generation, and technology is applied to treating waste.

Municipal solid waste management system involves various activities like storage, collection, transportation, disposal etc. These activities if not properly controlled and with proper precautionary measures adopted, may have adverse impact on land, water, and air environment, human and environmental health, aesthetics and quality of life (Justine, 1993). The environmental and Health Impact Assessment may

help in increasing the potential adverse effects of these activities and in formulation of precautions which could prevent these effects from taking place (UNEP, 2009).

Waste was an unavoidable by-product of human activities. Economic development, urbanization and improved living standards in cities contribute to increase in the quantity and complexity of generated solid waste. If accumulated, it leads to degradation of urban environment, stresses natural resources and leads to health problems. Solid waste management has become a major environmental issue in India. Waste management, however, remains a major challenge for any society, since all natural processes generate waste. Rag pickers play an important, but usually un recognised role in the waste management system of Indian cities. They collect garbage in search of recyclable items that can be sold to scrap merchant like paper, plastic, tin...etc. This activity requires no skills and is a source of income for a growing number of urban poor people (Syamala Devi *et al.,* 2014). The objective of the present study garbage solid waste generated from residential areas in Tirupati city, Andhra Pradesh, India

Methodology

The study is based on primary sources of data. Data regarding household disposal of garbage and solid waste were drawn with the help of a questionnaire from a comprehensive survey of the 36 wards of Tirupati city. Stratified random sampling was done. Spearman's Rank Correlation Coefficient method (Gupta 1994) was applied to calculate the relationship existing between the various household garbage, solid waste management conditions and the occurrence of environmental pollution.

Results and Discussion

Household Garbage and Solid Waste

Residential domestic waste forms the bulk of all resources of solid waste produced in the city. Household solid waste includes organic and non-organic material, tins, cans, papers old news papers, polythene bags, food scraps, worn out furnitures, broken toys, etc. Collection, transportation, processing and recycling and continual activities in the resolution of waste problems, a disturbance in the chain may have an un fare effect on the environment. Domestic waste is estimated to form a greater proportion of all resources of solid wastes produced in this city. Due to rapid population and commercial growth, the problem of waste management has become severe. The earlier role of municipality was to keep the streets clean and to collect garbage from public and also to ensure its safe disposal. But due to the shortage of employees engaged in these tasks, wastes generated are left uncollected.

Reliable estimates of solid waste generation are not readily available. But most of the estimates are based on per capita norms. And it is estimated that in Tirupati city each resident generates about 345 to 1,000 grams of solid waste every day which accounts for nearly 250 tons of garbage per day. Out of this huge total, nearly 40 percent (100 tones) of garbage is left uncollected daily. Such a large quantity of garbage requires proper system of collection, transportation and disposal

While considering the garbage and solid waste condition of the respondents, the factors which were taken into consideration are the mode of storage of household waste in the house (in open or in closed containers or no storage), mode of disposal (official dump or at the collection points or on the roadside or burn it), industrial waste in the wards (yes or no), garbage collection by the municipality (collected or not collected) and lastly the frequency of garbage collection (daily or twice a week or monthly). The data regarding these aspects were collected through field survey.

In the total 2,180 sampled households as a whole it is seen from Table 1 that maximum 39.27 percent of the households store household waste inside the house in open containers. About 30.30 percent dispose of their garbage in official dumps i.e., the bins placed by municipality and 22.65 percent dispose at the collection points i.e., in the open fields and plots which has become a collection centre of garbage. Nearly 55 percent of the households reported of industrial and commercial waste in their wards. 20.15 percent of the households also reported that garbage is not collected by the municipality from their wards and only 22.97 percent households reported that garbage is collected daily from wards. Whereas 1.89 percent of the sampled households reported that garbage is collected only once in a month.

Table 1 Household garbage and solid waste of the total sampled households in Tirupati City

Sl. No		Household Garbage and Solid Waste	Percentage
1	Mode of storage Waste in the house	1. in open containers 2. in closed containers 3. Do not store in the house	39.27 41.05 19.68
2.	Mode of disposal of household waste	1. Official dumps 2. Collection points 3. Roadside 4. Burn	30.30 22.65 44.21 2.84
3.	Industrial and commercial waste in the wards	1. Yes 2. No	54.51 45.49
4.	Garbage collection by municipality	1. Collected 2. Not collected	79.85 20.15
5.	Frequency of garbage collection	1. Daily 2. Twice a week 3. weekly 4. Monthly	22.97 33.07 42.07 1.89

Source: Based on field survey (2006-07)

Mode of Storage of household waste

Solid waste can create problems inside the house if it is not stored properly. **Table.2** are showing the distribution of the

sampled households according to mode of storage of household waste inside the house.

Table 2: Distribution of the sampled households according to the mode of storage of household waste in Tirupati City (in percentages)

Income Group	In open Containers	In closed containers	Do not Store	Total
Very low	75.93	4.01	20.06	100.00
Low	87.83	7.54	4.63	100.00
Medium	40.43	30.97	28.55	100.00
High	--	67.29	32.71	100.00
Very high	--	92.78	7.22	100.00
Total	**39.27**	**41.05**	**19.68**	**100.00**

Source : Based on field survey (2006-07)

It is observed from **Table 2** that 75.93 percent of the very low, 87.83 percent of the low and 40.43 percent of the medium income households store their waste inside their house in open containers. The waste kept in open containers attracts flies in the house. So, they have more flies in their Kitchens or in food preparation areas. They complain of more rats, cockroaches and mice. The risk of pest infection due to open waste storage indoor is generally higher than those who used close containers to store garbage. About 30.97 percent of the medium 67.29 percent of the high and 92.78 percent of the very high income households use closed containers to keep their waste indoors because they are educated and know about the hazards of keeping waste in open containers, whereas 28.55 percent of the medium 32.71 percent of the high and 7.22 percent of the very high income households do not store waste indoor. They throw it out keeping waste in polythene bags. Polythene bags containing waste attracts flies and animals. It is not surprising to note that 4.01 percent of the very low and 7.54 percent of the low income households store their household waste in close containers. This shows that the lower income households are also getting familiar with the hazards of keeping waste open in the home. But it is mainly the wealthy households who use more closed containers indoors and this made a better

understanding of safe waste storage practice.

Mode of Disposal of Household Waste

Safe disposal of household waste is very important in order to keep the household environment and the surroundings clean. The households disposed of waste at four places i.e., either in official dumps or at collection points or along the roadside or it was burnt. **Table 3** is showing the distribution of the sampled households according to the mode of disposal of household waste.

Table 3 : Distribution of the sampled households according to the disposal of household waste in Tirupati City (in percentages)

Income Group	Official Dumps	Collection Points	Roadside	Burnt	Total
Very low	--	23.15	76.85	--	100.00
Low	9.73	20.44	69.83	--	100.00
Medium	16.61	20.81	56.13	6.45	100.00
High	48.59	28.51	17.76	5.14	100.00
Very high	77.36	21.15	1.49	--	--
Total	**30.30**	**22.65**	**44.21**	**2.84**	**100.00**

It is seen that roadside waste disposal practice is very common in most of the households of lower income groups. But 48.59 percent of the high and 77.36 percent of the very high income households dispose of their household waste in official dumps. Two or three official dump containers been placed in every ward by the municipality. These waste containers are placed along the roadside. The higher income households are aware of the hazards of waste disposal along the roadside, and since they do not want to create dirt and filth in their wards so they dispose of their waste properly. Nearly one-fifth of respondents belonging to different income households dispose of their household waste at collection points. The collection points we mean the open plots or field or at the corner of the streets. Due to the absence of official dump, containers households start disposing their waste in open plots which in due course of time

turns into collection points, Very few households i.e., 6.45 percent of the medium and 5.14 percent of the high income households burn the household waste in front of their houses. Burning of waste is not safe practice of waste disposal because by burning waste enormous amount of smoke is emitted which pollute indoor air.

Industrial and commercial solid wastes in the wards

Table 4 is showing the distribution of the sampled households according to the industrial waste in their wards.

Table 4 : Distribution of the sampled households according to the industrial waste in their wards in Tiruapti City (in percentages)

Income Group	Yes	No	Total
Very low	91.67	8.33	100.00
Low	82.97	17.03	100.00
Medium	64.84	35.16	100.00
High	27.80	72.20	100.00
Very high	7.96	92.04	100.00
Total	**54.51**	**45.49**	**100.00**

It is observed from the above table, that industrial and commercial solid wastes are seen nearly in all the wards in which different income group households reside, but it is much higher in the areas where lower income households reside such as in 91.67 percent of the very low, 82.97 percent of the low and 64.84 percent of the medium income households. Because these households are living mostly in centre part of the city where various small scale factories such as steel, wood furniture, brass casting. Bakery, flower vendors, printing, engineering repair etc.

Garbage Collection of the Municipality

It is the prime duty of Municipality (sanitary department) to collect the household waste which has been thrown along the street. But due to the irregularity in collecting garbage by Municipality some wealthy households use private labourers in

order to make their surroundings clean. But this is not a frequent practice. Table 5 is showing the distribution of the sampled households according to the garbage collection by the Municipality.

Table 5: Distribution of the sampled households according to the garbage collection by the municipality in Tirupati City (in percentages)

Income Group	Collected	Not Collected	Total
Very low	22.26	77.74	100.00
Low	54.80	45.20	100.00
Medium	67.45	35.65	100.00
High	85.35	14.65	100.00
Very high	89.47	10.53	100.00
Total	**79.85**	**20.15**	**100.00**

It is observed that in the wards of very low income group 77.74 percent, 45.20 percent in the ward of low and 35.55 percent in the wards of medium income households garbage is not collected by the Municipality. This is because of workers do not perform their duty properly. While 67.45 percent of the medium, 85.35 percent of the high and 89.47 percent of the very high income households reported that garbage is collected by municipality, the garbage is collected by municipality in a two stage operation. In the first stage, collection is done by the individual households, who deposit their domestic waste in bins and either along the roadside or at the collection points. The sweepers who are employed by the municipality to clean the roads and drains early in the morning also dump garbage in the open fields. The night soils are also thrown by the sweepers in the collection bins at the collection points along the roadside.

Frequency of Garbage Collection

Table 6 is showing the distribution of the sampled households according to the frequency of the garbage collection.

Table 6: Distribution of the sampled households according to the frequency of garbage collection in Tirupati City (in percentages)

Income Group	Daily	Twice a week	Weekly	Monthly	Total
Very low	--	--	11.11	88.89	100.00
Low	--	--	15.29	84.71	100.0
Medium	--	9.29	72.12	18.58	100.00
High	43.53	48.18	5.70	2.59	100.00
Very high	74.32	20.27	5.41	--	100.00
Total	**42.07**	**33.07**	**22.97**	**1.87**	**100.00**

It is observed from Table 6 that in the wards where 88.89 percent of the very low, 84.71 percent of the low and 18.58 per cent of the medium income households are living, the frequency of garbage collection is monthly or even more than a month. There are two reasons behind this poor frequency. One is due to the shortage of staff and second due to the lack of interest of cleaning the wards. Daily garbage collection was observed only from the wards of 43.53 percent of the high and 74.32 percent of the very high income households. Nearly 72 percent households who belonging to medium income group reported of weekly garbage collection. The risk to health from the existence of uncollected garbage collection wards as potentially high as the waste remain uncollected for weeks in the lower income household for months. This uncollected garbage attracts various animals such as Pigs, Cows, Dogs and Buffaloes which further add to the environmental degradation of the wards.

The conditions of garbage and solid waste of the sampled households in the different income group shows that nearly 75.93 percent of the very low, 87.83 percent of the low and 40.48 percent of the medium income households keep their household waste indoor in open containers and they mainly dispose it along the roadside. Due to this, they have more flies in their kitchens and sleeping rooms. Whereas 67.29 percent of the high and 92.78 percent of the very high income households keep their waste in close containers and dispose it mainly in official dumps. It is also clearly seen that the frequency of

garbage collection from the higher income households reported that garbage was collected every day from their houses in the morning. The above discussion clearly shows that the lower income households are living in the full of filth and garbage.

Discussion

Solid waste management is a worldwide phenomenon. It is a big challenge all over the world for human beings. The problem of municipal solid waste management (MSWM) is also prevailing in the urban environment of Mysore. Therefore the present study was taken to find out the problems and prospects of Municipal solid waste in Mysore city. A detailed investigation was made regarding the methods of practices associated with sources, quantity generated, collection, transportation, storage, treatment and disposal of Municipal solid waste in Mysore city. The data concerning to SWM in Mysore was obtained through questionnaire, individual field visit, interacting with people and authentic record of municipal corporation. Photographic evidences were also made about generation, storage, collection, transportation, treatment and disposal of MSW. This study reveals that the present system of MSWM in Mysore city is not satisfactory based on Municipal Solid Waste (Management & Handling) Rules 2000.

Summary and conclusion

This study shows that 'poverty is the greatest problem in the society. There is a relationship between the income levels of household garbage and solid waste management. Accumulation of solid waste creates problem at the final disposal sites, at the neighbourhood dumping sites and even with in houses. In the study area nearly 60 percent of the very low, 77 percent low and 30 percent of the medium income the households keep the household waste inside the house in open containers and they

mainly dispose it along the roadside. Due to this they have more flies in the kitchens and sleeping rooms. Whereas most of the high income households keep their waste in close containers and dispose it mainly in official dumps. There is no effective waste disposal system in the study area. The municipality is unable to collect properly the waste generated and existing disposal sites are already overused. This leads to over accumulation of waste with storage of household waste in the houses are relatively independent of the waste collection system but can affect the indoor environment. The survey results indicated for example, that open storage of household waste within the homes is associated with higher prevalence of insects.

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