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RESEARCH ARTICLE

Characterisation of municipal solid waste of household and Sukali dumping depot of Amravati city

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ABSTRACT : Increasing population and urbanization created various problems among which solid waste management is the one. It arouses the problem of public health and environmental deterioration. Lifestyle of unconcern people is the root cause of this problem. Proper characterization of municipal solid waste is the first fundamental step for the planning of municipal waste management services. Based on composition/ characterization of waste, appropriate waste processing technologies can be selected and implemented. Characterisation of the solid waste at the duping site shows the presence of high percentage of organic matter (24%) and inert material (25 %) in the waste. Characterisation of the solid waste of the household samples shows high percentage of organic waste (55%) and low inert material (8.37%). Thus, it indicates that the proper on site (household level) segregation of different components of the waste *viz.*, organic waste, plastic waste, metals, glass, paper, can reclaim the resources and better use it. It can be concluded that the way we manage will decide how well prepared we are for the better future.

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We have entered twenty first century, the beginning of a new millennium. The past century is a story of astounding advancement in technology and tremendous achievements in the economic well-being of many nations of the world. But human development can become a curse, was realized when more richness created more waste. Technology has provided many answers but it is unable to give solution for how to get rid of this waste.

The term "Municipal solid wastes" applies to those solid wastes generated by households and to solid wastes of similar character derived from shops, offices and other commercial units (Cointreau, 1982).

Solid waste is inextricably linked to urbanization and economic development. As countries urbanize, their economic wealth increases. As standards of living and disposable incomes increase, consumption of goods and services increases, which results in a corresponding increase in the amount of waste generated (World Bank, 2012).

Durant (1954) in "The story of civilization", noted that it is in cities, particularly that man has demonstrated his capacity to modify his environment to suit his ends and whims. While great achievements have emerged with the advance of civilization (City culture), ignorance, in difference, mis management and pre-eminence of economic values have frequently joined to give cities the image of poverty, pollution and pestilence

(Trivedi, 2005).

Currently, world cities generate about 1.3 billion tones of solid waste per year. This volume is expected to increase to 2.2 billion tonnes by 2025. Waste generation rates will be more than double over the next twenty years in lower income countries. Globally, solid waste management costs will increase from today's annual $205.4 billion to about $375.5 billion in 2025. Cost increase will be most severe in low income countries (more than 5-fold increases) and lower-middle income countries (more than 4-fold increases) (World Bank, 2012).

Due to degradation of environment and adverse impact on public health and life style, solid waste management has become top priority. Solid waste management has emerged as one of the greatest challenges facing municipal authorities worldwide especially in developing countries (Babatunde *et al*., 2013).

The open burning of waste causes air pollution; the products of combustion include dioxins, which are particularly hazardous (Harilal *et al*., 2007).

Different environmental issues, health problems, chances for epidemics, economic crises and management problems are involved with municipal solid waste management programmes (Kumar, 2010).

Over 5 million people are estimated to die every year in south form diseases related to the inadequate disposal of waste (UNDP, 1985).

Ligy Philip (2010) reported that municipal solid waste (MSW) management contributes 14 per cent of the total global methane emission and methane is produced through the natural process of the bacterial decomposition of organic waste under anaerobic conditions in sanitary landfills and open dumps.

As there is very little space in cities for living, it has to put their waste in nearby villages which is creating the situation of conflicts. The problem of waste is becoming intense with passing time all over the world. The problem of SWM got worsened by high consumption pattern and low per capita availability of land (Anonymous, 2008).

The National Institute of Urban Affairs (NIUA) has estimated the infant mortality rate in slum areas at 123 per 1000 births. The major causes are diarrhoea, diphtheria, tetanus, measles and poor sanitary conditions. (Goswami, 1998).

Collapsed and unplanned system is responsible for all this. If we go deep to the basic of this, lifestyle of unconcern people is the root cause of this problem. Waste is mainly a by-product of consumer-based lifestyles that drive much of the world's economies (World Bank, 2012).

India is among the top 10 countries generating the highest amount of MSW in the world (Abazeri, 2014).

Urban india generates 3 million trucks piled high with garbage every day. According to statistics, more than 70 per cent of the collected urban waste is dumped straight into the landfill. As much as 43 million tonnes of solid waste is collected annually, out of which only 22-28 per cent is treated, while the rest is left untreated and dumped at the landfill sites (The Hitavada, Sunday, September 10, 2017).

Total generation of MSW in Maharashtra is estimated at 26,820.29 MT/Day and treated 6286 TPD. (CPCB consolidated Annual review report: 2013-14).

It was reported that the total solid waste generated in India in a year is 30 million tons. The generation of solid waste in India can be projected to increase at a rate of 1 to 1.33 per cent annually (Shekdar, 1999).

In many developing countries, only a small proportion of the population on many urban areas has access to municipal solid waste services (WHO, 1990).

Assessment of SW management and handling, study of its characterization and generation is necessary. Proper characterization of municipal solid waste is fundamental for the planning of municipal waste management services (Oyelola and Babatunde, 2008).

No rational decisions on solid waste systems are possible until composition of solid waste is known. The disposal methods may be conditioned by proportions of recycled materials, degradable and non-degradable materials etc. (Sharma, 2012).

Characterization of solid waste is important in evaluating alternative equipment needs, systems, management programme and plans, especially with respect to the implementation of disposal, resource and energy recovery options (Hosetti, 1998).

Plastic waste has been an important and increasing component of domestic refuse. About 100 g per week of waste plastic are given out per dwelling, but the nuisance created by waste plastics has been much greater than has been suggested (Sharma, 2012).

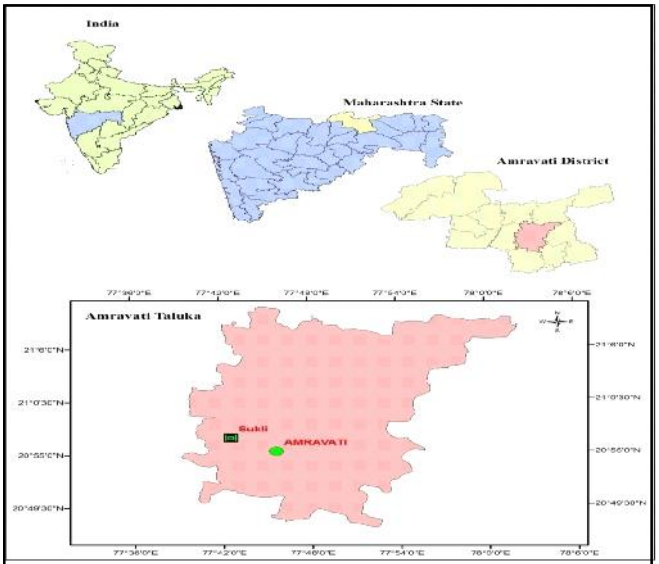

Fig. A : Study of Sukali, Amrawati area

Fig. B : Solid waste dumping site Nr. Sukali village

EXPERIMENTAL METHODOLOGY

Solid waste characterisation of dumping site:

Characterisation of the solid waste was done according to procedure given in "manual on solid waste management" by Ministry of Urban Development, Govt. of India, 2000.

For sampling, 10 kg of fresh solid waste emptied on dumping site by the tipper/truck was taken. To make the volume of sample 10 kg, 1 kg of solid waste was picked up randomly from 10 different places including surface and deeper inner side of the solid waste heap/ load. It was weighed by spring balanced in plastic sac.

The solid waste sample was brought to the laboratory terrace. To avoid its foul odour, the sample was allowed to air dry. For that purpose, the sac was kept with opened mouth on the terrace for 2-3 days.

Then it was weighed again for calculating moisture content. The sample was then spread on the cleaned terrace for sorting purpose. Then each content of the sample was weighed again on the spring balance. The material which was below 50 g was weighed on the analytical balance in the laboratory with accuracy of 0.001 g.

Solid waste characterisation of household waste:

For characterisation of the household waste, students of the college were conveyed to bring solid waste generated within 24 hours of their house in college instead of handing it to the Ghanta Gadi (tricycle). First every sample's total weight was taken and then sorted into different components. Then each of the sample components weighed and similar components from different samples added. Each content was calculated for per cent wise weight.

Both the solid waste samples *i.e.* from dumping site and of the household was sorted for the following components in Table A.

Table A : Solid waste samples

Food/ organic waste	Textiles	Inert
Papers	Rubber	Plastic
Polythene	Wood	Batteries
Leather	Ferrous and non-ferrous metals	Glasses

EXPERIMENTAL FINDINGS AND DISCUSSION

The findings of the present study as well as relevant discussion have been presented under following heads :

Characterisation (composition) of waste :

For characterization *i.e.* for finding the composition of waste, sample was taken from dumping site as well as collected from house hold. There is slight difference in composition of both the samples. In the sample from dumping site percentage of inert material is found high as compared to samples from household. It is due to addition of soil, stones while transferring the solid waste manually by shovel into the tractor or container. Also percentage of polythene and paper is found high in household waste compared to waste found at dumping site. This may due to picking up of recyclable material

Plate 1 : Collection of solid waste sample from dumping site for characterisation

Plate 3 : Segregation of solid waste into different components

Plate 2 : Weighing of solid waste sample for characterisation

Plate 4 : Collection of segregated waste in seperate carry bag

including polythenes, paper etc. by rag pickers before dumping the waste at dumping site. For the convenience the composition of waste is shown into two types.

Composition of waste from dumping site :

The dumping site waste depict that food/ organic waste is 24 per cent ; paper-4.8 per cent ; polythene- 5 per cent ; textile 7.5 per cent ; leather- nil ; wood- 1.16 per cent ; glass-7.5 per cent ; Batteries- nil ;metal- 1.42 per cent ; plastic- 2.42 pe cent ; other (tetrapacks)-1.83 per cent ; inert (soil, stones etc.)- 25 per cent. In this waste after inert, organic waste is found in high percentage followed by glass, textile waste followed by polythenes and paper. Rubber is found in very least quantity. The quantity is given in Table 1.

Composition of waste from house hold:

To see the difference in composition, the waste is also collected from house hold. 30 familiar houses were selected from different areas randomly to collect sample. The sample was collected in two times in summer and in winter during the period of January 2014 to January 2016. The polythene bags were distributed to them and told to give their one day waste. The waste was collected and its composition was weighed separately from each houses. Then the percentage of each material was calculated on average basis. In the house hold sample food/ organic waste was high in percentage *i.e.* 55 per cent; paper- 11.45 per cent ; polythene- 12.80 per cent ; textiles- 0.22 per cent ; rubber- nil ; leather- nil ; wood – 2.37 per cent; glass- nil ; batteries- nil; metals- 0.40 per cent;

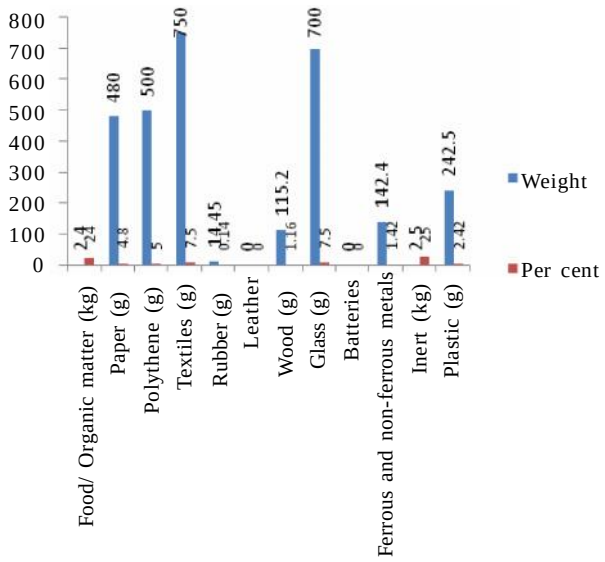

Fig. 1 : Characterisation (composition) of solid waste (average) of dumping site

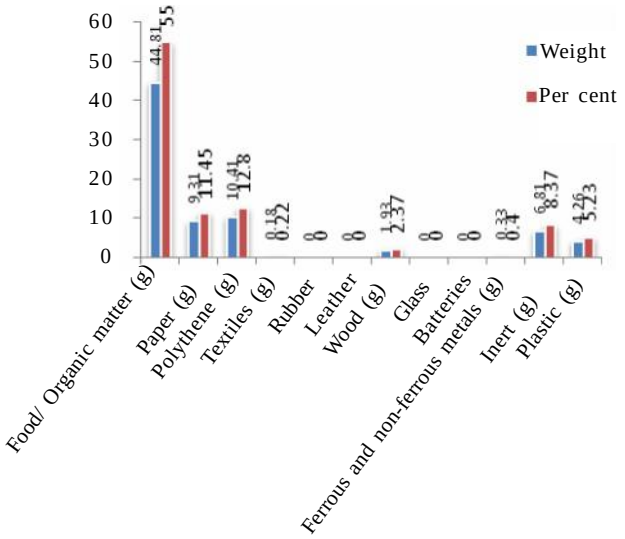

Fig. 2 : Characterisation (composition) of solid waste (average) of house hold

Table 1: Characterisation of solid waste (average) (Disposal/dumping site) -

Sr. No.	Name of material	Weight	Per cent
1.	Food / organic matter	2.4 kg	24 %
2.	Paper	480 g	4.8 %
3.	Polythene	500g	5 %
4.	Textiles	750g	7.5 %
5.	Rubber	14.45g	0.14 %
6.	Leather	-	-
7.	Wood	115.20 g	1.16 %
8.	Glass	700g	7.5 %
9.	Batteries	-	-
10.	Ferrous and non-ferrous metals	142.40g	1.42 %
11.	Inert	2.5kg	25 %
12.	Plastic	242.50	2.42 %
13.	Other	183.40	1.83 %

Table 2 : Characterisation (composition) of solid waste (average) of house hold

Sr. No.	Name of material	Weight	Per cent
1.	Food / Organic matter	44.81 g	55 %
2.	Paper	9.31 g	11.45 %
3.	Polythene	10.41 g	12.80
4.	Textiles	0.18 g	0.22 %
5.	Rubber	--	--
6.	Leather	--	--
7.	Wood	1.93 g	2.37 %
8.	Glass	--	--
9.	Batteries	--	--
10.	Ferrous and non- ferrous metals	0.33 g	0.40 %
11.	Inert	6.81 g	8.37 %
12.	Plastic	4.26 g	5.23 %
13.	Other	3.27 g	4.02 %

plastic- 5.23 per cent ; 0 ther (tetra pack) -4.02 per cent ; inert- 8.37 per cent. In the house hold waste organic material is found in high percentage followed by polythene, paper, inert, plastic and other. Least percentage is found for textiles followed by metals. Some materials rubber, leather, glass and batteries is not found in the waste. The quantity is given in Table 2.

Conclusion:

It is found that generation rate of solid waste is increasing in Amravati city with increasing year due to increase in population of the city and expansion of city in all direction. Gm/ capita /day generation rate of solid waste has increased from 309 g/capita/day in 2013-14 to 386 g/capita/day in 2016-17.

Characterisation of the solid waste of the duping site shows the presence of high percentage of organic matter (24%) and high percentage of inert material (25 %) in the waste. Characterisation of the solid waste of the household sample also shows high percentage of organic waste (55%) and low inert material (8.37%). Thus, it indicate that if we segregate different components of the waste *viz.*, organic waste, plastic waste, metals, glass, paper, at household level with least inert material we can reclaim the resources and better use it. So, different steps should be taken to encourage people to separate their waste into different components before handing over it to the door to door collector system. It can be concluded that the way we manage our waste today will decide how well prepared we are for the better future.

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