



Municipal Solid Waste and its Management (A Study on Varanasi City)

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ABSTRACT

The main aim of this research is to find out the status of municipal solid waste generation and its composition along with the relationship of economic condition of different inhabitants with per capita of waste composition in Varanasi, the most crowded city in the state of Uttar Pradesh, India. Municipal Solid waste (MSW) is a heterogeneous in composition and varied from place to place. Increasing population levels as well as rapid economic growth and rise in living standard of people speeded the generation rate of municipal solid waste in metropolitan cities of India. The objective of this paper is to providing an insight of the stages of waste management i.e. Prevention, Minimization, Recycle, Reuse, Energy recovery, Disposal and its composition and amount in order to improve the current solid waste management practice of Varanasi municipality and also to provides a further insight of feasibility and aids of adopting segregation at source and decentralization of solid waste management in order to provide better future. Research data is gathered from preliminary field investigation, questionnaire survey and face to face interview which show that with population of around 11,98,491[1]waste generated is 593TPD which comprises of food waste (29.6%), followed by plastic (18%), paper & cardboard (12.8%), textile (8.5%), rubber & leather (5.7%), bulk waste (9.6%) metal (2.8%) other (5.7%). Since about 15% (nearly 80 ton) of compost is produced from an average of 500-600 metric ton which is sold at Rs.1,000 per ton if decentralization and segregation of waste at its generation point is done effectively it would be sold at Rs.415 per ton result in better standard of living society . out of 593 TPD waste only nearly 350 TPD which would lead to dispose much less amount then

current scenario as a result reduction in GHGs emission and lead to creation of safe environment.

Thus on the basis of above research we can conclude that solid waste management and recycling a major issue of Varanasi district and with proper segregation and decentralization of solid waste we can reuse and recycle various kind of waste depending upon nature of waste. As a result less amount of waste need to be disposed which further lead to reduction of greenhouse gas emission and thus would help to lower down carbon footprint.

Keywords: MSW, SWM, VMC, TPD, MT

1. INTRODUCTION:

Municipal solid waste (MSW) commonly called as trash or garbage or sometime rubbish is a waste type consisting of everyday items that are no longer in use to the people like household garbage and litters , sanitation residues, street sweeping, construction waste and demolition debris, trade and non-hazardous industrial refuse and treated bio-medical solid waste, electrical and electronic waste[2].

The problem is further extended by the facts that waste generation has been on the rise consequent of living of people in the urban areas. Because of rapid urbanization and population growth waste quantity is increasing at a very rapid rate in India per capita waste generation increasing by 1.4% per annum With urban population increasing between 3-3.5% per annum thus yearly increase in waste generation is around 5% annually as an estimate India produces more than 55 million tons of municipal solid waste annually. It is thus an obligatory duty of municipal

authorities in the country to keep cities/towns clean and provide a good and safe quality of life 6/17/20186/17/20186/17/20186/17/201810: 36 PMUttar Pradesh is the most populous state in India and it is having five cities above one million populations, in which Varanasi is one of the cities. Varanasi municipality is stretched between $82^{\circ} 56' E - 83^{\circ} 03' E$ and $25^{\circ} 14' N - 25^{\circ} 23.5' N$. The daily generation of MSW is approximately 593 TPD(ton per day) of which 450 MT is collected and disposed thus for proper management of waste the city is divided into 14 sanitary wards and for effective management of waste entire operation of solid waste management is divided into four heads namely cleaning, collection, transportation and disposal. The cleaning and collection operations are performed by the Nagar Nigam Varanasi, while transportation and disposal of MSW are being performed by the transportation wing of VMC further the waste is dumped into depots (26 depots are available in Varanasi) after that waste is then loaded into the transportation vehicles, which transport the waste to different disposal sites where wastes are disposed in the open dumping ground, slightly away from city and adjacent to river Ganges. In Varanasi dumping grounds are not engineered sanitary landfills, it emits foul smelling gases and produces leachate which affects soil and water the problems turns to be stern during summer season due to the faster degradation of organic compounds (Dasgupta et al. 2013) [3] .

Socio-economic status, cultural habits, urban structure, population and commercial activities etc. also play an important role in determining the quality and quantity of MSW generated by a particular

community thus help in planning, designing and operation of municipal solid waste management system. In context to Indian, MSW contains more organic material and less hazardous material than western countries like USA, Canada, France etc. [4]. The quantity of waste paper in India MSW, is comparatively less than other developed nation because the quantity thrown away is picked up by people and use it as a fuel and also for packaging of materials.

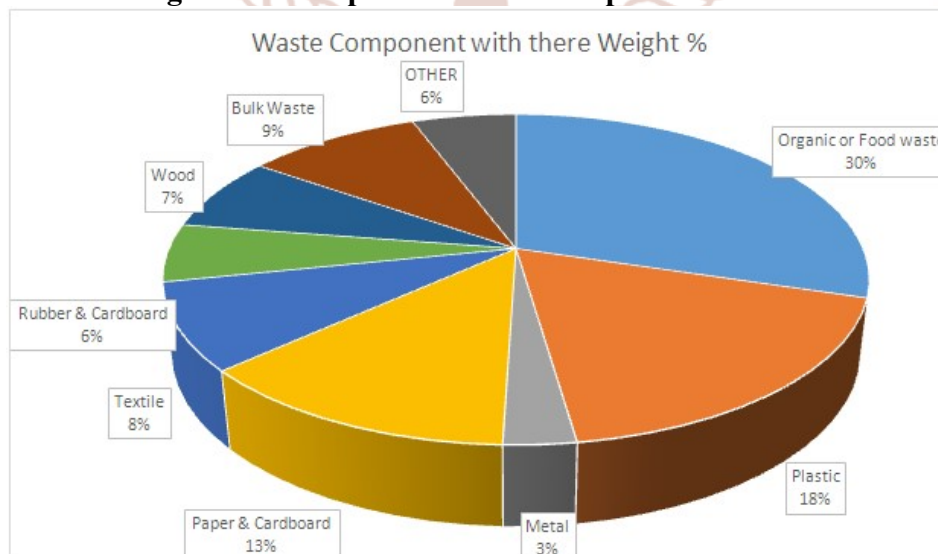
2. Sources and Quantity of MSW and its Composition:-

The percentage of MSW generated for various sources in Varanasi Municipal Corporation (VMC):-

SOURCES OF WASTE	PERCENTAGE
Household	35
Restaurants	24
Street Sweeping	10
Market	7
Shops And Workshop	5
Office	3
Hospital	4
Hotel	12
Total	100

Table 1: Percentage of MSW generated for in Varanasi Municipal Corporation

Figure 1:- Composition Of Municipal Solid Waste



3. Method of collection of MSW:-

A. Primary collection of MSW:-

In Varanasi Sweepers collect the MSW from the roads/streets and carry it to the nearest collection points (called as depots or community bins). Waste that is produced from households is carried to the specified collection point or just deposited on the adjacent roadside area from where it is collected when the roads are swept. This type of collection is called primary collection. The problem is already taken a shape in cities and towns as the disposal facilities have not been able to keep space with the quantum of wastes being generated. It is common to find large heaps of garbage lying in a disorganized manner at every nook and corner in the cities.

B. Secondary collection of MSW:-

In Varanasi city the disposal sites are generally within 25 km of the collection points, hence, transfer stations are in use and the MSW is not directly hauled by the collection vehicle from the collection points to the disposal site. Since municipal solid waste is collected again from the destined collection points for transportation to the final disposal site, it is termed secondary collection. The hauled container and manually loaded dumper, stationary container along with mechanically loaded dumper systems are used for secondary collection, transportation and disposal of MSW in Varanasi . The hauled container system is a collection system in which the containers used for the storage of wastes are hauled to the processing, transfer or disposal sites, and then emptied and returned to either their original location or some other location generally dumper placer is used to carry the large size of community bins (4.4 m³) containing MSW from its fixed point to its final disposal site.

4. Methods of storage:-

VMC has provided 26 depots for the temporary storage of MSW, which are scattered throughout the city. The depots are an open space enclosed on three sides with a masonry wall of about 1.35 m height, with capacities ranging from 15 to 40 m³ and located in a congested area containing narrow winding streets. Unfortunately, only 38% of the depots are in good condition and the rest have been damaged during loading by the loader and by Animals; 16% of the depots having no wall (VMC, 2011).

5. Disposal of Municipal Solid Waste :-

MSW is sent to waste treatment plant at karsana and also at Bhavaniya where it is disposed by scientifically and in well-designed engineered manner. . Previously waste had been deposited in the area near Varuna tributary of river Ganges and Ramnagar dumping grounds. But Nowadays about 15% (80 tonnes) of compost is produced from an average of 500-600 metric tonnes of waste processed every day in waste treatment plant which is sold to the locals at Rs.1000 per tonnes. if decentralization and segregation of waste at its generation point is done effectively it would be sold at Rs.415 per ton thus result in better standard of living society.

6. Disposal Hazardous waste :-

Varanasi does not have many industries that produce hazardous products, hence the presence of industrial hazardous waste is low. However house hold hazardous waste like detergents, pesticides, medicines which have crossed expiry date, cleaning products, automobile wastes, batteries, etc. were seen in plenty.

7. METHODOLOGY :-

Primary and Secondary data collection method are used in order to analyze the research questions of the study. The secondary data were collected directly from concerned offices like Varanasi Nagar Nigam and VDA (Varanasi development authority), research institutions like BHU(Banaras Hindu University) and some NGOs, which are closely dealing with the solid waste management issues. After reviewing their concerned reports, the primary data were also collected on the related issues, which are not dealing with, or not clearly mentioned in reports through “key informed consent approach”. The secondary data is collected from a combination of electronic and printed form of materials like published books, research papers, journals and articles etc. and door-to-door surveying in order to collect data about MSW quantity, daily disposal, availability of containers, collection frequency and satisfaction level, etc.

The following method were adopted for the collection of required data

- Detailed study of yearly solid waste reports of concerned institutions.
- Key information interview with solid waste management staff.
- Review of already published literature.
- Visit in the city and to the waste disposal sites to assess the solid waste management system.

7.1 Data Analysis:-

Data are presented in the form of tables, analyzed and compare on the basis of cost/ton of waste processing in different technologies.

$$\text{Generation rate (kg/capita/day)} = \frac{\text{Quantity of solid waste (kg/day)}}{\text{Population (capita)}}$$

Relationship of economic condition of different communities with per capita waste production in Varanasi (2015) :-

S.NO	INCOME GROUP	PERCENTAGE OF TOTAL POPULATION	WASTE GENERATION (GM PER CAPITA PER DAY)	Waste generation (Tonne's per day)
1	HIGH	17	746	152
2	MIDDLE	38	540	246
3	LOW	30	384	138
4	SLUMS	15	317	57
TOTAL				593 TPD

Table 2: Per capita waste production in Varanasi

8. RESULT AND DISCUSSION :-

In Varanasi city study reveal that the per capita MSW generation rate is 0.50 kg/capita/day this rate varies from 0.48 kg/capita/day in Pindar and Babatpur to 0.53 kg/capita/day in Sigra and Rohania. In Varanasi, VMC reported the percentage of MSW generated for various sources in Varanasi city as shown in table 1 and municipal waste composition is shown in figure also quantity of wet waste is found to be 265.22 MT and of dry waste it is 342.58 MT. An attempt is also made to show relationship of Economic Condition of different Communities with per capita waste production in Varanasi city is shown in table 2.

8.1 Barriers to improved waste management in Varanasi:-

The current status of SWM in Varanasi is found to be unsatisfactory because the best and most applicable methods from waste collection to disposal are not being used. The availability of qualified and well trained waste management professionals is limited and also lack of training in SWM to the people. Because of lack of budget that are insufficient to cover the costs of developing systematic waste collection, storage, treatment and disposal thus lack of accountability in current solid waste management practice.

The lack of strategic MSW plans, waste collection/segregation and a government finance regulatory framework are major barriers to achieving effective SWM in India. Public attitudes to waste are also a major barrier to improving SWM in Varanasi and also in India.

8.2 Preferable solution:-

With the above analysis it was found that adopting segregation of waste at source can be beneficial both economically and environmentally like improvement in aesthetic condition of the locality, thus limiting the use of secondary collection of waste by the municipality which in turn lead to decrease in volume of the dumping site.

On the basis of research data collected it was found that quantity of Dry waste is more than Wet waste as shown in table above and these dry waste can be recycled and reused thus will save public money to transport waste to its dump yards further Wet waste can be used for making manure by disposing waste at source, i.e. at their premises or zone wise. Composting and installing of biogas system are the ways in which garbage disposal can be done and also will help to generate income, provide opportunities and employment options to underprivileged sections of the society in the locality.

CONCLUSION :-

The following silent conclusions were drawn from the above research work:-

1. Lack of Public participation in waste and its recycling management were the major issues seen in Varanasi district.
2. Lack of development of engineered landfill and waste-to-energy facilities along with unawareness of people toward waste and its associated waste.
3. Shortage of Availability of appropriately trained people in the waste management sector.
4. Proper management of waste lead to reduction in GHGs emission and result in lower carbon footprint.
5. Thus sustainable, preventative and comprehensive approach towards waste is needed which must ensure maximum resource extraction from waste, combined with safe disposal of residual waste.

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