Management of Solid Waste from Jaipur City; Seasonal Variation of City Waste Corporation and Features

Dr. Neha Sharma, Lecturer at ICG College, Jaipur

ABSTRACT

https://doi.org/10.34047/MMR.2020.8204

Solid waste management is one of Jaipur's major environmental concerns. Solid waste creation in cities is increasing as a result of exponential urbanization, industrialization, and population growth. Solid waste neglect can have negative environmental consequences, pose a public health concern, and cause other socioeconomic issues. This document summarises the current state of concerned authorities' initiatives and researchers' efforts to identify more areas for improvement.

Keywords: Solid Waste, Environmental Concerns, Municipal Waste Management

1. Introduction

Human activities generate garbage, which is then managed, stored, collected, and disposed of, posing environmental and public health problems (Saxena et al., 2010). Economic development, urbanization, and increased living standards all contribute to a rise in the quantity and complexity of solid waste generated in cities (Gidde et al., 2008). Domestic, commercial, industrial (due to building and demolition), agricultural, institutional, and other solid wastes are all examples of solid waste. The term "municipal solid waste" refers to a mixture of residential and commercial waste generated by the general public (Rajkumar et al., 2010).

Degradable (paper, textiles, food waste, straw, and yard waste), partially degradable (wood, disposable napkins, and sludge), and non-degradable materials (leather, plastics, rubbers, metals, glass, ash from fuel-burning like coal, briquettes, or woods, dust, and electronic waste) make up the majority of municipal solid waste in Jaipur (Jhaet al., 2011). Rapid industrialization and population growth in India have prompted people to migrate from rural to cities, resulting in the generation of hundreds of tonnes of MSW per day. Waste has become one of the pollution sources as a result of poor solid waste management, resulting in a variety of environmental repercussions as well as risks to human health and safety (Shazwin and Nakagoshi, 2010). Jaipur is one of India's least urbanized cities. Due to their high occupancy, metropolitan cities account for more than 42 percent of India's urban population (Ghosh and Kansal, 2014). They are also India's top generator of MSW. Waste has become one of the pollution sources as a result of poor solid waste management, resulting in a variety of environmental repercussions as well as risks to human health and safety (Shazwin and Nakagoshi, 2010). Jaipur is one of India's least urbanized cities. Due to their high occupancy, metropolitan cities account for more than 42 percent of India's urban population (Ghosh and Kansal, 2014). They are also India's top generator of MSW. The most important issues limiting improvements in SWM, according to a review of literature on SWM in India (Hanrahan et al., 2006), are institutional/financial issues. "There is an urgent need for much improved medium-term planning at the municipal and state level so that realistic investment projections can be developed and implemented," they write.

2. Qualitative and quantitative analysis of MSW

The amount of MSW generated is determined by a variety of factors, including eating patterns, living standards, commercial activities, and seasons. Data on production quantity and variance can help with collection and disposal system planning. Indian cities today create eight times more MSW than they did in 1947, thanks to increased urbanization and changing lifestyles.

The amount of waste produced and the types of garbage produced have changed in tandem with Jaipur's development. The population of Jaipur is

currently 3,812,262. There was a time when the needs of the people of Jaipur were relatively limited, and the majority of the wastes were cow and human faeces. In 2011, the city of Jaipur disposed of 1100 MT of waste every day. According to BVG India Ltd, the daily rubbish output from Jaipur city in 2018 was 1700 MT/day, which increased to 1800 MT/day in 2019. By 2021, it is anticipated that the city's garbage will reach 3643 MT/day CDP, Draft City Development Plan, Jaipur, 2005. Table 1 shows a qualitative and quantitative overview of MSW in Jaipur.

3. Population growth rate and weather-wise tonnage details of MSW Jaipur.

Since 1971, the population of Jaipur has been increasing at varied rates. Between 1951 and 2001, there was a significant increase in the number of women in the workforce. According to census reports, the city's population has increased by 5 times. In the previous 50 years, the population of Jaipur has expanded by more than tenfold. The population of the city was only 1.6 lakh in 1900. The population of the Jaipur Municipal Corporation increased from 23.22 lakh in 2001 to 30.46 lakh in 2011. It is regarded as one of the country's fastest-growing cities. In 2011, it grew at a pace of 2.38 percent on average. The yearly average population growth rate from 1971 to 1981 was 2.69 percent in 1981, but it dropped drastically to 10.86 percent in 2001 and 2011. There are 909 females per 1000 males in the city. The population of the city is growing at a pace of 2% per year.

(a) The population density in Jaipur.

The density of a population is an important metric for analyzing population distribution. The population density of Jaipur city is 6523 people per square kilometer, which is much higher than the population density of 1981 (2624 people per square kilometer). The population density of the walled city area is 42008 people per square kilometer in 2013, down from 16201 people per square kilometer in 1981. In 2001, the walled city's total area was 6.7 square kilometers (2.32 percent of JMC's total area). Although density has decreased from 1991 to 2013, this is the case. The population density of the JMC area as a whole over time. The rest of the JMC area has a low population density, as can be seen. However, in 2011 it was significantly higher than in 2010. In 2001, the population density of JMC was 5027 people per square kilometer, which increased by 1566 people per square kilometer to 6593 people per square kilometer in 2011.The population of Jaipur in 2018 is 36.28 lakhs. The fact is the last census of Jaipur was done only in 2011 and the next such census would be in 2021. But as per estimate and projection, the population of Jaipur in 2019 is 40 lakhs.

(b) Municipal solid waste, sessional variations.

The amount of municipal solid waste (MSW) generated by a town varies depending on a variety of factors such as people's habits, living standards, location, and climate conditions. The variance in the parameter in India is extremely vast, so the quantity and quantity estimation for a city or state cannot easily be extended to other areas to design an appropriate MSW management strategy. The estimation for the same city may vary depending on the season of the year and the month. MSW management consumes a significant percentage of a municipality's budget to ensure the safe and sanitary disposal of MSW. Municipal solid waste is collected in vehicles or community bins and transported to the final disposal point at various locations across the township, depending on the convenience of households and municipal officials. Those community dumpsters are common in third-world countries. Also, community bins are left open at the top, exposing them to the elements. The content and quantity of MSW were created to serve as the foundation for planning, designing, and operating the management system. When compared to MSW in Western countries, MSW in India has a very different composition and is far more hazardous. The composition characteristics and quantity generally MSW from a township is a function of several parameters like food habit, season, the living standard of people, commercial activities in the region, etc. To device an effective management strategy for such waste it is important to study the general composition of the MSW generated as well as the variation in composition and characteristics concerning the individual location, in one group of different localities and seasons of the year.

(c) Analysis of MSW sample for composition and characteristics.

The mixed sample waste was physically analyzed

for its composition, which included biodegradable paper, plastic, glass, metals, and inerts (dust, stone pieces, and others), and was expressed as a percentage of the total sample weight. Other MSW characteristics were determined, including moisture content, calorific value, bulk density, dry density, and waste generated per capita. The MSW was analyzed according to normal techniques.

(d) Physical certify of MSW

MSW samples collected from community bins were thoroughly mixed to create a composition sample for a specific location, and horrifying was performed to separate different types of MSW in general, including biodegradable (food waste, organic waste, etc.), paper, plastic, glass, metals, and inerts (dust, stone pieces, and others). The weight of each ingredient was calculated, and its portion was expressed as a percentage (percent) of the overall Wt weight of MSW.

The composition and qualities of the trash created by the community have a significant impact on municipal solid waste management. Seasons, living standards, geography, and other factors all influence the composition and characteristics of garbage. To visualize the true scenario, a change in the quantity and quality of MSW created by the community was also examined.

(e) Determination of Bulk density.

The empty weight and volume of a metallic cubicle measuring 45cm*45cm*45cm were measured. The sample was placed in a measuring cube and the net weight was collected to determine the bulk density. By dividing the weight of the sample by the capacity of the container containing the sample, the bulk density was calculated.

(f) Composition of MSW in Different seasons.

Summer season: - The average MSW composition throughout the summer. The average biodegradable fraction composition for the summer season was 45.90 percent, paper 4.05 percent, plastic 5.08 percent, glass 0.62 percent, metals 0.06 percent, textiles and leather 0.89 percent, and inert materials 44.5 percent.The average composition of MSW during the wet season. The biodegradable percentage is determined to be 39.60 percent, paper 4.83 percent, plastic 3.37 percent, glass 0.15 percent, metals 0.11 percent, textiles, and leather 0.64 percent, and inert materials 52.99 percent during the rainy season.

The average composition of MSW throughout the winter season. The average composition of a biodegradable fraction is 52.98 percent, paper 4.444 percent, plastic 5.07 percent, glass 0.69 percent, metals 0.15 percent, and inert materials 36.15 percent for the winter season.

Comparison of Characteristics of MSW in Different seasons.

Sr. No	Weather Wise	Total tonnage	Package-I			Package-II		Package-III		
			VD ZONE	AMER	HMW	CLZ	MNZ	HME	SNZ	MD ZONE
1	Mansoon (Rainy Season) (June-Sept 2017)	103497.29	24250.08	7711.00	13527.21	20871.53	16362.88	3230.05	3811.85	13732.70

2	Autumn (Oct-Nov 2017)	96914.69	20109.30	5736.11	872.23	17806.15	14295.54	6763.46	8983.28	14438.64
3	Winter (Dec2017-Feb 2018)	179379.84	32752.71	8990.86	12253.17	32157.38	21785.80	17757.61	26952.83	26729.50
4	Summer (Mar-May 2018)	189824.80	35157.13	8478.99	9027.78	36274.40	26136.73	17519.57	32437.97	24792.23
	Mansoon (June-Sept 2018)								33843.	32415.6
6	Autumn (Oct-Nov2018)	114832.41	27269.21	3899.30	5807.87	23828.23	17583.17	10318.36	13524.10	12602.18
7	Winter (Dec 2018-Feb 2019)	148955.33	34799.52	5782.05	6699.88	29669.18	19984.59	14320.23	20317.80	17382.11
8	Summer (Mar-May 2019)	143204.060	31815.730	5156.445	7243.930	29247.475	16843.190	15167.385	20875.640	16854.265
9	Mansoon (Rainy season) (June-July 2019)	94936.940	20545.200	3622.240	5147.050	22369.295	10704.515	9260.265	14490.505	8797.870
	Gross Total	**1313899.088**	**276368.919**	**57752.726**	**81881.622**	**262856.772**	**176488.937**	**115567.654**	**175237.335**	**167745.123**

The different characteristics of MSW in different seasons, as well as the yearly average of these characteristics, are compared that the total variation of moisture content was observed to be, 124%, itwas lowest in the summer season (21.34%) and highest in the rainy season (47.87%). Variation in calorific value of MSW and was observed to be varying from 560 Cal/kg in the rainy season (lowest) to 974 Cal/kg in summer season (highest). A total variation of 73.9% was observed in the value of calorific values. That the bulk density of MSW was 0.31% gm/cc in summer (lowest) and 0.38 gm/cc in rainy season (highest), a total variation of 22.5% was observed. The variation of dry density of MSW and was found to vary in a narrow range 0.25% gm/cc in summer to 0.26 gm/cc in rainy and winter season, a total variation of the per capital MSW generation in different season and was observed 0.31 kg/day in rainy season to 0.45 kg/day in summer season, a total variation of 45.16% was observed. The variation in characteristics of MSW with respect to different season are found to be significant for most of the parameters studied.

4. MSW characteristics and composition

The composition of MSW in the production sources and in the collection points was determined on the basis of composition wet weight and consists mainly of a large organic fraction (40-60%), ash and fine earth (30-40%), paper (3-6%) and plastics, glass and metals (each less than 1%). According to data of the year 2015-16, the physical characteristics of the MSW in Jaipur city are shown in table 1Out of the waste generated in the city of Jaipur, 60% of the biowaste which comes out of the kitchen, 15% dust and 25% of the garbage can be recyclable.

5. Storage and collection of MSW

The collection of municipal solid waste is the responsibility of the companies/municipalities. Municipal garbage containers placed in various places along the roads, which sometimes lead to the creation of unauthorized open collection points. Efforts to organize door- to-door collection begin only in many megacities such as Delhi, Mumbai, Bangalore, Madras and Hyderabad with the help of NGOs. It has been observed that many municipalities have used private contractors for secondary transport from communal warehouses or collection points to disposal sites. welfare associations in specific monthly payments organize collection in certain urban areas. A sweeper that sweeps the raids manually is assigned a specific area (around 250 m2). The sweepers place the waste from the road in a wheelbarrow and then transfer the waste to garbage cans or collection points.

Numerous studies of the urban environment have shown that the efficiency of MSW collection depends on two main factors: labor availability and transport capacity. Most cities cannot provide waste collection services in all parts of the city. In general, low-income, overcrowded institutions do not have municipal solid waste collection and disposal services. The reason is that these settlements are often illegal and that locals do not want or cannot pay for services. They throw rubbish near or around their homes at different times, which make collecting and transporting waste very difficult in these areas. The central pollution control board (CPCB) has collected data for the 299 class I cities to determine how municipal solid waste is collected. It has been found that manual collection comprises 50%, while collection with trucks comprises only 49% (CPCB, 2000).

Today, the municipal corporation of Jaipur is divided into 8 zones for the purpose of collection and storage of wastes. The zonal commissioner is responsible for the cleanliness of each zone, whose Sanitary Inspector, health officer and a chief sanitary inspector assist. With the cleaning point, these 8 zones again divided into 91 wards. In each ward, the responsibility of cleaning is done by the sanitory inspector, who provides the Jamadar, supervisor and sanitary worker support related to that ward. The cleaning work in Jaipur Municipal Corporation is based on three-tier system. Sweeping, Door to Door garbage collection and nallia cleaning. For garbage collection fixed containers have never been installed in the city by the Jaipur municipal corporation; it always mobile containers have been used.

6. Transfer and transport of MSW

The transfer stations (except in some cases such as Madras, Mumbai, Delhi, Ahmadabad and Calcutta)

are not used, and the same vehicle, which collects waste from individual containers, sends them to the treatment or disposal site. Municipal solid waste collected in garbage cans and collection points is transported to treatment or disposal sites using a variety of vehicles. The vehicles used to transport MSW are generally open-body type and generally remain uncovered; therefore, during transport, the waste tends to spread on the road, which results in unhygienic hygiene conditions. In some cities, modern hydraulic vehicles are being introduced gradually.

Collection and transportation activities account for approximately 80-95% of MSWM's total budget; therefore, it is a key element in determining the economy of the entire MSWM system. Three areas have been selected out of the city for disposal of garbage by the Jaipur municipal corporation it is Mathuradaspura, Sevapura, Langariyawas. There are three places where the garbage of the whole city is brought in. the total area of these three is 859 bigha. The distance from the city of these three areas is 17 km, 20 km, 21 km. The average amount of garbage brought from the city of Jaipur in Mathuradaspura is 700-800 MT/day, Sevapura 250-300 MT/day, Langariyawas 350-450 MT/day.

7. MSW disposals and treatment

• Composting

Composting is an organic material that has been broken down and recycled as a fertilizer and soil amendment

Langariyawas:- Here the waste is converted into RDF, which is used as a fuel in cement factories.

Sevapura:- The plant to build compost fertilizer capacity of 250 MT garbage. Apart from this, the garbage that is left is untouched, which pollutes the environment there.

• Landfill

The landfill is the oldest and most common method of treating solid waste.

Mathuradaspura:- Is used as an open dumping ground for non-segregated municipal solid waste about 800 tons of municipal waste is dumped here every day.

8. Conclusion

Biodegradable materials account up 45.92 % of MSW in Jaipur, followed by paper 4.38 %, plastic 4.45 %, glass 0.48 %, metals 0.11 %, textiles and leather 0.90 %, and inert materials 43.93 %. The MSW of Jaipur city varies by 124 % in moisture content, 73.9 % in calorific value, 22.5 % in bulk density, 4% in dry density, and 45.16 % in trash creation per person per day depending on the season. The seasonal fluctuation in MSW characteristics was discovered to range from 4-124 percent. As a result, none of the MSW management methods (i.e., land dumping, composting, recycling and recovery, burning, and energy generation) can be sufficient for efficient MSW management. Because different seasons have varying weights of solid waste, seasonal variation in MSW features also gives an idea regarding arrangements to be made for the collection, transportation, and change in tonnage ratio of solid waste estimation. The seasonal variation in characteristics of MSW also gives an idea about arrangements to be made for the collection, transportation, change in tonnage ratio of solid waste estimation because the different season has a different weight of solid waste Of MSW and disposal of different quality of MSW generated in different season.

Reference

Census of India, census of Rajasthan (1981) http//www.censusindia.netof called August 2011. “Census of India, census of Rajasthan (1981) http// www.censusindia.netofcalled August 2011.”n.d.

Anita Agerwal, Rama panday, M.L Agerwal. “seasonal variation in comosition and characteristics of India municipal solid waste. A Case Study. Recent Research in science and Technology 2013, 5(5):40-43,.” n.d.

Census of India, census of Rajasthan (1981) http//www.censusindia.netofcalled August 2011. “Census of India, census of Rajasthan (1981) http//www.censusindia.netofcalled August 2011.” n.d.

Akolkar, A. B. 2002. “Management municipal solid waste in India. Status and Options: An Overview, In: Proceedings of Asia Specific Regional Workshop on Sustainable Waste Management,

Singapore, 8-10, 2002, German Singapore Environment Technology Agency." n.d.

Census of India, census of Rajasthan (1981) http//www.censusindia.netofcalled August 2011. "Census of India, census of Rajasthan (1981) http//www.censusindia.netofcalled August 2011." n.d.

"Standard Methods: For the Examination of Water and Waste Water." Analytical Biochemistry, vol. 186, no. 1, 1990, p. 183. Crossref, doi:10.1016/0003-2697(90)90598-4.

Khan, F. R. "Thesis. Department for Water Supply and Sanitation." *Thesis. Department for Water Supply and Sanitation*, e-book, Department for water Supply and Sanitation, 2001, pp. 320–22.

Prama Esther soloman and Surendra Singh chauhan, 2018. Indra Gandhi centre of human ecology, environmental and population studies, Rajasthan University, India. Int. Res. J Environmental sci. ISSN- 23191414, vol. 7 (2), 42-448, February (2018)

Saxena, S., Srivastava, R.K., &Samaddar, A.B.,. "Sustainable Waste Management Issues in India." *Sustainable Waste Management Issues in India.*, 2010, p. 3 (1), 72–90. *IUP J. Soil Water Sci.*, papers.ssrn.com/sol3/papers.cfm?abstract_id=1557590.

Gokhale, Medha Vijay, and Dr. Milind V Telang. "Development Of Sidewalk Evaluation Model For Existing Pedestrian Environment In Indian Cities: Case Example Of Pune City, Maharashtra, India". *International Journal Of Scientific Research*, vol 2, no. 11, 2012, pp. 39-43. *The Global Journals*, https://doi.org/10.15373/22778179/nov2013/13.

Beede, David N., and David E. Bloom. "THE ECONOMICS OF MUNICIPAL SOLID WASTE". *The World Bank Research Observer*, vol 10, no. 2, 1995, pp. 113-150. *Oxford University Press (OUP)*, https://doi.org/10.1093/wbro/ 10.2.113.

Ghosh, Ruchira, and Arun Kansal. "Urban Challenges in India and the Mission for a Sustainable Habitat." *INTERdisciplina*, vol. 2, no. 2, 2014. *Crossref*, doi:10.22201/ceiich.24485705e.2014.2.46530.

https://updatepublishing.com/journal/index.php/rrst/article/view/1060

Jha, Arvind K., et al. "Greenhouse Gas Emissions from Municipal Solid Waste Management in Indian Mega-Cities: A Case Study of Chennai Landfill Sites." *Chemosphere*, vol. 71, no. 4, 2008, pp. 750–58. *Crossref*, doi:10.1016/j.chemosphere. 2007.10.024.

Nagarajan, Rajkumar, et al. "Impact of Leachate on Groundwater Pollution Due to Non-Engineered Municipal Solid Waste Landfill Sites of Erode City, Tamil Nadu, India." *Iranian Journal of Environmental Health Science & Engineering*, vol. 9, no. 1, 2012. *Crossref*, doi:10.1186/1735-2746-9-35.

Yoshida, Mitsuo. "International Cooperation in Developing Countries for Material Cycle and Solid Waste Management Sector and Challenges for Achieving Sustainable Development Goals (SDGs)." *Material Cycles and Waste Management Research*, vol. 31, no. 2, 2020, pp. 89–99. *Crossref*, doi:10.3985/mcwmr.31.89.