

# SOLID WASTE MANAGEMENT OF JAIPUR CITY AND SEASONAL VARIATION IN COMPOSITION & CHARACTERISTICS OF MSW: A REVIEW

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## Abstract

Municipal solid waste management is a major environmental issue in Jaipur. Due to rapid increase in urbanization, industrialization and population, the generation rate of municipal solid waste in city is also increased. Mismanagement of municipal solid waste can cause adverse environmental impacts, public health risk and other socio-economic problem. This paper presents an overview of current status of solid waste management in Jaipur city which can help the competent authorities responsible for municipal solid waste management and researchers to prepare more efficient plans.

**Keywords :** MSW, Seasonal Variation In Composition & Characteristics of MSW.

## 1. Introduction

Human activities create waste and these wastes are handled, stored, collected and disposed of, which can pose risks to the environment and to public health (Saxena et al., 2010). Economic development, urbanization and improved living standards in cities increase the quantity and complexity of generated solid waste (Gidde et al., 2008). In discussing solid waste, generally and traditionally certain categories of wastes are well recognized as they are very common. For example, solid wastes include domestic, commercial, industrial, (due to construction and demolition), agricultural, institutional and miscellaneous. Many times domestic and commercial wastes cannot be differentiated and are considered together as urban wastes (Syed, 2006). Municipal solid waste is generally a combination of household and commercial refuse which is generated from the living community (Rajkumar et al., 2010). The continuous indiscriminate disposal of municipal solid waste is accelerating and is linked to poverty, poor governance, urbanization, population growth, poor standards of living, low level of environmental awareness (Rachel et al., 2009) and inadequate management of environmental knowledge.

Municipal solid waste in Jaipur city generally includes 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) (Jha et al., 2011). Rapid industrialization and population explosion in India hassled to the migration of people from villages to cities, which generate thousands of tons of MSW daily. Poor collection and inadequate transportation are responsible for the accumulation of MSW at every nook and corner. The management of municipal solid waste is going through a critical phase, due to unavailability of suitable facilities to treat and dispose of the larger amounts of MSW generated daily in metropolitan cities. Due to improper solid waste management, waste has become one of the pollution sources that has caused diverse environment impacts as well as detrimental towards human health and safety (Shazwin and Nakagoshi, 2010). Jaipur is one of the least urbanized city in the India. Metropolitan cities (Delhi, Mumbai, Kolkata and Chennai) account for more than 42% of India's urban population (Ghosh and Kansal, 2014) and been a top producer of MSW in India due to its high occupancy. In the present study, an attempt has been made to provide a comprehensive review of MSWM for Indian cities to evaluate the current status and identify the problems of MSWM. A review of literature of SWM in India highlights institutional/financial issues as the most important ones limiting improvements in SWM (Hanrahan et al., 2006) specifically note that "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."

## 2. Qualitative and quantitative analysis of MSW

There are many categories of MSW such as food waste, garbage, commercial waste, institutional waste, street sweeper waste, industrial waste, construction and demolition waste, and sanitation waste. MSW contains recyclable materials (paper, plastic, glass, metals, etc.), toxic substances (paints, pesticides, used batteries, medicines), compostable organic matter (fruit and vegetable envelopes, food waste) and waste dirty (stained cotton) with blood, sanitary napkins, etc.

The amount of MSW generated depends on a number of factors, such as eating habits, standard of living, degree of commercial activity, and seasons. Data on the quantity and variation of production are useful in planning collection and disposal systems. With increasing urbanization and changing lifestyles, Indian cities now generate eight times more MSW than in 1947.

As per 2016 data, 62 million tons of garbage in India comes out every year. According to an estimate, MSW coming out in the country by year 2051 will be 300 million tons per annum. At present according to the central pollution board, but the rate of the capita depends on the level of income of the country. The level of MSW in the higher income countries of Asia is also high. Per capita MSW is directly related to the increases in income levels and on. According to the MSW rules 2016, the town's population is more than 10,00000 the per capita generation rate of MSW is 350 to 650 grams.

Changes can be seen in the amount of garbage and its type in the same manner as the development of Jaipur has grown. Currently the population of Jaipur city is 3,812,262. There was a time when the requirements of Jaipur's people were very limited, at that time the most part of the wastes was cattle and human stools. In the year 2011, the garbage disposed from Jaipur city was 1100 MT/day. In the

research carried out by Rahul Nandwana and RC Chhipa in the year 2014, he said that the garbage from Jaipur Municipal Corporation was declared 1340 MT/ day, whereas according to the figures of Jaipur Municipal Corporation, it was 1200 MT/ day in year 2015 and in the year 2016, it was 1300 MT/ day was there. According to Rajasthan Patrika in year 2016 garbage is generated 1500 MT/ day in Jaipur, according to the research done on the Jaipur city of MSW management in 2016, by Nisha Jain, Sourab Meena and Rohit Tak the waste per day in the city is 1600 MT/ day. According to BVG India Ltd, the garbage coming out daily from Jaipur city in the year 2018 is 1700 MT/ day, which has become 1800 MT/ day in year 2019. It is estimated that by 2021 the waste every day in the city will be 3643 MT/ day CDP, Draft City Development Plan, Jaipur, 2005. Qualitative and quantitative analysis of MSW in Jaipur city are shown in Table 1.

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

- Population is the change in the number of in habitats of a territory during a specific period of time. If the population of a given area increase in a specific period of time. It is called positive change. At present in most parts of the Jaipur Rajasthan city. The population change is almost in variable positive. The Jaipur city population has been growing at varying rates ever since 1971. Over the period from 1951 to 2001. Overall increased in the city's population has been 5 times as per census reports.

- The population of Jaipur city grew at an accelerated rate which rose from 3.67% in 1971 and 3.46% in 2001. The average Annual growth rate of population declined to 2.38%. The major growth has occurred outside the wall city are. The population growth within the walled city was nearly equal to that of the rest of the JMC area between 1981-1991. However between 1991-2001 the walled city has witnessed a declined in population growth rate as compared partly due to Migration and also due to expansion in the JMC area. Demographic characteristics of population in Jaipur.

The population in Jaipur city has increased more than 10 times in the last 50 years. In 1900 of waste the population of the city was only 1.6 lakh. In 2001 Jaipur Municipal Corporation had population of 23.22. Lakh which reached to 30.46 lakh in 2011. Regarded as on of the fastest growing cities in the country.

It has on average growth rate of 2.38% in 2011. The annual average population growth rate of 1971 to 1981 was in the year 1981 but it declined sharply by 2.69% in 2001 and 10.86% in 2011. The city stands at 909 females per 1000 males. The city population is increasing at a rate of 2% every year.

#### (a) Population density in Jaipur.

Population density is an important measure to analyze population distribution. Jaipur city's population density of 6523 person's Sq. km is much bigger than 1981 population density (2624 person's Sq. Km) that the population density of the walled city area is 42008 person's Sq. Km in 2013 as decreased by 16201 person's Sq. Km in 1981. The total area of the walled city is 6.7 Sq. Km (2.32% of the total area of JMC) in 2001. This is despite the fact that density has declined from 1991 to 2013. The population density of JMC area as whole for different year's. It is evident that the rest of the JMC area has relatively low population density. But in 2011 it was highly as compared to 2011. In 2001 population density of JMC was 5027 person's Sq. Km which increased phenomenally by 1566 person's Sq. Km to 6593 person's Sq. Km in 2011.

Population of Jaipur in 2018 is 36.28 lakhs. The fact is last census of Jaipur was done only in 2011 and next such census would be in 2021. But as per estimate and projection, population of Jaipur in 2019 is 40 lakhs.

#### (b) Municipal solid waste, sessional variations.

Municipal solid waste (MSW) generated by community differs in quantity as well as in depending on several parameters like, habit of the people, living standards, location, climate conditions etc.

In India the variation in the parameter is very wide and thus the quantity as well as quantity estimation for a city or state cannot be simply extended for other locations to formulate on effective MSW management strategy. The estimation for the same city may also differs at different seasons of the year as well as months. Management of MSW constitute a major portion of budget of a municipality for it's safe and hygienic disposal of MSW. The municipal solid waste is collected in vehicle or in community bins kept at different locations in the township according to the convenience of habitats and municipal authorities for it's transportation to the final disposal point. In third world countries those community bins are kept open at top and thus exposed to the climate. The composition and the quantity of MSW generated from the basis on which the management system needs to be planned, designed and operated. In India, MSW differs greatly with regard to the composition and hazardous nature, when compared to the MSW in the western countries.

The composition characteristics and quantity generally MSW from a township is a function of several parameters like, food habit, season, 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 with respect to the individual location, in one groups of different localities and seasons of the year.

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

The mixed sample waste physically analysed for it's composition such as biodegradable paper, plastic, glass, metals and inerts (dust, stone pieces and others) and expressed as % of total sample weight characteristics of the MSW here also determined like moisture content, calorific value, bulk density, dry density and waste generated per capital. Analysis of MSW was carried out as per the standard procedures.

#### (d) Physical certify of MSW.

Samples of MSW collected from communities bins were mixed thoroughly to make a composition sample for a specific location and shortify was done to separate out differently in generally such as biodegradable (food waste, organic etc.), Paper, plastic, glass, metals and inerts (dust, stone pieces and others). Weight of individual ingredient was taken and it's fraction was represented in terms of percentage (%) of total Wt weight of MSW.

Management of municipal solid waste highly depends on the composition and characteristics of the waste that is generated by the community. The composition and characteristics of the waste is dependent on the several aspects like, seasons, living standard, location etc. A variation in quantity and quality of MSW generated by the community was also analysed to visualise the real situation.

**(e) Determination of Bulk density.**

A metallic cubicle of 45cm\*45cm\*45cm was taken and the empty weight and volume of cubicle was measured. Sample is filled up in measuring cube and net weight of the of the sample was taken to determine the bulk density. The bulk density was obtained by dividing the weight of sample by volume of the container containing sample.

**(f) Composition of MSW in Different seasons.**

**Summer season:** - The average composition of MSW in summer season. For summer season the average composition of biodegradable fraction is found to be 45.90%, paper 4.05%, plastic 5.08%, glass 0.62% metals 0.06%, textiles & leather 0.89% and inert materials 44.5%.

**Rainy season:-** The average composition of MSW in rainy season. For rainy season the average composition of biodegradable fraction is found to be 39.60%, paper 4.83%, plastic 3.37%, glass 0.15% metals 0.11%, textiles & leather 0.64% and inert materials 52.99%.

**Winter season:-** The average composition of MSW in winter season. For winter season the average composition of biodegradable fraction is found to be 52.98%, paper 4.444%, plastic 5.07%, glass 0.69%, metals 0.15%, and inert materials 36.15%.

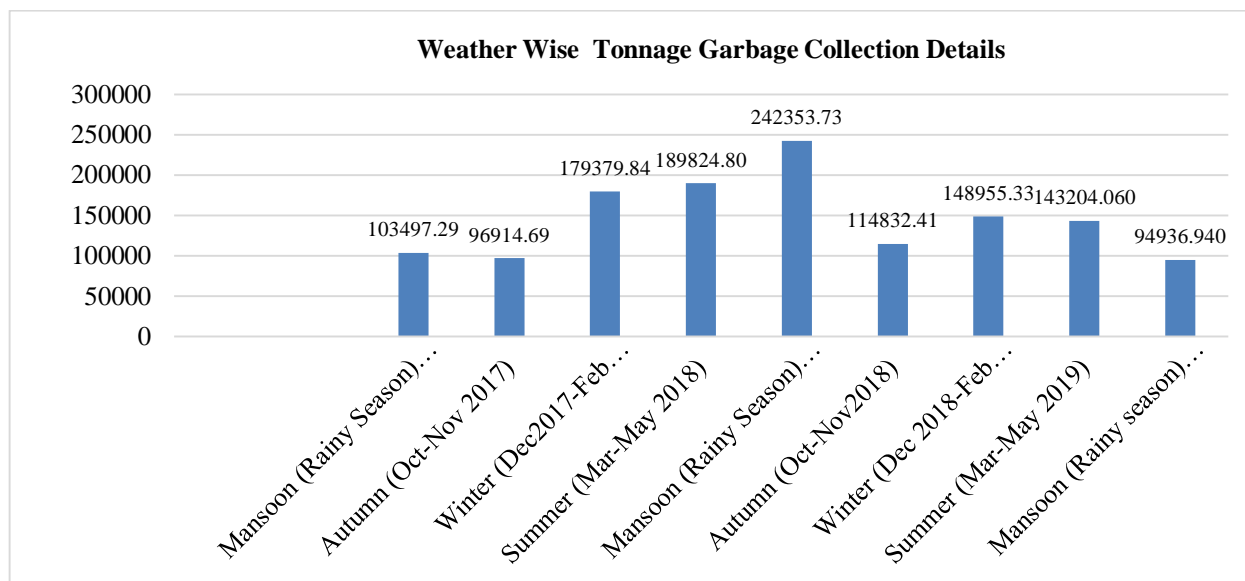
**Comparison of Characteristics of MSW in Different seasons.**

The different characteristics of MSW in different seasons as well as the yearly average of these characteristic are compared that the total variation of moisture content was observed to be, 124%, it was lowest in summer season (21.34%) and highest in rainy season (47.87%). Variation in calorific value of MSW and it was observed to be varying from 560 Cal/kg in 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 capita 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.

**Weather Wise Tonnage Details and Collection****Tonnage of Month of June-17 to July- 19**

Sr. No	Weather Wise	Total tonnage	Package-I			Package-II		Package-III		
			VD ZONE	AMER	HMW	CLZ	MNZ	HME	SNZ	MD ZONE
1	Monsoon (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
5	Monsoon (Rainy Season) (June-Sept 2018)	242353.73	49670.05	8375.74	13392.51	50633.14	32792.54	21230.73	33843.38	32415.65
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	Monsoon (Rainy season) (June-July 2019)	94936.940	20545.200	3622.240	5147.050	22369.295	10704.515	9260.265	14490.505	8797.870
	<b>Gross Total</b>	<b>1313899.088</b>	<b>276368.919</b>	<b>57752.726</b>	<b>81881.622</b>	<b>262856.772</b>	<b>176488.937</b>	<b>115567.654</b>	<b>175237.335</b>	<b>167745.123</b>

Source:- B.V.G India



Source:- B.V.G India Ltd.

**4. MSW characteristics and composition**

The composition and quantity of municipal solid waste generated is the basis on which the management system must be planned, designed and operated. In India, MSW differ greatly in terms of composition and hazardous nature compared to MSW in western countries. 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%). The C/N ratio is between 20 and 30 and the lowest heating value is between 800 and 1000 kcal/ kg. The physical characteristics of the MSW in metropolitan cities are presented in table 2. It has been observed that the physical and chemical characteristics of the MSW change with the population density.

According to data of the year 2015-16, the physical characteristics of the MSW in Jaipur city are shown in table 1

**Table 2 Characteristics of the MSW.**

City	Paper	Cloths	Plastics	Glass	Ash and others	Food products
Jaipur	6-0	2-0	1-0	2-0	47-0	42-0

Source:- Jaipur municipal corporation

Out 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.

**Table 3 Percentage of garbage in Jaipur**

Garbage	Percentage
Bio-waste	60%
Dust	15%
Recyclable,	25%

Source:- DainikBhaskar

**5. Storage and collection of MSW**

Significantly absent in most urban areas. Garbage cans are common in decomposable and non-decomposable waste (no waste separation in performed) and waste is stored in a common storage facility. Storage containers can be classified as mobile containers and fixed containers. Mobile containers are flexible in terms of transport but lack durability, while fixed containers are more durable but their position cannot be changed once they have been built.

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. Others have used NGOs and citizen committees to supervise the separation and collection of the production source at the collection points located at intermediate points between the sources and landfills. In addition, 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.

In most cities, a fraction of the generated MSW is still not collected on the streets and what is collected is transported to the treatment or disposal sites. The efficiency of collection is the amount of municipal solid waste collected and transported from the streets to storage sites divided by the total amount of MSW generated during the same period.

Numerous studies of the urban environment have shown that the efficiency of MSW collection depends on two main factors: labor availability and transport capacity.

The collection efficiency is high in cities and states, where private contractors and NGOs are employed to collect and transport MSW. 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 sanitary 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. Earlier the number of garbage depots in the city was 3000, which is now only 150 in year 2019 (before introducing BVG India's for door-to-door garbage collection). The door-to-door garbage collection in Jaipur city was started on May 8, 2017 by Mayor Ashok Lahoti and JMC Commissioner Ravi Jain (IAS). That time BVG started 08 wards with 08 hooper in each wards for door to door garbage collection. Gradually BVG cover entire Jaipur for door to door. It's first time when after a long time any company covers and started door to door garbage collection in Jaipur. Not only this BVG deployed small carts have been set up by the company for carrying garbage from wall city where vehicle unable to reach. These small carts easily come into sakri lanes which facilitates taking garbage in the sakri lanes. Every hooper having capacity about 700 Kg of garbage, which receives garbage from 800 to 1000 houses in approximately one shifts (08 hr). For efficient and more effective garbage collection BVG deployed the machinery and manpower. *Due to this Jaipur not only got 39<sup>th</sup> ranking in all India but also got "Fastest mover state capital in the country" This is first time when Jaipur received this awards in swachhata survection 2018.*

The number of vehicles used by the BVG Company to lift the garbage from 8 zones of the city is shown in table 04.

**Table 4 BVG INDIA LTD Zone wise Vehicle List**

S. N.	Package	Zone	Tata Ace	RC	E - Rickshaw	Try Cycle	Dumper/Hywa	JCB	Tractor Trolley/Loader	Total
1	I	HMW	38	0	0	12	3	2	34	89
2	I	VDZ	165	0	0	0	20	14	4	203
3	I	AMER	28	3	0	0	5	2	10	48
4	II	CLZ	119	2	8	0	17	11	6	163
5	II	MNS	79	0	7	2	14	5	8	115
6	III	HME	62	0	0	2	5	3	20	92
7	III	MDZ	68	2	1	0	14	5	20	110
8	III	SNG	79	3	0	0	13	8	13	116
Total Ward Vehicles			638	10	12	16	91	50	115	932
Spare			40	4	13	11	4	1	0	71
Total Vehicles			678	14	25	27	95	51	115	1003

Source:- BVG India

Presently, waste collection and transferred at following transfer stations by BVG India

**Table 5 BVG INDIA LTD TRANSPORTATION LIST**

List Of Transferstation Point			
Sr.No	ZONE	Transferstation Name	Dumping Station Name
1	VDZ	Badhana Puliya	Sevapura
2		Swarn Jayanti Park	
3		Kalward Road	
4	HMW	Lal Dungri	Mathuradaspura
5	AMER	Jal Mahal Pal	Mathuradaspura
6	MNZ	V.T. Road	Sevapura
7		Jhulelal	
8	CLZ	Kalward Road	Sevapura
9		Civil Line Fatak	

10		Darbaar School	
11		V.T. Road	
		Karni Vihar Police Station	
12		Railway Station	
14		Lal Kothi Subzi Mandi	
15	SNZ	Muhana Mandi	Mathuradaspura/Langrayeewas
16		Bambala Puliya	Mathuradaspura
17		Ghodha Circle	Mathuradaspura/Langrayeewas
18		Khaniya Bandha	Mathuradaspura
19	MDZ	Goal Market	Langrayeewas
20		Jhalana	Mathuradaspura/Langrayeewas
21		Murdha Ghar	Mathuradaspura/Langrayeewas
22		Gautam Nagar	Mathuradaspura/Langrayeewas
23	HME	Lal Dungri	Mathuradaspura

Source:- BVG India

## 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. In small towns (rural), semitrailers, tricycles, etc. They are mainly used for the transport of municipal solid waste. Light motor vehicles and trucks are generally used in the main cities or towns for the transport of municipal solid waste. The trucks 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. Municipal agencies use their own vehicles to transport MSW, although in some cities they are hired by private contractors. MSW collection is the responsibility of the companies/municipalities. The predominant collection system in most cities is through communal containers located at various locations along the roads, which sometimes leads to the creation of unauthorized open collection points. Efforts to organize door-to-door collection are starting in many megacities such as Delhi, Mumbai, Bangalore, Madras and Hyderabad with the help of NGOs. It has been observed that many municipalities have contracts with private contractors for secondary transport from communal containers or from collection points to disposal sites. Others have used NGOs and citizen committees to monitor segregation and collection from the source of production to collection points at intermediate points between sources and landfills. In addition, social assistance associations organize specific monthly collections in certain urban areas. A sweeper who sweeps the roads manually is assigned a specific area (about 250m<sup>2</sup>). Sweepers place road waste in a wheelbarrow and then transfer waste to garbage cans or collection points.

Three areas have been selected out of the city for disposal of garbage by the Jaipur municipal corporation it is Mathuradaspura, Sevapura, Langariyawas. This is the 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 and their description is shown in table 5

**Table 6 Places of garbage disposal in Jaipur city**

Place	Area	Distance from city
Mathuradaspura	176 bigha	17 km
sevapura	200 bigha	20 km
Langariyawas	483 bigha	21 km

Source:- Jaipur municipal corporation

According to the figures of the year 2019, the average amount of garbage brought from the city of Jaipur in Mathuradaspura, Sevapura, Langariyawas is shown in table 6.

**Table 7 Garbage disposal of the year 2019 per day**

Place	Garbage
Mathuradaspura	700-800 MT/day
Sevapura	250-300 MT/day
Langariyawas	350-450 MT/day

Source:- Jaipur municipal corporation

## 7. MSW disposals and treatment

### ➤ Composting

Composting is an organic material that has been broken down and recycled as a fertilizer and soil amendment. The composting process simply requires that the pile of wet organic matter be known as green waste and that the material decomposes into humus after a period of a few weeks or months. Compost is rich in nutrients. It is used in gardens, landscaping, horticulture and agriculture. Compost itself is beneficial to the soil in a number of ways, including as a soil conditioner, fertilizer, addition of humus or humic acid, and as a natural soil pesticide.

**Langariyawas:-** In the city of Jaipur the waste processing plant of 350 MT garbage performance capacity was set up in 2007 for the purpose of solid waste execution in a scientific way. This is still working. Here the waste is converted into RDF, which is used as a fuel in cement factories.

**Sevapura:-** to make the city completely out of the waste by the municipal corporation, the plant to build compost fertilizer capacity of 250 MT garbage has been installed in year 2014. According to the information received from the Jaipur municipal corporation, after the completion of the service, about 250MT of garbage that is rising from the city is disposed daily. Apart from this, the garbage that is left is untouched, which pollutes the environment there.

### ➤ Landfill

Landfill is the oldest and most common method of treating solid waste. This is done on a particular site or land called a dump. The waste is poured into the soil by weight in a uniform manner. After the spill, the debris is covered with a layer of soil after each day. It does not require any infrastructure or equipment, so it is the most economical process of waste management. Methane produced from waste, which is a greenhouse gas, is a major threat to the environment and is highly flammable and explosive. It is the disposal of waste that cannot be reused, recycled or recovered, in or on land. The aim is to avoid contact between the waste and the surrounding environment, especially groundwater.

**Mathuradaspura:-** in Mathuradaspura about 700 to 800 MT of garbage is added daily in the city. And about 1700-1800 MT of waste is generated Jaipur every day. Surprising here is that the dumping site of Mathuradaspura of Jaipur is one as such example. The present study thus focuses on the effect of dumping of municipal solid waste in mathuradaspura dump site. It also effect soil quality disturbing the soil microflora and microflora.

Study area: Mathuradaspura village which lies in the north east part of the Jaipur about 20km away from the main city, situated in jamwaRamgarh Tehsil of Jaipur. The area adjoining the village is used as open dumping ground for non-segregated municipal solid waste about 800 tons of municipal waste is dumped here every day.

## 8. Conclusion

In this paper, an attempt has been made to study the changing trends of quantity and characteristics of MSW in Jaipur city. The changing pattern of waste composition emphasizes the importance of segregation for successful operation of waste management facilities. Municipal authorities should maintain the storage facilities in such a manner that they do not create unhygienic and unsanitary conditions. A new survey should be carried out on the generation and characterization of MSW in Jaipur city. Since the MSW is heterogeneous in nature, a large number of samples have to be collected and analyzed to obtain statistically reliable results. It is highly recommended that regular, monitoring of the ground water resources in and around a dump site must be carried out. Strict waste segregation schemes be adopted. Properly engineered landfill must be used for the dumping of municipal solid waste which would restrict the entry of leachate and pollutants to the ground, that would reduce the pollution on the soil and consequently on the ground water resources.

The yearly average composition of MSW of Jaipur city has biodegradable 45.92%, paper 4.38%, plastic 4.45%, glass 0.48%, metals 0.11%, textiles & leather 0.90% and inert materials 43.93%. The MSW of Jaipur city shows a seasonal variation of 124% in moisture content 73.9% in calorific value, 22.5% in bulk density 4% in dry density and 45.16% in generation of waste per person per day. The seasonal variation in characteristic of MSW was found to be in a wide range of 4-124%. So none of the method of MSW management (*i.e.*, dumping on land, composting, recycling and recovery, burning and energy generation) alone can be sufficient for efficient of MSW. The seasonal variation in characteristics of MSW also gives an idea about arrangements to be made for collection, transportation, change in **tonnage ratio** of solid waste estimation because the different season has different weight of solid waste Of MSW and disposal of different quality of MSW generated in different season.

## References

- 1 Census of India, census of Rajasthan (1981) <http://www.censusindia.netofcalled> August 2011.
- 2 Census of India, census of Rajasthan (1991) <http://www.censusindia.netofcalled> August 2011.
- 3 Census of India, census of Rajasthan (2011) <http://www.censusindia.netofcalled> August 2011.
- 4 Anita Agerwal, Rama panday, M.L Agerwal, seasonal variation in composition and characteristics of India municipal solid waste. A Case Study. Recent Research in science and Technology 2013, 5(5): 40-43,
- 5 Akolkar, A. B. 2002. Management municipal solid waste in India. Status and Options: An Overview, In: Proceedings of the Asia Specific Regional Workshop on Sustainable Waste Management, Singapore, 8-10, 2002, German Singapore Environment Technology Agency (GSETA)
- 6 APHA-AWWA-WPCF, 1989, Standard method for Examination of waste and Waste water, 17 Ed. Washington DC.
- 7 Khan, F. R. 2001. Study of Ground water pollution. M.Tech , Thesis. Department for water Supply and Sanitation, Addis Ababa, Ethiopia, 320-322.
- 8 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)

- 9 Saxena, S., Srivastava, R.K., & Samaddar, A.B., 2010. Sustainable waste management issues in India. *IUP J. Soil Water Sci.* 3 (1), 72–90.
- 10 Gidde, M.R., Todkar, V.V., & Kokate, K.K., 2008. Municipal solid waste management in emerging mega cities: a case study of Pune city. *Proceedings of Indo Italian Conference on Green and Clean Environment, Pune, India (March 20-21)*.
- 11 Syed, S., 2006. Solid and liquid waste management. *Emirates J. Eng. Res.* 11 (2), 19–36.
- 12 Rajkumar, N., Subramani, T., & Elango, L., 2010. Groundwater contamination due to municipal solid waste disposal — a GIS based study in Erode City. *Int. J. Environ. Sci.* 1 (1), 39–55.
- 13 Rachel, O.A., Komine, H., Yasuhara, K., & Murakami, S., 2009. Municipal solid waste management in developed and developing countries — Japan and Nigeria as case studies Available at: [http://www.geo.civil.ibaraki.ac.jp/komine/mypapers/JGSPaper/2009/JGS2009\(973\)Rachel.pdf](http://www.geo.civil.ibaraki.ac.jp/komine/mypapers/JGSPaper/2009/JGS2009(973)Rachel.pdf).
- 14 Jha, A.K., Singh, S.K., Singh, G.P., & Gupta, P.K., 2011. Sustainable municipal solid waste management in low income group of cities: a review. *Int. Soc. Trop. Ecol.* 52 (1), 123–131.
- 15 Shazwin, T.M., & Nakagoshi, N., 2010. Sustainable waste management through international cooperation: review of comprehensive waste management technique and training course. *J. Int. Dev. Coop.* 16 (1), 23–33.
- 16 Ghosh, R., & Kansal, A., 2014. Urban challenges in India and the mission for a sustainable habitat. *Interdisciplina* 2 (2), 281–304.
- 17 Hanrahan, D., Srivastava, S., & Ramakrishna, A.S., 2006. *Improving Management of Municipal Solid Waste in India*. The World Bank.

