

SOLID WASTE MANGEMENT OF INDORE CITY: A REVIEW

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Abstract - One of the major causes of the problem in the Indore city (M.P.) is solid waste management (SWM) which acts as an obstruction in the development of Indore. In this Study the practical problem of separating the different disposal waste and their effect has been carried out which includes: Separation, Collection, Transportation and their disposal with various disposal techniques such as composting, land incineration, etc. The emphasis is to carry out the current status and diagnose the major issues. Determination of the amount and type of municipal solid waste and managing the waste so that it does not create pollution to environment is the best management system. With the modernization in technologies the waste generation pattern is also changing.

Key Words: Municipal Solid Waste, Indore Municipal Corporation

I. INTRODUCTION

The rapid industrialization and population explosion in India has led to the migration of people from villages to cities, generating thousands of tons of MSW per day. The amount of municipal solid waste is expected to increase significantly in the near future as the country strives to achieve industrialized nation status by 2020. Poor collection and inadequate transportation are responsible for waste accumulation municipal solid in every corner and corner. The management of the MSW is in a critical phase, due to the lack of adequate facilities to process and dispose of the largest amount of MSW generated daily in metropolitan cities.

In general, municipal solid waste is eliminated in low areas without precautions or operational controls. As a result, MSWM is one of the biggest environmental problems in the megacities of India. It covers activities related to the production, storage, collection, transport and transport, treatment and disposal of solid waste. However, in most cities, the MSWM system includes only four activities, i.e. production, collection, transport and waste disposal. The management of municipal solid waste requires adequate infrastructure, maintenance and updating for all activities. This is becoming increasingly costly and complex due to the continued and unplanned growth of urban centers. The difficulties in providing the desired level of public service in urban centers are often attributed to the poor financial situation of municipal governments.

According to the 2011 census, the population of the city of Indore was about 2.17 million, which represents an increase of nearly 47% since the last census of 2001. The rapid population growth, the industrialization, urbanization and

economic growth of the city generates thousands of tons of municipal solid waste per day. Poor collection and inadequate transportation are responsible for the accumulation of MSW in every nook and cranny. As more land is needed for the final disposal of this solid waste, the problems associated with disposal have become a big challenge. The management of the MSW is going through a critical phase, due to the lack of adequate facilities to process and eliminate the large amount of MSW that is generated daily. Typically, in Indore, MSWs are placed in an open area without taking the necessary precautions and measurable controls, which is why it has become the main cause of environmental pollution and human health.

Solid waste management activities related to the production, storage, collection, transfer and transport, treatment and disposal of solid waste. But in Indore, MSWM only has four activities: waste generation, collection, transport and disposal. The solid management of solid waste requires adequate infrastructure, maintenance and updating for all activities. The management of MSW covers the planning, engineering, organization, administration, financial and legal aspects of the activities related to the production, storage, collection, transport, processing and elimination of waste.

II. 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. Currently, about 90 million tones of solid waste are generated each year as by-products. Industrial, mining, municipal, agricultural and other types. It is estimated that the amount of MSW generated per capita increases from 1 to 1.33% per year.

Table 1
Municipal solid waste generation rates in different states in India

S. No.	Name of the state	No. of cities	Municipal population	Municipal solid waste (t/day)	Per capita generated (kg/day)
1	Andhra Pradesh	32	10,845,907	3943	0.364
2	Assam	4	878,310	196	0.223
3	Bihar	17	5,278,361	1479	0.280
4	Gujrat	21	8,443,962	3805	0.451
5	Haryana	12	2,254,353	623	0.276
6	Himachal Pradesh	1	82,054	35	0.427
7	Karnatka	21	8,283,498	3118	0.376
8	Kerala	146	3,107,358	1220	0.393
9	Madhya Pradesh	23	7,225,833	2286	0.316
10	Maharashtra	27	22,727,186	8589	0.378
11	Manipur	1	198,535	40	0.201
12	Meghalaya	1	223,366	35	0.157
13	Mizoram	1	155,240	46	0.296
14	Orissa	7	1,766,021	646	0.366
15	Punjab	10	3,209,903	1001	0.312
16	Rajasthan	14	4,979,301	1768	0.355
17	Tamil Nadu	25	10,745,773	5021	0.467
18	Tripura	1	157,358	33	0.210
19	Uttar Pradesh	41	14,480,479	5515	0.381
20	West Bengal	23	13,943,445	4475	0.321
21	Chandigarh	1	504,094	200	0.397
22	Delhi	1	8,419,084	4000	0.475
23	Pondichery	1	203,065	60	0.295
		299	128,113,865	48,134	0.376

Source: Status of MSW generation, collection, treatment and disposal in class-I cities (CPCB, 2000).

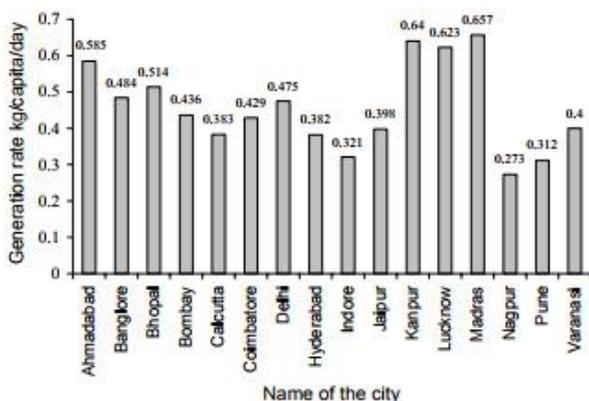


Fig. 1. Per capita generation rate of MSW for Indian cities (CPCB, 2004).

It is also estimated that the total MSW generated by 217 million people living in urban areas was 23.86 million t/yr in 1991 and more than 39 million t in 2001. The quantity of MSW generated (CPCB, 2000) and the per capita generation rate of MSW (CPCB, 2004) is shown in Table 1 and Fig. 1, respectively. It can be seen from Table 1 and Fig. 1 that the per capita generation rate is high in some states (Gujrat, Delhi and Tamil Nadu) and cities (Madras, Kanpur, Lucknow and Ahmedabad). This may be due to the high living standards, the rapid economic growth and the high level of urbanization in these states and cities. However, the per capita generation rate is observed to be low in other states (Meghalaya, Assam, Manipur and Tripura) and cities

(Nagpur, Pune and Indore).

III. 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 the MSW in the production sources and in the collection points was determined on the basis of 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.

IV. Storage and collection of MSW

The storage of municipal solid waste at the source is significantly absent in most urban areas. Garbage cans are common in decomposable and non-decomposable waste (no waste separation is 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 positions 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 roads 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 average collection efficiency of DSMs in cities and states of India is about 70%, as shown in Figure 2 and Table 5.

Table 5 and Figure 2 show that 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).

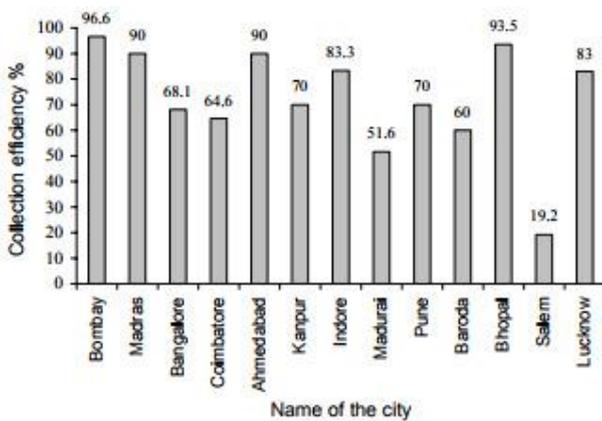


Fig. 2. Collection efficiency of MSW for Indian cities (Gupta et al., 1998; Khan, 1994; Maudgal, 1995).

Table 5
Per capita generation, disposal and collection efficiency of MSW for Indian state

State	Per capita generation (g/cap/day)	Per capita disposal (g/cap/day)	Collection efficiency (%)
India (sample average)	377	273	72
Andhra Pradesh	346	247	74
Bihar	411	242	59
Gujarat	297	182	61
Haryana	326	268	82
Karnataka	292	234	80
Kerala	246	201	82
Madhya Pradesh	229	167	73
Maharashtra	450	322	72
Orissa	301	184	61
Punjab	502	354	71
Rajasthan	516	322	62
Tamil Nadu	294	216	73
Uttar Pradesh	439	341	78
West Bengal	158	117	74

Source: (Nema, 2004).

V. Transfer and transport of MSW

The transfer stations (except in some cases such as Madras, Mumbai, Delhi, Ahmedabad 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), semi-trailers, 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 250 m²). Sweepers place road waste in a wheelbarrow and then transfer waste to garbage cans or collection points

VI. MSW disposals and treatment

Gasification

Gasification is a process in which the organic substance containing carbonaceous material becomes CO. This is done at a temperature (> 700 ° C) without combustion, with a controlled amount. The product of this process is the synthesis or the production gas. Syngas is a renewable energy source. The merit of gasification over combustion is that the synthesis gas produced in gasification is more efficient. Synthetic gas is widely used to produce electricity. The byproduct of gasification is a solid waste (ash). Currently, several types of gasifiers are available for

commercial use: fixed bed in countercurrent, fixed bed in parallel, bed fluidized bed, entrained flow, plasma and free radicals.

Incineration

Incineration is a waste treatment process that involves the burning of organic matter present in the MSW. Ashes and combustion gases are the by-products of this process. Incineration is beneficial for hazardous waste, pathogens, toxins and waste produced by hospitals. It also reduces waste from 80 to 85% by weight and from 90 to 96% by volume. This is done in a computer called an incinerator. Incineration can produce 2/3 MWh of electricity per ton of MSW. This is a bad option because the waste consists mainly of high organic matter (40-60%) and high inert content (30-50%), as well as low heat content (800-1100 kcal / kg) and high moisture content (40-60%) in MSW and high plant installation and operation costs.

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, land spacing, 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.

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.

Recycling

Recycling is a process of converting waste into new products. Recycling is the key element of modern waste reduction and is the third component of the waste hierarchy. Recyclable materials include many types of glass, paper, metal, plastic, electronics and textiles. Recycling is a key element of modern waste reduction.

CONCLUSION

The paper presentation indicates the proper management and processing of Indore's MSW. The determination and type of MSW and the treatment with the respective method is the best way to manage the MSW, so it does not create pollution and damages our society. Indore Municipal Corporation (IMC) generally uses landfill and composting methods for the treatment of MSW. IMC can also use different treatments such as gasification technology for MSW treatment because it is a renewable energy source for electricity production. As the population grows rapidly as urbanization accelerates, the generation of MSW also increases, this document will help MSWM authorities improve the city.

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