



Solid Waste Management in India

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ABSTRACT

In India due to industrialization, there is rapid urbanisation and increase in per capita income results into increase in total waste generation. It is also seen that the use of electronics equipment is increased and this also contributing in E-waste and plastic waste generation. Urban India facing significant challenges like collection, transport, treatment and disposal of waste.

In India 90% waste is collected, from that only 27% goes to further treatment. Even today, large portion of solid waste is dumped outside of towns or cities without any prior treatment, which leads to percolation of leachate and release of foul gases and ultimately results into ground water contamination and air pollution. Current system of waste management is not appropriate for the increasing load of waste. So it is now urgency in Indian cities to move the waste management system from direct dumping to scientific treatment, also with extraction of energy from waste.

Keywords – Disposal, Generation, landfill, Segregation, Waste.

I. INTRODUCTION

Deterioration of environment is increasing day by day. This degradation resulted into the climate change and ultimately whole natural cycle of environment is disturbed. Due to this reason, there is increase in social as well as environmental pressure all local bodies for sustainable solid waste management scheme. Problem of solid waste disposal is getting severe from last decade in India according to that Central Pollution Control Board (CPCB) established one plan named as “National action plan for solid waste management”.

There is a fact that, the cities and towns of India are choked with the garbage. In most of cities or towns, only main places are cleaned and remaining are full of garbage, which states on the ground, streets, etc. There are number of cities and towns do not having proper collection system for waste collection. Also the collected waste are disposed on any land which do not having a technical capacity to handle the waste. The entire waste is



dumped into landfill without any treatment. Due to this the valuable recyclable reusable things are dumped. This will result into loss of sources and increase the rate of filling of landfill site. The speed with which population of cities/ towns is increasing unfortunately regulatory authorities and government missionary are unable to grow accordingly.

WASTE GENERATION IN INDIA

In last 60 years, India experienced rapid urbanisation and rapid population growth.

The population of India in 2011 is 1210.2 million, as compared to 1028.7 million in 2001^[15]. This growth in urbanisation is one of the major roles in increasing the quantity of municipal solid waste.

Table 1 - Population growth between 1911 to 2011 in India.

(Source: Population Statistics, India, 2011)

Census year	Population x10 ⁶	Decadal growth x10 ⁶	Average annual exponential growth rate (%)	Progressive growth ratio compared with 1911(%)
1911	252.0	13.7	0.56	5.72
1921	251.3	-0.8	-0.03	5.42
1931	278.9	27.6	1.04	17.02
1941	318.6	39.7	1.33	33.67
1951	361.1	42.4	1.25	51.47
1961	439.2	78.1	1.96	84.25
1971	548.1	108.9	2.20	129.94
1981	683.3	135.1	2.22	186.64
1991	846.4	163.1	2.16	255.05
2001	1028.7	182.3	1.97	331.52
2011	1210.2	181.4	1.64	407.64

The Indian major cities are experiencing increase in the population by migration from small towns, villages, etc. This will affect into the increase in the quantity of waste generated by these major cities. These major cities are having a huge economic growth and generation of waste.

Table 2- Major cities in India and their respective waste generation 2010-11.

(Source: Census of India 2011, CPCB Report 2011)

City	Population (2011) *10 ⁶	Total waste generated in tonnes per day	Waste generation (kg/capita/day)
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Ahmedabad	6.3	2300	0.36
Hyderabad	7.7	4200	0.54
Bangalore	8.4	3700	0.44
Chennai	8.6	4500	0.52
Kolkata	14.1	3670	0.26
Delhi	16.3	5800	0.41
Mumbai	18.4	6500	0.35

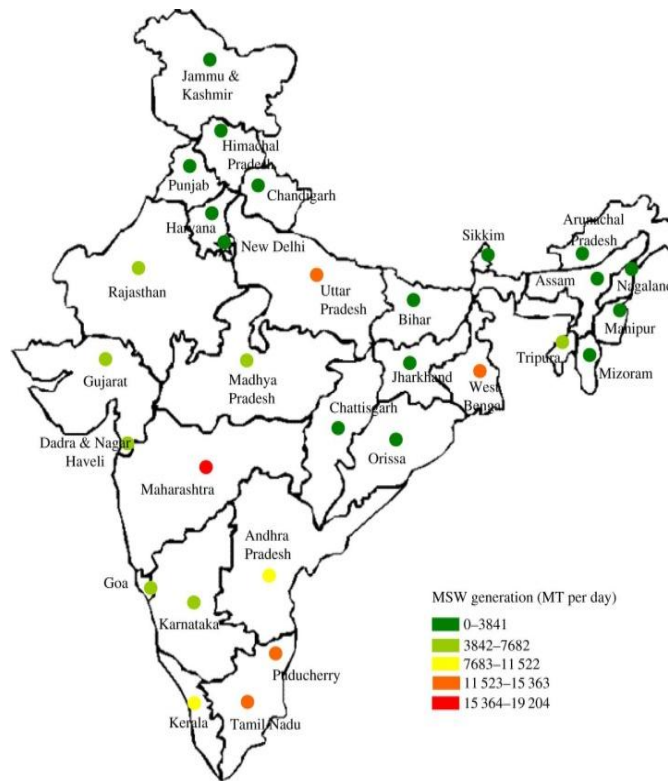
It is essential that, to forecast the waste generation for the planning of effective solid waste management system. It is always seen that the quantity of solid waste generated is depend on the habits of population, living standard, eating habits and season. Municipal Solid Waste (MSW) generation per capita in India ranges from approximately 0.17 kg per capita per day in small towns to approximately 0.62 kg per person per day in cities.

Table 3- Waste generation per capita in Indian cities.

(Source: “Characterization of municipal solid waste (MSW) and a proposed management plan for Kharagpur, West Bengal, India” Kumar KN, et. al., 2009)

Population	Waste generation rate (kg/capita/day)
Cities with population < 0.1 million (eight cities)	0.17-0.54
Cities with population of 0.1-0.5 million (11cities)	0.22-0.59
Cities with population 1-2 million (16 cities)	0.19-0.53
Cities with population >2 million (13 cities)	0.22-0.62

Waste generation rate is depends on factors like population density, economic status, culture and city/region. In India as per the CPCB reports of 2013-14 and 2014-15 total generation of solid waste is 1,41,064 tons per day and from that 1,27,531 tons per day waste is collected, which is 90% of total waste. The further treatment of collected waste is only 34,752 tons per day which is 27% of collected waste. This huge amount 1,06,312 tons per day weight is not treated^[10].



(State-level statistics of MSW generation in India (2009–2012))

(Source: Central Pollution Control Board, Govt. of India, 2012)

Also it is observed that municipalities do not maintaining any record of waste generation and its composition regularly. There are only few references we have, the National Environmental Engineering Research Institute (NEERI) study carried over 59 cities is one of them. It is found that there is no specific and authentic data is available with states and local bodies. The average generation of solid waste in 2014-15 is 0.2 to 0.6 kg per day per capita of urban population^[10]. The composition of waste generation is as follows:

Table 4- Composition of Solid wastes in Indian Cities.

(Source: “Improving Solid Waste Management in India”, Zhu D, et.al. 2008)

Composition	1996	2005
Biodegradables	42.21	47.43
Paper	3.63	8.13
Plastics & Rubber	0.60	9.22
Metal	0.49	0.5
Glass	0.60	1.01
Rags	-	4.49



Other	-	4.016
Inert	45.13	25.16

It is seen that the plastic, rubber, glass, paper and metal are recyclable and reusable material, which are about 15 to 20% in waste. Therefore such a big amount of a material can be reused and this will minimise the demand of resource. According to characterization of solid waste the further procedure of treatment and disposal is determined. The status of solid waste management is varies from city to city.

II. COLLECTION

The storage, collection, and transportation of the waste are one of the major challenges in waste management. It is the responsibility of the local body to provide the bins for biodegradable and non biodegradable waste. The collection should be made door to door. The waste is collected into community bins which fabricated by metal, concrete or composite. The street sweeping waste is also dumped into the communal bins. It is also seen that the commercial waste from nearby area also dumped into communal bins.

TRANSPORTATION AND DISPOSAL

The modes of transport of solid waste in India are bullock cart, trucks, tractors, hand rickshaws, compactors and dumpers. The trucks capacities in smaller towns are 5-9 tons capacity. The collection and transport is responsibility of local bodies. Local bodies spend Rs. 500-1000, for the waste collection and transport. From that 70% spent on collection and 30% spent on the transport. The waste generates in India is about 50% of biodegradable waste. In developed country it is about 30% only.

Table 5- Treatment Plant in Indian States.

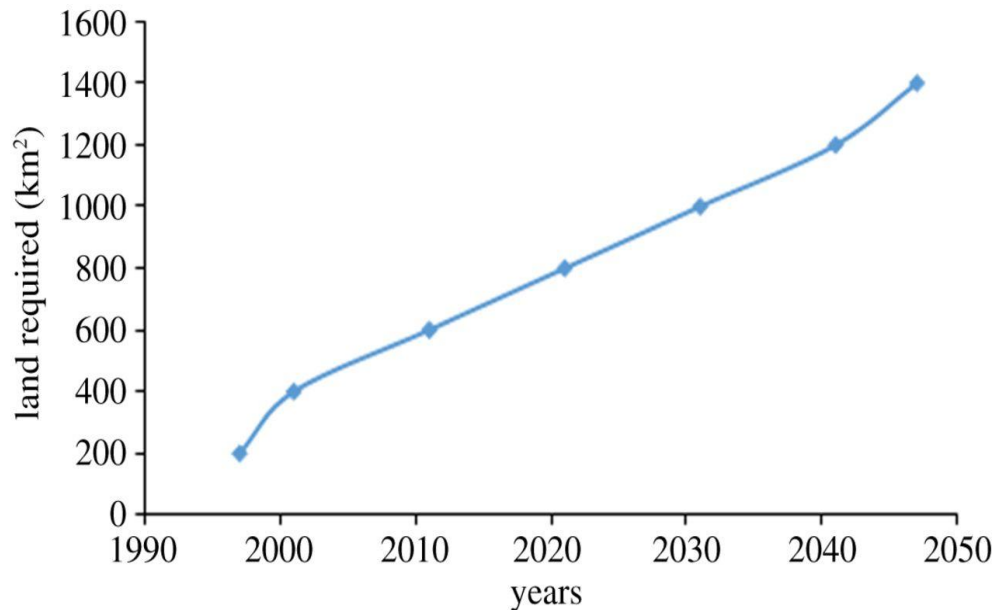
(Source: CPCB 2013)

State	Number of plants (composting & vermin- composting)	State	Number of plants (composting & vermin- composting)
Andhra Pradesh	32	Madhya Pradesh	4
Chhattisgarh	15	Maharashtra	125
Delhi	3	Meghalaya	2
Goa	5	Orissa	3
Haryana	2	Punjab	2
Gujarat	86	Rajasthan	2
Himachal Pradesh	13	Tripura	13
Karnataka	5	Uttarakhand	3



Kerala	29	West Bengal	9
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The biodegradable and inert materials are often dumped into the landfill and burning of it is common practice in the India. The 90% of waste is dumped in unsatisfactory manner. It is estimated that approximately 1400 km² was occupied by waste dumps in 1997.



Graph 1 - Cumulative land required (km²) for disposal of MSW.

(Source: “Solid waste management in India: status and future directions”, Singhal S, et.al. 2001)

There is requirement of properly planned waste disposal, which results into protection of public health, and preserve ground water, surface water, air quality and land fertility from contamination. The statistics of the landfill used in Indian cities are listed below.

Table 6 - Landfill sites associated with different cities in India.

(Source: “An analytical study on problems and policies of solid waste management in India: special reference to Bangalore city”, Parvathamma GI, 2014)

City	Number of landfills	Area of landfills (hectares)
Chennai	2	465.5
Coimbatore	2	292
Surat	1	200



Greater Mumbai	3	140
Greater Hyderabad	1	121.5
Ahmedabad	1	84
Delhi	3	66.4
Jabalpur	1	60.7
Indore	1	59.5
Madurai	1	48.6
Grater Bangalore	2	40.7
Vishakhapatnam	1	40.5
Ludhiana	1	40.4
Nasik	1	34.4
Jaipur	3	31.4
Srinagar	1	30.4
Kanpur	1	27
Kolkata	1	24.7
Chandigarh	1	18
Ranchi	1	15

The present scenario of solid waste management are as follows:

1. The overall strategy needed to fight with waste management is not stated effectively.
2. segregation is initial and prime requirement in solid waste management, which is not practiced at most of waste generation source. This segregation is found out in a very few cities where the local body takes efforts for awareness and created the facility for collection of segregated waste.
3. Door to door collection is required to improve, also the facility of collection of segregated waste should provide.
4. Waste from medical centres hospitals and slaughterhouse are mixed with domestic solid waste at central or community level and directly duped into the land fill.
5. The waste collected in community bins are not maintained properly. Due to this odour and litter spreads into nearby area causes a nuisance. This places are become a breeding place for rodents and flies.
6. It is observed that the transportation vehicles which are uncovered causes the less density material spread on streets. Also the litter spreads on road, from where the vehicle moves. The waste transport vehicles are not maintaining cleanliness results into the odour spreads into area.
7. The landfill site is not technically and scientifically prepared^[23].Due to this it is always been threat of contamination of groundwater and also decrease in the quality of ambient air.



8. There are many cities who set up the processing plant, but from that most of plants are shut down or closed down due to the maintenance cost of those. The few are running with a loss i.e. it is seen that those all plants are not self sustainable, so those are closed.
9. The rich calorific material is only picked by waste pickers for the further procedure and less calorific value material left behind which cannot be utilised for energy production.
10. The local body do not have any long term plan for waste management. Local bodies rely on short term plan.

III. CONCLUSION

Rapid urbanisation and population growth in the major cities of India creates a huge generation of the solid waste. For waste minimization the Reuse, Recycle and Reduction techniques should be implemented. These wastes need to be collected by using door to door waste collection system, with the segregation of waste at source of generation. Also it is required to make awareness, motivation among the citizens. Need to improve and maintain the transport and secondary collection system. The landfills are required to be designed scientifically. The waste treatment plant should be designed for self-sustained. The less calorific value material also to be separated and recycled. Any single solution is not applicable for waste treatment throughout India, so depending on the composition of the waste choose proper treatment method for treatment. Now it is a need of the total waste management system should improve by introduction of private sector with strict terms and conditions.

REFERENCE

- [1] A. Ahsan, M. Alamgir, M. M. El-Sergany, S. Shams, M. K. Rowshon, N. N. NikDaud, "Assessment of Municipal Solid Waste Management System in a Developing Country", Chinese Journal of Engineering, Volume 2014, article ID 561935.
- [2] AnuragGarg, Ibtisam E. Tothill, "A Review Of Solid Waste Composting Process- The UK Perspective", j. Dynamic Soil, Dynamic Plant 3 (Special Issue 1)2009: 57-63.
- [3] C. Malwana, T. K. Weerasinghe, S. Pilapitiya, "Determination of Optimal Pile Dimensions during Thermophillic Windrow Composting of Municipal Solid Waste in Srilanka", Int. J. Bioscience, Biochemistry and Bioinformatics, Vol. 3(6), November 2013: 552-556.
- [4] Nambhau H. Katre, "Use Of Vegetable Waste Through Aerobic Composting Of Village Bahmani, District:Gondia (Maharashtra State), India", Int. J. Life Sciences Biotechnology and Pharma Research Vol. 1(4)Oct 2012:134-142.
- [5] L. R. Kuhlman, "Windrow Composting of agricultural and municipal waste", Resources, Conservation and Recycling, 4(1990): 151-160.
- [6] Sridevi P, Modi M, Laxmi MVVC, Kesavarao L, "A review on integrated solid waste management", Int. J. Eng. Sci. Adv. Technol. 2, 1491-1499.

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ISBN: 978-93-87793-13-2

- [7] Sunil Kumar, JK Bhattacharya, A. N. Vaidya, TapanChakrabarti, SukumarDevotta, A. B. Akolkar, "Assessment of the status of municipal solid waste management in metro cities, state capitals, class I cities, and class II towns in India: An insight" Waste Management Vol. 29 Issue 2, February 2009:883-895.
- [8] MufeedSharholy, Kafeel Ahmad, GauharMahmood, R.C.Trivedi, "Municipal Solid Waste Management in Indian Cities-A Review", Waste Management Vol. 28 Issue 2, 2008:459-467.
- [9] ArunKansal, "Solid waste management strategies for Indian cities", Ind. J. Environ. Protect. 22(4),2002: 444-448.
- [10] Annual Report 2014-15, Central pollution Control board, Ministry of Environment, Forest and Climate Change, India.
- [11] K. H. Chowdhury, M. Alamgir, Q.H. Bari,M.K. Chowdhary, "Collection system of solid waste from source in Rajashshi city, Bangladesh", in Proceedings of the 3rd Annual Paper Meet and International Conference on Civil Engineering, IEB Dhaka, Bangladesh, 2005: 25-33.
- [12] H. An, J. Englehardt, L. Fleming, J. Bean, "Occupational health and safety amongst municipal solid waste workers in Florida" waste management and research, Vol. 17 (5) 1999:367-377.
- [13] Narayan T, "Municipal solid waste management in India: from waste disposal to recovery of resources", Waste Management Vol. 29, 2008:1163-1166.
- [14] Ministry of Environment and Forests (MoEF). The Gazette of India. Municipal solid waste (Management and Handling) rules, New Delhi, India. 2015.
- [15] Census of India- 2011 Ministry of Home Affairs, Government of India, New Delhi, India.
- [16] CPCB (Central pollution Control Board), 2000. Management of municipal solid waste in Delhi.
- [17] S. Singhal, S. Pandey, "Solid waste management in India: status and future directions", TERI Inf. Monitor Environ Sci. 6, 2001: 1-4.
- [18] Annepu RK "Report on sustainable solid waste management in India", Waste-to-Energy Research and Technology Council (WTERT), 2012: 1-189.
- [19] Planning Commission, Government of India. "Report of the task Force on waste to energy (Volume I) in the context of integrated municipal solid waste management" 2014.
- [20] Parvathamma GI, "An analytical study on problems and policies of solid waste management in India: special reference to Bangalore city", J. Environ. Sci. Toxicol. Food Technol. 8, 2014: 6-15.
- [21] A. Khajuria, T. Matsui, T. Machimura, T. Morioka, "Assessment of the challenge of sustainable recycling of municipal solid waste management in India", Int. J. Environ. Technol. Manage. 13, (2010) 1-187.
- [22] D.P. Komilis, "A kinetic analysis of solid waste composting at optimal condition", Waste Management, Vol. 26(2006), 2004: 82-91.
- [23] AbhishekNandan, Bikarama Prasad Yadav, SoumyadeepBaski, Debajyoti Bose, "Recent Scenario Of Solid Waste Management in India "World Scientific News 66 (2017) 56-74.