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A Review on Present Practices, Issues and Challenges of Municipal Solid Waste Management in India

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ABSTRACT: Municipal Solid Waste Management (MSMW) has become a foremost environment issue in India. Consistent and hasty increase in urban populations, rapid economic development, industrialization and urbanization are solely responsible for generation of solid waste at an alarming rate in Indian cities and towns. MSMW, is already a gargantuan task in India is going to be more complicated with the increase in its quantity and composition. This review provides an overview on the current status and practices of MSWM in India. This rapid increase in solid waste and its unscientific practices & mismanagement can cause adverse environmental impacts and leads to unsustainability. This review elucidates the numerous impact of solid waste on environment sustainability. Also, the end of this review concludes with challenges of MSWM, which can help the competent authorities responsible for it and researchers to prepare more efficient plans.

Keywords: Municipal solid waste management, Industrialization, Urbanization, Environment, Sustainability.

I. INTRODUCTION

Municipal waste is a term, coined to the solid waste. Solid waste refers to discard, refuse, garbage, rubbish material etc., which is generated by people and society in their daily activities as a natural phenomenon. Now a day, it has been recorded as a trend of continuous increase in the generation of municipal solid waste at an alarming rate because of consistent & hasty increase in urban population, rapid economic development, industrialization and urbanization in India. The trend of generation solid waste shows a positive relation with economic development, industrialization and urbanization as a consequence of improved life style and social status (Kumar and Kaushal, 2015). These factors directly affect the quantity of municipal solid waste (MSW) generated (Singh and Sharma, 2002; Minghua *et al.* 2009). In India, the urban population is at a stage of acceleration due to increasing level of urbanization. The urban population increased from 286 million to 377 million, accounted as 31 percent of total population. It is assumed that the urban population will increase to 600 million and account as 40 percent of total population by 2031. Due to the same, generation of solid waste in India is increasing rapidly. Generation and characteristics of MSW may vary at the level of country, state, city as well as within different areas of the same city. According to report of Indian energy portal, the municipal solid waste in India has an uninterrupted increasing trend from 1971-25. The per capita waste and total urban municipal waste increased from 375 g/day and 14.9 MT/yr. in 1971 to 490g/day and 48.5 MT/yr. in 1997 respectively. It is assumed that the generation of per capita waste and total urban municipal waste will increase to 700 g/day and 97 MT/yr. by 2025 respectively, which is approximately double of the amount of solid waste in 1997.

This continuous increase in generation of solid waste become havoc due to poor management practices in India. It is very important basic services provided by the Government of India and for its management, usually municipalities and other local bodies are responsible under the Municipal Solid Waste Management and Handling Rules -2000. But municipalities and local bodies generally fail to attain this responsibility (Sujauddin *et al.* 2008). The poor practice is mainly due to lack of appropriate collection, transportation and disposal system, lack of technical expertise and insufficient financial resources (Guerrero et al. 2013). Due to poor practice, MSW is disposed off in low lying areas or open dumps in the outskirts of towns/cities without necessary precautions. This kind of unscientific practice of solid waste leads to environment unsustainability by air, soil and water pollution.

Hence, to ensure the environment sustainability, an efficient and integrated municipal solid waste management is required for the municipality and local bodies. This review paper primarily illuminates the current status, practices, impact, challenge related to municipal solid waste, so it can help the competent authorities responsible for municipal solid waste management and researchers to prepare more efficient plans.

II. PRESENT STATUS OF MUNICIPAL WASTE GENERATION IN INDIA

Rapid urbanization and population growth contributes enhanced municipal solid waste generation. Generation and characteristics of MSW may vary at the level of country, state, city as well as within different areas of the same city. According to report of Indian energy portal (Fig. 1), the municipal solid waste in India has an uninterrupted increasing trend from 1971-25. The per capita waste and total urban municipal waste increased from 375 g/day and 14.9 MT/yr. In 1971 to 490g/day and 48.5 MT/yr. In 1997 respectively. It is assumed that the generation of per capita waste increased and total urban municipal waste will increase to 700 g/day and 97 MT/yr. By 2025 respectively, which is approximately double of the amount of solid waste in 1997.

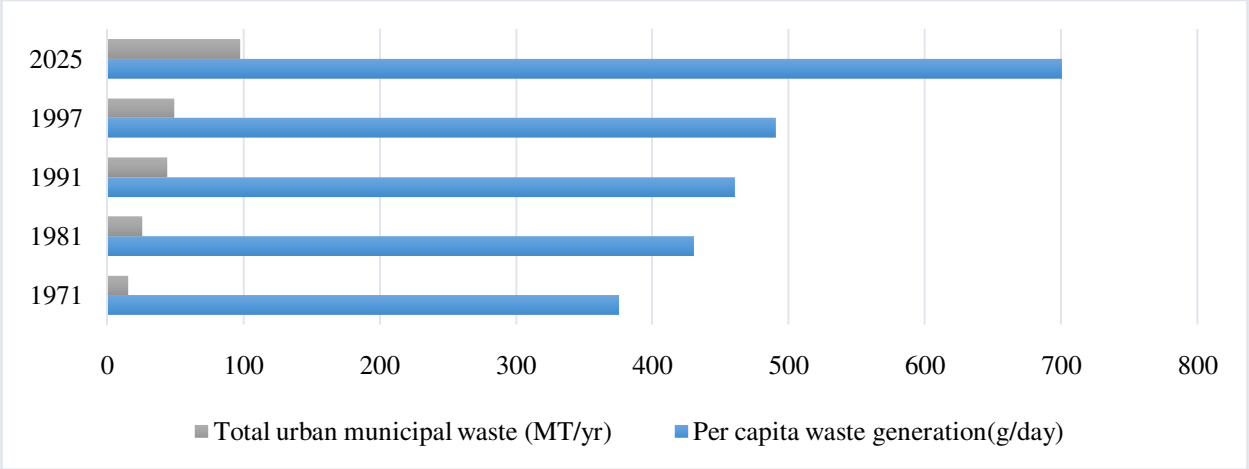

Fig. 1. Waste Generation Trends in India. (Source: - India Energy portal).

According to survey conducted by Central Pollution Control Board (CPCB) for 59 Indian cities, has reported that the generation amount of MSW was approximately 35,401 tonnes per day during 2004-05. Thereafter, Central Institute of Plastic Engineering and Technology (CIPET) also conducted a survey for the same cities as selected in survey of CPCB and suggested that the generation amount of MSW was approximately 50592 tonnes per day during 2010-11.

Table 1: Municipal Solid Waste Generation in Indian Cities.

S.No.	City	MSW generation (tonnes / day)		S.No.	City	MSW generation (tonnes / day)	
		2004-05a	2010–11b			2004-05a	2010–11b
1.	Ahmedabad	1,302	2,300	**11.**	Jammu	215	300
2.	Bangalore	1,699	3,700	**12.**	Kanpur	1,100	1,600
3.	Bhopal	574	350	**13.**	Kolkata	2,653	3,670
4.	Bhubaneswar	234	400	**14.**	Lucknow	475	1,200
5.	Chandigarh	326	264	**15.**	Mumbai	5,320	6,500
6.	Chennai	3,036	4,500	**16.**	Patna	511	220
7.	Dehradun	131	220	**17.**	Pune	1,175	1,300
8.	Delhi	5,922	6,800	**18.**	Shilong	45	97
9.	Guwahati	166	204	**19.**	Srinagar	428	550
10	Indore	557	720	**20.**	Varanasi	425	450

Sources: - a- NEERI, Nagpur (2004–2005) and b- CIPET (2010-2011)

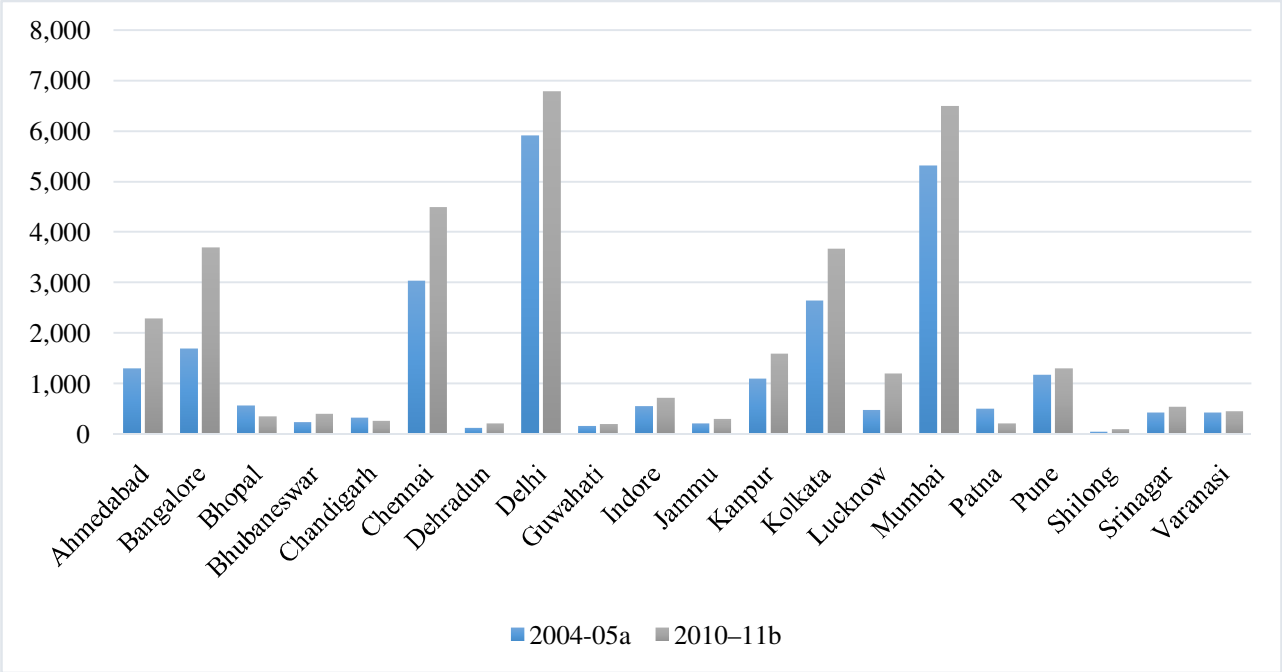

Fig. 2. Municipal Solid Waste Generation in Indian Cities.

Table 1 and Fig. 2 shows, that the generation of municipal solid waste is very high in Delhi, Mumbai, Chennai and Bangalore while the generation of municipal solid waste in Dehradun, Guwahati, and Shilong is very less. It is also observed that Ahmedabad, Bangalore, Chennai, Delhi, Kanpur, Kolkata, Lucknow, Mumbai and pune generate more than 1000 TPD of solid waste. Indore and Srinagar generate waste between 500-1000 TPD and Bhopal, Bhubaneswar, Chandigarh, Dehradun, Guwahati, Jammu, Patna and Shilong generate less than 500 TPD of solid waste.

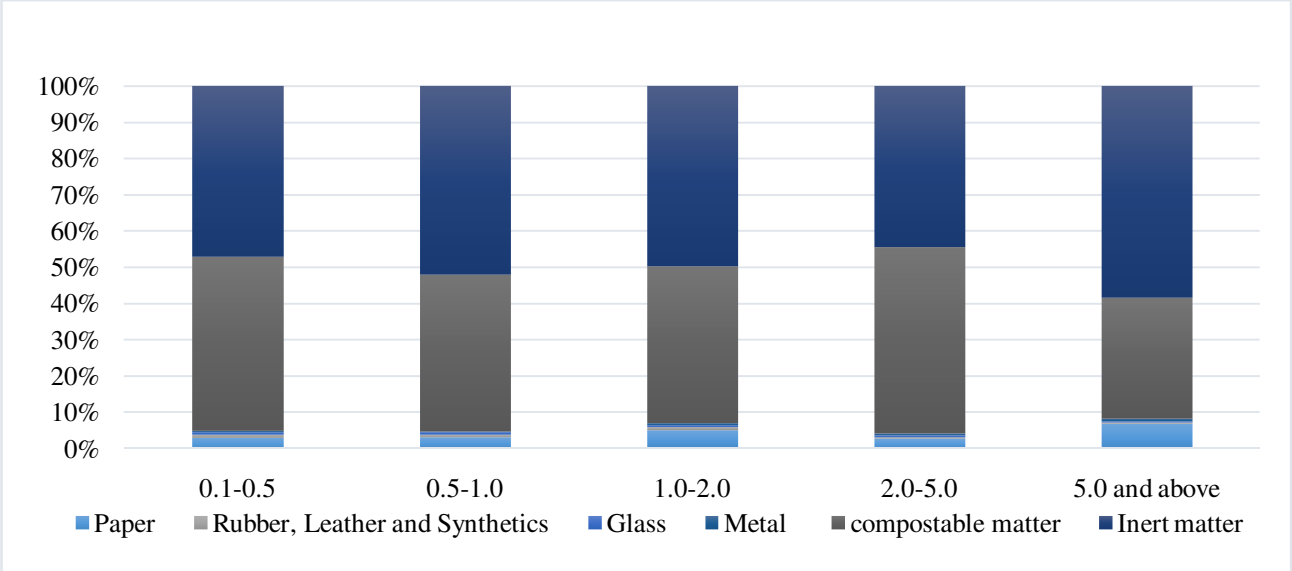

Fig. 3. Composition of MSW in Indian Cities as Per Population Ranges (In Million). Source: - Gupta N. *et. al.* (2015).

As we know that the composition of solid waste depends on a wide range of factors such as food habits, cultural traditions, climate and income (Srivastava *et al.,* 2014; Naveen *et al.,* 2013; Kumar *et al.,* 2009). Here fig. 3show the variation in average composition of solid waste as per the population ranges of Indian city. It shows that the foremost portion of municipal solid waste is compostable materials (40%-60%) and inerts (30%-50%) in Indian cities. It is also observed that the cites with population 0.1-0.5 million has higher fraction of compostable matter and cites with population 5.0 million and above has higher fraction of inert matter. Also, it has been noticed that the percentage of recyclables (paper, glass, plastic and metals) is very low in Indian cities.

III. MUNICIPAL WASTE MANAGEMENT AND PRACTICES IN INDIA

MSWM is very important basic service provided by the Government of India and for its management, usually municipalities and other local bodies are responsible under the Municipal solid waste Management and Handling rules -2000. The entire solid waste management is divided in generation, collection at primary source, transportation to the secondary/ locality storage/community bins, storage at locality level, transport to dumping sites and treatment plants and proper treatment and dumping of solid waste. The following figure shows the current practice of MSWM in Indian cities.

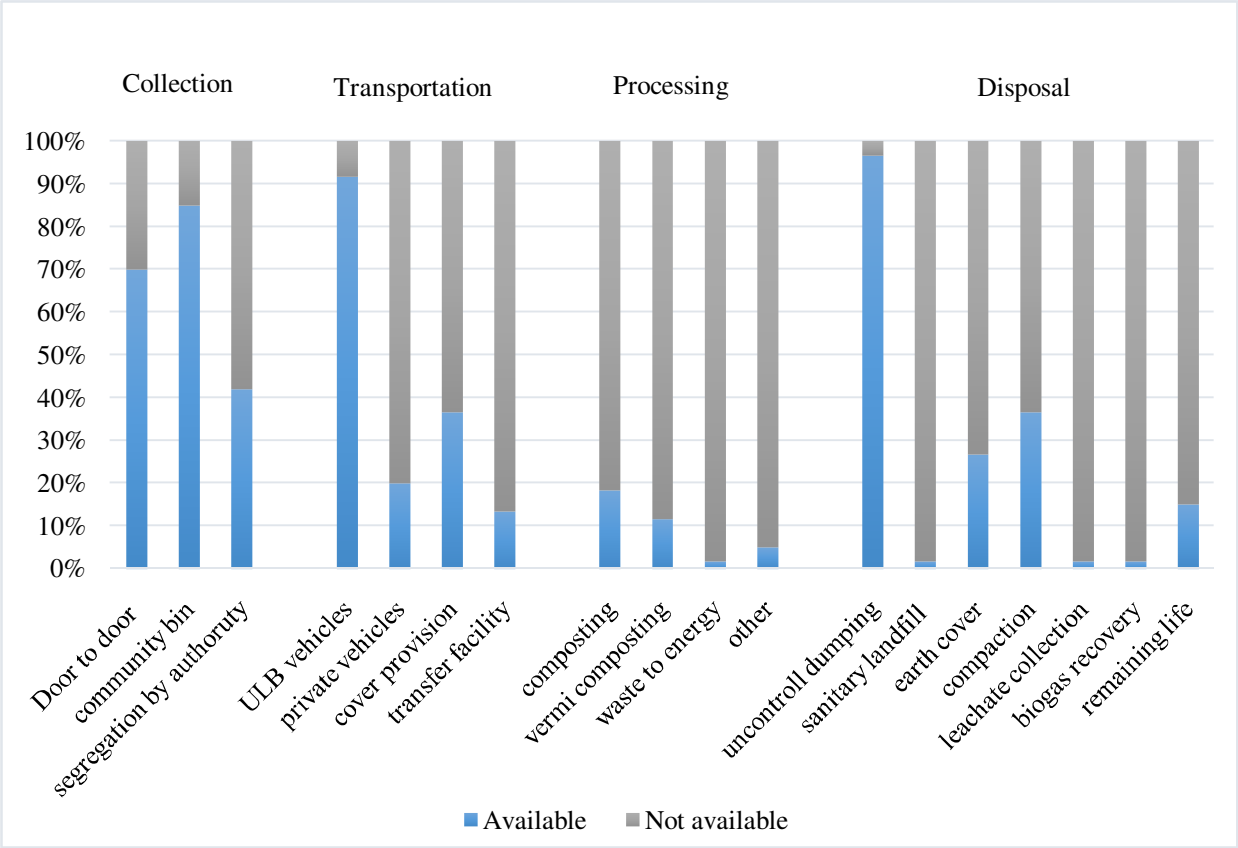

Fig. 4. MSWM Practices in Indian Cities. Source: - Kumar *et al*., (2009).

Fig 4 shows that no cities in India can claim 100% segregation of waste at dwelling unit and by authority and on an average only 70% waste collection is observed form door to door& 82% from community bin, while the remaining waste is again mixed up and lost in the urban environment. it is also observed that only 12% cities have a proper transfer facility. The processing of solid waste through various process like as compositing, vermi composting, waste to energy conversion is generally unavailable in most of the Indian cities. There are no efficient and scientific methods for disposal of solid waste and generally solid waste is disposed off in low-lying areas, outskirts of cities, alongside roads or any vacant place wherever waste collectors find that they will not be seen or objected by anybody. Most of Indian cities (approx. 96% of selected cities) are found with uncontrolling dumping of solid waste.

There are various issues in practice of MSWM in Indian cities such as quite old laws& their poor implementation, no separate department for waste management, lack of labor force, finance constraints & poor finance plan and expenditure, services are not provided to the desired level (Viz D., 2012).

IV. ENVIRONMENTAL IMPACT OF MSW

The poor practice and improper management of solid waste is leads to unsustainability of environment through air, soil, water pollution. The disposal of solid waste in low-lying areas, outskirts of cities, alongside roads or any vacant leads to pollution of aesthetic and visual environment. Uncontrolled burning and improper incineration of MSW contributes considerably to air pollution. Also the generation of greenhouse gases (specially methane CH4) from the decomposition of organic wastes in landfills, are the prime source of air pollution. The direct disposal of solid waste and untreated leachate are the key source of soil and water (surface and ground) contamination (Alam and Ahmade, 2013).

V. CHALLENGES IN MSWM IN INDIA

The major challenges and weakness in practice of municipal solid waste management in India are:

(i) Rapidly increasing population & solid waste respectively

(ii) No provision of integrated solid waste management

(iii) No regulation, laws for disposal & treatment of solid waste and lack of planning

(iv) Lack of financial resources and old equipments & technology

(v) Societal Apathy

VI. CONCLUSION

In India, the generation of solid waste is continuously increasing due to consistent & hasty growth in populations, rapid economic development, industrialization and urbanization. Unfortunately, no Indian city can claim 100% efficiency in practice and management of municipal solid waste, which leads to serious environmental problems and further results in unsustainability. This situation become havoc due to absence of proper regulation, laws for disposal & treatment of solid waste, lack of planning, lack of financial resources, old equipments & technology and societal dispiritedness. Hence to ensure sustainability in a holistic manner, Indian cities should adopt integrated solid waste management with proper laws and citizen participation.

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