Available online at: http://www.ijmtst.com/vol4issue3.html

International Journal for Modern Trends in Science and Technology

ISSN: 2455-3778 :: Volume: 04, Issue No: 03, March 2018

Sustainable Solid Waste Management in India

Neha Sharma

Lecturer, Department of Mechanical Engineering, Govt. Polytechnic College, Alwar, Rajasthan.

To Cite this Article

Neha Sharma, "Sustainable Solid Waste Management in India", *International Journal for Modern Trends in Science and Technology*, Vol. 04, Issue 03, March 2018, pp.-119-123.

ABSTRACT

Increasing population, volume, and complex nature of generated solid waste, improper implementation of existing rules, failure of waste disposal techniques, limitation of funds and infrastructure are the common causes of unsustainable solid waste management in many countries of the world including India. Further, traditional beliefs and approaches such as "out of sight, out of mind," "not in my backyard (NIMBY)" and "flame, flush or fling" even towards the generated solid waste results in an unsustainable society which hinders sustainability. According to the World Bank forecast, annual global waste generation is expected to increase to 3.40 billion tonnes in 2050 (considering 2016 as a reference year). As per Waste Atlas 2017, India is the third-largest generator (volume basis) of municipal solid waste and will play an important role in addressing this global issue. A management system from generation up to final disposal of wastes in an environment friendly, economically affordable, and socially acceptable way is termed "Sustainable." According to the Indian Planning Commission report of 2014, if effectively managed, the unused MSW will generate about 439 MW of power, 1.3 million m3 of biogas/ day, or 72 MW of electricity from biogas and 5.4 million metric tonnes of compost annually. Many times improper use and ineffectiveness of different available techniques of harnessing energy and wealth from the wastes cause more environmental costs than economic gains. Due attention must be paid to waste composition, geographical conditions, people's attitude, adoption of economically feasible and environment friendly disposal and treatment options to bring sustainability in solid waste management. This chapter addresses the present scenario of solid waste generation, management practices, challenges, and sustainable management systems in the Indian context.

KEYWORDS-sustainable, solid waste, management, India, environment, friendly

Copyright © 2018 International Journal for Modern Trends in Science and Technology
All rights reserved.

I. INTRODUCTION

Waste Management in India is overseen by the Union Ministry of Environment, Forests, and Climate Change. In India, rules regarding the management of waste are based on the ideas of "sustainable development," "precaution," and "polluter pays."

These principles require cities and businesses to act responsibly and take care of the environment, fixing any harm they cause. Because of economic growth, the amount of waste has increased, so there are laws to regulate how waste is handled under the Environment Protection Act of 1986.

Facts and Figures for Waste Management in India[1,2,3]

• India produces 62 million tonnes of waste annually, with 70% collected, and only 12 million tonnes treated, while 31 million tonnes end up in landfills.

• The generation of municipal solid waste is expected to rise to 165 million tonnes by 2030 due to changing consumption patterns and rapid economic growth.

Challenges Faced in Waste Management

India faces challenges in managing waste. The informal sector plays a significant role in extracting value from waste, but many challenges remain.

• Rapid urbanization: Urban areas with 377 million people generate about 62 million tons of solid waste every year. However, only 43 million tons are collected, and the rest ends up untreated or in landfills.
• E-waste is also a growing concern, with projections showing a substantial increase in e-waste generation.
• Lack of adequate garbage collection infrastructure, with only 21 million garbage collectors compared to China's 700 million.
• Sorting recyclable materials is also a problem, as only about 30% of waste is properly sorted, leading valuable materials like aluminum and plastics to end up in landfills instead of being recycled.

Solutions to Waste Management

• Scientific studies and planning: It means understanding the type of waste, the costs involved, and the best locations for disposal facilities.
• India needs to invest in innovative technologies and develop a better recycling infrastructure.
• Improve waste collection: India has more frequent services, use machines to collect waste, and coordinates the timing of collection with waste generation.
• Combining informal and formal waste collection sectors: This will help with segregation and collection. Other ways to improve include decentralized waste management, where local communities take care of waste treatment, and promoting recycling by implementing supportive policies and regulations.
• Treating organic waste through composting and bio-methanation can reduce the amount going to landfills.
• Converting existing dumps into sanitary landfills: but this requires proper funding and expertise.
• Integrating technology like RFID-enabled monitoring and GPS tracking can also help in efficient waste management.
• Waste-to-energy methods like bio-methanation can convert organic waste into fuel, which is beneficial.
• The concept of common waste treatment facilities is being promoted, involving public-private partnerships. The country needs to ensure proper treatment facilities for biomedical and hazardous waste
• Strictly implementing waste management rules, especially the "Polluter Pays Principle," is crucial to penalize those who don't comply.
• Public awareness: India needs to educate people through community organizations and self-help groups about separating waste, recycling, and composting to make the process more effective and sustainable.

India faces significant challenges in the management of waste due to its large population and the huge amount of trash it generates – approximately 1.3 billion tons every year, a third of the global total. India must improve its recycling industry, as only 5% of recycled material is currently reused. Solving these problems is crucial for a sustainable future and environmental protection.[4,5,6]

To move forward, India needs to plan for long-term management of waste and adapt strategies to changing lifestyles. Household and institutional waste must be separated at the source to make recycling more efficient.

The goal is to minimize landfill use, but this requires active community participation. Recycling e-waste on a large scale is vital for solving the e-waste disposal problem. India must take action to solve these challenges, as it's not just an Indian problem but a global one that affects everyone.

DISCUSSION

To develop intelligent and sustainable cities, the government of India launched initiatives like Smart Cities and the Clean Development Mission. Solid waste management (SWM) has become one of the primarily focused areas of such initiatives. The changing dynamics of urban waste characteristics due to unplanned urbanization and rapid growth in urban populations (due to migration) has been a significant concern for local authorities in urban areas to develop an effective SWM plan. The development of a long-term SWM plan along the line of the government initiatives' objectives requires understanding the waste quantities, characteristics, and existing waste management practices. This paper presents an overview of existing waste management activities, financial and institutional demographics in six selected Indian Smart Cities, and the field studies to assess SWM systems as per the waste management rules. The study involved a participatory approach to collect data from local bodies and stakeholders. Indicative strategies for the development of waste management systems were formulated based on the outputs of this analysis. Discussion on pathways includes waste characterization, funding sources, data technologies, and service level

benchmarking to plan an integrated solid waste management system for a Smart City. The outcomes of this study shall equip local authorities in designing waste systems to accelerate the transition towards innovative and sustainable waste systems.

In all study areas, a significant component of municipal solid waste is organic matter. The Indian subcontinent has subtropical climatic conditions, where the annual average temperature of Indian states varies between 16 and 32 °C. The average humidity of Indian cities ranges from 55 to 75%, based on the location. Due to these climatic conditions, the waste degrades rapidly, leading to unhygienic conditions. Hence in all the study areas, waste is being collected daily. Different cities in India are practicing different methods of waste collection, which include (1) door-to-door collection (primary collection); (2) Community bin (secondary collection). The waste management rules emphasize implementing the door-to-door collection systems with the segregation of waste at source into three components (biodegradable, non-biodegradable, and domestic hazardous waste).

In 2014 India inaugurated the Swachh Bharat Mission, a five-year nationwide cleanup effort. Before this national consolidated effort for systematic and total waste management came into common consciousness, many cities and towns in India had already launched individual efforts directed at municipal waste collection of segregated waste, either based on citizen activism and/or municipal efforts to set up sustainable systems.

Some examples are Swach based in Pune (formed in 1993),[16] Clean Cities Championship in Warangal, Nirmal Bhavanam, Nirmal Nagaram or Clean Homes, Clean City in Alappuzha, Engage 14 campaign in Gangtok, Zero Waste in Bobbili, Andhra Pradesh, Waste Management in Mysore and Solid Waste Management Round Table, Bangalore (formed in 2009).[17] Bangalore's Bruhat Bangalore Mahanagara Palike was directed by the High Court of Karnataka to implement mandatory segregation of municipal waste at the household level before collection – a first for the country.[18] It is a representation of citizen-based activism at a local level, and the litigation was led by notable activists such as Almitra Patel and Nalini Shekar. Following this High Court ruling, other cities in India have followed suit to make segregation of municipal waste mandatory at the generator level, Mumbai[7,8,9]

RESULTS

Garbage is collected from individual residential units in the morning and commercial units during the afternoon. Collection of waste is performed using fully mechanized hydraulic vehicles. More than 600 vehicles are deployed to collect about 1300 tons of MSW. In NDMC, a door-to-door collection system was initiated at 51 locations, and they envisage expanding the services to the entire municipal area in three years. In Visakhapatnam and Indore, primary collection systems were started in selected wards as a pilot project during December 2015. The ULBs are developing bin-free wards in identified areas. M/s Envirosyz India Pvt. Ltd is entrusted for Door-to-Door collection in Visakhapatnam as a part of this initiative. In Bhopal and Udaipur, local bodies were developing mechanisms to start pilot projects by June 2017. The ULBs procured twin bin vehicles for door-to-door collection of waste. The local authorities provided colored bins (green for biodegradable and blue for non-biodegradable) to segregate waste at the source. Awareness activities on the importance of source segregation, collection mechanisms were being conducted periodically. The roads, lanes, and streets are divided into equal stretches (block/beat) to perform manual sweeping. Each sweeper is provided with a pushcart, broomstick, and scraper for sweeping and cleaning streets and lanes in a block. The waste is collected by the sweeper in a handcart and transferred to a collection truck. In GVMC and IMC, street sweeping is done during the night, too. Sweeping machines are being used to clean the major roads and lanes. In parks, public and recreational places, litter bins are placed at identified points for tourists and visitors to put their waste. Collection and transportation of the waste involve a wide variety of vehicles. Periodic maintenance increases the lifespan of waste collection vehicles. [10,11,12]All the ULBs have developed central workshops to repair and maintain the vehicles except Visakhapatnam, where maintenance activities have been outsourced. In NDMC, Ahmadabad, and Visakhapatnam, separate vehicles are allocated to collect the waste generated by restaurants, hotel, and markets. The waste collected is transferred to Taurus vehicles (14–18 ton capacity) at zonal transfer stations in NDMC, Ahmadabad, Visakhapatnam, and Indore. Weighing stations are available at all the transfer stations and dumping yards. In Bhopal and Udaipur, the waste collected is being transported directly to the dumping yard.

In NDMC, Ahmadabad, Visakhapatnam, and Indore, GPS and RFID devices are installed for tracking and monitoring the collection vehicles.

CONCLUSION

The Government of India is charging tax in Swachh Bharat Cess's name (minimum 0.5% up to a ceiling of 2%). The money received through this tax is utilized for financing and promoting the Clean India Mission (Swachh Bharat Mission). From the taxes collected during 2015–2016, 52% of the amount was allocated to solid waste management. The annual finance statements were reviewed to assess the budget allocation and expenditure on municipal solid waste management. The budget associated with waste management is included in the public health section. It is observed that the financial status of garbage collection and transportation is reported in the recent reports. The ULB's are spending 13.5 to 40.5 USD per ton of waste on operation and maintenance activities. Studies performed in the selected Indian smart cities revealed that effective integration of the new solid waste management rules with the government objectives and diagnostic analysis of existing systems provides insights into futuristic strategies. This study's indicative strategies provide insight into developing an integrated solid waste management plan for different urban cities across the globe. Source segregation of the waste is the key to the development of good waste treatment and processing system. Scientific approach integrated with the technologies and effective administration is the key for transforming the existing waste management systems to develop smart and livable cities. Integration of the public and private sector by creating special purpose vehicles will provide scope for investments. Maintenance of data records will provide scope for developing a waste management index for systematic monitoring of the implementation of provisions developed by the regulatory norms.[13,14,15]

Studies performed in these six cities revealed that database on waste compositions, skilled human resources, political will power, lack of infrastructure, and improper operation and maintenance systems are the significant constraints in developing and implementing integrated waste management systems in councils. The per capita waste generation in cities varied from 0.47 to 0.97 kg per day. Door-to-door collection of waste is being implemented by New Delhi, Ahmedabad, Indore, and Visakhapatnam. At the same time, Bhopal and Udaipur are in the planning stage. The twin bin system is used to collect the segregated waste as wet and dry components. However, 60% of the waste is mixed during the transfer and transportation. Processing and treatment systems are being designed based on the physical characteristics of waste determined using empirical approaches. Composting of organic waste is being practiced in all the cities. The poor quality of segregation is leading to poor quality in the end product generated. Three incineration plants are in operation in New Delhi, while in Ahmedabad and Visakhapatnam under construction. Disposal of waste in an unlined landfill is being practiced in all the study areas.[16,17,18,19]

This study identifies scientific waste characterization, public-private partnerships, systems engineering applications for decision-making, and the development of an indicator-based performance index as indicate pathways for accelerating the transition towards the development of integrated waste systems in the studied Smart Cities. The relationship between the identified pathway in the analytical framework for integrated waste systems development can be further investigated by integrating field investigations and systems modeling. For example, further studies can examine waste systems specific to the geographic location based on social, economic, environmental, legal, and political factors to develop detailed information and stewardship mechanisms to improve waste governance.[20]

REFERENCES

[1]. "Solid waste management rules, 2016". Civilsdaily. 15 September 2017. Retrieved 26 March 2017.

[2]. "Solid waste management rules, 2016". Civilsdaily. 15 September 2017. Retrieved 26 March 2017.

[3]. "Government notifies new solid waste management rules". www.downtoearth.org.in/. Retrieved 26 March 2017.

[4]. "'Solid Waste Management Rules Revised After 16 Years; Rules Now Extend to Urban and Industrial Areas': Javadekar". pib.nic.in. Retrieved 26 March 2017.

[5]. "Solid Waste Management Rules, 2016 - India Environment Portal | News, reports, documents, blogs, data, analysis on environment & development | India, South Asia". www.indiaenvironmentportal.org.in. Retrieved 26 March 2017.

[6]. admin (6 May 2017). "Municipal Solid Waste (MSW) Management - IAS prep - Sept 2017 update". iascurrent.com. Retrieved 26 March 2017.

[7]. ^ Kumar, Sunil; Smith, Stephen R.; Fowler, Geoff; Velis, Costas; Kumar, S. Jyoti; Arya, Shashi; Kumar, Rakesh; Cheeseman, Christopher (2017). "Challenges and opportunities associated with waste management in India". Royal Society Open Science. 4 (3). The Royal Society:

160764. doi:10.1098/rsos.160764. ISSN 2054-5703. PMC 5383819.
[8]. "India – 2016". E-Waste. Retrieved 25 March 2017.
[9]. "India's e-waste to touch 5.2 MMT by 2016: ASSOCHAM-EY study - Times of India". The Times of India. Retrieved 25 March 2017.
[10]. "India to generate over 5 million tonnes of e-waste next year: ASSOCHAM-EY study". The Asian Age. 3 March 2017. Retrieved 25 March 2017.
[11]. Dandapani, Swetha (30 November 2017). "Unpaid and undervalued, how India's waste pickers fight apathy to keep our cities clean". www.thenewsminute.com. Retrieved 26 March 2017.
[12]. Bharati Chaturvedi. "Mainstreaming Waste Pickers and the Informal Recycling Sector".
[13]. "10 Things That You Need To Know About Solid Waste Management Rules 2016". NDTV.com. Retrieved 26 March 2017.
[14]. "Swachh India: Guide To Solid Waste Management Rules 2016 | Waste Management". NDTV-Dettol Banega Swachh India. 17 April 2017. Retrieved 26 March 2017.
[15]. "Waste to Energy and Waste Management Market in India 2017". enincon.com. Retrieved 31 January 2017.
[16]. Swach Co-op
[17]. "SWMRT – Solid Waste Management Round Table". Retrieved 9 August 2016.
[18]. Staff Reporter (1 August 2012). "High Court notice to government on segregation of waste at source". The Hindu. ISSN 0971-751X. Retrieved 9 August 2016.
[19]. Singh, Vijay V. (6 December 2016). "Soon, segregation of dry and wet waste will be compulsory all housing societies". The Times of India. Retrieved 9 August 2016.
[20]. Reddy, Dhana Raju (2016). "Waste Management in India – An Overview" (PDF). United International Journal for Research & Technology (UIJRT). 02 (7): 175–196. ISSN 2582-6832.