



Regulations And Disposal Techniques In Solid Waste Management: Insights From Maharashtra, India

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ABSTRACT

Maharashtra is facing increasing challenges in meeting the infrastructural demands of its rapidly growing urban population. Effective waste management remains a critical concern for industrial, commercial, and institutional (ICI) sectors, particularly as waste generation continues to rise. While municipal bodies primarily regulate solid waste management through local legislation and policies, several state-level regulations also play a significant role. Most organizations are now required to adopt sustainable practices such as waste reduction, recycling, and composting. This paper focuses on the treatment and management of Municipal Solid Waste (MSW) in Maharashtra, highlighting the crucial role of source segregation into dry and wet waste. It further emphasizes the importance of relevant legislative frameworks and the adoption of appropriate recycling, reuse, and scientific disposal techniques to ensure efficient and sustainable solid waste management.

Key Words: Solid waste, segregation, legislation, waste management, scientific disposal

Introduction:

The Swachh Bharat Mission represents a bold and forward-looking initiative aimed at addressing one of India's major urban challenges by promoting the scientific processing and disposal of Municipal Solid Waste (MSW) (MoHUA, 2016). Maharashtra, among the most urbanized states in the country, faces mounting pressure to meet the infrastructure needs of its rapidly expanding urban population (Government of Maharashtra, 2020). Implementing Solid Waste Management (SWM) through scientific methods is essential for maintaining quality of life and fostering healthier, greener urban environments (CPCB, 2020).

In the context of large-scale industrial production and the resulting environmental impacts, waste management has become a significant challenge for the industrial, commercial, and institutional (ICI) sectors (World Bank, 2018). These organizations must handle diverse materials, large quantities of waste, and the varied behaviors of employees, customers, visitors, and students from within and outside the state. Although no single approach can meet the needs of all ICI establishments, adopting a strategic solid waste management plan can help generate effective, adaptable solutions (Sharholy et al., 2008).

Integrated waste resource management encourages organizations to develop comprehensive, flexible strategies that can evolve with changes in economic conditions, social dynamics, material composition, and environmental factors (Planning Commission of India, 2014). While municipal bodies are primarily responsible for regulating waste management through local policies and legislation, state-level regulations also play a crucial role (MoEFCC, 2016). Additionally, the operational logistics involved in handling waste form a key component in designing an efficient and practical waste management system. The equipment, human resources, and budgetary requirements of the plan must be considered throughout its design, implementation, monitoring, and modification phases. Most organizations require authorized service providers for handling commercial waste, recycling, and composting (CPCB, 2020). This paper focuses on the treatment of Municipal Solid Waste and emphasizes the importance of source segregation into dry and wet waste, guided by legislation, and identifies appropriate technological options based on population categories to support effective MSW treatment and achieve the stated objectives.

Study Area:

Major municipal corporations of Maharashtra are considered here for the assessment of solid waste management. Maharashtra is extended 15°40' to 22°00' North latitude and 72°30' to 80°30' East Longitude.

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Geographically State has a total of 3, 07,713 sq.km areas. There are 262 local bodies, comprising of 26 Municipal corporations, 13- A class Municipal councils, 57-B class Municipal councils, 151- C class Municipal councils, 06-Nagar panchayats, and 06- Cantonment Boards. Maharashtra generates 82.38 lakh metric tonnes (MT) of waste per annum or 22,570 MT waste each day, of which 44% is being treated. The second largest waste generator is Uttar Pradesh (61.3 lakh MT).

Objectives of Study:

1. To examine the existing laws and regulatory frameworks governing solid waste management in Maharashtra.
2. To analyse the roles and responsibilities of various stakeholders involved in waste generation.

Research Methodology and Data Sources:

To study solid waste management, secondary data sources are used, i.e., reference books, research papers, government publications, newspapers, and magazines.

Discussion:

i) Definition of Solid Waste:

The term “solid waste” means any garbage, refuse, sludge from a waste treatment plant, water supply treatment plant, or air pollution control facility and other discarded material, including solid, liquid, semisolid, or contained gaseous material resulting from industrial, commercial, mining, and agricultural operations, and from community activities, but does not include solid or dissolved materials in domestic sewage.

“The solid waste includes residential, light industrial, commercial and industrial waste that is collected by a municipality or by contracted collectors on behalf of the municipality”.

Table: 1 Sources of Waste, Waste Generators and Solid Waste Contents

Source	Typical waste generators	Solid waste contents
Residential	Single and multifamily dwellings,	Food wastes, paper, cardboard, plastics, textiles, leather, wood, glass, metals, ashes, electronics, batteries, oil, tires, and household hazardous wastes.
Commercial	Stores, hotels, restaurants, markets, office buildings	Paper, cardboard, plastics, wood, food wastes, glass, metals, special wastes, hazardous wastes
Institutional	Educational institutions, hospitals, Administrative centres	Paper, cardboard, plastics, wood, food wastes, glass, metals, special wastes, medical and hazardous wastes.
Construction and demolition	New construction sites, road repair, renovation sites, demolition of buildings	Wooden materials, glass, steel, concrete, etc.
Municipal Services	Street cleaning, landscaping, parks, beaches, other recreational areas, water and wastewater treatment plants.	Street sweepings; drain silt; landscape and tree trimmings; general wastes from parks, beaches, and other recreational areas; sludge

Source: *What a waste: Solid waste Management in Asia*, Hoornweg, Daninel with Laura Thomas, (1999)

ii) Types and Sources of Municipal Solid Waste:

Municipal solid waste (MSW), also called Urban Solid Waste, and is a waste type that includes predominantly household waste (domestic waste) with sometimes the addition of commercial wastes, construction and demolition debris, sanitation residue, and waste from streets collected by a municipality within a given area (Table 1). They are in either solid or semisolid form and exclude industrial hazardous wastes and bio-medical waste. MSW can be broadly categorized into four broad categories such as:

- a) Biodegradable waste:** food and kitchen waste, green waste i.e. vegetables, flowers, leaves, fruits and paper.
- b) Recyclable material:** paper, glass, bottles, cans, metals, certain plastics, etc.

- c) Inert waste:** construction and demolition waste, dirt, rocks, street sweeping, drain silt, debris.
- d) Domestic hazardous waste** (also called "household hazardous waste") and toxic waste: medication, e-waste, paints, chemicals, incandescent bulbs, fluorescent tubes, spray cans, fertilizer and pesticide containers, batteries, shoe polish.

iii) Legislation:

India has Environment (Protection) Act, 1986, the Water (Prevention and Control of Pollution) Act, 1974, Water (Prevention and Control of Pollution) Cess Act, 1977 and the Air (prevention and Control of Pollution) Act, 1981. Maharashtra Non-Biodegradable Garbage (Control) Act 2006:

Garbage (control) Act 2006 to regulate the non-biodegradable municipal solid waste generated in the urban areas. As per Maharashtra Municipal Solid Waste Rules 2006[5], notified under this Act; no person, by himself or through another shall knowingly or otherwise throw/ cause to throw any non-biodegradable garbage, Construction debris or any biodegradable garbage in any drain, ventilation shaft, pipe & fittings, sewage lines, natural or manmade lake, wetlands; which is likely to interrupt the drainage & sewage system, interfere with the free flow or affect the treatment & disposal of drain & sewage contents, be dangerous or cause a nuisance or be prejudicial to public health and damage the lake, river water and wetland. Also no person shall knowingly or otherwise, place or permit to place any biodegradable or non-biodegradable garbage in any public place or open to public view.

a) Maharashtra Plastic Carry Bags (Manufacture and Usage) Rules 2006:

To minimize the environment and health impact of plastic waste State government issued Maharashtra plastic Carry Bags (Manufacture and Usage) Rules 2006 under Maharashtra Non- biodegradable Garbage Control Act 2006 [1]. To control plastic waste generation, manufacturing (and stocking, distributing or selling) plastic carry bags made of virgin or recycled plastic of thickness less than 50 micron and of the size 8 x 12 inches are banned in Maharashtra state.

b) Direction of Hon'ble National Green Tribunal (NGT):

Hon'ble NGT in OA No 199 of 2014 (Almitra H. Patel Vs Union of India) on 5th February, 2015 directed that "The Central Pollution Control Board shall submit its independent comment in relation to formulation of a national policy with regard to collection and disposal of a municipal solid waste as a National policy to be adopted [2].

c) Municipal Solid Waste (Management & Handling) Rule:

The Ministry of Environment and Forest has notified to the Municipal Solid Waste (Management & Handling) Rule, 2000 under the Environment (Protection) Act, 1986 to manage the Municipal Solid Waste (MSW) generated in the country [3]. According to this rule there is specific provision for collection, segregation, storage, transportation, treatment and disposal of MSW & it applies to all Municipal Authorities. There is special provision listed in MSW rule for collection of Municipal solid wastes. Littering of municipal solid waste shall be prohibited in cities, metropolis and in urban areas notified by the State Governments. To prohibit littering and facilitate compliance, the following steps shall be taken by the Municipal Authority: i) Organizing house-to-house collection of municipal solid wastes through any of the methods, like community bin collection (central bin), house-to-house collection, collection on regular pre-informed timings and scheduling by using bell ringing of musical vehicle (without exceeding permissible noise levels);

- (ii) Devising collection of waste from slums and squatter areas or localities including hotels, restaurants, office complexes and commercial areas;
- (iii) Wastes from slaughter houses, meat and fish markets, fruits and vegetable markets, which are biodegradable in nature shall be managed to make use of such wastes;
- (iv) Bio-medical wastes and industrial wastes shall not be mixed with municipal solid wastes and such wastes shall follow the rules separately specified for the purpose.
- (v) Collected waste from residential and other areas shall be transferred to community bin by hand-driven containerized carts or other small vehicles;
- (vi) Horticultural and construction or demolition wastes, or debris shall be separately collected and disposed off following proper norms. Similarly, wastes generated at dairies shall be regulated in accordance with the State laws;
- (vii) Waste (garbage, dry leaves) shall not be burnt;
- (viii) Stray animals shall not be allowed to move around waste storage facilities or at any other place in the city or town and shall be managed in accordance with the State laws.

The Municipal authority shall notify waste collection schedule and the likely method to be adopted for public benefit in a city or town. It shall be the responsibility of generator of waste to avoid littering and ensure delivery of wastes in accordance with the collection and segregation system to be notified by the municipal authority.

d) Duties of waste generators/ every waste generator shall observe the following principles:

- i) Segregate and store the waste generated by them in three separate streams namely bio- degradable, non-biodegradable, and domestic hazardous wastes in suitable bins and handover segregated wastes to authorised waste pickers or waste collectors as per the direction or notification by the local authorities from time to time.
- ii) Cover securely the used sanitary waste like diapers, sanitary pads etc., in the pouches provided by the manufacturers or brand owners of these products or in a suitable wrapping material as instructed by the local authorities and shall place the same in the bin meant for dry waste or non- bio-degradable waste;
- iii) Deposit separately construction and demolition waste, as and when generated, in his own premises and shall dispose off as per the Construction and Demolition Waste Management Rules, 2016 [4].
- (iv) Store horticulture waste and garden waste generated from his premises separately in his own premises and dispose of as per the directions of the local body from time to time.
- v) No waste generator shall throw, burn or burry the solid waste generated by him, on streets, open public places outside his premises or in the drain or water bodies.
- vi) All waste generators shall pay such user fee for solid waste management, as specified in the byelaws of the local bodies.
- vii) No person shall organise an event or gathering of more than one hundred persons at any unlicensed place without intimating the local body, at least three working days in advance and such person or the organiser of such event shall ensure segregation of waste at source and handing over of segregated waste to waste collector or agency as specified by the local body.
- viii) Every street vendor shall keep suitable containers designed for storage of waste generated during the course of his activity such as food waste, disposable plates, cups, cans, wrappers, coconut shells, leftover food, vegetables, fruits, etc., and shall deposit such waste at waste storage depot or container or vehicle as notified by the local body.
- ix) All resident welfare and market associations shall, within one year from the date of notification of these rules and in partnership with the local body ensure segregation of waste at source by the generators as prescribed in these rules, facilitate collection of segregated waste in separate streams, handover recyclable material to either the authorised waste pickers or the authorised recyclers. The bio-degradable waste shall be processed, treated and disposed off through composting or bio-methanation within the premises as far as possible. The residual waste shall be given to the waste collectors or agency as directed by the local body.
- x) All Gated Communities and Institutions with more than 5,000 sq. metre area shall, within one year from the date of notification of these rules and in partnership with the local body, ensure segregation of waste at source by the generators as prescribed in these rules, facilitate collection of segregated waste in separate streams, handover recyclable material to either the authorised waste pickers or the authorized recyclers. The bio-degradable waste shall be processed, treated and disposed off through composting or bio-methanation within the premises as far as possible. The residual waste shall be given to the waste collectors or agency as directed by the local body.
- xi) All hotels and restaurants shall, within one year from the date of notification of these rules and in partnership with the local body ensure segregation of waste at source as prescribed in these rules, facilitate collection of segregated waste in separate streams, handover recyclable material to either the authorised waste pickers or the authorised recyclers. The bio-degradable waste shall be processed, treated and disposed off through composting or bio-methanation within the premises as far as possible. The residual waste shall be given to the waste collectors or agency as directed by the local body.

The role of the citizens have to be trained in the three 'Rs' with respect to management of waste are reduce, reuse and recycle [5].

iv) Collection and Disposal Techniques of Solid Waste:

Waste collection is the collection of solid waste from source point (residential, industrial, commercial, institutional) to point treatment or disposal (Table 2). Municipal solid waste is collected in several ways:

1. **House-to-House:** Waste collectors visit each individual house to collect garbage. The user generally pays a fee for this service.
2. **Community Bins:** Users bring their garbage to community bins that are placed at fixed points in a neighbourhood or locality. MSW is picked up by the municipality, or its designate, according to a set schedule.
3. **Curb side Pick-Up:** Users leave their garbage directly outside their homes according to a garbage pick-up schedule set with the local authorities (secondary house to house collectors not typical).
4. **Self Delivered:** Generators deliver the waste directly to disposal sites or transfer stations, or hire third-party operators (or the municipality).
5. **Contracted or Delegated Service:** Businesses hire firms (or municipality with municipal facilities) who arrange collection schedules and charges with customers.

Table: 2 Disposal Techniques of Solid Waste

i)	Open burning	vi) Ploughing in fields
ii)	Dumping into the sea	vii) Hog feeding
iii)	Sanitary Landfills	viii) Grinding and discharging into sewers
iv)	Incineration	ix) Salvaging
v)	Composting	x) Fermentation and biological digestion

v) Status of Solid Waste Management in Maharashtra:

Maharashtra is second largest state in India in terms of population and third in terms of area having a population 11.24 crore and a spread over of 3.08 lakh sq. km as per Census 2011. Maharashtra is also the second most urbanised state in India. Maharashtra has 35 districts, divided into six revenue divisions for administrative purposes including Konkan, Pune, Nashik, Aurangabad, Amravati and Nagpur. Local self-governance institutions in rural areas include 33 Zilla Parishads, 355 Panchayat Samitis and 27,993 Gram Panchayats. Urban areas in the state consists of 258 Urban Local Bodies 239 Municipal Corporations/ Councils, 7 Nagar Panchayats and 6 Cantonment Boards.

Disposal is referred to the 'different treatments which are given to the waste for avoiding environmental & health hazards' (table:2). Success of Solid Waste Management System is directly related to Disposal efficiency. According to mpcb (2008), Municipal corporations are used different mode of solid waste disposal techniques, i.e. composting techniques used by Mumbai Municipal Corporation, landfill techniques applied by the MNC's of Thane, Ulhanagar, Nagpur, Amravati and Mira- Bhyander. Dumping ground techniques adopted by the MNC's of Kalyan Dombivali, Malegaon, Jalgaon, Dhule, Aurangabad, Nanded Waghala, Bhivandi Nijampur and Akola, whereas dumping and composting techniques applied by Pimpri Chinchwad and Solapur MNC's.

Conclusion:

Scientific Solid Waste Management (SWM) is essential for maintaining a good quality of life and creating healthier, greener surroundings. Despite this, managing waste remains a major challenge for the industrial, commercial, and institutional (ICI) sectors. Solid waste is generated from multiple sources such as residential areas, recreational facilities, commercial establishments, industries, and construction and demolition activities. Municipal Solid Waste (MSW) is broadly classified into four categories: biodegradable waste, recyclable materials, inert waste, and hazardous waste.

India has established several environmental legislations to protect the environment, including the Environment (Protection) Act, 1986; the Water (Prevention and Control of Pollution) Act, 1974; the Water Cess Act, 1977; and the Air (Prevention and Control of Pollution) Act, 1981. In Maharashtra, waste management is further regulated through state-level rules such as the Maharashtra Non-Biodegradable Garbage (Control) Act, 2006; the Maharashtra Plastic Carry Bags (Manufacture and Usage) Rules, 2006; directions issued by the National Green Tribunal (NGT); the Municipal Solid Waste (Management & Handling) Rules; and clearly defined duties for waste generators.

Although these policies and regulations provide a strong framework for solid waste management, their success depends on effective implementation and public participation. Greater awareness, consistent monitoring, and strict enforcement are essential to minimize the hazards associated with solid waste and to reduce environmental pollution. Strengthening these efforts will help Maharashtra achieve more sustainable and efficient waste management outcomes.

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