



## An Overview Of Solid Waste Management Practices, Challenges, And Opportunities With Special Reference To Pune City

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### Abstract:

Waste generation is a serious global problem that impacts the environment, people's health, and the economy. As cities grow rapidly, industries expand, and people's habits and lifestyles change, the amount of waste we produce has increased significantly. This includes everything from household garbage to industrial and electronic waste. If waste is not managed properly, it can lead to harmful effects such as pollution of air, water, and soil, which in turn affects ecosystems and human well-being. Uncontrolled waste can also create health hazards, like the spread of diseases in areas with poor sanitation<sup>i</sup>. Additionally, improper waste management can strain local economies due to the high costs of cleanup, disposal, and environmental damage. To address these issues, it is crucial to find better ways to handle waste, such as reducing what we throw away, recycling materials, and adopting sustainable practices in production and consumption. Efficient waste management not only minimizes these negative impacts but also helps conserve resources and create a healthier environment for everyone. This paper focuses on the overview of Solid waste generation and its management in Pune city.

**Key Words:** Waste Generation, Segregation, Solid Waste Management, Recycling, Waste Collection, Sustainability.

### Introduction:

In today's age, we see there are lots of economic activities that are going on like construction, production, rendering services and facilities. These activities and tasks need some input to carry out their process. In the process of completing these tasks human beings create a lot of waste. What exactly is waste? Waste is nothing but unwanted or unusable material. Waste is anything that can't be used again or is discarded after its primary use, something which is not useful, not worthy, defective. All these can be termed as waste<sup>ii</sup>.

Waste is a major source of harmful pollutants that affect the climate. It is the third-largest human-made source of

methane, a gas that contributes to climate change and ozone pollution. Burning waste in the open and using polluting collection vehicles release black carbon, a dangerous air pollutant that is part of fine particulate matter (PM2.5)<sup>iii</sup>. Poorly managed waste can also release toxins and harmful microbes, polluting the air, soil, and water. Managing, separating, and treating waste properly is essential to reduce its harmful effects on the environment and people's health<sup>iv</sup>.

Waste can have very hazardous effects on human life and the surrounding as well. Waste can lead to spread of disease and can cause unhygienic conditions in the environment. Waste materials can be treated well if there is an

efficient system for the same. As we can see, day to day, there are different types of solid waste namely medical waste, industrial waste, wet waste, E- waste (electronic waste). Each type of waste has a different way of treating as their nature and composition is different. Each type of waste has a different method of being collected, segregated and treated<sup>v</sup>. If properly managed waste can be treated well and likewise it won't damage human health and environment. Different types of waste pose different levels of risks, and prioritizing them based on their hazards can save costs. Municipal solid waste is a mix of materials generated by residents, which can be divided into recyclable and non-recyclable items, as well as compostable materials. The amount and type of waste depend on factors like income levels, living standards, population size, social behavior, climate, and industrial activity (Bamne & Mhatre, 2019)<sup>vi</sup>.

According to the Intergovernmental Panel on climate change (IPCC), municipal solid waste is expected to reach around 3.4 Gt by 2050. It was also studied that about a fourth of Municipal waste is not collected properly, a fourth is not dumped properly instead it is burnt in fire at open places creating pollution in the environment<sup>vii</sup>. According to the global e-waste monitor, 2017, India generates 2 million tons (MT) of e- waste annually which includes discarded computer monitors, mother boards, mobile phones, charges, compact discs, headphones, television sets, air conditioners and refrigerators. India stands at fifth position in producing e - waste after the USA, China, Japan and Germany. In India the state of Maharashtra is the topmost solid waste

generator as of 2018. According to the 2011 census, India's population was 1.21 billion, with 31% living in cities. By 2050, it is estimated that half of India's population will reside in urban areas. With this rapid growth, managing Municipal Solid Waste (MSW) has become a serious challenge, not just for environmental and cleanliness reasons but also because of the huge amounts of waste produced daily<sup>viii</sup>.

### **Selection of the Study:**

Pune is a place where a large number of people, almost one third of the population of Pune lives in urban areas. Apart from this there are large numbers of production, manufacturing plants in and on the outskirts of Pune city. Pune is basically considered the land of education owing to its large number of colleges and schools. The city overall has a huge crowd including employees of various professions, students of schools and colleges etc<sup>ix</sup>. These many people require a lot of goods, services and facilities to enjoy better living.

The city produces around 1300 to 1400 metric tons of solid waste every day<sup>x</sup>. This means each person in Pune produces 500 grams of waste. In other words, per capita per day solid waste is 500 grams in Pune<sup>xi</sup>. Pune Municipal Corporation is the chief authority that looks after the management of solid waste in Pune. Waste is an unwanted or unworthy material which needs to be treated properly or else it can cause several harmful effects on human lives<sup>xii</sup>. Pune city has its own department of waste management. Pune Municipal Corporation works in the direction of achieving the goal of a clean and healthy city.

Pune, a city in India, is one of the few places working to treat all the waste it produces. In Pune, the main contributors to solid waste are households, shops, hospitals, hotels, restaurants, and markets. These sources generate waste through everyday activities, such as cooking, shopping, medical treatments, and food services. The local authorities are responsible for tasks such as collecting, storing, sorting, transporting, and disposing of all the solid waste generated in the city. There are 18 Urban Local Bodies [ULBs]<sup>xiii</sup>.

**Research Methodology:**

Data will be collected from secondary sources. Secondary data would be obtained and collected from Books, Thesis, Magazines, Websites based on Waste management. Various reports and publications of Pune Municipal Corporation, Union ministry of Environment, forest and climate change, Maharashtra control board will be referred for collecting data. There are research papers, articles on Waste management, these will be reviewed for better understanding and putting up judgements and observations.

**Review of Literature:****Solid Waste Management in India: A State-of-the-Art Review:**

This paper was written by Anunay A. Gour and S.K. Singh which delves into the current state of solid waste management in India, offering insights into the challenges faced, with potential applicability to developing and low-income nations. The primary driver of escalating waste is attributed to population growth and evolving lifestyles linked to increased per capita income<sup>xiv</sup>.

The paper highlights the critical need for a stringent policy framework to address these challenges, emphasizing that some countries struggle to implement such policies effectively. To further explore the root causes and seek viable solutions. Overall, the focus is on understanding the evolving landscape of waste composition and sources, the environmental repercussions, and the barriers hindering effective waste management.

**Solid waste issue: Sources, composition, disposal, recycling, and valorization by Hussein I. Abdel-Shafy a , Mona S.M. Mansour**

In this paper, Hussein I. Abdel-Shafy a , Mona S.M. Mansour have tried to grasp a focus on how the disposal of solid waste poses a pervasive challenge in both urban and rural areas across developed and developing countries. Current research places significant emphasis on the valorization of food organic waste<sup>xv</sup>. Established technologies for waste disposal include landfill, incineration, and composting, with their own merits and drawbacks. Composting and anaerobic digestion (AD) are traditionally prominent for treating and valorizing the organic fraction of MSW. The global generation of organic solid waste (OSW) is on a significant rise each year, primarily composed of agricultural waste, household food waste, and human and animal waste.

**What is Solid Waste?**

Any material that is discarded or is not of use or is abandoned. A solid waste can be in solid, liquid or gaseous form. It includes material like garbage, utilized discarded products. Solid waste is any material discarded after use. It can refer to any substance generated by human activity and animals. Urbanization and

industrialization are key concepts in the process of growth and require a lot of economic activities to take place<sup>xvi</sup>. This pathway to a better standard of living causes us to inculcate some actions for the future. In the course of time, we undergo the habit of utilizing goods and services in such a manner that it leads to waste generation<sup>xvii</sup>.

**Classification and Generation of Solid waste<sup>xviii</sup>:**

Year	Population	Waste Generation
2011	3,115,431	1374
2021	4,487,573	2677

2031	6,211,404	4125
2041	8,597,417	6071

**Table: 1**

The table shows the rise in both population and waste generation from 2011 to 2041. Relevant data can be found in global databases like the World Bank (2023), United Nations (2021) reports on urban growth, and local government waste management records. Additionally, national environmental agencies, including the EPA, offer more specific statistics on population and waste trends<sup>xix</sup>.

**Source of Generation:**

Sr. No	Source of generation	Quantity (MT)	% of total
1	Household	950	69.1
2	Street sweeping& drainage cleaning	140	10.2
3	Hotels &restaurants	150	10.9
4	Markets / commercial area	50	3.6
5	C and D Waste	75	5.5
6	Fruit, vegetable, Vish meat market waste	7.5	0.5
7	Biomedical waste	1.8	0.1

Table:2 (MPCB English AR 2022-2023-06.06.2024-organized\_0)

Household waste is the largest contributor, accounting for over two-thirds (69.1%) of the total waste. Other major sources include waste from hotels and restaurants (10.9%) and street sweeping and drainage cleaning (10.2%)<sup>xx</sup>. While construction and

demolition (C&D) waste (5.5%) and commercial area waste (3.6%) also contribute, smaller amounts of waste come from categories such as fruit/vegetable/market waste and biomedical waste, which Make up a small part of the total<sup>xxi</sup>.

**Municipal Solid Waste Statistical Data of Pune FY 2023:**

Sr No	MSW Generation (MT)	MSW treated (MT)	Treatment (%)
1.	4,306.79	4,100.79	95.21

Table 3: (MPCB English AR 2022-2023-06.06.2024-organized\_0)

**Hazardous Waste inventory at disposal site for past five years (FY 2023):**

Facility Name	2018-19	2019-20	2020-21	2021-22	2022-23
MEPL, Ranjangaon, Pune	1,10,288	1,07,765	90,325	1,10,063	1,01,261.84

Table 4:(MPCB English AR 2022-2023-06.06.2024-organized\_0)

**Statistical information on Plastic Waste in Pune (FY 2023):**

MPCB Region	No. of ULBs	Plastic Waste generated (in tons)	Plastic Waste collected (in tons)	Plastic Waste channelized for recycling (in tons)
Pune	56	72,727	70,727	69,344

**Table 5:** (MPCB English AR 2022-2023-06.06.2024-organized\_0.)

**Solid Waste Management:**

Proper waste management is essential for keeping the environment clean and ensuring public health. Waste management is an act of properly collecting, separating, segregating and decomposing of waste<sup>xxii</sup>. Each type of solid waste namely household, bio medical, organic etc. need different ways of decomposing as the materials are different in nature. A lot of health risks and health issues are associated with collection and decomposing of waste<sup>xxiii</sup>. Waste management is relatively an expensive task but it is essential to keep the city clean, livable and risk free. It is estimated that waste management requires 20 - 40 % of the municipal budget. Municipal authorities provide solid waste management as a fundamental and crucial service to maintain clean cities.

**The study of Pune City’s SWM:**

The management of solid waste collection, transportation, and disposal in Pune falls under the jurisdiction of the Pune Municipal Corporation (PMC). On average, Pune generates approximately 1,374.3 metric tonnes (MT) of solid waste daily, with a reported waste collection efficiency of 100%. Various waste streams, including municipal, biomedical, industrial, hotel waste, and construction debris, are managed in line with the Municipal Solid Waste (MSW) Rules, 2000. However, the city lacks a scientific disposal system for electronic waste (e-

waste) and construction and demolition (C&D) waste<sup>xxiv</sup>.

Solid waste collected from across the city is transported to a landfill site located approximately 20 kilometers away at Devachi Uruli. By 2041, waste generation in Pune is projected to rise significantly to 5,771 tonnes per day (TPD). To address waste management challenges, PMC has implemented successful initiatives like the Garbage-Free Katraj Model and a project generating electricity from wet waste in Kothrud. Building on the success of these models, city-wide projects inspired by these initiatives are included in the revised Comprehensive Development Plan (CDP)<sup>xxv</sup>.

A service-level benchmark study indicates that both waste collection efficiency and the scientific disposal of waste meet the 100% target. Furthermore, waste recovery rates and responsiveness to customer complaints exceed the benchmark standards. However, only 27.96% of waste is segregated at source, which is significantly lower than the target of 100%. Additionally, household-level coverage for Solid Waste Management (SWM) services is at 52.7%. While door-to-door waste collection has improved, the absence of scientific methods for disposing of C&D waste and e-waste presents a significant challenge. Currently, C&D waste is being disposed of in low-lying areas along the river, underscoring the urgent need for enhanced wte processing facilities.

**Available Infrastructure in Pune:**

	Ghantagadi	Dumper Placer	Compactor	BRC	Mechanical Sweeper	Other	Total
Existing Vehicles	160	85	24	59	2	119	449
	Biogas	Composting	Bio CNG	Thermal Composting	Mixed Waste	other	
Processing Plants	25	5	1	7	5	0	43
Transfer Stations	7						

An impressive fleet of **160 trucks** tirelessly crisscrosses Pune every single day, ensuring waste is collected from nearly every doorstep. Together, these trucks haul away a staggering **250 to 300 tons of waste daily**, making Pune a city dedicated to keeping its streets clean<sup>xxvi</sup>.

- **Containers and Buckets:** Over **1,000 strategically placed containers and bins** are scattered across Pune, ensuring citizens have no excuse to litter. These containers serve as a vital part of the city’s waste management network<sup>xxvii</sup>.
- **Ward-wise Waste Generation:** Residents generate an average of **500 to 1,000 grams of waste per person daily**, highlighting the immense challenge of managing waste in one of India’s fastest-growing urban centers<sup>xxviii</sup>.
- **Construction and Demolition Waste:** The booming construction sector generates a massive **200-250**

**tons of debris every day**, a testament to the city’s rapid development.

- **Garden Waste:** Pune’s greenery is productive, generating **80-100 tons of garden waste daily**, showcasing both the city’s love for nature and the responsibility of managing this organic load<sup>xxix</sup>.
- **Hotel Waste:** With Pune’s thriving food scene, hotels contribute **150-180 tons of waste daily**, underscoring the vibrancy of the city’s hospitality industry<sup>xxx</sup>.
- **Biomedical Waste:** Even the smallest category, biomedical waste, amounts to **10-15 tons daily**, reflecting the scale of healthcare activities and the critical need for its safe disposal.

**Flowchart of Waste Management Stages:**

Collection → Storage → Segregation → Recycle & Reuse → Transportation → Processing → Scientific Disposal <sup>xxxi</sup>.

**Waste Collection centers in Pune:**

Waste Collection centers Area	Number of Collection centers	Waste Collection centers Area	Number Collection centers	Waste Collection centers Area	Number Collection centers
Satara Road	25	Solapur Road	25	Peth Area	2
Kothrud	13	University Area	36		
Katraj Kondhwa	11	Sinhgad Road	12		

## Challenges & Opportunities of SWM in Pune City:

### Challenges

#### 1. City growth and administration:

Pune is a rapidly expanding city experiencing rising inward migration, enhanced living standards, and a corresponding increase in waste generation. While the administration operates within individual departments, there has been a lack of effective interdepartmental coordination in the city<sup>xxxii</sup>.

#### 2. Vigorous Solid Waste:

The city's rapid growth has outpaced development efforts, leading to problems like air and water pollution, improper waste management, and poor service delivery. The Mula and Mutha rivers are heavily polluted with sewage and solid waste due to upstream settlements lacking basic sanitation, fast-growing outskirts, and areas without sewer connections that release untreated waste into the rivers. This has also caused more frequent flooding in the city.

#### 3. Present waste management systems:

Pune has a unique waste collection system run by the SWaCH cooperative, a group of self-employed waste collectors. The framework of this organisation has worked well in assisting separation and collection of waste more effectively in the city. Segregation of waste in neighborhoods only happens where SWaCH offers house - to- house collection services.

• Waste management in Pune is complicated due to urbanization, rising migration, increasing waste generation, a large informal-sector

workforce, a complex value chain, and frequent regulatory changes<sup>xxxiii</sup>.

• The city's waste ecosystem involves many stakeholders, including the local government, SWaCH, informal recyclers, compost service providers, private businesses, small enterprises, voluntary civil society groups, and resident associations.

• Despite these efforts, most waste still ends up in a nearly full landfill. The city faces challenges with limited land for waste management and the infrastructure needed to meet its growing demands<sup>xxxiv</sup>.

### Prospective Pathways:

- The city has created a solid waste management plan to support local systems, engage stakeholders, and set up information systems.
- Citizens can play a key role in supporting decentralized waste management solutions.
- The city has the chance to use the growing private sector to fund waste management services.
- The city can improve waste management by upgrading infrastructure, involving citizens, and focusing on decentralized practices to meet growing needs. Growing SWaCH services could improve waste sorting and collection directly from people's homes.
- Existing partnerships with stakeholders can be used to promote source segregation, work with waste aggregators for recycling, and expand material recovery facilities.
- Formalizing informal waste aggregators and recyclers could improve their safety and livelihoods.

- Community-driven, decentralized waste management models can be encouraged to ensure sustainability<sup>xxxv</sup>.

**Conclusion:**

Proper waste management is essential for keeping the environment clean and ensuring public health. When trash is disposed of properly, it prevents waste from damaging the environment around us. Recycling is an important part of waste management because it helps reduce the amount of trash we produce, which helps minimize pollution. It's important for everyone—whether individuals, communities, or businesses—to follow good practices when it comes to disposing of waste. This helps protect both our health and the health of the environment.

Using renewable energy and advanced technology can also play a big role in improving waste management. These tools can help reduce the impact of waste on the environment and make the process more efficient. In addition, public campaigns that encourage cleanliness and recycling are essential in teaching people why proper waste disposal is so important. Now is the time for all of us to take responsibility for how we manage waste. By doing so, we can help create a cleaner and more sustainable future for everyone.

<sup>i</sup> Alappuzha. (2021). *Waste-wise cities: Best practices in municipal solid waste management waste-wise cities. A NITI Aayog-CSE survey of 28 cities. Multiple initiatives.*

<sup>ii</sup> Bamne, P., & Mhatre, S. (2019). Municipal solid waste management in Pune (MS): Current challenges and future solutions for development. *Journal of Emerging Technology and Innovative Research*, 6(5), 611–615.

<sup>iii</sup> Agarwal, R. (2017). *A first-of-a-kind campaign in Pune creates awareness about sanitary waste segregation.*

<sup>iv</sup> Bhat, V., & Patil, Y. (2021). An integrated and sustainable model for e-waste management for Pune city households. *Journal of Physics: Conference Series*, 1964(6), 062111.

<sup>v</sup> Chhura, B., & Kumar Makhija, M. (2015). E-waste: A new challenge and approach for India: An overview. *International Journal of Management and Technology*, 2(2), 1–12.

<sup>vi</sup> Hemalata, H. N. (2012). Existing situation of solid waste management in Pune city, India. *Research Journal of Recent Sciences*, 1, 348–351.

<sup>vii</sup> Kumar, A., & Agrawal, A. (2020). Recent trends in solid waste management: Status, challenges, and potential for the future Indian cities – A review. *Current Research in Environmental Sustainability*, 2, 11.

<sup>viii</sup> Le Doze, S., Harms, N., Siddique, O., Vougioukas, A., Archer, D., Johnson, O., & Gadgil, M. (2018). Closing the loop: Pune, India case study.

<sup>ix</sup> Link, T. (2016). What India knows about e-waste: Report on awareness levels of e-waste amongst common citizens in India.

<sup>x</sup> <https://www.ijraset.com/research-paper/a-review-of-solid-waste-management-systems-in-pune-city>

<sup>xi</sup> Narayanan, L., & Anantkrishnan, L. (2022). What we waste: Household waste generation and recovery by waste pickers in Pune.

<sup>xii</sup> Pune Municipal Corporation (PMC). (2014). Public-health & sanitation bye-laws. Pune Municipal Corporation, Pune.

<sup>xiii</sup> Pune Municipal Corporation (PMC). (2017). Solid waste management strategy plan 2017-2025. Pune Municipal Corporation, Pune.

<sup>xiv</sup> Solid Waste Management in India: A State-of-the-Art Review (n.d.).

<sup>xv</sup> Hussein, I., & Mansour, M. S. M. (n.d.). Solid waste issue: Sources, composition, disposal, recycling, and valorization.

<sup>xvi</sup> Ohkhlet, D., & Nagargoje, S. (2020). Municipal solid waste management: A comparative study between Sydney (Australia) and Pune (India)

<sup>xvii</sup> Supe, G. N., Kshirsagar, K., Mahind, P., Thobde, S., Yalangphale, A., & Professor, A. (2021). Municipal solid waste management system for Pune city.

<sup>xviii</sup> Maharashtra Pollution Control Board (CPCB). (2022-23)

<sup>xix</sup> Maharashtra Pollution Control Board (CPCB). (2022-23)

<sup>xx</sup> Maharashtra Pollution Control Board (CPCB).

<sup>xxi</sup> Maharashtra Pollution Control Board (CPCB).



<sup>xxii</sup> Effective role of microorganisms in waste management and environmental sustainability. (n.d.).

<sup>xxiii</sup> Narayanan, L., & Anantkrishnan, L. (2022). What we waste: Household waste generation and recovery by waste pickers in Pune. Kashtakari Panchayat.

<sup>xxiv</sup> Summary: revising/ updating the city development plan (CDP) of Pune city – 2041 under JNNURM. (n.d.).

<sup>xxv</sup> Agarwal, R. (2017). A first-of-a-kind campaign in Pune creates awareness about sanitary waste segregation.

<sup>xxvi</sup> An Overview of Solid Waste Management Practices in Pune, Maharashtra, India

<sup>xxvii</sup> An Overview of Solid Waste Management Practices in Pune, Maharashtra, India

<sup>xxviii</sup> <https://cpcb.nic.in/uploads/DEP/Pune-DEP>

<sup>xxix</sup> *Directive 2008/98/EC of the European Parliament and of the Council on waste and repealing certain directives.* (2008).

<sup>xxx</sup> An Overview of Solid Waste Management Practices in Pune, Maharashtra, India

<sup>xxxi</sup> Role of Microorganism in Waste Management and Environmental Sustainability.

<sup>xxxii</sup> *UrbanOcean Waste Profile: Pune.* (n.d.).

<sup>xxxiii</sup> *UrbanOcean Waste Profile: Pune.* (n.d.).

<sup>xxxiv</sup> *UrbanOcean Waste Profile: Pune.* (n.d.).

<sup>xxxv</sup> *UrbanOcean Waste Profile: Pune.* (n.d.).