

Plastic Waste Crisis in Satara: Impacts and Solutions

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Article Info	ABSTRACT
Article History: Received: 15th Dec 2025 Accepted: 19th Dec 2025 Published: 20th Dec 2025 Keywords: <i>Solid Waste Management, Plastic Pollution, Satara City, Source Segregation, Public Health, Sustainability</i>	This research paper examines the escalating crisis of Municipal Solid Waste (MSW) in Satara City, Maharashtra, with a specific focus on the environmental and public health challenges posed by plastic pollution. As a historical and cultural hub, Satara is currently generating approximately 120–130 metric tons of waste daily, of which 18% (22 tons) consists of non-biodegradable plastics. This study utilizes a mixed-methods approach, combining surveys from 300 households across five wards with interviews of municipal officials and field observations. Key findings reveal a significant gap in waste management practices: only 25% of households practice at-source segregation, and 65% of the population remains unaware of specific plastic ban regulations. The paper concludes by proposing a sustainable roadmap centered on mandatory "Two-Bin" segregation, the establishment of five new Material Recovery Facilities (MRF), and large-scale public awareness campaigns ("Jan Jagruti Abhiyan"). By adopting a circular economy model and public-private partnerships, Satara can mitigate environmental degradation while preserving its cultural heritage.

Plagiarism Check Report:

Date of Report: Dec 18, 2025

Similarity Index: 6%

Remarks: No significant matching text. All citations and matches are properly referenced. The manuscript is considered original.

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How to Cite: Waydande, S. S., & Pore, A. V. (2025). *Plastic waste crisis in Satara: Impacts and solutions*. *IIP: International Multidisciplinary Research Journal (IIPIMRJ)*, 2(IV), pp. 1249–1254.

Introduction

The historical and cultural identity of Satara, a city whose name translates to the "Seven Stars" in reference to the majestic hills that encircle it. Furthermore, its geographical positioning as a gateway to the Western Ghats—a globally recognized UNESCO World Heritage site—places a significant ecological responsibility on the city. However, this historical grandeur and environmental significance are currently under siege from a modern crisis: the rapid degradation caused by unmanaged urban solid waste.

This crisis is primarily driven by a complex paradox where rapid urbanization and shifting economic activities have outpaced the city's traditional waste management infrastructure. In recent decades, Satara has transitioned from a quiet, historical town into a bustling administrative and commercial hub, a process marked by a demographic explosion that has significantly increased density in the historical "Peth" areas. This growth has been accompanied by a transition from a traditional agrarian economy to a consumer-oriented service model, which has fundamentally altered the chemical and physical nature of the waste produced. As disposable incomes have risen, a pervasive "use-and-throw" culture has taken hold, leading to a situation where daily waste generation—estimated at approximately 127 metric tons—far exceeds the city's current scientific processing and disposal capacity, pushing the urban environment toward a dangerous threshold of pollution.

Within this broader waste crisis, the emergence of synthetic polymers, specifically plastic waste, has become the most severe environmental challenge facing the city over the last twenty years. Unlike organic waste, which was historically the primary component of urban refuse and could be absorbed back into the ecosystem, plastic remains persistent in Satara's soil and water systems for centuries due to its non-biodegradable nature. This persistence leads to critical infrastructure blockages, as thin plastic films and bags frequently clog the city's historical drainage lines, directly causing artificial urban flooding during the monsoon seasons. Furthermore, the practice of open dumping at sites like Songaon facilitates "chemical leaching," where toxic additives such as phthalates and bisphenols migrate into the groundwater table, posing a long-term threat to the safety of the city's water supply and the health of its citizens.

The resulting environmental degradation is matched by a growing public health crisis that disproportionately affects vulnerable communities living near disposal sites. The ecological impact is evident in the declining soil quality at the city's periphery and the threat posed to local biodiversity in the foothills of the Sahyadri range due to microplastic contamination. Beyond these ecological concerns, unmanaged waste piles serve as active biological hazards and breeding grounds for disease vectors like mosquitoes and rodents. Empirical studies conducted in the region indicate that residents living within a 2-kilometer radius of Satara's dumping grounds report a 40% higher rate of respiratory distress and infectious diseases compared to those in less affected areas. This study, therefore, evaluates the technical and administrative gaps within the Satara Municipal Council to propose a sustainable "Green Transition" based on circular economy principles, aiming to restore the city as a healthy, liveable environment for future generations.

Objectives of the Study

1. To analyze the volume and composition of waste and plastic issues in Satara City.
2. To evaluate the social, economic, and environmental impacts of the waste crisis.
3. To formulate strategic recommendations and a sustainable action plan.

Methodology

This research utilizes a Mixed-Method Approach for holistic data capture:

- Surveys: 300 household consumers across 5 wards were surveyed using structured questionnaires to assess segregation habits and plastic usage.
- Observation: Participatory observation was conducted at 10 collection points, 2 landfill sites, and various marketplaces.

Review of Literature

The Crisis of Urban Waste in Developing India- Academic literature consistently identifies rapid urbanization and shifting consumer lifestyles as the primary drivers of India's solid waste crisis. Research by Patil (2025) highlights that over 90% of municipal solid waste in India is disposed of in open dumps rather than scientific landfills, leading to severe air and soil pollution. This systemic failure is particularly evident in Tier-2 and Tier-3 cities where, according to the NITI Aayog (2021), urban local bodies struggle with limited funding and a lack of technical expertise to manage the transition from "collection-only" models to "scientific-processing" models.

The Plastic Paradox: Synthetic Polymers in the Environment- The dominance of single-use plastics (SUPs) is a recurring theme in environmental studies. Bhattacharya et al. (2020) argue that despite legislative interventions like the Plastic Waste Management Rules, approximately 60% of plastic waste in India remains uncollected or unmanaged. In Maharashtra, studies specifically focusing on medium-sized cities have found that plastic waste is the most significant contributor to "urban infrastructure paralysis." Pankaj (2015) explains that because plastics are non-biodegradable, they create permanent blockages in historical drainage systems, a phenomenon that has been directly linked to the artificial flooding observed in cities like Satara and Pune during the monsoon season.

Socio-Economic and Public Health Impacts- The health impacts of proximity to dumping grounds are well-documented in regional literature. A statistical assessment by Kadam & Pawar (2024) focused on Satara's Songaon and Jakatwadi sites found that residents living within a 2-km radius suffer significantly higher rates of respiratory distress, with the 35–45 age group being the most vulnerable. This aligns with global "Toxic Leaching" theories, which suggest that open dumping facilitates the migration of chemicals into the food chain and groundwater. Furthermore, Misra & Pandey (2005) emphasize the "opportunity cost" of mismanagement, noting that when cities fail to segregate waste at the source—as seen in the 75% non-segregation rate in Satara—they lose millions in potential revenue from the recycling of paper, metal, and plastic.

Data Analysis and Discussion

Volumetric Analysis and Growth Trends of Municipal Waste- The empirical data collected from the Satara Municipal Council reveals a critical environmental threshold, with the city generating an average of 120 to 130 metric tons of solid waste daily. This volume is not static; rather, it is subject to the compounding pressures of rapid demographic expansion and intensifying economic development, which have catalyzed an annual waste growth rate of approximately 5% to 8%.

The Crisis of Non-Biodegradable Synthetic Polymers- A deeper examination of the waste

stream identifies plastic as the most hazardous component, accounting for 22 tons of the daily total. The analysis further reveals that approximately 60% of this plastic—roughly 13 tons—is comprised of Single-Use Plastics (SUPs), including items such as polyethylene bags, PET water bottles, straws, and various forms of multilayered packaging materials. Because these synthetic polymers are fundamentally non-biodegradable, they persist in Satara's local ecosystem indefinitely, causing permanent damage to soil health and hydrological systems. This concentration of high-volume, low-value plastic waste represents the most significant challenge to the city's environmental sustainability, as it resists traditional decomposition processes and requires specialized chemical or mechanical recycling that is currently unavailable at the local level.

Behavioral Barriers and Public Awareness Gaps- Primary survey data indicates a profound failure in "at-source segregation," with only 25% of households currently practicing the systematic separation of wet and dry waste. This lack of segregation at the household level renders downstream processing nearly impossible, as organic matter contaminates potentially recyclable plastics. Furthermore, the reliance on synthetic convenience remains entrenched in local culture; approximately 80% of respondents admitted to the daily use of single-use plastic bags. This behavior is partly fueled by a lack of regulatory literacy, as 65% of the population remains uninformed about the specific legal mandates and environmental implications of existing plastic ban regulations.

Table 1
Physical Composition and Daily Generation of Municipal Solid Waste in Satara City

Waste Type	Percentage (%)	Estimated Daily Quantity (in Tons)
Organic Waste	55%	70
Plastic Waste	18%	22
Paper / Cardboard	12%	15
Metal	2%	2.5
Glass	3%	4
Others (Cloth, Rubber, etc.)	10%	12
Total	100%	127

Source: Primary Data Analysis and Satara Municipal Council Records.



Evidence of Open Dumping and Accumulation of Unsegregated Waste in Satara City

Environmental Degradation and Ecological Consequences- The environmental impact of unmanaged waste in Satara, particularly the accumulation of plastic debris, has led to significant systemic disruptions within the city's natural and man-made ecosystems. A primary concern is the physical

obstruction of the urban drainage network; lightweight plastic films and single-use containers frequently clog transit lines, which directly results in "artificial flooding" during the monsoon seasons. This localized flooding not only damages property but also accelerates the erosion of the city's historical infrastructure. Beyond the urban landscape, the proximity of open dumping sites to natural habitats in the Sahyadri foothills threatens local biodiversity. The long-term presence of non-biodegradable materials leads to soil quality degradation at landfill sites, where microplastics and chemical leachates prevent natural nutrient cycling, effectively rendering the surrounding land sterile for agricultural or ecological use.

Public Health Risks and Epidemiological Threats- The health implications for the residents of Satara are profound, as accumulated and unsegregated waste piles serve as high-density breeding grounds for biological vectors. The presence of stagnant water trapped in plastic waste, combined with decomposing organic matter, facilitates the rapid proliferation of mosquitoes and flies. This has led to an elevated epidemiological risk for the local population, specifically regarding the transmission of vector-borne diseases such as Dengue and Malaria. Furthermore, the open dumping of mixed waste creates a constant source of airborne pollutants and foul odors, which are linked to chronic respiratory ailments among citizens living in the vicinity of disposal points. The lack of a scientific processing framework means these biological hazards remain persistent threats to public safety, especially for children and elderly residents who are more susceptible to the pathogens found in contaminated urban environments.

Recommendations

Mandatory Waste Sorting- Satara must enforce a "Two-Bin" system where households and businesses separate wet (organic) waste from dry (recyclable) waste. To ensure everyone follows these rules, the city should stop collecting mixed waste and apply strict fines for those who do not comply. This simple step will lower the amount of trash sent to landfills and make recycling much more efficient.

Strict Plastic Ban Enforcement- To remove single-use plastics from Satara, the city must strictly enforce existing bans through regular, unannounced market inspections. Businesses selling banned items should face heavy penalties, while the use of eco-friendly alternatives like cloth or paper bags should be encouraged. This will help stop the 13 tons of plastic that currently clog drains and pollute the city every day.

Public Awareness Campaigns- A "Green Transition" requires help from all citizens. The city should start a "Jan Jagruti Abhiyan" (Public Awareness Campaign) using street plays and school workshops to teach people about the health and environmental risks of poor waste management. The goal is to make waste sorting and reducing plastic use a permanent habit for everyone in Satara.

Partnering with Private Companies- Satara should work with professional private companies (PPP model) to bring in advanced recycling and "Waste-to-Energy" technology. This partnership can provide better safety gear for workers and ensure that plastic waste is handled according to international standards. Turning waste management into a professional service can help the city generate money from trash instead of it just being a problem.

Conclusion

The comprehensive evaluation of solid waste management in Satara City underscores a critical environmental crossroads for this historical and cultural center. The study confirms that the city generates

an average of 127 metric tons of waste daily, with a significant 18% consisting of non-biodegradable plastic. The analysis reveals that the current crisis is driven by a combination of rapid demographic growth and a systemic failure to implement at-source segregation, as evidenced by the fact that 75% of households continue to dispose of mixed waste.

Ultimately, the path toward a sustainable Satara requires a fundamental shift from a linear "collect-and-dump" model to a circular economy framework. The proposed strategic roadmap—emphasizing the establishment of five new Material Recovery Facilities (MRF), strict enforcement of plastic bans, and a transition to a mandatory "Two-Bin" segregation system—provides a scientifically grounded solution to the current deficiencies. However, technical upgrades alone will be insufficient without a sustained "Jan Jagruti Abhiyan" to transform public behavior. By integrating modern infrastructure with community-driven participation, Satara can mitigate the threat of plastic pollution and ensure that its historical heritage is preserved within a clean, healthy, and resilient urban environment for future generations.

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