

Solid Waste Management in Tier II Indian Cities: A Case of Jammu City

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Abstract

Indian cities are expanding at an enormous rate to meet the demand for built spaces, which is ever-increasing due to high increase in urban population and lead to development of different residential colonies on outskirts of cities. These residential colonies are mostly deprived of basic infrastructural facilities and have unhygienic and unhealthy living conditions and causes huge environmental degradation. Though, infrastructural facilities of major cities are upgraded under JNNURM but, still there are many aspects of infrastructure which require upgradation and have minimal technological interventions for their provision and management. Solid waste management is one such infrastructure which is essential for providing healthy and clean living environment in cities and presently has minimal use of technology for its collection, transportation, sorting, recycling and disposal, as well as, for monitoring of waste disposal sites. Moreover, available contemporary technologies (like, GIS, remote sensing etc.) are not used efficiently for formulating solid waste management plan. This paper highlights various issues and problems of existing solid waste management process adopted in Jammu city and its possible impacts on environment in and around the city. This paper also highlights the use of technological interventions which can be adopted in the process of solid waste management at various stages, in the specific context of Jammu city.

Keywords: Urban population, technological interventions, solid waste management

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INTRODUCTION

Indian cities and towns are increasing at a very fast rate and it is expected that the urban population will be tremendously increased from 340 million (*i.e.* 30% of total population) in 2008 to 590 million (*i.e.* 40 of total population) in 2030, as it is highlighted in MGI report on India's Urban Awakening: Building Inclusive Cities, Sustaining Economic Growth, 2010 no other country in the world (except china) have experienced such large scale and speed of urban growth in such a small duration of 20 years^[1]. As a result of this enormous urban growth it is expected that urban centers of India will have manifold increase in next 02 decades and these over

developed urban centers will face tremendous problems related to basic infrastructural provisions for residents to have quality living as the existing infrastructural facilities, which are currently inadequate are going to be proven insufficient to support this high population growth. These problems of inadequate/insufficient and inappropriate provisions of infrastructural facilities are more pronounced in Tier II and Tier III cities which are presently facing problems and issues to provide basic infrastructural facilities like water supply, sewage system, transportation network and system and solid waste management (SWM) and the

condition can further be aggravated with further increase in population^[2].

Any discarded or after used materials which can be solid, liquid and semi-solid or containerized gaseous materials is termed as waste. Solid waste is generally heterogeneous in nature and its characteristics vary from place to place, and season to season, which depend upon the use, source and life style of the people. Solid waste can be categorized into different categories based on the source of the generation and nature of the solid waste. On the basis of source of generation, solid waste can be broadly categorized as residential waste, commercial waste, institutional waste, industrial waste, and based on the nature of solid waste it can be classified as garbage, ashes, bulky waste, street sweeping dirt, bulky waste, dead animals, construction waste, inert waste and hazardous waste. The SWM system covers the full cycle from collection of waste generated from household and commercial establishments to the acceptable final disposal. In the process, efforts are made to reduce the final volumes, through recycling and material recovery as well as treatment in an environmentally sound manner^[3, 4].

Jammu is one such Tier II city which is experiencing numerous problems due to inappropriate SWM process adopted in the city.

JAMMU: THE STUDY CONTEXT

Jammu-summer capital and the second largest city of Jammu and Kashmir is one such city which is currently facing issues and problems related to provisions of basic infrastructural facilities. Its municipal boundary covers an area of 112 sq. km. The population of city is grown from 2,23,361 in 1981 to 5,03,690 in 2011 and which is further expected to be increased

at much higher rate. SWM is one such infrastructural facility which is inappropriately provided in Jammu and as a result of this, problems of pollution, contamination of air and surface and ground water, environmental degradation and deteriorating living conditions are persist in Jammu city.

Very serious issues and problems like foul smell, unhygienic conditions, health problems, ground water contamination, choking of drains *etc.* are observed in the many localities of Jammu due to inefficient SWM System. On the basis of Quantification and Characterization (Q & C private agency) survey, Solid Waste from residential area is found to be 298.675 gm/capita/day; so, the approximate quantity of municipal Solid Waste generated from residential area comprising of total population of about 8,77,387 is 262 MT, which includes entire Jammu Development Authority (JDA) area of 287 sq. km. But the Jammu Municipal Corporation (JMC) is only managing the SWM Operations for waste quantity of 183 MT only generating from 6, 13,091 from 66 sq. km. area thus there is no arrangement for remaining residential area. The Jammu Municipal Corporation has not adopted scientific method of solid waste management nor have developed proper land fill sites^[5]. Presently Solid Waste is being crudely dumped at the bank of Tawi, resulting in environmental degradation and causes various kinds of health hazards.

Existing Solid Waste Management in Jammu City

Existing system of SWM is done with no segregation and no treatment of the solid waste. Solid waste need to be sorted, recycled, treated, processed and compacted before being dumped on the landfill site.

Table 1: Existing Processes or Technologies Used in Jammu.

Steps involved in SWM	Processes of technologies used
Collection	Door to door (in few localities) ,Community bin
Sorting	Rag pickers, Selling recyclable materials
Transportation	Open Vehicle
Segregation	No segregation
Treatment	No treatment
Disposal	Dumping without segregation and on the banks of the Tawi river
Monitoring	Manual Monitoring

PROBLEMS RELATED TO SOLID WASTE MANAGEMENT IN JAMMU CITY

The main Solid Waste generation sources in Jammu city are Residential, Commercial and Market, Slum, Slaughter Houses, Institutional Organization like Hospitals, Hotels and Restaurants, Small and Big Scale Industries, Construction and Demolition Waste (Debris) *etc.* Various problems related to SWM as observed in Jammu city are as follows:

1. The collection capacity available with local authorities are insufficient, as a result considerable quantity of solid waste remains uncollected on the streets, road side, open places *etc.* which results in unhygienic unpleasant and unsanitary conditions in thickly populated residential areas in Jammu city.
2. There is no segregation of solid waste at the source and much of solid waste generated is not collected by local municipality.
3. The number of waste collection points and bins placed in the city are insufficient to collect all waste generated. Moreover, the existing collection bins are inappropriately placed which further makes the waste collection more difficult.
4. Collected solid waste is indiscriminately dumped at the outskirts of the Jammu city due to non availability of suitable landfill site.
5. The transportation facilities used for transportation of collected solid waste are insufficient in number and also existing vehicles are mostly unmaintained, which further worsen waste transportation process.

Table 2: Existing Transportation Facilities Available with Jammu Municipal Authority.

S. No.	Type of Equipment	No. of Equipments (MANDA YARD)	Waste Carrying capacity per trip (in tonnes)	Waste Carrying capacity per 3 trips (in tonnes)
1	Tipper 8 cum	1	3	9
2	Tipper 6 cum	2	2	12
3	Tipper 4 cum	2	1	6
4	Tipper 3 cum	2	1	6
5	Tractor 2.5 cum	2	1	6
6	Auto 1 cum	2	0.5	3
7	Dumper Placer 4.5 cum	2	1.5	9
8	Refuse Collector 8 cum	1	4	12
Total				63 tonnes

Source: Jammu Municipal Authority^[5].

6. The carrying capacity of drains in Jammu city is reduced due to dumping of plastic waste in the open drains, which interns causing considerable water pollution to the nearby water bodies.
7. Jammu City is also facing acute shortage of suitable storage/community bins at desired locations. If, community collection bins are provided their locations are inappropriate and are not catering effectively the neighboring residential areas.
8. There is no scientific treatment or processing of waste done in Jammu City before it being dumped on the site.
9. Sorting is not done at household level. Rag pickers pick plastic material, polythene and recyclable material from the collection points and rest of the waste is mixed and not segregated when it is transported to landfill sites.
10. Open vehicle transportation is another issue which creates problem because the waste over flow and fall on the roads and result in choking of the drains along the side of the roads.
11. Suitable landfill site is not available in Jammu generally dumping is done on the banks of the Tawi River which pollute its water.
12. Process of waste sorting, recycling, reuse and reduce are not adopted before final waste disposal at landfill sites.



Fig.1: Sanitary Landfill Site near Bhagwati Nagar.



Fig. 2: Sanitary Landfill Site near Kot Bhalwal Village.

Most of the problems of SWM can be resolved by the use of available technologies. Different technological interventions are required at different levels of process of SWM like Collection, sorting, transportation, segregation, treatment, composting, disposal, monitoring.

STRATEGIES TO INCLUDE TECHNOLOGICAL INTERVENTIONS FOR SOLID WASTE MANAGEMENT IN JAMMU

Different technological intervention in different stages of SWM can be adopted by following any of the two below discussed strategies^[6]:

1. Short Term Strategies
2. Long Term Strategies

Short Term Strategies are kind of strategies which can be immediate steps taken by authorities like:

1. An awareness campaign to be planned to inspire the people to put the waste into the bins.
2. Soiled paper utensils can be compacted using a bailer and sold to a recycler on a monthly basis.
3. Number of laborers, employees *etc.* can be increased, so that the SWM can be done at household level. It can support better techniques like door to door collection, and can also access the narrow streets of core areas of the city.
4. Number of dustbins can be increased as an immediate step to improve the waste management process.
5. Number of collection points can be increased to keep the city free from waste littering on roads and streets because more collection points will lead to more efficient waste collection.
6. Number of vehicles can be increased to transport more waste from these collection points so that a neat and clean environment is seen in the city. Use of covered vehicles is recommended so that waste does not litter on the road while transporting it.
7. Giving Contracts to private companies so that the process of SWM can be carried out at faster rate and latest technologies can be used for energy recovery and reduction in land filling.
8. Involve Public Private Partnership for better technological interventions.

Long Term Strategies are kind of strategies which can be impact based strategies applied for long term benefits like:

1. Technologies like GIS, MCE Technique, ICT, *etc.* can be incorporated in the process of SWM. The GIS can be used as a tool for mapping and managing whole SWM process for Jammu city. This can be an effective tool for selection optimum

location for placement of community bins, deciding appropriate location of transfer points, deciding most optimum route and trip duration for transportation of waste and above all for appropriate selection of land filling sites. Further ICT can be used as an effective tool for disseminating information and creating awareness amongst the resident regarding hygiene, issues and problems arises due to inappropriate solid waste management.

2. To meet the cooking needs powdered biomass based steam generators (PBSGs) can be installed. This will reduce the usage of LPG.
3. Monitoring of Process can be done by Wireless technology, GIS, GPS, *etc.*
4. Aware amongst people need to be created about the segregation of bio-degradable and non bio-degradable wastes at household levels so that it can be sent for treatment/recycling and requirement of the landfill site reduces.
5. Energy recovery from waste by using techniques like incineration, pelletisation, biomethanation, *etc.*

CONCLUSION

The technologies which can be helpful in making environment of the city prosperous, livable and more attractive to the tourists and pilgrims as Jammu is known for its tourism and pilgrimage need to be introduced at appropriate levels of SWM. Technological intervention is important in SWM to achieve better and clean environment of Jammu city. The main concern is that these techniques should be incorporated in the process by the local authorities for the betterment of city and its people.

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