

Status of Municipal Solid Waste Management in Srinagar City of Kashmir Valley

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Abstract

Srinagar is the fastest growing city of Western Himalayas and here the municipal solid waste management is a major challenge for the local authorities. For the past many years, the government has failed to address the menace of solid waste as the city generates nearly 520 metric tons of solid waste every day and is dumped in the heart of Srinagar, at Achan, the only landfill site in Srinagar. The waste is not just dumped at the dumping site, but one can find it everywhere. The waste is directly dumped around a residential area, a government backed land filling site at Achan without being treated. With a population of more than 16 lakh, spread over an area of 227.34 sq. km on both sides of the river Jhelum, not even in a single residential area or commercial area in Srinagar has the waste generation facility; and much of the waste is deposited into water bodies like the river Jhelum, Dal Lake etc. The MSW management is carried out at ward level through unskilled and skilled persons. There is a complete lack of shift and night sweeping in the city. House to house collection of MSW is being undertaken in 25% of households through SMC and some NGO's. 44.72% of the total waste generated is regularly collected and taken to Achan dumping site while 55.28% is dumped in adhoc dumping sites or remain unattended. Disposal of solid waste by SMC is only through land filling at Achan dumping site. The present research reveals that due to lack of funding and unscientific management in the city the existing solid waste management system is not working successfully. The inadequate infrastructures and lack of governance for waste collection, transportation and management are the foremost constrains in designing a suitable MSW management plan for the Srinagar city.

Key words: Municipal solid waste, Srinagar municipal corporation, Waste generation, NEERI, Waste quantification

Solid waste refers to a discarded material that is not a liquid or a gas. Such unwanted materials or wastes have been a part of human environment since the beginning of civilization. As the society progressed and as affluence increased with time, the proportion or quantity of solid waste also increased. Thus, it may be safely generalized that the nations with high standards of living and life style tend to produce more waste than the less developed nations. In the coming years, the quantity of solid waste is expected to increase steeply, not only because of increasing population, but also because each person in the world will discard more and more garbage [1]. As the components of waste are becoming unpleasant & unbearable day by day, the places to dump these are becoming scare. In recent years, the amount of solid waste has reached mountainous proportions an unfortunate trend that in all likelihoods expected to continue in the years to come [2]. Modern method of production has filled the commercial sector with immense varieties of products. Disposable commodities are more in demand than their reusable counter parts. It is more convenient to throw away a defective item than getting it repaired.

Solid Waste Management (SWM) may be thus defined as the discipline associated with the control of waste generation, collection, storage, transfer and transport, processing and disposal of solid wastes in a manner that is in accordance with the best and sustainable principles of public health,

conservation, aesthetics, economics, engineering, and other environmental considerations [3-4].

Due to rapid urbanization and uncontrolled growth rate of population, MSWM has become acute in India. Municipal solid waste management, though an essential duty, is given less priority. Lack of financial resources, institutional weakness, improper choice of technology and public apathy towards MSW has made this service far from satisfaction [5]. The current practices of the unplanned and uncontrolled dumping of waste on the outskirts of villages, towns and cities have created a serious environmental and public health problem.

Municipal Solid Waste Management (MSWM) is one of the major challenges in urban places throughout the world. Most of the towns, cities and tourist resorts throughout the world are experiencing unplanned urban sprawl and heavy pressure of human population. The net result is an enormous generation of waste. The amount of waste generation mainly depends on the population, economic growth and the efficiency of the reuse and recycling and reprocessing system. In the present world, one of the big important issues is prevention and protection of human civilization from the dangerous effect of human-made wastes [6].

Over the next two decades, growing urbanization in India will result in a massive increase of waste. By the year 2025, the urban population is expected to represent 41% of the

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overall population. A study conducted by the CPCB on management of MSW in the country estimates that waste generation from the present 48 million tons (MT) per year is expected to increase to 300 MT per year, by the year 2047 (490 g per capita to 945 g per capita). The estimated requirement of land for disposal would be 169.6 square kilometer (km²) in 2047 as against 20.2 km² in 1997.

- India produces 48.0 million Tons of MSW annually at present.
- Urban population increasing between 3 – 3.5% per annum.
- Per capita waste generation in India is increasing by 1.3% per annum.
- Yearly increase of waste generation in India is around 5%.

To tackle the waste generated in urban areas, the urban local bodies are investing around 35-50% of its available funds, spending about Rs. 500-1500 per ton on solid waste management. Hence there is an urgent need to increase efficiency for better service delivery and optimization. Land disposal of solid wastes has been practiced for centuries. Municipal, industrial, agricultural and urban activities produce huge amounts of wastes, which require safe and permanent secured disposal. In view of growing challenge of solid waste management in the country, the Central Government has incorporated solid waste management as one of the components in the Jawaharlal Nehru National Urban Renewal Mission (JNNURM) programme, initiated by the Central Government for extending financial resources. Many cities are getting benefit from this massive programme. The aim of this study is to investigate the overall situation of MSW management in Srinagar city, J&K, India. The comprehensive survey was conducted in different wards of the city and data were also collected from local municipality office.

MATERIALS AND METHODS

The study area is Srinagar city of Jammu and Kashmir union territory. Srinagar city also known as the city of lakes is located in the northern most part of India between 74°-56' and 75°-79' East longitude and 33°-18' and 34°-45' North latitude. Srinagar Municipal Corporation is responsible for the management of MSW generated in city. The city is divided into 74 sanitary wards and the entire operation of MSWM system performed under four heads namely cleaning, collection, transportation and disposal. Srinagar city has seen an increase in population growth during last three decades.

Sampling method: A random sampling was carried out in all the three sampling sites to study the composition of municipal solid waste that is biodegradable and non-biodegradable with the interval of almost sixty days. During the study period waste was examined and evaluated from household and community bins, collection points, temporary dumping sites and final landfill sites. The focus was given to know the existing management practices of MSW that is collection, composition, segregation, transportation, impacts and final disposal.

Survey and data collection: For collecting the data from various municipal wards generating MSW, questionnaires were sent along with the inspection teams. Information regarding MSW was collected from sweepers, transporters, and municipal staff and from landfill site administration.

Data processing: Data that was collected from various sources was analyzed and compiled.

RESULTS AND DISCUSSION

In Srinagar city, since ancient times number of techniques have been adopted by the people and local authority. Most of these techniques either suffered from economic limitations or were unviable due to geographical or climatic infeasibility and environmental ineffectiveness. The chiefly preferred technique in the city was open dumping wherein the waste was dumped in open locally without any prior treatment practice. The other way of getting rid of the waste menace would consist of dumping the waste in nearby nallahs and Jhelum River by the people. Now a day's the responsibility of waste collection and management is handled by Srinagar Municipal Corporation. Municipal solid waste is usually generated from households, commercial establishments, hospital and clinics, theatres, educational institutions, parks, markets, hotels and street sweepings. During the research period it was found that as the population of Srinagar city goes increasing, the quantity of waste also increased [7-8]. The data of waste generation on yearly basis in the city was obtained from the SMC and from secondary sources. (Table 1) represents the historical data on municipal solid waste generation from 2010 to 2022 in Srinagar city.

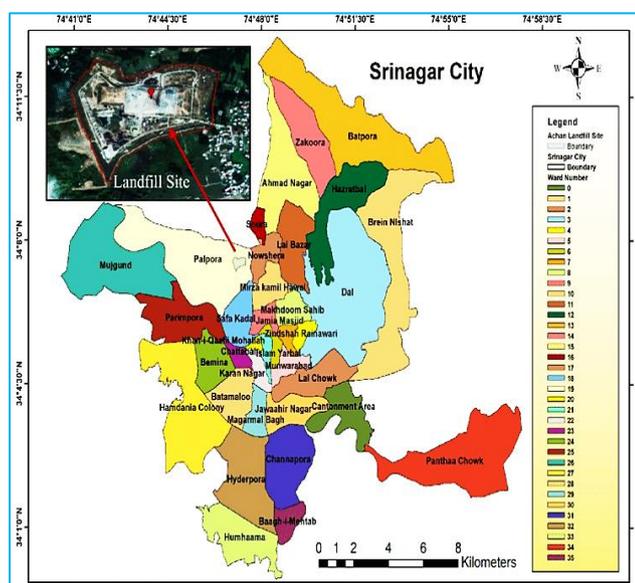
Table 1 Historical data on MSW generation of Srinagar city

Year	Population	MSW (MT Year-1)	Households
2010	984,537	76,856	171,550
2011	1,236,829	82,585	178,213
2012	1,259,463	87,738	181,777
2013	1,282,511	95,510	185,413
2014	1,305,981	160,168	189,121
2015	1,329,880	135,922	192,903
2016	1,354,217	131,967	196,762
2017	1,478,999	141,506	200,697
2022	1,627,000	187,200	210,413

Source: Srinagar Municipal Corporation

Waste quantification

The waste generation has increased due to a number of factors like increase in population and increase in per capita generation. The per capita generation recommended by IS 12647-1989 is 0.4 Kgs/Capita/Day whereas it is 0.2 to 0.5 Kgs/Capita/Day as per CPHEEO Manual. NEERI recommends it to be 0.1 to 0.6 Kgs/Capita/Day depending on the type of place, habits of people and life style. There is also a seasonal



variation in solid waste quantity generated. The quantity is more during the tourist season or marriage season, which are mostly in the months of August, September and October. More paper items are disposed in summer than in winter due to holidays and shifting of offices to winter capital Jammu of the Union Territory [9]. Keeping all these factors in to consideration and from observations, a value of 0.4 Kgs/Capita/ Day seems appropriate. The population of Srinagar city in 2022 as per estimated data is 1.627 million. Assuming a design period of 10 years, design population in 2032 = 2.136 million. Hence solid waste generation in design year = 834 tons/day assuming 0.4 Kgs/Capita/Day. (Table 2, Fig 1) shows the breakup of MSW generation while as table 3 represent the quantification of waste in Srinagar city.

Table 2 Breakup of municipal solid waste generation in Srinagar city

Sources of MSW generation	Percent	Quantity of waste generated (TPD)
Households	55	321
Commercial places (shops, Markets etc.)	24	148.8
Street sweeping	8	49.6
Lakes	1	6.2
Restaurants/ Hotels	10	62
Others	2	12.4
	100	520

Source: Srinagar Municipal Corporation

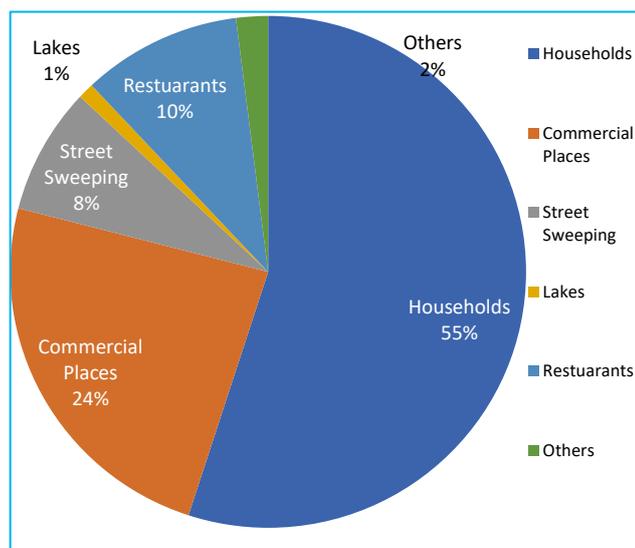


Fig 1 Breakup of MSW generation in Srinagar city

Table 3 Quantification of MSW in Srinagar city

Particulars	Quantity
Average per capita of MSW	0.4 kg/person/day
Total MSW generation in the city (Year-2022)	520 tons per day
Projected waste generation in (Year – 2025)	690 tons per day
Construction and demolition waste generation	100 tons per day
Domestic hazardous waste generation	5 tons per day
Quantity of E-waste generation	2 tons per day
Poultry waste generation	6 tons per day

Source: Srinagar Municipal Corporation

Collection of solid waste in Srinagar city

During the survey it was also noticed that sweeping operation which includes collection of waste from roads / streets is carried out in certain areas, important roads and markets daily. Some areas are swept on alternate days or twice a week, while others are swept occasionally or not at all. There are no defined working norms for sweeping and road length for a sweeper to be swept is not standardized. In Srinagar at many places, sweepers are carrying out their routine sweeping on beat basis consisting of 100 - 200 households including main roads, link roads, lanes, bye-lanes, in some cases work is assigned on the basis of road length which varies from 250 running meters to 500 running meters of main road inclusive of various links which join these roads. In Srinagar city, at present about eighty percent population is attended to regularly under street sweeping and collection of solid waste, leaving 20 % of the population unattended especially in outside the urban fringes which are part of Srinagar corporate limits. In these areas certain slum pockets, heaps of stinking solid waste are sent at number of places which remains unattended and is removed only when situation deteriorates. Street sweeping in Srinagar is done in one shift from 7 am to 2 pm. In the morning hours, sweeping on streets and roads is carried on as per the work assigned to each sweeper. In the afternoon, most of the streets are not swept as a result the solid waste is seen littered at most places which warrants introduction of shift sweeping. Besides group sweeping concept is almost missing in the city except during sanitation drives. The collected solid waste is carried in handcarts to the community bins these handcarts have very small capacity and ill designed as they have to upturn for unloading the waste on the ground [10].

The community bin system which is wide spread practice in Srinagar is also not available at convenient locations for collection of municipal solid waste. Appropriately designed / covered bins are grossly inadequate; as a result, in most cases waste is dumped at open collection points which generates public nuisance. Also due to the shortage of space and community bins people throughout the city deposit the solid waste on open grounds/streets and sweepers also are compelled to dump waste at such places. It is also found that in some areas the collected waste remains in heaps and not removed, these areas often attract stray animals and rag pickers [11].

Processing and disposal of solid waste in Srinagar city

Srinagar city generates large quantities of waste which is unscientifically and indiscriminately disposed. At present about 520 tons of solid waste is produced within Srinagar municipal limits out of which about 390 tons are daily taken care by Srinagar municipality and disposed off at Syedpora Achan dumping site without any resource recovery. During the research period the consultant observed that few people or *Safai Karamcharies* also dump the waste illegally in depressions, *nallahs*, or river embankments, unattended open spaces or is locally incinerated both by individuals or *Safai Karamcharies*. This indiscriminate dumping within residential areas or at the periphery of settlements is generating environmental problems of dereliction of land, contamination of water, air and unpleasant surroundings. The individual household/sweeping staff also quite often burns the waste in the street corners and back yards leading to the release of toxic chemical compounds in the air within the habitation area. The improper dumping of solid waste by the Srinagar Municipality at Achan with least concern to the location of water sources, either surface or underground, results in leachate action or contamination of water sources. In addition, the adhoc dumping in dried *Doodganga* river from *Sanatnagar* to *Parimpora* (24 points),

the periphery of the city shallow depressions, unattended / abandoned sites can also have adverse effects on the ground / surface water sources and the environment [12-14].

In Srinagar despite indiscriminate disposal of solid waste, adverse effects of improper and inadequate solid waste management operations are still partially appreciated as it is still difficult to link the resultant health effects directly to the inadequacy in waste management. However, polluted water being the prime reason for incidence and spread of a number of infections / contagious diseases, the consultant carried out a detailed study of the dumping sites to analyze the prevalent dumping practices at Syedpora Achan and at other adhoc dumping sites within the city. Achan landfill site is spread over an area of 600 kanals of land. Dumping of Municipal solid waste is in process there since 1983. During the last 39 years 60% of area has got filled. It has enough capacity to serve the purpose for next 10-15 years, if same process continues, however if dumping process is modernized and if disposal of waste is done in more scientific manner; it has sufficient capacity to absorb the full volume of wastes of the city for about next 20-25 years [15-17].

(a) *Evaluation of landfill site*

The consultant conducted a detailed survey of Syedapora Achan landfill site and collected the relevant information about the existing dumping practices in Srinagar. Evaluation has been based upon the techniques and criterion to achieve an environmentally friendly landfill, designed to protect environment and aesthetics. The study of landfill site has been arrived out with respect to following:

1. *Location*: The landfill site must necessarily be away from the inhabited area but need to be easily accessible and approachable. The Syedapora Achan site has appropriate location, however, has difficult approach through built up area. It has also been observed that expansion of residential houses has started towards landfill site which need to be checked.

2. *Separation and shredding*: In land filling site separation and shredding are very important pre-requisites. In Syedapora Achan and adhoc dumping sites of Srinagar Municipality, separation and shredding are not being practiced. Unauthorized rag pickers indulge in the activity for personal gains and are collecting heaps of few reusable items, spoiling the surrounding and risking life. The rag papers, packaging polythene bags and other find their way to Achan landfill and create problems of compaction. This has further added to the problems of midway dumping within Achan landfill site and blocking the entry of the site.

3. *Periodic soil cover*: It helps in leveling and compaction. It also acts as vector control as well as odor and bird control. In case of fire, the area becomes confined and the resulting heat kills the insects and micro-organisms. The aesthetics also becomes unpleasant. At Syedapora Achan dumping site, soil cover is not applied. However, few years back about 500 truckloads of soil were purchased which have been dumped at Achan. Unfortunately, few of these trucks loads of soil have not been spread over the waste and still lie in heaps.

4. *Compaction and leveling*: The waste to Achan site is brought by tippers/ tractor trolleys, while as it is brought by wheel barrows/hand carts to adhoc dumping sites. After tipping the waste at Achan, it is leveled occasionally by bulldozers. In the absence of any soil cover and shredding whatever little compaction is achieved is by plying trucks progressively over the extending waste surface. In the absence of appropriate compaction and leveling during field visit by consultant, heaps of wastes were visualized at the site. This is generating problems of operation and movement of trucks/tippers, equipment and poor site development for future use. It is also resulting into increased permeability, less bulk density and shear strength of the filled site.

5. *Animal menace*: At present Syedapora Achan is a thriving ground for stray animals and birds. In the absence of any scientific method of developing the site, birds and stray animals are also becoming victims and vectors of disease. The site is also enclosed, fenced from all sides which make movement of stray animals easier. Measures to check the entry of animal/ bird menace are immediately needed.

6. *Insects / flies*: During the field survey it has been observed that Syedapora Achan site being located amidst of agricultural land, the insects/ flies which often become vectors of disease, damage the crops of adjacent agricultural fields. Therefore, strict control is required to prevent the serious outbreak of diseases.

7. *Aesthetics of the site*: Syedpora Achan presents a very poor aesthetics. Overall view of the site is highly disturbing. The site presents a picture of heaps of waste with stray animals, birds and unauthorized rag pickers moving over these heaps. The rag pickers set fires to garbage to enable them to recover scrap material which fetches some value in market. Also, odor from the site invades inhabited areas and dust/smoke flying from site often engulfs large areas around it causing danger of a number of health disorder and damages to the standing crops.

Table 4 The present scenario of solid waste management in Srinagar city

Functional element	Details
Segregation or storage at source	Generally absent, waste is thrown on streets
Primary collection	Does not exist, waste is deposited on the streets and picked up through sweeping
Waste storage deposits	Very unscientific, waste is stored on open sites/ Masonry enclosures. A few containers are however, in use
Transportation	Manual loading is open trucks/ Partly dumper placers
Frequency of removal	Irregular/Alternate day/ Once in three days/ Once in a week
Processing	No processing is carried out
Disposal	Unauthorized dumping in open space

8. *Ground surface water*: The surface of the Syedpora Achan site is leveled and is at par to the adjacent agricultural fields. During dry seasons the water table is three feet below while as in wet season because of predominance of paddy fields around it, water table is above the ground level. In absence of

any protective measures due to high water table during wet season, wastes have high potential for leachate/ contamination. In addition, no measure has been taken to protect ground water. Low molecular weight chlorinated solvents as leachate e.g., Trichloroethylene, carbon tetrachloride etc. are very harmful;

these are of great concern due to high lateral mobility of water to surrounding areas during paddy season. The overall present scenario of municipal solid waste management in Srinagar city of Jammu and Kashmir is given in (Table 4).

CONCLUSION

Human activities produce waste, and the ways it is handled, collected, stored, and disposed off can pose risks to the environment and public health. Srinagar is the first metropolis and the fastest growing city of Western Himalayas and here the municipal solid waste management (MSWM) is a major challenge for the local authorities. More than 15,000 metric tons of solid waste generated every month in Srinagar may become one of the major challenges for the successful implementation of the Smart City project in the summer capital. For the past many years, the government has failed to address the menace of solid waste as the city generates nearly 520 metric tons of solid waste every day and is dumped in the heart of Srinagar, at Achan, the only landfill site in Srinagar. The waste is not just dumped at the dumping site, but one can find it everywhere. The waste is directly dumped around a residential area, a government backed land filling site at Achan without being treated. With a population of more than 16 lakh, spread over an area of 227.34 km² on both sides of the river Jhelum, not even in a single residential area or commercial area in Srinagar has the waste generation facility; and much of the waste is deposited

into water bodies like the river Jhelum, Dal Lake etc. The whole work can be concluded as follows:

- Srinagar Municipality provides Solid Waste Management services since 1886.
- The area of Srinagar municipality is 227.34 Kms² in 2022 and has been divided in to 74 wards of varying population and size.
- The population of the Srinagar Municipality is more than 16 Lakhs in 2022.
- Municipal Solid Waste of Srinagar is characterized as 67.06% bio-degradable and rest as non-biodegradable.
- The MSW management is carried out at ward level through unskilled and skilled persons.
- There is a complete lack of shift and night sweeping in the city.
- House to house collection of MSW is being undertaken in 25% of households through SMC and some NGO's.
- About 520 tons of solid waste is collected in Srinagar city, out of which 390 tons are disposed of by SMC at Achan landfill site and the rest 130 tons are used for composting.
- About 10 – 14% of the households dispose of their wastes into nallahs / rivers / lakes.
- Disposal of solid waste by SMC is only through land filling at Achan dumping site.
- The overall percentage composition of non-biodegradable MSW in all the three selected wards is 5.55 % and that of Biodegradable waste is 14.56%.

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