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Composition of Municipal Solid Waste in Srinagar City of Jammu and Kashmir

MUDASIR AMIN SHEIKH[1] and RAYEES AFZAL MIR[2]

[1-2] Department of Environmental Science, Glocal School of Agricultural Sciences, Glocal University, Saharanpur - 247 001, Uttar Pradesh, India

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Abstract

Solid wastes comprise all the wastes arising from human and animal activities that are normally solid, discarded as useless or unwanted. Solid wastes are those organic and inorganic waste materials produced by various activities of the society, which have lost their value to the first user. Improper transport and disposal of solid waste pollutes all the vital components of the living environment (i.e., air, land and water) at local and global levels. There has been a significant increase in MSW (municipal solid waste) generation in Srinagar in the last few decades. This is largely because of rapid population growth and economic development. The Municipal Solid Waste generating sources in Srinagar are households, restaurants, street sweeping, markets and work shops, offices, Hospitals and Hotels. On average the total waste generated in Srinagar includes biodegradable waste (53.82%), recyclable waste (15.87%), inert waste (30.31%) and the moisture content (43.44%). The average composition of MSW in Srinagar city includes plastic 8.58%, polythene 11.61%, glass 2.30%, metal 0.38% and miscellaneous non-biodegradable wastes as 5.89%. Similarly, the average composition of biodegradable waste materials include paper 15.25%, cardboard 10.18%, food waste 23.83%, cloth 3.06% and miscellaneous biodegradable waste as 18.96%.

***Key words*:** Biodegradable waste, Non-biodegradable, Innert waste, Srinagar municipal corporation, Tons per day

Municipal Solid Waste (MSW)—more commonly known as trash or garbage arises from Residential, Commercial, Institutional and Industrial sources. It is composed of paper, plastic, glass, cloth, metals, organic waste and ashes etc. It has been observed that the wastes are almost always produced whenever we convert a natural resource into a commodity, though its nature and quantity can vary. Municipal solid waste is a heterogeneous mixture of paper, plastic, cloth, metal, glass, organic matter, etc. generated from households, commercial establishments and markets. The proportion of different constituents of waste varies from season to season and place to place, depending on the lifestyle, food habits, standards of living, the extent of industrial and commercial activities in the area, etc. Solid wastes comprise all the wastes arising from human and animal activities that are normally solid, discarded as useless or unwanted. Solid wastes are those organic and inorganic waste materials produced by various activities of the society, which have lost their value to the first user. Solid waste refers to any waste that is in a solid state, including both organic (biodegradable) and inorganic (non-biodegradable) materials. Organic waste includes things like food scraps and yard waste, while inorganic waste comprises materials like plastics, metals, glass, and paper [1]. The concept of losing value to the first user may be more related to the economic or functional value of an item rather than its classification as a solid waste. For example, when products or materials are discarded, they may no longer hold value for the initial user, but they can still have potential value in terms of recycling or repurposing. Improper transport and disposal of solid waste pollutes all the vital components of the living environment (i.e., air, land and water) at local and global levels. There has been a significant increase in MSW (municipal solid waste) generation in Srinagar in the last few decades. This is largely because of rapid population growth and economic development. Poor collection and inadequate transportation are responsible for the accumulation of MSW at every nook and corner. According to Tchobanoglous *et al.* [2], solid waste management may be defined as the discipline associated with the control of generation, storage, collection, transfer and transport, processing and disposal of wastes in a manner that is in accord with the best principles of public health, economics, engineering, conservation, aesthetics, and other environmental considerations that are also responsive to public attitudes. Management of municipal solid waste continues to remain one of the most neglected areas of urban development in India and same is the case of Srinagar city. Municipal solid waste generation in Srinagar has increased from180 tons to 530 tons within last 30 years. This tremendous increase of MSW has posed great pressure on Govt. and the Srinagar municipality for proper collection, transport and disposal of the waste [3-5].

The composition of Municipal Solid Waste (MSW) varies from place to place or region to region. It depends on the number of factors such as social, custom, standards of living, Geographical location, climate etc. MSWM is heterogeneous in nature and consists of a number of different materials derived from various types of activities. The Municipal Solid Waste

***Correspondence to:** Mudasir Amin Sheikh, E-mail: mehraj.evs@gmail.com

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(MSW) is mainly categorized into biodegradable and non-bio degradable waste [6].

Biodegradable waste consists of paper, cardboards, food waste, cloth and miscellaneous waste. Non-biodegradable waste comprises of plastic, polythene, glass, metal and miscellaneous waste. Biodegradable miscellaneous waste includes wood, fine dust, bricks etc. Non-biodegradable miscellaneous waste consists of rubber, leather etc.

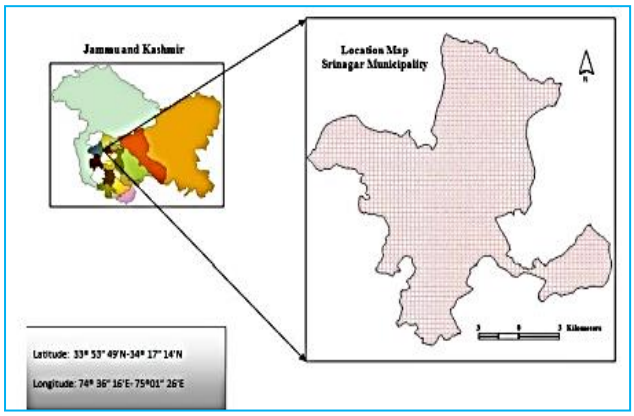
Table 1 Major components of household waste

S. No.	Components	Items
1.	Biodegradable	Vegetables, Kitchen wastes, garden sweeping, food waste etc.
2	Plastics	Carry bags, wrappers, vessels, containers, and other plastic items.
3	Paper	Newspaper, wrappers, Trash paper, Cardboard etc.
4	Solids	Leather, Metals, textiles, batteries, earthenware, rubber etc.
5	Glass	Glass bottles, bowls, glass cups, utensils, etc.
6	Sanitary	Incontinences pads, sanitary towels, etc.
7	Medical	Waste medicine, syringes, surgical wastes, soiled bandages etc.
8	Inert Material	Comprises mainly of construction and demolishing debris, dirt, ashes etc.

MATERIALS AND METHODS

Study area

The study area selected for analysis was Srinagar city during January 2022 to July 2023 for effective sampling and its study purpose. 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. Every day around 520 tons of municipal waste is collected by SMC out of which 390 TPD is unloaded by vehicles of Srinagar Municipal Corporation at Achan landfill site and 130 TPD is used for composting and RDF and the waste generation in 2035 is expected to be more than 1723 tons per day (SMC).



Study area

Methods used

A field work of the entire Srinagar city was started from January, 2022 to June, 2023 to visualize the existing scenario of solid waste composition and disposal by the Srinagar Municipal Corporation. A number of 3 wards of Srinagar city were randomly selected viz Rajbagh, Sonwar and Channapora. A questionnaire was prepared covering all aspects of solid waste management and conducted survey of 3 wards, covering a major portion of the Srinagar city. For the determination of nature, composition and magnitude of solid waste, several places were visited along with the SMC workers (Safaikaramcharies). The total quantum of household waste collected by the workers of Srinagar Municipal Corporation was categorized into specific fractions, lying almost emphasis on the possibilities of utilization and providing scope for recycle, reuse of these fractions of wastes and therefore, aiming at the maximum reduction of the volume of waste eventually left for the final disposal. The waste collected from households were examined by a weighing balance. Data that was collected from various sources was analyzed and compiled.

RESULTS AND DISCUSSION

The Municipal Solid Waste generating sources in Srinagar are households, restaurants, street sweeping, markets and work shops, offices, Hospitals and Hotels.

Primary collection

Sweepers collect the MSW from the roads /streets and carry it to the nearest collection points. MSW produced from individual households in Srinagar is taken to the collection point or just deposited on the adjacent roadside from where it is collected by the sweepers. This type of waste collection is called primary collection.

Methods of storage

SMC has placed dumps/ open sheds at various places which are scattered throughout the city. Open bin or missionary bin for temporary storage of waste.

Secondary collection of MSW

The MSW is collected again from the collection point for transportation to the disposal site. It is termed as secondary collection. Transportation of waste from collection center by un-covered tippers/trucks and Tractors to dumping site.

Final disposal of MSW

There is a single sanitary landfill site in Kashmir at Syedapora, Achan where Municipal solid waste to some extent is dumped in a scientific manner. Every day around 520 tons of garbage is unloaded by vehicles of Srinagar Municipal Corporation (SMC) at Achan site and the waste generation in 2035 is expected to be 1723 tons per day (SMC). Therefore, there is an urgent need to assess available land in Srinagar city and identify potential landfill sites before it is too late.

Composition of municipal solid waste in Srinagar

Municipal waste has been classified into two parts, non-biodegradable waste and biodegradable waste. Non-biodegradable waste is those wastes that cannot be decomposed or dissolved by natural means. They remain on earth for hundreds of years without any degradation. Therefore, the threat they pose is also more critical. Examples of non-biodegradable wastes found in study sites are polythene, plastics, glass, cans, metals, rubber, leather and chemicals for agricultural and industrial purposes [7-9]. They are the main causes of water, air, and soil pollution and diseases like typhoid, hepatitis, cancer etc.

Biodegradable waste are such wastes that are and can be degraded by natural agents like microbes (e.g. bacteria, fungi, protozoa etc.) and abiotic elements like oxygen, temperature,

UV, etc. Some examples of such wastes found in the study area are food materials, kitchen wastes, paper, cardboard, food waste, cloth and other natural wastes. Microorganisms and other abiotic factors work together to break down complex substances into simpler organic substances, which eventually floats and fade into the soil. The whole process of degradation is natural, which can be fast or slow [10]. Therefore, the environmental problems and risks from biodegradable wastes are low. On average the total waste generated in Srinagar includes biodegradable waste (53.82%), recyclable waste (15.87%), inert waste (30.31%) and the moisture content (43.44%). The total calorific value has been found to be 1421.5 kcal/kg. (Table 2) shows the characterization of Municipal Solid Waste in Srinagar city by different agencies [11].

Table 2 Characterization of municipal solid waste in Srinagar city

Component	CPCB-NEERI	ERA	SMC	Average
Biodegradable waste	61.77%	58.50%	41.19%	53.82%
Recyclable waste	17.76%	10.30%	19.54%	15.87%
Inert waste (Combustible and Non-combustible)	20.47%	31.20%	39.27%	30.31%
Moisture content	61%	25.88%		43.44%
Calorific value	1264 kcal/kg	1579 kcal/kg		1421.5 kcal/kg

Source: SMC

Table 4 Represents the percentage composition of waste in Srinagar

MSW composition	S_1	S_2	S_3	S_4	S_5	S_6	S_7	S_8	S_9	S_{10}	Over all %
Non bio degradable waste materials											
Plastic	9.0	6.0	10.30	11.0	8.20	7.70	10.10	5.20	8.30	10.0	8.58
Polyethene	6.20	6.30	7.20	8.0	15.0	12.20	15.80	16.0	17.40	12.0	11.61
Miscellaneous	3.0	7.0	10.20	8.50	4.10	7.5	7.30	-	4.30	7.0	5.89
Glass	1.60	2.10	4.20	3.0	3.40	1.25	3.0	3.50	-	1.0	2.30
Metal	-	1.10	-	-	-	1.20	-	-	1.50	-	0.38
Biodegradable waste materials											
Paper	16.30	14.30	13.30	13.40	11.0	15.0	15.10	21.10	13.0	20.0	15.25
Card board	9.90	8.80	10.20	12.20	14.0	3.30	10.10	13.0	10.30	10.0	10.18
Food waste	26.20	27.40	23.20	23.40	25.0	22.80	20.30	25.0	23.0	22.0	23.83
Cloth	7.50	6.40	3.20	-	2.00	9.5	-	-	2.0	-	3.06
Miscellaneous	20.30	20.60	18.20	20.50	17.30	20.00	18.30	16.20	20.20	18.0	18.96

Table 3 Average composition of MSW generated in Srinagar

S. No.	Waste category	Percentage
1	Food	30
2	Cardboard	16
3	Wooden items	13
4	Paper	18
5	Bones	11
6	Glass	3
7	Plastic and polythene	5
8	Metals	2
9	Batteries	

The composition of Municipal Solid Waste varies in selected wards (Rajbagh, Sonwar and Chanpora) of the city. However, on an average composition of Municipal solid waste in Srinagar city is listed in the following (Table 3).

The composition of municipal solid wastes in Srinagar city varies from place to place and from one ward to another ward. As shown in the (Table 4, Fig 1), the average composition of non-biodegradable waste in Srinagar city includes plastic 8.58%, polythene 11.61%, glass 2.30%, metal 0.38% and miscellaneous non-biodegradable wastes as 5.89%. Similarly, the average composition of biodegradable waste materials include paper 15.25%, cardboard 10.18%, food waste 23.83%, cloth 3.06% and miscellaneous biodegradable waste as 18.96%. These percentages represent the proportion of each type of non-biodegradable waste in the overall waste composition. Such data is crucial for waste management and environmental planning. It helps authorities and communities design effective strategies for recycling, disposal, and reducing the environmental impact of these materials [12].

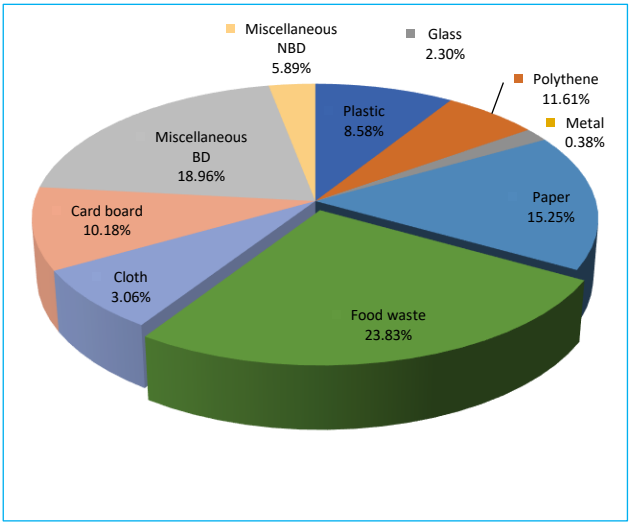


Fig 1 Composition of municipal solid waste in Srinagar

CONCLUSION

Municipal Solid Waste generating sources in Srinagar city of Jammu and Kashmir are households, restaurants, street sweeping, markets and work shops, offices, hospitals and hotels. Municipal waste has been classified into two parts, non-

biodegradable waste and Biodegradable waste. Non-biodegradable wastes found in study sites of Srinagar are polythene, plastics, glass, cans, metals, rubber, leather and chemicals for agricultural and industrial purposes. They are the main causes of water, air, and soil pollution and diseases like typhoid, hepatitis, cancer etc. Some examples of biodegradable wastes found in the study area are food materials, kitchen wastes, paper, cardboard, food waste, cloth and other natural wastes. On average the total waste generated in Srinagar includes biodegradable waste (53.82%), recyclable waste (15.87%), inert waste (30.31%) and the moisture content (43.44%). The total calorific value has been found to be 1421.5 kcal/kg. Every day around 520 tons of garbage is unloaded by vehicles of Srinagar Municipal Corporation (SMC) at Achan landfill site and the waste generation in 2035 is expected to be 1723 tons per day (SMC). Therefore, there is an urgent need to assess available land in Srinagar city and identify potential landfill sites before it is too late.

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