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GROUND REALITIES OF MUNICIPAL SOLID WASTE MANAGEMENT IN SRINAGAR CITY

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ABSTRACT

Solid waste management is becoming a critical issue in the urban and sub-urban areas of Srinagar city due to its faulty handling and disposal practices. The paper presents the current status of municipal solid waste generation and disposal practices, and different sort of environmental problems arising out of it. Major problems identified include land and water pollution, inadequate technical know how, shortage of sweepers and collection bins, non-availability of sanitary landfill, uncontrolled disposal of solid waste by people, lack of public awareness, etc. a comprehensive survey of the whole city revealed that biodegradable/ compostable food waste was the major constituent of municipal solid waste (MSW) stream followed by inert material and recyclable materials including polythene, plastic, cardboard and paper. Most of the solid waste generated was found to remain unattended and only 40 – 45% was being collected that too irregularly by municipal workers and unscientifically disposed off at a dumping ground located in the buffer zone of Anchar Lake, around 8 km north of Srinagar city. Irregular and selective waste collection was the major force behind disposal of solid waste in water bodies, roadsides and open spaces by the people. Keeping in view the great cultural, socio-economic, ecological values and great tourism potential, some remedial measures for municipal solid waste management in the city have been suggested which include: segregation of solid waste into dry and wet wastes for recycling and bioremediation respectively, use of hand carts fitted with bins for door to door segregated waste collection, increase in the existing number of man power in the form of sweepers and transport fleet, regularized waste collection, comprehensive public awareness, and encouragement of private initiatives in MSW management.

Key words: municipal solid waste, Srinagar city, dumping ground, awareness, waste management

INTRODUCTION

Solid waste is being generated in ever increasing volumes in the urban areas world over, but as compared to developed countries, the organization and planning of the solid waste collection service in developing countries is very rudimentary. The pathetic condition of the waste collection services is reflected in the unknown quantity and type of solid waste collected, the amount recovered and recycled, the inadequate selection of final disposal sites, as well as inefficient reutilization and recycling programmes (Gupta *et al.*, 1998; Buenrostro and Bocco, 2003). Inadequate waste disposal creates serious environmental problems that affect health of humans and animals and cause serious economic and other welfare losses.

The valley of Kashmir is situated in the midst of the Himalayan Mountains system and is world famous for its natural beauty. The historical Srinagar city which is the summer capital of Jammu and Kashmir State has great cultural, aesthetic, socio-economic and ecological values. It is surrounded by hills on east and northeastern side located between the geographical coordinates $34^0\,05'$ N latitude and $75^0\,50'$ E longitude. The area of Srinagar city has

increased from 83 Km^2 in 1971 to 103.81 Km^2 in 1987. It further expanded to 177 Km^2 in later years. With further expansion of the city, the area increased to 300 Km^2. The Master Plan (2000-2021) has termed the Srinagar city as Greater Srinagar and placed the area measurement to 416.25 Km^2. At present the Srinagar city has been divided into 68 electoral wards and 34 administrative wards (Figure 1). Being the capital and largest urban settlement of Jammu and Kashmir State, Srinagar city has become a hub of major administrative, political, economic, commercial and other specialized activities. The city has recorded uninterrupted and accelerated population growth from 1971 onwards. Srinagar city is also famous for its lakes with house boats floating over them attracting thousands of tourists every year. The population of Srinagar city according to 2001 census was estimated 9.71 lakhs, excluding population of about 2 lakhs of 138.15 km^2 recently added master plan area, tourists flow numbers, office move employees, floating population and the strength of security forces located in Srinagar city. The projected population of Srinagar Municipal area at the end of year 2006 within coverage area of 278.1 km^2 was estimated about 11.37 lakhs whereas in entire SDA area, it was estimated to be 12.83 lakhs in coverage area of 416.25 km^2.

There is pathetic condition of MSW management in Srinagar city. Solid waste collection and disposal efficiency is only about 40% due to lack of manpower, equipments, and transportation fleet. Because of unregulated municipal collection, the solid waste generated daily is simply disposed off on streets, bylanes, open spaces, drains, and water bodies, especially in River Jhelum and Dal Lake. The pollution thereby created is objectionable and damaging for the possible hazards to public health and ecological and aesthetic damage to the attributes of lakes and the river. About 351.54 metric tons (MT) of MSW is generated daily of which approximately 55 – 60 % remains unattended due to poor waste collection and disposal services in the city. In the present communication the generation, characterization, existing system of MSW management and deficiencies in MSW management faced by the local urban body (SMC) along with some suggestive measures are presented.

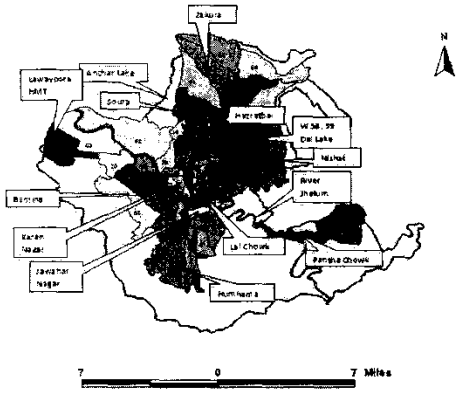

Fig. 1: Map of Srinagar city showing municipal wards (electoral) and outer SDA boundary line

MATERIAL AND METHODS

Survey and sampling of municipal solid waste (MSW) in Srinagar city of Jammu and Kashmir, India, was carried out from March 2004 to February 2006. Collection of MSW samples for physical characterization was carried out in two stages: selecting the truck from which to take the sample and collecting the sample from the load discharged from the selected truck. The selection of trucks was made according to the selected representative sites from where they used to bring MSW regularly. Each time the truck drivers were directed to discharge the waste load in a separate area for sample collection. Four samples of about 5 kg were collected from each load using blind grab method. The samples were then mixed to obtain a well formed composite sample. The well-mixed samples were then reduced to approximately five kg by quartering method. The representative samples were then manually screened for the determination of physical composition at the disposal facility. Physical composition was determined in terms of biodegradable waste material including food wastes, yard trimmings, fruit waste, vegetable remains etc., paper, cartons, clothe rags and wooden chips and non-biodegradable waste material, both combustible and noncombustible, including polythene, plastic/ rubber, glass, metal scraps and inert materials. Per capita per day MSW generation was also determined in two stages. First the per capita house hold solid waste was determined by weighing the solid waste generated by the selected households located in different parts of the city. Composition of household solid wastes was determined instantly. Per capita per day MSW was then determined by comparing the physical composition of household with the composite samples collected from collection points. Increase in percent composition of individual components was considered as addition of waste materials from various sources other than household solid waste materials.

RESULTS AND DISCUSSION

Prevailing system of MSW management in Srinagar city:

Management of MSW in Srinagar city is the primary responsibility of Srinagar Municipal Corporation (SMC). The Srinagar city is divided into 68 electoral wards and 34 administrative wards. The Municipal Commissioner is the overall in-charge of the city under him are the Health Officer, Ward officers, Transport officer, Sanitation officer, Assistant Sanitation Officers, Sanitary Inspectors, Sanitary Supervisor and Sweepers. The SWM department of SMC has only 1342 regular and 614 consolidated safaiwalas (sweepers) for street sweeping and collection of MSW.

According to SMC sources 235 MT of solid waste is daily collected and transported to the disposal facility. This figure of 235 MT was contradictory with SMCs own calculation of 258 MT (SMC, 2006) as given in Table 1. The SMC was found to estimate on the basis of presumed number of trips made by the tippers and dumpers per day. There was no system in place for regular supervision and verification of actual number of trips. However the present study revealed that only about 125 MT of MSW is collected, transported and disposed off by the SMC daily except holidays (Table 1). Due to shortage of sweepers, equipments, low collection efficiency, shortage of transport fleet, irregular collection services and lack of other waste management options like recycling, composting, etc. the inhabitants are forced to throw or dispose off the solid waste on streets, bylanes, open spaces, drains and water bodies especially in river Jhelum – the lifeline of Kashmir valley and world famous Dal lake. Open burning of the waste material has also been found a common practice almost everywhere in the city. The solid waste collected and transported by SMC is dumped in an open dumping ground at Saidpora, Achan which is spread over an area of 31.13 hectares and is in operation since 1986 (SMC, 2006). This dumping ground is located in the buffer zone of Anchar lake and very close to human settlement causing inconvenience to the inhabitants because of regular movement of trucks loaded with garbage. The inhabitants also do not want the MSW to be dumped there because they are exposed to possible health hazards associated with its unscientific and open dumping.

Table 1. Details of vehicles used for Transportation of MSW and the quantity of waste transported (source: SMC, 2006; primary data)

Type of Vehicles	Number	Capacity (MT)	Avg. load (as observed)	Avg. no. of trips per day	Avg. no. of trips per day	Total MSW transport	Total MSW transported (as
Tippers	21	3	2.62	52	30	156	78.6
Dumper Placers	12	1.5	1.14	36	36	90	41.04
R-4 Refuse collector	1	5	5	2	1	10	5
Tractor	1	1	0.8	2	0.5	2	0.4
Total						**258**	**125.04**

Generation of MSW

Per capita per day solid waste generation was determined in two stages. In first stage, household per capita solid waste generation was determined by collecting samples from selected households belonging to different income groups like high income, medium income and low income groups. The practice was carried out for one year on monthly basis. It was observed that on an average 149.13 grams of household solid waste was generated per person per day. Component composition was also determined instantly. The results revealed that 85 – 90% of waste was biodegradable food wastes followed by polythene, paper, cardboard and dust sweeping. In second stage solid waste samples were collected from the community collection points. On comparing the physical composition of these samples with that of household waste samples, an increase of about 45.5 % in the composite waste was observed. The major contributor was found to be the inert material followed by polythene, plastic/rubber, cardboard, clothe rags, etc. On the basis of these analyses, the per capita per day MSW generations in Srinagar city was estimated to be 273.66 grams, say 274 grams. Therefore, the total quantity of MSW generated per day for a projected population at the end of 2006 in municipal limits turns out to 311.53 MT and for whole coverage area of 416.25 km^2 it is 351.54 MT. The figures do not include the quantity of waste generated by tourists, office move employees, floating population and the strength of security forces located in Srinagar city.

Physical Characteristics of MSW

The data on physical characterization of MSW in Srinagar city have been presented in Table 2. Biodegradable waste that included food waste, vegetable and fruit waste, grass clippings, and other fine organic matter was found to be the major component of waste stream except at commercial site where inert material dominated other components. Biodegradable waste ranged between average value of 58.69 % to 33.62 % for residential and commercial areas respectively. Higher proportion of biodegradable waste in the waste stream was mainly due to maximum usage green vegetables, cuttings of gardens and lawns and due to high moisture content. Proportion of paper, cardboard, polythene, and inert material was found higher at commercial site due to the usage of polythene and paper as packaging material. Patil *et al.* (1985) have also reported higher proportion of paper in commercial areas mainly due to packaging, etc. Comparatively higher proportion of inert material at commercial site was mainly due to street sweeping of paved interior streets, and construction and demolition waste. Plastic waste that included mineral water and cold drink bottles was found higher at the tourist cum commercial site at Nehru Park – the front side of world famous Dal lake. This was mainly due to the larger usage of these utility items which are otherwise less used

in residential areas. On the other hand clothe rags' proportion was less at the tourist site as compared to other sites. Other minor contributions into MSW stream were from wooden chips, glass and metal scraps. During the course of study it was observed that paper, cardboard, plastic, selected polythene, and metal scraps were collected by rag pickers to earn their livelihood by selling these items to the scrap dealers.

Deficiencies in existing MSW management system

Human activities create waste and the increasing scale of economic conditions has led to sharp increase in the quantity of waste generated. The whole process of MSW management comprises of waste generation, storage, collection, transportation, intermediate processing and treatment, transportation and final disposal. Effective waste management through MSW composition studies is important for numerous reasons, including the need to estimate material recovery potential, to identify sources of component generation, to facilitate design of processing equipment, to estimate physical, chemical and thermal properties of the waste and to maintain compliance with national laws (Gidarakos *et al.*, 2006). Moreover, atempts to promote waste minimization in developping countries have been hampered by lack of data on waste production, collection and disposal (WHO, 1998). In Srinagar city the SMC has not carried out physical and chemical studies of the solid waste and there was no record of how much solid waste is generated daily, how much is collected, transported and disposed.

The important problem areas identified during the study period were shortage of sweepers, transportation vehicles, equipments, shortage of collection bins / containers, no maintenance of collection bins / containers, very low collection efficiency, open collection points exposed to rag pickers and scavenging animals and ideal breeding grounds for vectors, multiple handling of waste resulting in wasteful use of manpower and time, non-availability of sanitary landfill, any recycling plant, compost plant, lack of awareness, etc. Existing system of MSW management was mainly focused on crude type of waste collection without any consideration to proper waste treatment or disposal resulting in environmental and health problems like contamination of surface and ground water through leachate and direct disposal of waste into the water bodies, air pollution by open burning of waste, fly nuisance, release of bad odour and other harmful gases.

% MSW components	Sampling Locations				
	Residential	Commercial	Mixed (Residential cum Commercial)	Tourist cum commercial	Composite (dumping site)
Biodegradable	58.69	33.62	49.58	51.24	56.31
Paper	1.54	2.68	1.93	1.44	1.38
Cardboard	2.33	9.58	3.79	4.29	2.92
Clothe Rags	2.28	2.64	2.72	1.88	2.25
Wooden Chips	0.87	1.73	1.17	0.50	0.86
Polythene	3.48	8.29	5.2	5.37	4.33
Plastic/Rubber	1.90	4.46	2.57	4.89	2.29
Glass	0.56	0.90	1.47	1.21	0.76
Metal Scraps	0.11	0.39	0.41	0.16	0.17
Inert Material	28.24	35.71	31.16	29.02	28.73

Suggestive measures to overcome the existing deficiencies

The process of only collection and disposal of garbage is not sufficient to manage this problem. Waste should be managed in such a way that it can generate livelihood and enrich soil by means of recycling and composting. Today reuse and recycling of materials have become both economic as well as ecological necessity. Current waste disposal philosophy is to treat all waste as a resource material – some for recycling, some for conversion to compost, some as source of energy and the balance for land reclamation (Singh and Sharma, 2004). The present study has revealed a number of deficiencies in the existing MSW management system and to overcome these deficiencies some constructive measures need to be taken by the SMC. Keeping in view the population strength, area and the quantity of MSW generated in Srinagar city, the number of sweepers should be raised from existing 1956 to about 4000. There should be at least 10 sweepers / km^2. Handcarts fitted with bins, separately for dry and wet wastes, should be provided to sweepers for door to door collection. People should be encouraged to not to litter and to segregate the solid waste at their homes and commercial establishments through mass awareness campaigns. During the course of study, the inhabitants in different localities were found ready to cooperate with SMC if regular and door to door service is provided. If provided this type of service will also overcome the problems of multiple handling of MSW resulting in wastage of time and manpower, open collection points and scavenging animals. The number of transport-tation vehicles is also less and inadequate. Three

times increase in the number of existing transport fleet will be able to cater the solid waste transportation problem. More collection bins are required to be procured by the SMC and kept separately for dry and wet waste at appropriate distances. Maintenance of the collection should be carried out regularly. There is also a need of setting up of micro-enterprises for the purchase of recyclable materials in each ward to encourage segregation of MSW at source.

The study concluded that MSW generated in the city contains higher percentage of compostable material followed by inert and recyclable materials. Therefore, priority should be given to composting and recycling so that only a small portion of MSW should reach the disposal facility. Public should be encouraged for backyard composting of the biodegradable household waste. Moreover, conventional methods of waste management should be replaced by applying new appropriate strategies and technologies based on community participation. For this purpose private initiatives in the waste collection, disposal or utilization should be encouraged.

REFERENCES

Buenrostro, O. and G. Bocco. 2003. Solid waste management in municipalities in Mexico: goals and perspectives. *Resources, Conservation and Recycling*. **39**: 251 – 263.

Gidarakos, E., G. Havas and P. Ntzamilis. 2006. Municipal solid waste composition determination supporting the integrated solid waste management system in the island of Crete. *Waste Management*. **26**: 668 – 679.

Gupta, Suchi, K. Mohan, R. Prasad, Gupta, Sujata and A. Kansal. 1998. Solid waste management in India: options and opportunities. *Resources, Conservation and Recycling*. **24**: 137 – 154.

Master Plan 2001 – 2021. *Srinagar Metropolitan Area*. Srinagar Development Authority. Government Press, Srinagar.

Patil. A. D., B. Z. Alone and A. D. Bhide. 1985. Characteristics of municipal solid waste and its variation in Pune city. In: R. K. Trivedy and P. K. Goel (Eds.) *Current Pollution Researches in India*. pp 185 – 187.

Singh, D. and R. C. Sharma 2004. Characterization and management of municipal solid waste of Srinagar - Garhwal *JOURNAL OF ENVIRON. SCIENCE & ENGG.* **46** (2): 102 – 107.

SMC, 2006. *Status of solid waste management – 2005-06*. Srinagar Municipal Corporation, Jammu and Kashmir, Srinagar.

WHO, 1998. *Health and Environment in Developing*. World Health Organization, Geneva.