

Domestic Solid Waste Generation— A Case Study of Semi-Urban Area of Kathua District, Jammu, J & K, India

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Abstract- Solid waste management is a major problem for most of the Indian cities due to growing urban population and per capita waste generation rate, poor public awareness, participation and calamitous financial and organizational capacities of the urban local bodies. This paper deals with the composition of the Domestic Solid Waste (DSW) generation in the semi-urban area of the Kathua District. The various components of the solid waste were categorized into biodegradable, non-biodegradable and inert waste. It is observed that the study area produces around 70.62% of biodegradable material and the rest is contributed by non-biodegradable and inert waste. Moreover, a comparative account of relationship between domestic solid waste generation and education level of the families was also carried out.

Index Terms- Solid waste, Biodegradable waste, Composition, Inert material.

I. INTRODUCTION

Problem of waste generation originated from riotous human activities. The more advanced the society economically is, the more complex becomes the waste generation. In most of the developing countries, solid waste is being dumped on land without adopting any acceptable sanitary land filling practices. Most of the Indian cities are experiencing unplanned urban growth and heavy pressure of population. This results in an enormous production of solid waste (Planning Commission, 1995).

The waste generally contains discarded material like paper, plastic bags, glass, metal, fine earth particles, ash, sewage sludge, dead animals etc. Even the generation of solid waste is not constant and varies from 2.75 to 4.00 Kg per capita per day in the high income countries but it is as low as 0.5 Kg per capita per day in low-income countries. However waste generation increases continuously in proportion with population and increasing land requirements (Indris *et al.*, 2004). The Environmental Protection Act (1986) defines waste as “Any substance or object which the holder discards or intends to discard”. Many of the wastes generated at present are used or reused in uneconomic manner or left completely unutilized, causing a great damage to the human health and environment. Solid waste can be classified into different types depending on their sources viz- Municipal waste, Agricultural waste, Sewage waste, Industrial and mining waste, Hazardous waste, Radioactive waste and Bio-medical waste.

Ecologically, solid waste can be classified as: Biodegradable, Non-biodegradable and Inert waste. Association of solid waste disposal with outbreaks and various epidemics has been well established. The other negative effects include generation of obnoxious odour, attraction and support of disease vectors, degradation of aesthetic quality of environment etc. Generally, all low and middle income countries have a high percentage of compostable organic matter in the urban waste stream, ranging from 40 to 85 percent of the total (IBRD/The World Bank, 1999).

Incidence: A lot of study has been done on solid waste generation and its composition in various parts of India by various workers e.g. Dutta *et al.* (1999), Garg and Parsad (2003), Bhide (2004), Yousaf and Rehman (2007), but not much attention seem to have been paid to this rapid growing menace of solid waste from this sub tropical belt of the country except some efforts made by Rampal and Kour (2005), Sharma and Gupta (2011) etc.

Objective of the Study: The present study is carried out to estimate the amount of solid waste generated in a semi-urban area of Kathua district, its characterization and to devise the plan of measures to be adopted for proper waste management in the area, thereby protecting the population of the area from its possible hazards.

II. MATERIAL AND METHODS

The study was carried out to estimate qualitative and quantitative composition of domestic solid waste in the study area. The present study is also based upon comparative account of relationship between the domestic solid waste generation and the educational level of the family (Head of the family). So the houses (Families) were categorized into three classes according to the educational level of family. **Class I:** Houses (Families) having educational level up to middle standard. **Class II:** Houses (Families) having educational level from middle to senior secondary level. **Class III:** Houses (Families) having educational level of above Senior secondary level. The sampling was done in 20 houses of each class (60 houses). The primary data was collected for six fortnights.

III. RESULTS AND DISCUSSION

The average total solid waste generated by the three classes was 8562.7g in 24 hours. The biodegradable, non- biodegradable

and inert waste contributed 6048.9g (70.62%), 2166 g (25.32%) and 347.7 g (4.06%) respectively (Table 1, Fig. 1). In the biodegradable waste, kitchen waste showed maximum quantity 2366.65 g (27.54%) followed by fruit waste 1566.6 g (18.38%), food waste 1034.1 g (12.08%), paper waste 943.7g (11.02%), plant waste 86.6g (1.01%) and textile waste 50.9 g (0.59%).

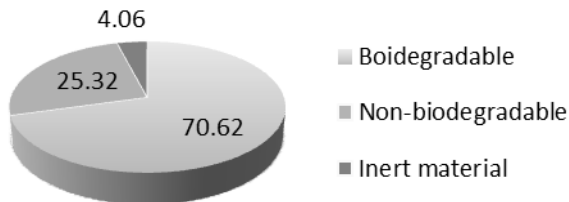


Figure 1: Percentage share of major components of solid waste

In non-biodegradable waste, plastic waste dominated with 1387.9 g (16.24%) followed by glass waste and metal waste i.e. 469.8 g (5.48%) and 308.4 g (3.6%), respectively. Inert material contributed 347.6 g (4.06%) and consisted of dust, hair wax etc. The average solid waste generated per capita per day was 83.91g. The solid waste composition in all three classes was analyzed separately. It varied slightly in classes I, II and III. Class I showed biodegradable content, 67.23%, non-biodegradable, 28.64% and inert, 4.13%. In class II, the solid waste proportion was composed of biodegradable waste (71.55%), non-biodegradable waste (23.95%) and inert material (4.5%). In class III, 72.26%, 24.16% and 3.58% of the waste composition was attributed to biodegradable, non-biodegradable, and inert material, respectively.

But when we look at the quantity of waste generated, we find that in class I (Table 2) it was 351.9g/house/day as compared to 466.8 g/house/day in class II (Table 3) and 465.7g/house/day in class III (Table 4) (Fig. 2). This is due to the fact that the educational status of the people was observed to be quite low and it was somewhat related to the income of the family. So, the houses with less income utilized the resource efficiently and created less waste as compared to the houses of class II and III. Moreover, the per capita waste production also varied greatly. It was 65.16g, 95.26g and 91.31g per day in class I, class II and class III, respectively.

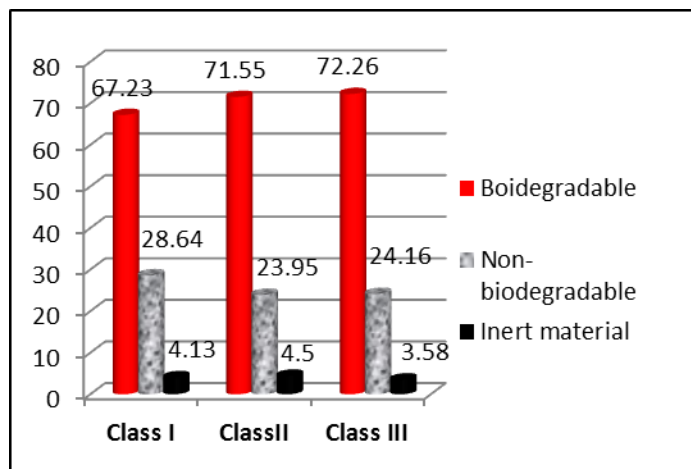


Figure 2: Percentage share of major components of solid in different house classes

IV. CONCLUSION AND RECOMMENDATIONS

People collected solid waste in plastic bags or dustbins and dispersed it in open or in drains. Sweepers were engaged for sweeping the lanes and streets, recyclables were also collected by rag pickers. The most of the waste generated was stored in the vacant plots or along the road side. Open vehicles or tricycles were used to transport solid waste from different places to site of disposal. Nearly 75-80% of the waste was sent to open dumps near the bank of river Ravi where its open burning was carried out. Rag pickers play an important role in segregation of recyclable material. Techniques like sanitary landfill, incineration, composting etc. should be adopted. Dustbins with lid at different locations should be placed. Mechanized and covered vehicles should be used for transportation. Reducing the waste generation at source, segregation of waste into biodegradable and non-biodegradable before its disposal, following the philosophy of four R's (Reduce, Reuse, Refuse, Recycle) and awareness among the masses are some of the measures which can help in combating the problem of solid waste in the study area. In natural systems there is no such thing as waste. Everything flows in a natural cycle of use and reuse. Living organisms consume materials and eventually return them to the environment, usually in a different form, for reuse. Solid waste (or trash) is a human concept. Unfortunately, what is worthless to one person may be of value to someone else. Solid wastes, in real, are really misplaced resources.

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Table 1. Qualitative and quantitative composition of domestic solid waste in the study area (average of all the three classes)

All CLASS ES	Biodegradable waste						Total	Non-biodegradable			Total	Inert waste		Total	Grand Total	Total SW /house/ day
	Kitchen waste	Fruit waste	Food waste	Plant waste	Paper waste	Textile waste		Plastic waste	Metal waste	Glass waste		Dust	Hair, wax.etc.			
Total waste	42598.8	28198.8	18614.4	1564.8	16987.8	918	108880.8	24982.2	5550.6	8457.6	38991.6	5401.2	857.4	6258.6	154131.6	
Average waste generation	2366.6	1566.6	1034.1	86.6	943.7	50.9	6048.9	1387.9	308.4	469.8	2166.1	300	47.6	374.6	8562.2	428.6
Percentage contribution	27.54	18.38	12.08	1.01	11.02	0.59	70.62	16.24	3.6	5.48	25.32	3.5	0.56	4.06	100	

Table 2. Qualitative and quantitative composition of domestic solid waste in class I Houses

CLASS I	Biodegradable waste						Total	Non-biodegradable waste			Total	Inert waste		Total	Grand Total	Total SW/ house/day
	Kitchen waste	Fruit waste	Food waste	Plant waste	Paper waste	Textile waste		Plastic waste	Meta l waste	Glass waste		Dust	Hair, wax.etc.			
Total waste	11326.8	7062.6	5164.2	532.2	4175.1	145.5	28406.4	7938.3	1462.8	2670.9	12072	1446.9	302.4	1749.3	42227.7	351.9
Average Waste generation	1887.8	1177.1	860.7	88.7	695.8	24.2	4734.5	1323	243.8	445.2	2012	241.1	50.4	291.5	7037.95	
Percentage contribution	26.82	16.72	12.22	1.25	9.88	0.34	67.23	18.81	3.51	6.32	28.64	3.42	0.71	4.13	100	

Table 3. Qualitative and quantitative composition of domestic solid waste in class II Houses

CLASS II	Biodegradable waste						Total	Non-biodegradable			Total	Inert waste		Total	Grand Total	Total SW/ house/d ay
	Kitchen waste	Fruit waste	Food waste	Plant waste	Paper waste	Textile waste		Plastic waste	Metal waste	Glass waste		Dust	Hair, wax.etc.			
Total waste	15399.3	11738.7	6404.4	575.1	5477.4	489.6	40084.5	8400.3	1108.5	3907.2	13416.9	2091.3	424.2	2515.5	56016	466.8
Average waste generation	2566.6	1956.4	1067.5	95.9	912.9	81.6	6680.7	1400	184.8	651.2	2236.1	348.6	70.7	419.3	9336	
Percentage contribution	27.49	20.95	11.43	1.02	9.77	0.89	71.55	14.99	1.98	6.98	23.95	3.74	0.76	4.5	100	

Table 4. Qualitative and quantitative composition of domestic solid waste in class III Houses

CLASS III	Biodegradable waste						Total	Non-biodegradable			Total	Inert waste		Total	Grand Total	Total SW/house/day
	Kitchen waste	Fruit waste	Food waste	Plant waste	Paper waste	Textile waste		Plastic waste	Metal waste	Glass waste		Dust	Hair, wax.etc.			
Total waste	15873.3	9397.8	7046.1	456.3	7335	0	40391.1	8643.9	2979.3	1879.8	13503	1862.7	131.1	1993.8	55887.9	465.7
Average waste generation	2645.5	1566.3	1174.3	76.05	1222.5	47.12	6731.75	1440.7	496.6	313.3	2250.6	310.5	21.8	332.3	9314.65	
Percentage contribution	28.4	16.81	12.6	0.82	13.12	0.51	72.26	15.46	5.34	3.36	24.16	3.34	0.24	3.58	100	