



Daily variation in solid waste generation in households of Kathua, J&K (A case study in ward no.5 of Kathua)

KEYWORDS

Biodegradable, Waste, Disposal, Households etc.

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ABSTRACT *The present study has been carried out to assess the solid waste generation in low income, middle income and high income households of ward no.5 of Kathua. It was concluded that high income households generate more solid waste than low income households*

INTRODUCTION

Solid wastes are the direct consequences of what we do in our modern society. (Hosetti, 2006) Solid waste is generated because of human activities. A country which is highly active in terms of industry and agriculture used to generate considerable amount of solid waste (Mediana, 2010). Land pollution is one of the gravest problems existing on this earth. Today the conquest of utilizing land and soil resources and conducting experiments on this earth is quiet understandable but is certainly not at the cost of its wellness. Mankind has been trying to exploit the natural resources and lead to generation of various types of wastes that may be bio-degradable, non-biodegradable, hazardous, inert etc that present a problem of their disposal. The word waste refers to useless unwanted or discarded material which is no longer considered of sufficient value and is thrown away by the possessor.

Solid waste is defined as unwanted or unwanted or discarded waste material from houses, institutions, hospitals, extraction waste, energy production waste, sewage sludge and agricultural wastes during from man's activities (Santra 2001).

Solid waste is the discarded mass of heterogeneous compound forms the urban household communities and relatively homogenous accumulation of commercial, agricultural and industrial activities. (Mukherjee 2010).

Ecologically solid waste is classified into three categories -Bio-degradable that can be easily degradable by microorganisms, Non-biodegradable waste that cannot be easily

degradable by microorganisms and Inert

The present study has been carried out to assess the solid waste generation in low income, middle income and high income households of ward no. 5 of Kathua (J&K) located at WikiMiniAtlas32°17' to 32°55'N latitude, 75°70' to / 76°16'E / 32.37; 75.52 longitude.

MATERIAL AND METHODS

Sampling of solid waste was done in 30 households randomly. Out of 30 households 10 were of high income having monthly income >35,000 per month, 10 of middle income having 25,000 per month and similarly 10 were of low income < 10,000 per month category. At each household sampling of solid waste was done for all the days of a week. During each sampling solid waste was collected for 24hrs a day and was segregated into bio-degradable solid waste/house/day and non-biodegradable solid waste/house/day. This waste was then weighed separately on a digital balance.

During the sampling period numbers of family members were also recorded to calculate average biodegradable waste/capita/day, average non-biodegradable solid waste/capita/day and average total solid waste generation /capita/house/day. All the average values of solid waste were further compiled to calculate average solid waste generation in high, middle and low income households. Average solid waste generations per week, per month and per year were also calculated by multiplying average solid waste generation/day by 7, 30, and 365 respectively.

Table (I) :- Average solid waste generation in High Income households of the study area.

Days	Solid waste generation (gm/day)			No. of residents	Solid waste generation per capita/day		
	BSW	NBSW	TOTAL		BSW	NBSW	TOTAL
Sunday	543.3 ± 176.84	65.7 ± 24.99	600 ± 183.31	5.3 ± 1.68	102.39 ± 15.14	13.52 ± 6.27	115.92 ± 18.09
	400-928	32-110	464 -1038	4.0 - 8.0	61.43 - 117.50	7.17 - 25.50	70.00 - 133.00
Monday	467.5 ± 161.40	74.3 ± 96.43	541.8 ± 227.74	5.3 ± 1.68	90.18 ± 17.03	14.35 ± 18.59	104.54 ± 66.03
	340 - 850	8.0 - 280	348 - 1130	4.0 - 8.0	46.50 - 106.25	2.0 - 62.50	50.13 - 167.25
Tuesday	475.8 ± 134.34	27.9 ± 9.63	503.7 ± 137.12	5.3 ± 1.68	92.94 ± 16.70	5.54 ± 2.26	98.49 ± 17.28
	350 - 800	10.0 - 42.0	384 - 840	4.0 - 8.0	48.75 - 110.00	3.14 - 10.50	53.13 - 115.50
Wednesday	472.9 ± 168.85	20.4 ± 6.77	493.3 ± 171.62	5.3 ± 1.68	90.69 ± 18.20	4.27 ± 94.96	94.96 ± 19.63
	300 - 880	10.0 - 30.0	311 - 908	4.0 - 8.0	52.50 - 112.50	1.25 - 7.50	53.75 - 120.00
Thursday	494.1 ± 166.93	30.2 ± 6.21	524.3 ± 171.00	5.3 ± 1.68	95.52 ± 19.68	5.97 ± 1.22	101.49 ± 19.94
	287 - 890	20 - 40	318 - 930	4.0 - 8.0	52.50 - 115.00	3.75 - 8.00	56.25 - 121.00

Friday	579.3 ± 158.05 461 – 1003	48.8 ± 14.04 36 - 80	628.1 ± 160.63 503 - 1056	5.3 ± 1.68 4.0 - 8.0	116.80 ± 34.54 63.63 - 180.00	10.25 ± 4.69 5.00 - 20.00	127.05 ± 37.46 69.50 - 190.00
Saturday	471.9 ± 145.72 324 – 802	38.2 ± 16.09 9.0 - 63	510.1 ± 151.76 372 - 853	5.3 ± 1.68 4.0 - 8.0	92.42 ± 20.41 42.50 - 120.00	7.52 ± 3.77 2.25 - 15.75	99.94 ± 21.21 47.38 - 127.75

Table (II): Average solid waste generation in Low Income households of the study area.

Days	Solid waste generation (gm/day)			No. of residents	Solid waste generation per capita/day		
	BSW	NBSW	TOTAL		BSW	NBSW	TOTAL
Sunday	317.2 ± 150.87 195 – 718	82.6 ± 24.90 37 - 110	399.8 ± 145.46 261 - 772	5.5 ± 2.25 2.0 – 11	64.53 ± 37.74 32.50 - 170.00	18.03 ± 9.20 4.91 - 35.00	82.56 ± 43.84 43.50 - 205.00
Monday	330.4 ± 17.6 230 – 900	17.6 ± 8.69 1.0 - 30	348 ± 187.66 242 - 901	5.5 ± 2.25 2.0 – 11	64.45 ± 34.75 34.29 - 161.00	3.88 ± 2.19 0.09 - 7.50	69.33 ± 35.69 38.14 - 168.00
Tuesday	517.9 ± 469.27 321 – 1902	33.5 ± 8.05 20 - 42	551.4 ± 467.70 231 - 1930	5.5 ± 2.25 2.0 – 11	92.31 ± 48.56 48.00 - 196.00	7.50 ± 4.33 2.55 - 18.00	99.81 ± 50.59 53.00 - 214.00
Wednesday	362.4 ± 255.75 210 – 1110	36.2 ± 60.01 1.0 - 215	398.6 ± 258.10 221 - 1126	5.5 ± 5.65 2.0 – 11	68.05 ± 32.77 37.14 - 151.00	13.35 ± 31.41 0.25 - 107.50	81.40 ± 61.49 40.14 - 258.50
Thursday	308.2 ± 100.91 231 – 603	21.72 ± 10.55 6.0 - 44	329.92 ± 98.92 240.2 - 617	5.5 ± 5.25 2.0 – 11	63.16 ± 3016 38.71 - 150.50	4.29 ± 2.06 1.27 - 7.33	67.45 ± 30.01 42.29 - 153.50
Friday	399.2 ± 471.0 140 – 1800	23.5 ± 6.34 13 - 36	422.7 ± 470.3 166 - 1820	5.5 ± 2.2 2.0 – 11	62.97 ± 35.4 38.57 - 163.64	5.18 ± 3.05 1.82 - 13.00	68.15 ± 35.12 41.86 - 165.45
Saturday	318 ± 138.36 208 – 716	17.05 ± 13.90 2.5 - 54	335.05 ± 141.49 223 - 740	5.5 ± 2.25 2.0 – 11	63.49 ± 29.28 41.60 - 146.00	3.24 ± 2.81 1.17 - 10.80	66.74 ± 29.08 38.14 - 147.25

Table (III) : Average solid waste generation in Middle Income households of the study area.

Days	Solid waste generation (gm/day)			No. of residents	Solid waste generation per capita/day		
	BSW	NBSW	TOTAL		BSW	NBSW	TOTAL
Sunday	312 ± 49.74 261 – 392	31.4 ± 17.16 9.0 - 64	343.4 ± 46.996 289 - 419	4.6 ± 0.80 4.0 - 6.0	69.49 ± 14.63 43.50 - 98.00	7.01 ± 4.26 2.25 - 16.00	76.50 ± 14.72 49.17 - 103.50
Monday	322.1 ± 31.38 280 – 391	21.3 ± 12.65 9.0 -- 47	343.4 ± 35.37 291 - 407	4.6 ± 0.80 4.0 - 6.0	71.75 ± 12.45 51.5 - 97.75	4.46 ± 2.12 2.25 - 9.40	76.21 ± 11.89 58.83 - 101.75
Tuesday	352.5 ± 48.38 285 – 422	24.5 ± 12.62 286 - 422	377 ± 49.74 287 - 422	4.6 ± 0.80 288 – 422	78.51 ± 14.99 289 – 422	5.30 ± 2.46 290 – 422	83.81 ± 14.72 291 – 422
Wednesday	352.5 ± 48.38 285 – 422	24.5 ± 12.6 286 - 422	377 ± 49.74 287 - 422	4.6 ± 0.86 288 – 422	78.51 ± 14.99 289 – 422	5.30 ± 2.46 290 – 422	83.81 ± 14.72 291 – 422
Thursday	435.5 ± 51.96 368 – 501	36.75 ± 10.21 24 - 61	472.25 ± 58.39 405.5 - 561	4.6 ± 0.80 4.0 - 6.0	96.29 ± 13.74 76.00 - 125.25	8.09 ± 2.18 5.60 - 12.20	104.38 ± 14.91 81.60 - 136.00
Friday	324.1 ± 120.37 75 – 508	37.6 ± 13.24 20 - 70	361.7 ± 125.93 111 - 553	4.6 ± 0.80 4.0 - 6.0	71.46 ± 29.14 18.75 - 127.00	8.33 ± 2.86 4.50 - 14.00	79.79 ± 30.26 27.75 - 138.25
Saturday	353.4 ± 61.21 274 – 472	52.1 ± 27.64 11.0 - 89.0	405.5 ± 62.72 339 - 561	4.6 ± 0.80 4.0 - 6.0	79.09 ± 18.87 50.83 - 118.00	11.48 ± 6.41 2.75 - 22.25	90.57 ± 20.37 61.17 - 140.25

Table (IV) : Average solid waste generation in Households of the study area.

Type	Solid waste generation (gm/day)			No. of residents	Solid waste generation per capita/day		
	BSW	NBSW	TOTAL		BSW	NBSW	TOTAL
High Income	500.69 ± 43.51	111.87 ± 191.06	534.94 ± 45.15	82.16 ± 203.34	160.26 ± 169.15	84.42 ± 202.38	167.11 ± 166.22
	467.5 - 579.3	20.04 - 534.3	493.3 - 628.1	5.3 - 543.3	90.18 - 534.3	4.27 - 534.3	94.96 - 534.3
Middle Income	350.3 ± 41.28	126.30 ± 154.79	329.88 ± 143.43	104 ± 169.76	124.88 ± 157.90	106.34 ± 168.17	161.78 ± 130.66
	312 - 435.5	21.3 - 532.5	21.3 - 472.5	4.6 - 352.5	69.49 - 352.5	4.46 - 352.5	76.21 - 352.5
Low Income	364.75 ± 74.69	33.17 ± 23.02	397.92 ± 76.64	5.5 ± 0	68.42 ± 10.67	7.92 ± 5.64	76.49 ± 12.26
	308.2 - 517.9	17.05 - 82.6	329.92 - 551.4	5.5 - 5.5	62.97 - 92.31	3.24 - 18.03	66.74 - 99.81
Average	405.25 ± 82.97	90.44 ± 50.12	420.91 ± 104.44	63.89 ± 51.73	117.85 ± 46.32	66.22 ± 51.67	135.13 ± 50.85
	312 - 435.5	17.0 - 82.6	21.3 - 472.5	5.5 - 5.5	62.97 - 92.31	3.24 - 18.03	66.74 - 99.81

The analysis of the data of average solid waste generation/day/house of high income household revealed that Friday exhibited highest avg. solid waste generation of 628.1g/day/house comprising of 579.3 g/day of biodegradable and 48.8 g/day of non-biodegradable solid waste, where as Wednesday exhibited minimum average solid waste generation of 493.3 g/day comprising 472.9 g/day of biodegradable and 20.4 g/day of non-biodegradable solid waste.

The studies on the average solid waste generated/day/house of low income household showed that Tuesday exhibited highest avg. solid waste generation of 551.4 g/day/house comprising of 517.9 g/day of biodegradable and 33.5 g/day of non-biodegradable solid waste, where as Thursday exhibited minimum average solid waste generation of 329.92 g/day/house comprising 308.2g/day of bio-degradable and 21.72g/day of non-biodegradable solid waste.

The investigations carried on the average solid waste generated/day/house of middle income household showed that Thursday exhibited highest average solid waste generation of 472.25/day/house comprising of 435.5g/day/house of biodegradable and 36.75g/day/house of non-biodegradable solid waste, where as Monday exhibited minimum average solid waste generation of 343.4 g/day/house comprising 322.1g/day of bio-degradable and 36.75 g/day of non-biodegradable solid waste.

A comparative analysis of all the three categories of households of the study area revealed that high income households of the study area exhibited highest value of solid waste generation followed by low income and least value was exhibited by middle income households but low income and middle income household values of solid waste generation/day were more or less same with little difference. The residents of high income households usually have high standard of living and they prefer to use packed material and thereby generate more solid waste. Abu *et al.* 1997 reported that solid waste generation was dependent on the income level. From this work it was concluded that high income households generate more solid waste than low income households and this was in support of the observation made in the present study.

Overall compilation of the data of all the households of

the study area reveal that the average solid waste generation in average households of the study area was observed to be 29.73kg/house/day comprising 24.3kg/house/day biodegradable waste and 5.43kg/house/day of non-biodegradable solid waste. Since the approximate no. of households in the study area was observed to be 60 so the average solid waste generation in the study area was calculated to be 420.91±104.44 kg/ day comprising 405.25 ± 82.97 kg/ day biodegradable waste and 90.44 ± 50.12kg/day of non-biodegradable waste. On the basis of overall compilation of the data the net average solid waste generation in the study is on weekly, monthly and yearly basis was calculated to be 385.21kg/week, 891.9kg/month and 10851.45kg/ year respectively.

Total biodegradable solid waste generation in the study area (w)= Z× No. of households in the study area

$$=405.25 \times 60= 24315gm (24.3kg)$$

Total biodegradable solid waste generation/week (w)

$$= \text{total solid waste generation} \times 7 = 170.1kg$$

Total biodegradable solid waste generation/month (m)

$$= \text{total solid waste generation} \times 30 = 729kg$$

Total biodegradable solid waste generation/year (y)

$$= \text{total solid waste generation} \times 365 = 8869.5kg$$

Total non-biodegradable solid waste generation in the study area (w)

$$= Z \times \text{No. of households in the study area}$$

$$= 90.44 \times 60 = 5426.4gm (5.43kg)$$

Total solid non-biodegradable waste generation/week (w)

$$= \text{total solid waste generation} \times 7 = 38.01 kg$$

Total solid non-biodegradable waste generation/month (m)

$$= \text{total solid waste generation} \times 30 = 162.9kg$$

Total non- biodegradable solid waste generation/year (y)

= total solid waste generation $\times 365 = 1981.95\text{kg}$

Total average solid waste generation in the study area (w)

= Z \times No. of households in the study area

= $420.91 \times 60 = 25254.6 \text{ gm (25.3kg)}$

Total solid waste generation/week (w)

= total solid waste generation $\times 7 = 177.1\text{kg}$

Total solid waste generation/month (m)

= total solid waste generation $\times 30 = 759 \text{ kg}$

Total solid waste generation/year (y)

= total solid waste generation $\times 365 = 9234.5\text{kg}$.

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