Prevalent Practices of Solid Waste Management in the Girls Hostels

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Abstract

Waste is generated on daily basis through different activities of human beings, which leads to pollution of the environment, which may have serious implications on the health of the individual. Waste generation is also a big problem in schools and universities. To keep that problem in mind study has been conducted on the campus of CCSHAU, Hisar; with the objective to study the type and volume of waste generated in the girl's hostels. The study estimated the daily waste generation from girl's hostels and found waste generation rate was high but the waste collection rate was very low because of the improper ratio between the total number of students and sanitary worker. The waste management system in the university girl's hostels requires not only an estimation of the solid waste but also an understanding of the students' habits and behaviour towards managing solid waste.

Introduction

With the development of human race around the globe, rigorous changes have come in our everyday activity like education, recreation, travelling, feeding, clothing and with all of these activity we are generating lots of wastes in different form such as solid, liquid, or gas and each have different methods of disposal and management (Arora and Agarwal, 2011; Coker, et al. 2016). According to the report by World Bank (2019) in 2016, the worlds' cities generated 2.01 billion tonnes of solid waste, amounting to a footprint of 0.74 kilograms per person per day. Waste management can be deals with any form whether it was industrial, biological, or household where it may be harmful to human health. Municipal solid waste management practices deal with large portion of different form of waste (Environment Glossary, 2016; Cheremisinoff, 2003). Waste management practices are also a big problem of the schools and universities. Inside the hostels of schools and universities bio degradable and non biodegradable waste is generated in massive amount and this waste impacts the health of college students and their academic performance (*Davidson, 2011*). Due to the large number of students lot of waste generated in the hostels and no proper management of the waste generation causes dirtiness in the hostel and this might be major concern of the student's health (Earthwatch, 2007). It is the extensively generic fact that many students depart their hostel room without taking care of it. The hostel sanitation practices directly affects on the living and learning condition student's and also affects the critical thinking, intellectual development and aesthetic appreciation of students (Burnt 1995). Some student having apathetic behaviour towards their hostel surroundings, this contributes to the poor hostel sanitation practices (Ikelegbe and Ogeah, 2007). Environmental knowledge and attitude of college and school students appears to be important as their point of view which plays an important role in providing solution to future environmental problems (Ehrampoush and Moghadam, 2005). These wastes products create serious problems for the municipalities and its safe disposal is becoming a serious environmental problem to our ecology and life supporting systems.

Methodology

Study has been conducted in the campus of CCSHAU, Hisar. For this study the all girl's hostels (Godavari (H1), International Girls Hostel (H2), Narmada (H3), Gangotri Old Wing (H4), Gangotri New Wing (H5), Gangotri Additional Wing (H6), and Women Scholar (H7)) was purposely selected.

Key information was taken from following methods:

1) Hostel prefects and hostel managers, interactions with waste handlers, mess workers, and

2) Personal field investigation, observation and, measurement.

Aim of the study was to estimate the daily waste generation and waste collection rate from girl's hostels and the current management practices. A weighing balance machine capacity up to 100kg was used for the measurement of wastes.

Waste analysis:

To determine the per capita waste generation and waste collection rate the following procedures were followed:

Waste generation rate (W_G):

Solid waste generation rates estimate the amount of waste created by residences or businesses over a certain amount of time (day, year, etc.). Waste generation includes all materials discarded, whether or not they are later recycled or disposed in a landfill (CalRecycle, 2019)

- Determination of the weight of solid waste (w)
- Numbers of students who contributed to the waste generation.

$$(W_G) = \frac{\text{wt(kg)}}{\text{no.of students X day}} \text{ (kg/capita/day)}$$

- Waste generation rate (Coker, Achi, Sridhar and Donnett, 2016)

Waste collection rate

Waste collection is the collection of solid waste from point of production to the point of treatment or disposal.

This will produce the waste composition according to the weight. The waste collection rate per students in the studied hostel block also had been determined.

$$\text{Waste collection rate} = \frac{\text{Total waste weighed (kg)}}{\text{No.of sample (bin)}} \text{ (Ishak, Mahayuddin, and Mohamed, 2013)}$$

Results

1. Type of waste generated in all the girls hostels

Generally, waste could be liquid or solid waste. Both of them could be hazardous. Liquid and solid waste types can also be grouped into organic, re-usable and recyclable waste.

Biodegradable waste is waste that can be broken down by natural processes. Typically, biodegradable waste is matter derived from plants and animals and other organisms, such as paper, food waste, plant-based plastics, and grass clippings.

Non-biodegradable waste is waste that cannot be broken down through natural processes. These materials include items such as plastic bags, synthetic materials, plastic bottles, electronic items, and aluminium cans. Biodegradable and non biodegradable waste is generating from the hostels is categorised in following:

Table 1: Biodegradable and Non biodegradable waste

Biodegradable waste	Non biodegradable waste
Paper and paper packing materials	Plastic waste, bottles & plastic packing materials, plastic bags
Cardboard, Carton,	Glass, Bulb
Cloth waste	Sanitary napkins, wrappers
Junk food waste	Rubber, Leather
Fruits waste, dry fruit waste, tree leaves	Metal
Kitchen waste	Expired Medicine
Sand/dust	Electronic Waste
Liquid waste	Cosmetic product waste

In the hostels both types of waste (biodegradable and non biodegradable) was generate but some waste were generated frequently and some were occasionally. Cloth, plastic bottles, plastic bag waste generate once in a week; rubber, glass, leather waste were generated once in a month where as paper waste, cardboard, food waste, kitchen waste, liquid waste, fruit waste, poly bags, sanitary napkins generated daily in measurable amount. Plastic waste were generated in huge amount daily in various form like, bottles, milk pouches, shampoo pouches, snacks packets, etc. Sanitary napkins were major non biodegradable waste generated from the all girl's hostels.

2. Volume of waste generated in the hostels

Large amount of waste generated from all the girls' hostels in the university. Both biodegradable and non biodegradable waste generated. There are following table shows the volume of waste generated in the girls hostels.

Table 2.1: Hostel H1

Floors	Volume of dustbin	A block			B block		
		No. of dustbins	No. of students	Volume of waste generate(kg/day)	No. of students	No. of dustbins	Volume of waste generate(kg/day)
Ground	15 kg	4	23	10 kg	18	1	7 kg
Ist	15 kg	2	18	7 kg	18	1	7 kg
IInd	15 kg	2	18	6 kg	18	1	6 kg
IIIrd	15 kg	2	22	9 kg	18	1	5 kg
Total	60 kg	10	81	32 kg	72	4	25 kg
Mess	15 kg	2		18 kg			
Total waste = 75 kg/day							

Table 2.1 showed that in H1 hostel there were two blocks, A and B. In Block A there were total 81 students and in Block B there were 72 students. In Block A, total waste generation was 32 kg/day and in Block B, total waste generation was 25 kg/day and 18 kg of waste generated from mess. Total waste generation from entire hostel was 75 kg/day

Table 2.2: Hostel H2

Floors	Volume of dustbin	No. of students	No. of dustbins	Volume of waste(kg/day)
Ground	15 kg	9	2	2 kg
Ist	15 kg	14	2	4 kg
IInd	15 kg	16	2	4 kg
Total	4 kg	29	6	10 kg
Mess	8 kg		1	8 kg
Total waste= 18 kg/day				

Table2.2 showed that in H2 Hostel there were total 29 students and total waste generated in one day was 10 kg where 2 kg from ground floor, 4 kg from first and second floor and 8 kg from the mess. So total waste generated from the hostel was 18 kg/day.

Table 2.3: Hostel H3

Floors	Volume of dustbin	No. of students	No. of dustbins	Volume of waste(kg/day)
Ground	15	23	3	7 kg
I st	15	40	3	15 kg
II nd	15	60	3	20 kg
Total	45 kg	123	9	42 kg
Mess	15		2	12 kg
Total waste= 54 kg/day				

Table 2.3 revealed that in H3 Hostel, in each floor there were three dustbins of 15 kg and 123 students generated 42 kg waste per day and 12 kg waste generated from the mess. Total 54 kg waste generated from the entire hostel per day.

Table 2.4: Hostel H4

Floors	Volume of dustbin	No. of students	No. of dustbins	Volume of waste(kg/day)
Ground	15 kg	62	8	20 kg
I st	15 kg	49	3	15 kg
II nd	15 kg	24	3	9 kg
Total	45 kg	135	14	44 kg
Mess	15 kg		2	15 kg
Total waste= 59 kg/day				

Table 2.4 estimated that H4 hostel, maximum waste was generated from ground floor (20 kg/day). Total 135 students generated 44 kg of waste per day and 15 kg of waste generated from the mess per day.

Table 2.5: Hostel H5

Floors	Volume of dustbin	No. of students	No. of dustbins	Volume of waste(kg/day)
Ground	15 kg	63	3	18 kg
I st	15 kg	46	3	12 kg
II nd	15 kg	26+21(RL)	3	15 kg
Total	45 kg	156	9	45 kg
Mess	15+35 kg		2	25 kg
Total waste= 70 kg/day				

Table 2.5 depicts that hostel H5, maximum waste generated from ground floor (18 kg/day) followed by second floor (15 kg/day) which also include RL (Residential Lab). Total 45 kg of waste generated from the floors per day. In the mess there were two types of dustbins, one was 15 kg and another was 35 kg and total waste generated from the mess was 25 kg/day. Total waste generated from the entire hostel was 70 kg/day.

Table 2.6: Hostel H6

Floors	Volume of dustbin	No. of students	No. of dustbins	Volume of waste(kg/day)
Ground	15 kg	41	1	10 kg
I st	15 kg	35+22	1	14 kg
II nd	15 kg + 10 kg	31	2	7 kg
Total	55 kg	129	4	31 kg
Mess	15 kg + 35 kg		2	20 kg
Total waste= 51 kg/day				

Table 2.6 depicts that H6 hostel, maximum waste generated from first floor (14 kg/day) which also include RL (Residential Lab). Total 31 kg of waste generated from the floors per day. In the mess there were two types of dustbins, one was 15 kg and another was 35 kg and total waste generated from the mess was 20 kg/day. Total waste generated from the entire hostel was 51 kg/day.

Table 2.7: Hostel H7

Floors	No. of students	No. of dustbins	Volume of waste(kg/day)
I st	8	1	10 kg (garbage window)
II nd	12		
III rd	10		
Total	30		10 kg
Mess	6 kg	1	6 kg
Total waste= 16 kg/day			

Table 2.7 showed that in H7 hostel, there were total 30 students. Lower first and second floor were professor residence and from third floor to fifth floor. In this hostel there was a garbage window and all the students and staff, dispose their waste in that garbage window. Total estimated waste generated from the hostel was 10 kg per day (excluding first and second floor residence) and 6 kg of waste generated from the mess per day.

Table 3: Total number of students and sanitary workers in the hostels

Hostel	No. of Students (n)	Sanitary Workers	no. of students(n)/sanitary worker	Total No. of Dustbins	no. of students (n)/dustbin
H1	153	3	51	16	10
H2	29	2	15*	8	4
H3	123	5	25*	11	11
H4	135	3	45	16	8
H5	156	3	52	11	14
H6	129	3	43	6	22
H7	30	2	15	2	15

*round figure

Table 3 showed H5 hostel have highest number of students (n=156) and there was only one sanitary worker over 52 students and one dustbin has been use by 14 students. Followed by hostel H1, H4 and H6 have only three sanitary workers over 153, 135 and 129 students and over one sanitary worker 51, 45 and 43 students respectively. In hostel H2 and H7 there was only 29 and 30 students over two sanitary workers. Therefore over 108 students (average) there were 3 sanitary workers (average) and 10 dustbins (average).

4. Volume of waste generated in the hostels

Table 4 showed that large amount of waste generated from all hostels in the university. Both biodegradable and non biodegradable waste generated.

In **H1** there were two blocks; A & B and total volume waste generation from entire hostel was 75 kg/day and rate of waste generation was 0.73 kg/capita/day. In **H2** there were total 29 students and total volume waste generated from the hostel was 18 kg/day and rate of waste generation was 0.34 kg/capita/day. In **H3**, there were three floors and on each floor there were three dustbins of 15 kg capacity and 123 students generated 42 kg waste per day and 12 kg volume of waste generated from the mess per day. Total 54 kg volume of waste generated from the entire hostel that was around 0.34 kg/capita/day. **H4**, maximum volume of waste was generated form ground floor (20 kg/day). Total 135 students generated 44 kg of waste per day and 15 kg of waste generated from the mess per day, so 135 students total rate of waste generation was 0.32 kg/capita/day. **H5**, having three floors, includes RL (Residential Lab). Total 45 kg of volume of waste generated from the floors per day. In the mess there were two types of dustbins, one was 15 kg and another was 35 kg and total volume of waste generated from the mess was 25 kg/day. Total waste generated from the hostel was 70 kg/day and rate of waste generation was 0.28 kg/capita/day.

Table 4. Volume of waste generated in the hostels:

Hostel	No. of students	No. of dustbins	Total estimated waste generated (students + mess) (kg/day)	Waste generation rate (kg/capita/day)	Waste collection rate (kg/bin)
H1	153	16	75	0.73	4.68
H2	29	8	18	0.34	2.50
H3	123	11	54	0.34	4.90
H4	135	16	59	0.32	3.68
H5	156	11	70	0.28	6.36
H6	129	6	51	0.24	8.50
H7	30	2	16	0.33	8.00

H6, having three floors, includes RL (Residential Lab). Total 31 kg of waste generated from the floors per day. In the mess there were two types of dustbins, one was 15 kg and another was 35 kg and total waste generated from the mess was 20 kg/day. Total waste generated from the entire hostel was 51 kg/day and rate of waste generation was 0.24 kg/capita/day. In **H7**, total 30 students. Hostel had a garbage window for waste disposal. Total estimated waste generated from the hostel was 10 kg per day (excluding first and second floor residence) and 6 kg of waste generated from the mess per day, total waste generation rate was calculated 0.33 kg/capita/day. Table 4 further shows the waste collection rate that in H6 waste collection rate was highest i.e. 8.50 kg/bin followed by H5 (6.36 kg/bin) H3 (4.90kg/bin), H1 (4.68 kg/bin), H4 (3.68 kg/bin) and H2 (2.5 kg/bin).

5. Pearson correlation coefficient (r) among variables:

Variables	No. of students	No. of dustbins	Total estimated waste generated (kg/day)	Waste generation rate (kg/capita/day)	Waste collection rate (kg/bin)
No. of students	1	0.71**	0.98**	0.24	0.07
No. of dustbins		1	0.78**	0.52	-0.61
Total waste generation			1	0.38	-0.03
Waste generation rate				1	-0.31
Waste collection rate					1

** Correlation is significant at the 0.01 level, * Correlation is significant at the 0.05 level,

Table 5 showed the correlation among the different variables, is the statistical analysis index that measures the linear correlation between variables. The value 0.00 to 0.30 (0.00 to -0.30) have negligible correlation, 0.30 to 0.50 (-0.30 to -0.50) have Low positive (negative) correlation, 0.50 to 0.70 (-0.50 to -0.70) have Moderate positive (negative) correlation, 0.70 to 0.90 (-0.70 to -0.90) have High positive (negative) correlation and High positive (negative) correlation have Very high positive (negative) correlation (Hinkle, Wiersma, and Jurs. 2003).

In the present study, available number of dustbins having high positive relation with number of students residing in the hostels ($r=0.71$) and total waste generated by the students ($r=0.78$) but moderate negative relation with waste collection rate ($r=-0.61$). Total estimated waste generation have very high positive relation ($r=0.98$) with total number of students residing in the hostels but negligible relation with waste collection rate ($r=0.07$). Waste collection rate have low negative relation ($r=-0.31$) with waste generation rate.

Summary

Studies carried in the girl's hostels of CCSHAU premises have shown the current waste management practice from the point of view of solid waste management operators and sanitary workers who are usually involved with biodegradable and non-biodegradable waste. Paper, snakes wrapper, polyethen and sanitary napkin waste were generated in large amount, similar results found in the study by Coke et al. (2016).

Based on the study table 2.1.1 to 2.1.7 showed the volume waste generation by the students on the different floor of the hostels. It revealed that in the hostel H1 per day generate 75 kilograms of biodegradable and non biodegradable waste which is highest among all girl hostels followed by H5 (70 kg), H4 (59kg), H3 (54 kg), H6 (51 kg), H2 (18 kg) and H7 (16 kg). Waste generation ranges between 0.24 to 0.73 kg/capita/day and waste collection rate ranging between 2.50 to 8.50 kg/bin, were recorded this is similar to the waste generation rates developed by Ogwueleka et al,(2009) which ranged between 0.44 and 0.66kg/capita/day. Where waste generating rate (kg/capita/day) was highest in hostel H1 (0.73) with waste collection rate 4.68 (kg/bin) and lowest in hostel H6 (0.24) with highest waste collection rate 8.50 kg/bin. In the present study correlation showed both positive and negative relation among the variables. Correlation showed the positive relation among total waste generation (kg/day) and number of students, but waste collection rate (kg/bin) have negative and negligible correlation among waste generation rate and number of students residing in the hostels. Therefore study can conclude that waste generation rate was high but waste collection rate was very low because of the improper ratio (36:1) between total number of students and sanitary worker. There was no segregation of waste by students, which created difficult situation in front of the sanitary workers. No provision of separate disposal of sanitary napkins.

Conclusions

Waste management system in the university girl's hostels requires not only an estimation of the solid waste but also an understanding of the students' habits and behaviour towards managing solid waste. Less number of sanitary workers was the major issue with low waste collection rate and no segregation of waste was one of the problems. This practise not only harmful for the students but also for the atmosphere of the university.

Suggestions:

Based on the findings, this paper proposed few recommendations:

1. Segregation of biodegradable and non biodegradable waste. For that at least two type of dustbin install in each and every floor. Dustbin should be differentiate by green and blue colour (biodegradable and non biodegradable).
2. The entire dustbin covered with disposable polyethenes. If dustbin covered with polyethene, it will be easy for the sanitary workers to clean the dustbin.
3. The university authority should also provide training for its staff and students on various waste management programs so that they can become custodians of the environment. Once the good waste management practices are institutionalized, it will definitely trickle down to the society.
4. Better utilisation of food waste. There are three ways of utilization of waste food. (a) First one is to feed the animals especially swine with this food (b) Second option available is composting of waste food and (c) last but very important alternative available is biogas production. Biogas production is an attractive mean to recycle waste food because it produces gaseous product with methane as the main constituent along with solid residue which can be used as manure similar to that of compost manure. Gaseous product produced from biogas plant can be used as cooking gas. Moreover, this gas can also be used as fuel in generation of electricity and thus, methane is not emitted in the environment thus, alleviating its greenhouse effect. However, during composting methane is generated and released into the environment and that is why biogas production is more beneficial than composting.
5. For the better ways of disposal of sanitary napkins incinerators must installed in every girls hostel, as per the number of the students.
6. Landfill should not treat with chemical for the disposal of the waste. Use of chemical may react with hazardous material and may generate hazardous gases.

Declarations

I declare that the work in this manuscript is original and is the result of my own work. This manuscript has not been submitted to any other journal for review/publication.

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References

1. Arora, L., & Agarwal, S. Knowledge, attitude and practices regarding waste management in selected hostel students of university of Rajasthan, Jaipur. *Int J Chem Environ Pharm Res*, 2011, 2(1), 40-43.
2. Burnett, G. Overcrowding in Urban Schools. ERIC/CUE Digest Number 107, 1995.
3. CalRecycle. Estimated Solid Waste Generation Rates. 2019. <https://www2.calrecycle.ca.gov/WasteCharacterization/General/Rates>. Accessed 8 April 2021
4. Cheremisinoff, N.P. *Glossary of environmental and waste management terms. Handbook of Solid Waste Management and Waste Minimization Technologies. Butterworth-Heinemann*, 2003.337–465.
5. Coker, A. O., Achi, C. G., Sridhar, M. K. C., & Donnett, C. J. Solid waste management practices at a private institution of higher learning in nigeria. *Procedia Environmental Sciences*, 2016, 35, 28-39.
6. Davidson, G. Waste management practices: Literature review. Dalhousie University, Office of Sustainability, 2011, 1-59.
7. Earthwatch.2007.Environmental Carer. Earthwatch Nigerian Magazine for Environment & Development,Port Harcourt,Nigeria. Environmetal Matter (2005) Annual Review World Bank. Washington D.C.
8. Ehrampoush, M. H., & Moghadam, M. B.Survey of knowledge, attitude and practice of Yazd University of Medical Sciences students about solid wastes disposal and recycling. *Journal of Environmental Health Science & Engineering*, 2005,2(2), 26-30.
9. Environment Glossary.*United Nations Statistics Division - Environment Statistics*. 2016. <https://unstats.un.org/unsd/environmentgl/gesform.asp?getitem=1178>. Accessed7 June 2020
10. Ishak, N. R., Mahayuddin, S. A., & Mohamed, M. R. Generation and composition of solid waste in university campus. In *Proceedings of the Colloquium on Administrative Science and Technology*, 2015,119-126, Springer, Singapore.
11. Ikelegbe, O. O., & Ogeah, F. N. Sanitation among students on campus. *A Multidisciplinary Journal National Association for the advancement of knowledge*, 2010, 15(1).
12. Ogwueleka, T. Municipal solid waste characteristics and management in Nigeria. *Journal of Environmental Health Science & Engineering*, 2009, 6(3), 173-180.
13. The World Bank. Solid Waste Management. 2019. <https://www.worldbank.org/en/topic/urbandevelopment/brief/solid-waste-management>. Accessed 4 April 2021