

## PAPER 113 – SOLID WASTE MANAGEMENT IN A NIGERIAN UNIVERSITY HOSTELS

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### **ABSTRACT**

Waste generation rate and characterization are prerequisites for developing a sustainable solid waste management system. This study presents the generation rate and characterization of solid waste within the hostels in University of Ilorin Campus. The study was aimed to determine the amount of waste generated and propose better disposal method. Structured questionnaires were administered both physically and online with 400 and 157 respondents obtained respectively. Data was analyzed using statistical tools. Quantification and characterization were also carried out in the 38 hostels within the campus. A total of 1528 Kg/day were generated in the hostels out of the 3255 Kg/day generated in the University. Methods of disposal observed were open burning (32.7%), open dumping (26.2%), Incineration (20.3%), burial in a pit (14.5%), others (6.3%). Food, polythene, plastic, glass, and metal wastes were major categories found. The study revealed 100% recyclable materials. It is therefore recommended that University of Ilorin school management take immediate action by educating the entire populace within the school premises on the concept of 7R's or creating awareness and/or other waste to wealth initiatives in their solid waste management system. It is also recommended that there should be sanction(s) for mismanagement of solid waste within the hostels on campus.

**KEYWORDS:** Waste generation, Waste characterization, Hostel, waste disposal/ end point, Ilorin

### **1. INTRODUCTION**

Solid waste is a complex mixture of different substances that are discarded by household, individual or organizations that are harmful to the environments and health ([Rushton, 2003](#)). [Umeh et al., \(2019\)](#) also described wastes as: “unwanted or unusable materials from industry and agriculture, businesses and other household items and can be liquid, solid or gaseous in nature, and hazardous or non-hazardous”. In a simple approach, waste is an irresistible material that emanates in daily activities. However, solid waste is neither liquid nor gaseous material that has performed primary functions and not useful again to its handler.

Solid waste management can simply be defined as the control of solid waste from birth to burial. The term “from birth to burial” in this context means from the point of generation, storage, collection, transfer and transport, processing and to the final point which is disposal. The fundamental target of solid waste management is to protect the health of the population, promote environmental quality, develop sustainability and provide support to economic productivity through utilization of waste as a resource ([Dong et al., 2005](#)). Waste management is an important element of environmental protection ([Igbinomwanhia & Olanipekun, 2009](#)). Waste management is important as improperly handled waste can have devastating effects on both the environment of its surroundings as a whole, and on the health of people in places where poor waste management occur ([Cogut, 2016](#)). Solid waste management problem has been a reoccurring issue in most developing countries higher institutions, especially in our dear country, Nigeria. In most Nigeria universities, solid waste management issue emerged every year as more students are being admitted.

University of Ilorin is located in Ilorin, the capital city of Kwara State on latitude 8.4799° N and longitude 4.5418° E, covering an approximate land mass of 5,000 hectare. Currently there are 38 hostels on the university campus. University of Ilorin, Ilorin is a federal government university, with potentials for massive growth and expansion for the fact that the institution remains the most sought after. Physical development and population increase yearly in the institution and these lead to increment in solid waste generation. According to [Hakami and Seif \(2015\)](#),

development does not come without environment burdens, generation of waste is one among them. The persistence of solid waste management menace is due to lack of generation rate data, proper characterization, knowledge on health and environmental effect, knowledge on Waste to Wealth, sensitization, intensive institutional research and adequate budgetary.

As University of Ilorin is known to be one of the largest institutions in Nigeria, there is no existing data for waste generated per day per capita which implies that there is no efficient solid waste management body. Most of the generated solid wastes are openly burnt in the university dump site which is harmful to public health and the environment. This work will ultimately make a revelation of the amount of waste being generated in the university hostels and characterization of the waste to propose efficient disposal method to the management.

## **2. METHODOLOGY**

The techniques that were employed in the study involved the collection of first-hand data from the porters, cleaners, waste collectors and students within the study area. The data collection techniques include the following:

### **2.1 Site Visitations**

This is the physical visitation to the study area to carry out reconnaissance survey

### **2.2 Questionnaire**

Structured questionnaires were administered both physical and online. Minimum sample size of 384 were obtained using Wayne (2007) formula. 400 were obtained in physical while 157 were obtained online.

The questionnaires were designed in a simple and clear manner to obtain accurate information from students. The questionnaire was targeted to obtain the following:

- (i) Types of waste generated daily
- (ii) Availability of waste bin for storage
- (iii) Method of collection
- (iv) Frequency of collection
- (v) Method of disposal

These questionnaires were administered in two forms which include the following:

- (i) Self-administered: Questionnaires were delivered to the targeted group of people to fill themselves.
- (ii) Online survey: Google form was designed to reach out to more students on campus. This was done also to reduce the amount of waste that will be generated from printing questionnaires.

### **2.3 Characterization**

This is a process of sorting out solid waste into different components. Characterization of solid waste is used to enhance processing, recovering, and proper management of solid waste. Waste characterization method of [Bernache-Pérez \*et al.\*, \(2001\)](#) which was used by [Oyelola and Babatunde \(2008\)](#), was applied in this study. The method involves measurement, classification and weighing of solid waste from specific sources. This method was also used by Okeniyi and Anwan, (2016). Thus, the solid waste was characterized in accordance with College and University Recycling Council (CURC) grouping system with modifications by Oladejo *et al.*, 2018 accommodate peculiar waste stream generated on campus. Plate 1 shows characterization process in a male hostel and plate 2 shows the open burning method on campus.

Solid waste in this study was categorized into the following components: paper, food, plastic (food packs, pet bottles, etc.), polyethylene (water sachets, nylon, etc.), metals (can drinks, etc.), glass, and sanitary (diapers, pads, and rags).

## **3. MATERIALS AND METHODS/METHODOLOGY/EXPERIMENTAL PROCEDURE**

- (i) Mechanical weighing scale
- (ii) Personal protective equipment/tools (PPE)
- (iii) Shovels, rakes, dust pans, hand brooms, magnets, and other necessary tools

## **4. RESULTS AND DISCUSSION**

The data was analyzed using the following tools:

- (i) SPSS 26
- (ii) Microsoft Excel



Plate 1: Characterization at a male Hostel



Plate 2: Open burning on campus

The mass-based distribution of the quantified wastes in different hostels within the university campus is presented in Table 1. The table shows that Hall B generated the highest amount of waste daily.

**Table 1:** Amount of waste generated per day per hall

S/N	Hostel	Day 1	Day 2	Day 3	Day 4	Average (Kg)
1	Hall A	41.27	40.90	16.70	38.03	<b>34.23</b>
2	Hall B	60.83	41.77	46.95	62.71	<b>53.07</b>
3	Hall C	50.23	39.11	75.45	31.88	<b>49.17</b>
4	Hall D	64.55	47.39	42.32	26.94	<b>45.30</b>
5	Hall E	53.77	41.35	26.95	42.80	<b>41.22</b>
6	Hall F	35.95	39.19	53.98	50.86	<b>45.00</b>
7	Hall G	29.91	36.73	62.19	37.79	<b>41.66</b>
8	Hall H	42.99	32.36	37.41	53.54	<b>41.58</b>
9	Hall I	35.59	58.12	53.75	35.22	<b>45.67</b>
10	Hall J	21.75	33.14	33.85	66.69	<b>38.86</b>
11	Hall K	43.72	34.87	44.88	13.96	<b>34.36</b>
12	Hall L	40.54	23.86	30.54	53.56	<b>37.13</b>
13	Hall M	39.37	23.08	54.57	46.79	<b>40.95</b>
14	Hall N	47.90	49.83	0.00	37.26	<b>33.75</b>
15	Hall O	32.64	26.92	39.85	23.44	<b>30.71</b>
16	Hall P	45.92	30.27	33.18	50.49	<b>39.97</b>
17	Hall Q	52.70	14.61	56.49	64.66	<b>47.12</b>
18	Hall R	28.45	56.34	26.94	28.24	<b>34.99</b>
19	Hall S	32.55	58.35	55.83	34.02	<b>45.19</b>
20	Hall T	25.60	39.32	47.10	54.39	<b>41.60</b>
21	Hall U	18.22	18.95	49.43	27.27	<b>28.47</b>
22	Hall V	37.00	48.03	22.06	37.25	<b>36.09</b>
23	Hall W	29.23	46.57	44.31	43.76	<b>40.97</b>
24	Hall X	24.39	54.03	24.00	39.78	<b>35.55</b>
25	Hall Y	64.22	28.49	43.82	48.90	<b>46.36</b>
26	Hall Z	54.48	23.07	50.50	39.42	<b>41.87</b>
27	Hall AA	14.00	52.54	51.33	32.37	<b>37.56</b>
28	Hall AB	58.19	36.01	37.33	57.88	<b>47.35</b>
29	Hall AC	52.78	54.48	27.90	43.89	<b>44.76</b>

30	Hall AD	35.94	11.52	26.99	42.67	<b>29.28</b>
31	Hall AE	70.56	32.58	48.77	32.07	<b>46.00</b>
32	Hall AF	71.12	40.48	35.85	55.32	<b>50.69</b>
33	Hall AG	42.60	38.84	47.92	72.53	<b>50.47</b>
34	Hall AH	42.89	27.81	61.38	35.07	<b>41.79</b>
35	Hall AI	24.52	33.46	58.38	33.64	<b>37.50</b>
36	Hall AJ	48.17	16.94	25.68	38.08	<b>32.22</b>
37	Hall AK	34.26	17.85	34.95	33.41	<b>30.12</b>
38	Hall AL	30.55	25.65	25.45	32.24	<b>28.47</b>

The average mass-based distribution of different components of waste in hostels within the university campus is presented in Table 2. The table shows that the most generated waste is food (169.61kg), followed by polythene (161.32kg), and plastic (158.41kg) while the least is metal (29.11kg) within the hostels. The characterization was done in accordance with the work of (Okeniyi & Anwan, 2012) at Covenant University, Ota, Nigeria with a little modification.

**Table 2:** Average daily generated solid waste per hall

Hostel	Paper(kg)	Plastic(kg)	Metal(kg)	Food (kg)	Polythene(kg)	Glass(kg)	Other(kg)
Hall A	1.28	5.30	1.20	7.58	5.67	1.10	1.35
Hall B	1.50	4.30	0.95	4.55	4.65	1.32	0.90
Hall C	2.15	5.74	0.89	8.54	6.93	0.95	2.00
Hall D	2.47	2.57	0.35	3.53	3.53	0.35	0.70
Hall E	2.10	3.30	1.25	3.75	2.65	0.80	0.67
Hall F	1.37	2.55	0.25	2.65	2.45	0.75	0.20
Hall G	1.54	4.00	0.70	2.18	3.84	1.25	1.20
Hall H	1.66	4.71	0.50	3.16	4.68	1.35	1.90
Hall I	2.45	4.50	1.20	3.35	4.56	1.20	1.16
Hall J	1.30	4.25	0.60	3.40	4.68	1.45	0.20
Hall K	1.30	3.81	0.61	4.71	4.05	0.91	0.80
Hall L	0.90	1.82	1.06	4.83	7.33	1.43	0.00
Hall M	1.33	3.30	0.71	3.81	6.08	0.55	1.22
Hall N	1.12	6.13	0.00	3.50	1.20	0.85	0.44
Hall O	2.36	4.34	1.44	1.15	4.62	0.73	1.31
Hall P	1.46	4.67	0.81	2.74	4.73	1.30	1.13
Hall Q	2.12	3.63	0.84	5.21	3.18	1.03	1.12
Hall R	2.00	3.66	0.73	6.77	6.70	2.14	0.80
Hall S	1.54	4.27	0.81	4.78	3.30	1.04	0.43
Hall T	1.93	4.21	1.56	6.50	4.51	1.43	0.42
Hall U	1.13	5.20	0.43	6.74	7.00	0.84	0.92
Hall V	1.47	1.70	0.53	4.00	6.04	0.85	1.62
Hall W	0.78	3.20	1.00	2.03	3.02	1.25	1.16
Hall X	1.97	3.82	0.65	5.05	3.08	0.60	0.40
Hall Y	1.73	3.82	0.26	3.14	3.86	1.00	2.24
Hall Z	2.15	3.83	0.52	3.54	3.92	0.71	0.00
Hall AA	1.50	4.45	0.90	1.87	2.57	1.00	0.00
Hall AB	1.11	3.72	0.56	4.05	4.06	1.52	0.73
Hall AC	1.80	3.90	1.57	4.60	4.73	1.27	1.13
Hall AD	2.01	3.53	0.40	4.67	3.10	1.00	1.26
Hall AE	2.84	3.36	0.97	4.84	5.50	1.07	0.61

Hall AF	1.32	4.00	0.56	2.93	4.89	0.55	1.00
Hall AG	0.76	4.10	1.11	9.30	4.43	0.70	0.02
Hall AH	1.46	6.71	0.94	4.80	0.37	1.08	0.00
Hall AI	1.42	6.32	0.78	5.72	5.05	0.62	1.52
Hall AJ	1.41	5.88	0.05	2.73	4.10	1.13	0.63
Hall AK	2.14	4.45	0.27	6.33	3.10	1.05	2.31
Hall AL	1.54	5.36	1.15	6.58	3.16	1.40	1.20
<b>TOTAL</b>	<b>62.42</b>	<b>158.41</b>	<b>29.11</b>	<b>169.61</b>	<b>161.32</b>	<b>39.57</b>	<b>34.70</b>

The summary of the responses of students from the questionnaire on solid waste disposal practices in their various hostels are presented in Table 3. 32.7% and 26.2% of all respondents agreed open burning and open dumping respectively are the solid waste disposal methods adopted in their various hostels.

**Table 3:** Methods of solid waste disposal

	Frequency	Percent	Valid Percent
Open burning	182	32.70	32.70
Open dumping	146	26.20	26.20
Incineration	113	20.30	20.30
Burial in a pit	81	14.50	14.50
Other	35	6.30	6.30
Total	557	100.00	100.00

## 5. CONCLUSIONS

Quantification and characterization of solid wastes generated in University of Ilorin has been carried out. The quantification identified Hall A, Hall AF, and Hall AG as the highest solid waste generation hostels amongst others as shown in table 1. It was also revealed from the study that recyclable materials are the most generated solid wastes on the university campus hostels as shown in table 2. The study also revealed that open burning and open dumping are mostly adopted amongst the hostels on campus as shown in figure 3. It was also revealed that most of the solid waste generated in the school are being burnt except plastic wastes being recycled by Vicfold Recycler. Hence it can be concluded that the solid waste management in the university is substandard and needs urgent intervention.

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