Monitoring and Assessment of Solid Waste Generated in Igbinedion University Okada

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Abstract: *Basic needs for the planning of a solid waste management system is centered on information about the nature of wastes, its composition, physical and chemical characteristics as well as the quantities that are generated. The objective of the study is to assess the solid waste generated within Igbinedion University Okada, campus 1 for the purpose of designing proper waste management scheme for the University by promoting waste reduction, minimization and separation for the purpose of reuse. Waste baskets were placed at the five various Colleges to determine the quantity of waste generated for each day, from each College. The obtained wastes were separated into different components comprising of polythene, plastics, paper and tin. Each components were placed on a well balance scale and weighed. From the results obtained, total waste generated in the Campus is 1841.79kg for the period of study. Oba Erediauwa College of Law generated largest amount of wastes of about 539.13kg (29.27%), College of Natural and Applied Sciences have a total of 388.33kg (21.08%) and 368.45kg (20%) for College of Engineering. Solid wastes were also characterized according to their components. An analysis of the composition, characteristics and quantities of solid wastes is very essential as it provides the basic data on which the management system will be*

INTRODUCTION

Solid waste are unwanted solid materials that are discarded from homes, institutions, industries, commercial and agricultural activities. They include plastics, paper, glass, metal, organic waste, food waste/garbage, rubbish, ash/residue, Demolition or construction waste, agricultural waste, cardboard, textiles, leather, yard wastes, wood, electronics, white goods, batteries, tires etc. Solid wastes are mostly categorized according to the source of origin or generation points. These materials that are discarded by the user as unwanted may be a very valuable material to another person. Some can also be recycled to make a better product. But this purpose can only be satisfied when there is an integrated plan or approach for solid waste management (Bridgewater and Mumford, 1979; Buekens and Patrick, 1985).

Improper management of these solid wastes which are continuously generated as a result of man-made activities lead to unhealthy and environmental nuisance (WHO, 1980, WHO, 1991, Isirimah, 2002; Takele, 2004). The university needs a proper solid waste management scheme. Solid waste management is a critical aspect of environmental hygiene which must be incorporated into environmental system planning (Howard, and Remson, 1978; Cook and Kalbermatten, 1981; Kiely, 1993; Cointreau *et al.,* 2000). Determining the type of wastes, amount of wastes generated, rate of generation, composition and characteristics of wastes are fundamental components toward the design of a proper waste management scheme for the University. Hence, understanding the quantity and the various components of solid waste produced within the university will serve as framework for the setting up of a proper waste management plan that will carter for the volume of waste produced.

MATERIALS AND METHODS

2.1 Description of the Study Area

Igbinedion University Okada is the first indigenous private university opened on May 1999 and is located in Okada town which is an administrative headquarter of Ovia North east local Government area of Edo State. It is located in Southern part of Nigeria which lies on latitude 6° 44 N and longitude 5°22 E of the equator. The university has three campuses and the study area is Campus 1 which comprises of the following Colleges and Administrative buildings.

    A.   General Abdulsalam Abubakar College of Engineering
    B.   College of Arts & Social Sciences (CASS)
    C.   Sanusi Lamido Sanusi College of Business & Management Studies.
    D.   Administrative Building (Paul Dike Central Administrative and Administrative block 2)
    E.   Oba Erediauwa College of Law
    F.   College of Natural & Applied Sciences

Igbinedion University Okada, is a tertiary institution of learning that comprises of people from all works of life, thus resulting to generation of solid waste.

2.2 Research Methodology

An examination of the composition, characteristics and quantities of wastes was carried out by mounting waste bins at various Colleges where it can easily be accessed and also at eatery locations where they also generate these wastes to serve as the collection points. Wastes generated and dumped in the waste bin were then measured using load count analysis method. The number of individual and corresponding characteristics of wastes load were segregated at the generation/collection point using hand sorting method which involve the separation of wastes into their various individual characteristics and constituents. The segregated wastes were then weighed appropriately to know the mass of each of the waste fraction. This was recorded over a period of time during when the school was in session actively (6th November, 2017 to 15th June, 2018 excluding Saturdays, Sundays and holidays) for both 1st and 2nd semesters of 2017/2018 academic year. Waste were measured using weighing balance, waste bins, hand gloves and nose mask and record sheet. For the purpose of this research, wastes were grouped into the following: Wood, Plastic, Metals, Glass, Paper & cardboard, Tin, Food waste and organic materials.

2.3 Waste Survey (Field Investigation) Analysis

Composition and characteristics of wastes in different colleges were recorded and calculated as given in Equation 1. Total waste generated in each College was calculated using Equation (2). Percentage Composition of each waste was evaluated using Equation (3).

$$Total\ waste\ component = \sum_{i=1}^{n} measured\ type\ of\ waste\ component (kg) \qquad (1)$$

$$Total\ waste\ generated\ in\ each\ College = \sum_{i=1}^{n} polyethene + \sum_{i=1}^{n} Plastic + \sum_{i=1}^{n} Paper/Cardboard + \sum_{i=1}^{n} Tin + \sum_{i=1}^{n} Glass + \sum_{i=1}^{n} metal + \sum_{i=1}^{n} wood + \sum_{i=1}^{n} food\ \&\ Organic \qquad (2)$$

$$\%\ composition\ of\ each\ waste = \frac{Total\ waste\ of\ each\ component}{Total\ waste\ generated\ in\ Campus\ 1} \ x\ 100 \qquad (3)$$

where,
n = number of days (as i starts with day 1)
% = percentage

RESULTS AND DISCUSSION

Assessment and monitoring of solid waste generated in the various colleges in campus 1 of the University was done for the period of one academic session. The total quantity and composition of solid waste generated at Gen. Abdulsalami Abubakar College of Engineering is 173.554kg for the period of twenty (20) days (Table 1), while Table 2 summarily is the generated components of waste in various Colleges for one hundred and thirty (130) days.

Table-1. Components of solid waste generated in Gen A.A. College of Engineering (20 days)

Days/ Weeks	Composition(kg)							
	Polyethylene	Plastic	Paper/ Cardboard	Tin	Glass	Metal	Wood	Food & organic
Week 1								
Monday	1.2	2.2	1.6	0.0058	-	-	16.7	2.2
Tuesday	1.1	1.7	1.4	-	15.6	-	-	3.6
Wednesday	0.9	1.2	0.5	0.0031	-	-	-	2.1
Thursday	0.9	1.9	0.3	0.008	-	10	-	2.6
Friday	0.8		0.2	-	-	-	-	0.9
Week 2								
Monday	1.5	2.0	2.0	0.0018	-	-	2.7	2.4
Tuesday	1.4	1.9	1.9	0.0027	-	-	-	2.1
Wednesday	1.3	1.4	0.3	0.0033	-	-	-	2.1
Thursday	0.7	1.4	0.1	0.0064	-	-	-	1.5
Friday	0.6	0.9	0.2	-		12	2.4	0.5
Week 3								
Monday	0.9	1.9	2.5	0.0016	-	-	-	2.4
Tuesday	1.2	1.4	0.4	0.0064	4.9	-	-	2.3
Wednesday	0.7	1.1	0.7	0.0034	-	-	-	1.3
Thursday	0.4	1.2	0.4	0.00319	-	-	-	1.9
Friday		0.7	0.2	0.0058	-	-	5.6	0.5

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Week 4

	Polyethene	Plastic	Paper	Tin	Glass	Metal	Wood	Food & organic
Monday	1.2	0.9	1.5	0.0014	-	2.5	-	3.1
Tuesday	0.9	0.6	0.3	0.00102	-	-	-	2.4
Wednesday	0.9	0.4	0.7	-	-	-	7.9	2.2
Thursday	0.5	0.4	0.8		-	-	-	0.5
Friday	0.4		0.4	-	-	-	-	1
Total per component	17.5	23.2	16.4	0.05391	20.5	24.5	35.3	36.1
Total waste in 20 days	173.554							

Table-2. Total quantity of constituent components of wastes obtained from Different Colleges in 130 days

Colleges	Components(kg)								Total Waste generated in each College (kg)
	Polyethene	Plastic	Paper	Tin	Glass	Metal	Wood	Food & organic	
Engineering	35.84	46.22	60.39	2.897	40.57	55.77	90.87	35.89	368.45
Natural and Applied Science	38.90	50.08	62.22	3.100	20.78	69.81	100.23	43.21	388.33
Art & Social Science	22.00	35.08	20.92	1.100	19.89	44.87	60.71	25.73	230.30
College of Law	52.50	73.00	60.44	3.280	60.88	88.96	153.18	46.89	539.13

Business and Management studies	23.00	30.92	21.65	0.989	9.72	23.42	50.73	19.34	179.77
Administrative Block	25.40	39.2	29.10	0.88	10.24	-	20.78	10.22	135.82
Total component of each waste	197.64	274.50	254.72	12.25	162.08	282.83	476.50	181.28	1841.80
% Composition	10.73	14.90	13.83	0.66	8.80	15.36	25.87	9.84	100

Total quantity of waste generated in Campus 1 of the University for a Period of 130 days is 1841.796kg. College of Law generates the highest amount of waste of about 539.13kg followed by Natural and Applied Sciences with total waste of 388.33kg. Wood is the highest constituent of solid waste generated in the University within the period with a percentage composition of about 25.87% probably because of the renovation works going on within the university for that period. Waste composition and characteristics are influenced by activities within the period of investigation and its composition varies with place and time (Solid Waste Manual, 1998). Fig. 1 depicts waste composition for all the sections in the Campus while Figure 2 shows the generated solid waste in each section of the Campus. Fig. 3-Fig. 8 shows the characterization and composition of wastes generated in each college respectively. College of Law recorded the highest amount of waste generated due to population of the students in that college. Increase in population increases the quantity of waste generated per individual (Takele, 2004). College of Natural and Applied Science has a total of 388.3kg followed by College of Engineering with total generated waste of 368.447kg. Wood and Metal wastes were observed to be most generated during the period of study due to renovation work going on the Colleges. Generation of plastic wastes were also observed to be higher than remaining other wastes due to consumption of plastic drinks by students across the colleges. Tins were observed to be very low due to low demand of canned (tin) drinks by the staff and students. Polyethylene and paper were also observed to be affected by weather and moisture content. Paper and cardboard were affected by rain especially during the rainy season. Some nylon and polyethylene also accumulate moisture which invariably affect the measurement.
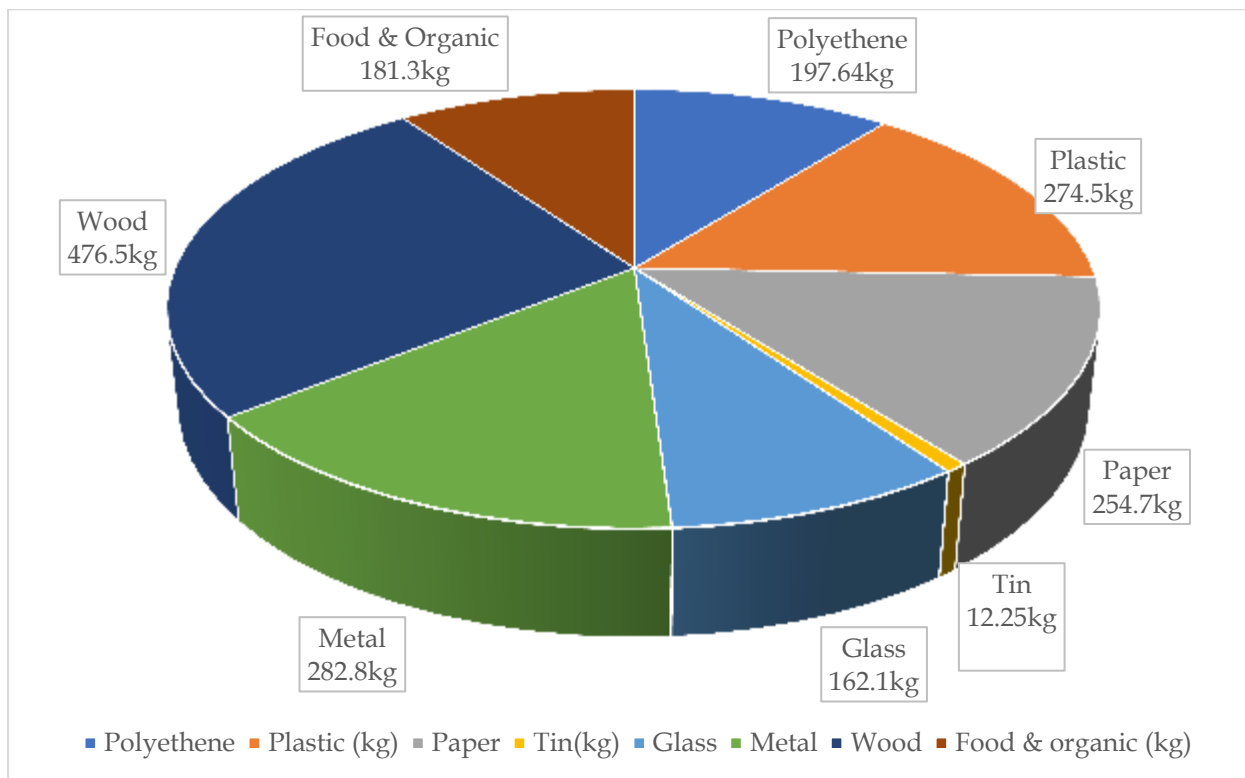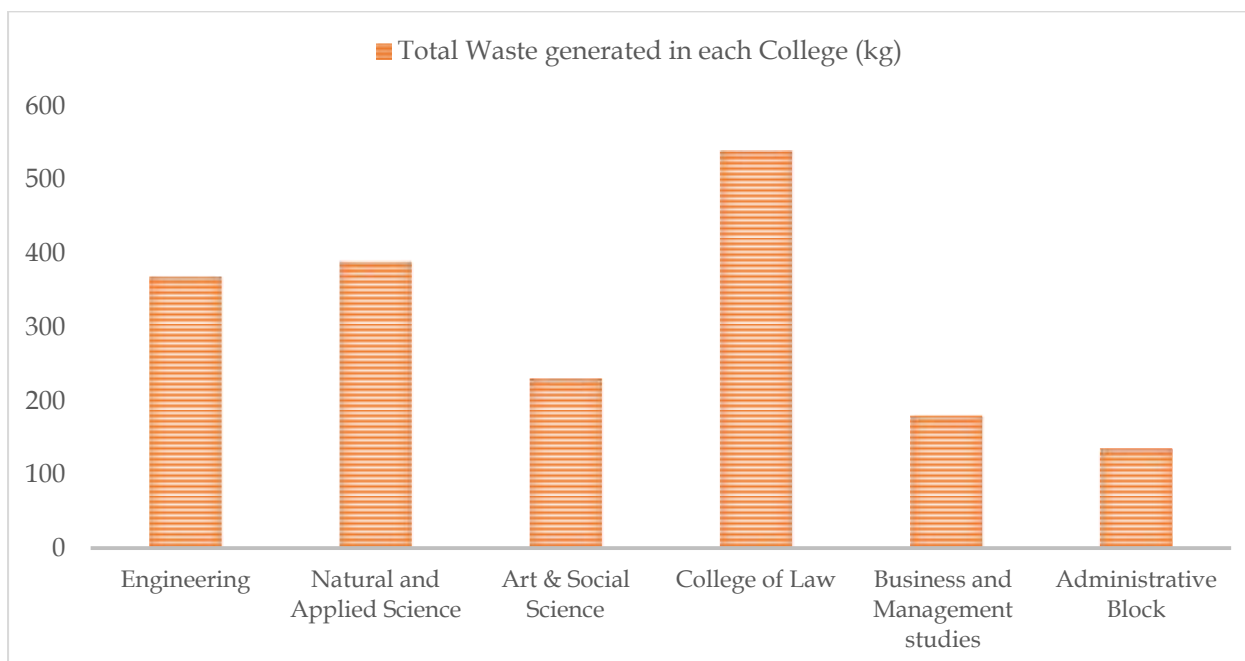
Fig.1 Composition of solid waste generated in the Campus

[Pie chart: Composition of solid waste generated in the Campus]
- Food & Organic 181.3kg
- Polyethene 197.64kg
- Wood 476.5kg
- Plastic 274.5kg
- Paper 254.7kg
- Tin 12.25kg
- Glass 162.1kg
- Metal 282.8kg

Legend: ■ Polyethene ■ Plastic (kg) ■ Paper ■ Tin(kg) ■ Glass ■ Metal ■ Wood ■ Food & organic (kg)

Fig.2 Total waste generated in each section of the Campus (kg)

[Bar chart: Total Waste generated in each College (kg)]
- Engineering: ~365
- Natural and Applied Science: ~388
- Art & Social Science: ~228
- College of Law: ~538
- Business and Management studies: ~178
- Administrative Block: ~135

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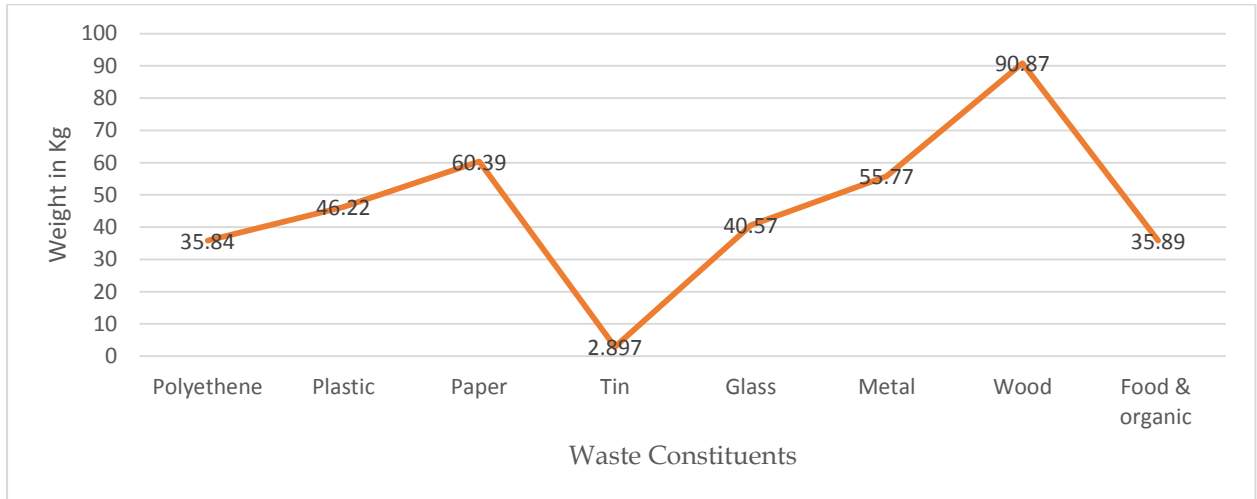
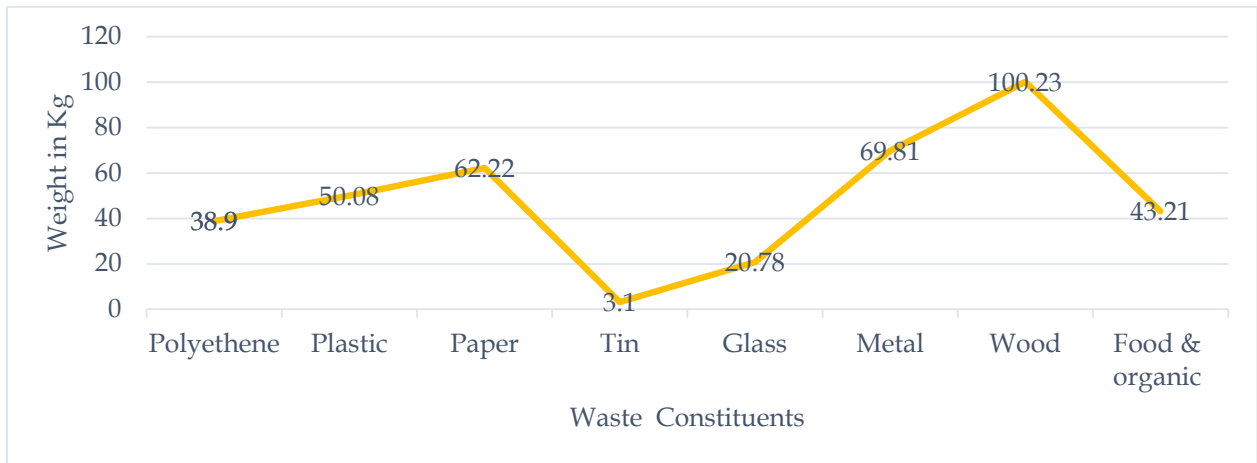Fig.3 Measured waste composition in College of Engineering.

Fig.4 Measured waste composition in College of Natural and Applied Sciences
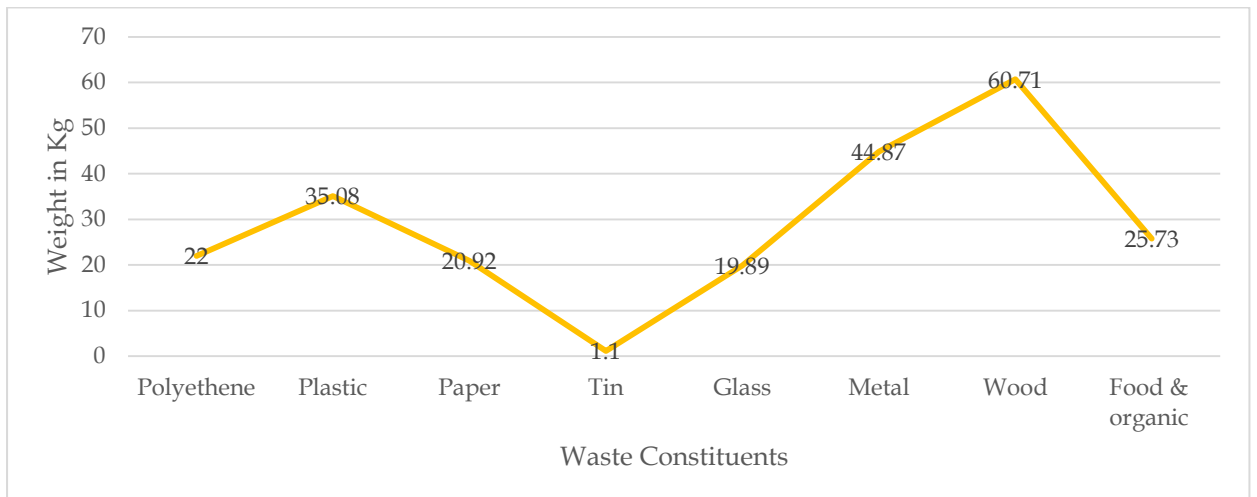

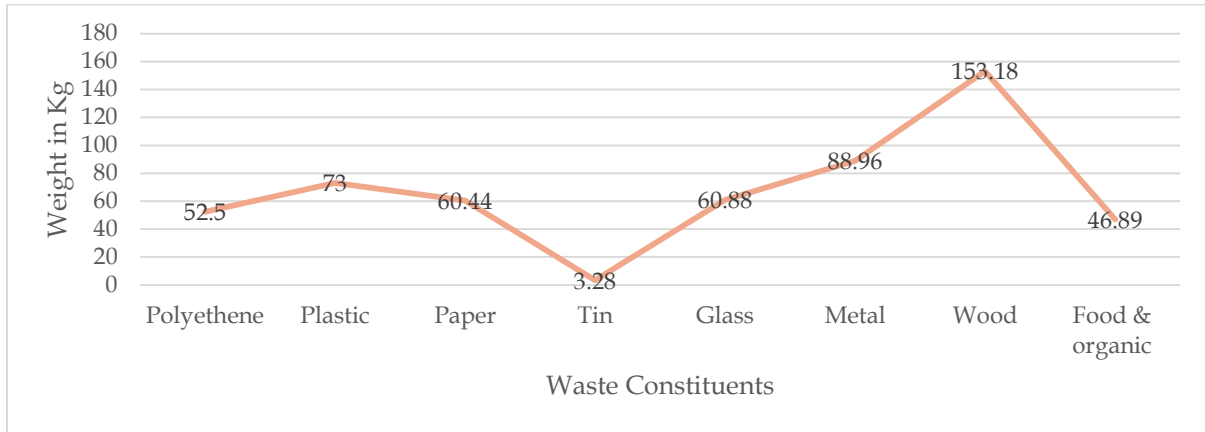Fig.5 Measured waste composition in College of Arts and Social Sciences

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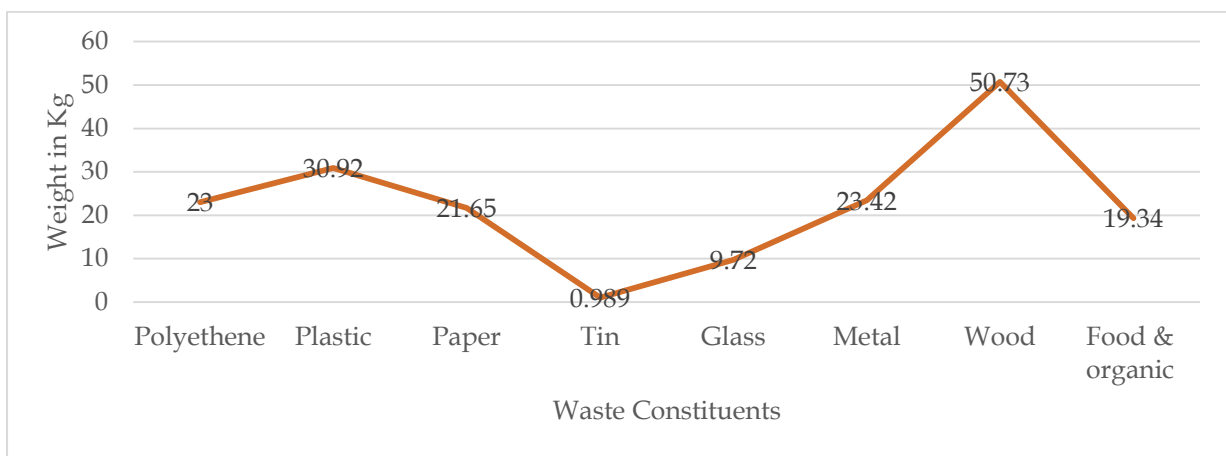Fig.6 Measured waste composition in Oba Erediauwa College of Law

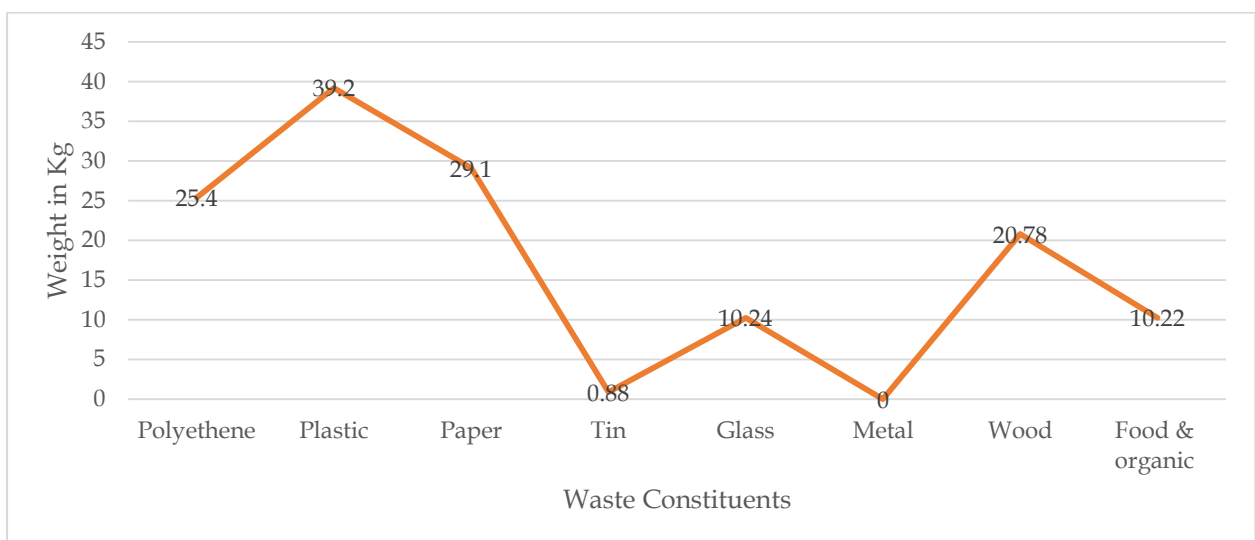Fig.7 Measured waste composition in Sanusi Lamido Sanusi College of Business & Management Studies

Fig.8 Measured waste composition in Administrative Building

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CONCLUSION

Solid waste generated at the different Colleges are mostly reuse -able. The amount of waste generated in the University are mostly high at the beginning of the week, which implies that the university is more active and populated from Mondays to Thursdays. Waste mostly generated in the university are plastics, paper and Polyethylene outside the wood and metals due to renovation works. The total quantity of waste generated at the Campus 1 of the University for a period of one hundred and thirty (130) days is estimated to be 1841.796kg. An analysis of the composition, characteristics and quantities of solid wastes is very essential because it provides the basic data on which the management system is planned, designed and operated. The changes and trend in composition and quantity of waste over a period of time help in future planning. It provides the information for the selection of equipment and appropriate technology. It indicates the amount and type of material suitable for processing, recovery and recycling.

RECOMMENDATION

The University should provide proper waste management scheme to handle solid waste generated at the different Colleges. The University needs to enlighten and create awareness to both members of staffs and students to proper discard their generated waste according to their characteristics and with such implementing tools put in place. Reusable waste can be recycled and serve as a source of revenue to the university.

CONFLICT OF INTEREST

We hereby state that no conflict of interest will arise in any form from the publication of this research work.

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