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CHARACTERIZATION OF MUNICIPAL SOLID WASTE, IN KAZAURE LOCAL GOVERNMENT AREA, JIGAWA STATE, NIGERIA

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ABSTRACT

Municipal solid waste is been one of the greatest challenge facing environmental Protection agencies in most cities of the world. This Paper presents a generation and compositions of municipal solid waste in Kazaure local government Jigawa state, the compositions of municipal solid waste were determined using samples obtained from Central collection situated at Kanti area. However, Kanti landfill received a volume of municipal solid waste from eleven wards of 175.07 m3 in dry season and 182.2 m3 in wet seasons. The compositions and percentages by mass of dry / wet season revealed the following: organic waste 53.18% / 62.75% and inorganic waste compositions are 46.82%/37.25%. The daily generation municipal solid waste per capita found to be 0.85 x 10-3 m3/person/day & 0.88 x 10-3 /m3/person/day by volume and 0.25 Kg/capita/day & 0.27 Kg/capita/day by mass with the densities of 293.03Kg/ m3 and 302.05 Kg/ m3 dry and wet seasons respectively. However, the waste can be best treat if one of these techniques is utilized composting, gasification and energy recovery in future for further reduction of waste.

KEYWORDS: Municipal Solid Waste (MSW), Per capita Waste Generation (PCG), Composition.

INTRODUCTION

The ever increasing of the population of globe particular African continent and rapid urbanization of west African cities, the collection and disposal of municipal solid waste (MSW) had been a serious environmental issue particular in sub-Sahara region of Nigeria (T. Ch. Ogwueleka 2009) . The poor collection process and lock of proper facilities to accommodate waste generated by the residential houses and even by the commercial area are some problems mitigating the effective management of MSW. Generally, Municipal solid waste is any unwanted or discarded materials generated by the habitant of particular environment through many sector of life (e.g. residential, Agricultural, industrial and commercial sector) with exclusion of sewage and hazard part of the waste (James, A 1997). The terrain, season of the year, eating habits and urbanization status of the town are some of the factor that influence the type waste composition and generation of the city (Thitame SN et al 2010). Usually the waste generator include the high-income and the low-income earners: the high-income earners areas usually generate more inorganic materials such as plastics and plastic bags, while low-income earners areas generate relatively more of organic waste. Uncontrolled or improperly sited open solid waste dumpsites constitute health hazards and damage the aesthetic beauty of many cities in Nigeria (Napoleon et al 2011).In some cases the flat terrain nature of the north Nigeria contributes the separate of MSW into the drainage system will leads to the blockage of the drain in turns trigger fold in most of the city in north. The proper and the effective way of management MSW is by identify the sources, rate of generation, and composition in order to monitor and measure it environmental effect to human health.

Characterization is also vital parameter to measure the health impacts on the nature as well as on society (Alamgir et al, 2005). At this period, there is no available data or information regarding the municipal solid waste composition

and it characterization. Hence it's paramount to study the composition and it characters for effect management and to develop means of reducing it hazardous impact on the environment. Consequently this research work is aimed for identifying the compositions in two different season of the year i.e. wet and dry season within Kazaure local government area Jigawa state of Nigeria. Treatment methods of MSW differ in dealing with different waste streams (Nabegu 2010). Options include recycling, land filling, biological treatment (i.e. composting and gasification), and thermal treatment such as mass burn incineration (with or without energy recovery) and fuel burning (Refuse Derived Fuels-RDF) (Babcock and Wilcox 2003). Municipal Solid Waste (MSW) data are measured in volume (m3/capita/day) or in weight (kg/capita/day).

STUDY AREA

Kazaure is situated in Jigawa State of northwestern Nigeria (between latitudes 12 41' 28.7" - 13 00' N and longitudes 007 50' E - 008 25' 21.1"E). Before its creation in 1976, Kazaure was an Emirate under the then former Kano province. It falls within the Sudan Savannah zone.

The minimum and maximum temperature ranges from 15.85ºC and 33ºC and fall as low as 10ºC during the Harmattan season between December and January. The Local Government Area has two seasons: rainy and dry Seasons. Temperatures during the Dry Season can be as high as 39^0C except in December and January when temperature could be as low as 20^0C, and average temperature in the rainy season is 25ºC.

Rainfall ranges from 500mm in the north to 1,200mm in the south. The people of Kazaure Local Government are predominantly farmers who engage themselves in both rainy and dry season farming (irrigation). Kazaure has total area of 690sq mi (1,780km^2).It also has a total population of 161,494 (Note: Kazaure LGA only) according to 2006 Census.

MATERIAL AND METHODS

Experimental Design

The dumping area considered in research work received waste generated from eleven wards collection centers of the local government area of kazaure which include Baauzini, Daba, Dabaza, Gada, Kanti, Maradawa, Sabaru, Unguwar arewa, Unguwar Gabas and Unguwar Yamma. However, two season where consider for the identification and constituent of the municipal solid waste. Sampling was carried at the intervals of four days in each of the seasons i.e. February & March (dry season) and June & July (wet season) representing the two season in Kazaure.

The open dump for MSW disposal is located at Kanti ward of KZR local government. At the initial stage the municipal solid waste was collected randomly at waste pile in order obtained a representative sample of waste content. Above 20Kg of the waste sample was reduces to 5kg by quartering techniques, extract care was taking during quartering to avoid misrepresentation of any component of the waste (Thitame SN et al 2010).

The 5Kg of the waste sample is sorted using hand grovels in to various component for the characterization of the waste component each measured with digital scale and recorded. The density is calculated by mass of the waste with of volume a container.

Municipal Solid Waste Generation

In this work the generation rate of the MSW was calculated from the Daily volume of the waste generated from the eleven ward area of the city received at the dump site in a day divide the total population of the eleven wards that generate the waste.

$$PGC = \frac{\{waste\ generation\ per\ day\}}{population}$$

Where PGC is the per capita waste generation of area (Oumarou MB. et al 2012)

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RESULT AND DISCUSSION

Per Capita Municipal Solid Generation in Kazaure (Kanti landfill)

Kazaure, Kanti landfill received waste form eleven ward area as mention previously the rate of generation MSW is calculated base on the waste collected by the authority managing the waste disposal in Kazaure zone, representing the data of waste generation in the two seasons. The landfill is currently handling a daily waste generation of 0.85 x 10^{-3} & 0.88 x 10^{-3} m^3/day/person by volume and 0.25 Kg/person/day & 0.27Kg/person/day by weigh mass in dry and wet season respectively, the per capita generation during dry season corresponded with value of obtain by Dauda .M and Osita O in Maiduguri Nigeria (2003). The population of Kazaure area stood at 206,380.00 according to national population commission (NPCN 2015). **Table 1** the density 293.03 Kg/ m^3 of MSW during the dry season also tally with the value given by the Lagos waste management authority (LWMA 2009). **Table 2** During wet season the density increase significantly to 302.05 Kg/ m^3 this mighty because of weight gained by the MSW as a result of increasing moisture content in the waste stream. The wet season density obtained here is similar to that of Port Harcourt Rivers (2009).

Table 1: Municipal Solid Waste Dry Season

S/N	CONSTITUENT	Mass in Kg	% CONSTITUENT by mass	volume (m^3)* 10^{-3}	% CONSTITUENT by volume	density Kgm^{-3}
Organic						
1	Food waste	1.62	32.38	1.00	5.87	1618.00
2	Vegetables	0.64	12.77	1.00	5.87	638.00
3	Inert matter	0.02	0.40	0.45	2.64	44.44
4	Textiles	0.01	0.18	1.20	7.04	7.50
5	Wood	0.01	0.24	1.80	10.56	6.67
6	Paper	0.36	7.21	0.42	2.46	857.14
	Total	**2.66**	**53.18**	**5.87**	**34.43**	**452.64**
Inorganic						
1	Glass	0.06	1.12	0.13	0.76	430.00
2	Electronic waste	0.09	1.80	0.10	0.59	899.00
3	plastic bags	0.16	3.10	3.60	21.11	43.06
4	Plastic container	0.10	1.96	3.00	17.60	32.67
5	Metals	0.57	11.39	0.15	0.88	3793.33
6	Ceramic	0.33	6.60	0.90	5.28	366.11
7	other plastic	0.52	10.49	3.00	17.60	174.67
8	construction material	0.02	0.36	0.10	0.59	179.00
9	Others	0.50	10.01	0.20	1.17	2500.00
	Total	**2.34**	**46.82**	**11.18**	**65.57**	**209.23**
	Net Total	**5.00**	**100.00**	**17.05**	**100.00**	**293.03**

Municipal Solid Waste Composition

In this research, 15 components were identified in the collected waste samples. **Table 1&2** Organic waste component constitute the highest percentage 62.75% & 53.18% by mass and 34.43 & 32.33 % by volume during dry and season, while inorganic constituted a waste portion of 46.82 % & 37.25 % by mass and 65.57% & 67.67% by volume of the total waste generated during dry and wet season respectively . Among the organic composition food waste takes the percentage of 32.38 % & 34.19 % by mass in dry and wet season, this make it predominant than the rest of organic matter in waste, the larger percentage of the waste is mostly mixture of food waste (Bichi et al. 2013).

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This indicates that weight and volume of the organic waste are approximately 10 percent higher in wet season as compared to dry season, this correspond with the waste generated in Oman (Hameed et al. 2014) . Organic waste account for large percentage of the waste generated in Kazaure for wet and dry season, this is in conformity with the most of waste generated in developing countries (Wakjira LA 2007), also presence of high organic matter in the waste stream makes it possible for the use as fertilize (Bichi et al. 2013). The present of high amount of organic matter in the waste stream post an alarming environmental concern such as bad odors , at the other hand may be advantageous when the waste is consider to be treat through composting techniques or gasification.

The second waste category is the plastic bags with 21.11 % and 24.77% by volume dry and wet seasons respectively, the percentage of the plastic waste increased with increasing percentage of food waste, this means that the two waste generation are related in the sane that the plastic bags are used to cover food stuffs as the traditional method of using leaves and other material to cover food had been replaced with plastic bags in modern days. Next to plastic is textile material with volume of 10.56 % and 13.29 % this mostly contain is remains of cloth sowing and old cloth.

Electronic waste even thus the percentage by mass of this waste substance is small, in both the two season (0.09% and 0.04 % dry and wet season respectively) toxicity potential can cause in very significant environmental problem.

Table 2: Municipal Solid Waste Wet Season

S/N	CONSTITUENT	Mass in Kg	% CONSTITUENT by mass	volume (m^3)* 10^{-3}	% CONSTITUENT by volume	density Kgm^{-3}
Organic						
1	Food waste	1.71	34.19	0.70	4.23	2441.43
2	Vegetables	0.56	11.14	1.10	6.65	506.36
3	Inert matter	0.04	0.82	0.35	2.11	117.14
4	Textiles	0.37	7.40	2.20	13.29	168.18
5	Wood	0.29	5.74	0.80	4.83	358.75
6	Paper	0.17	3.46	0.20	1.21	865.00
	Total	**3.14**	**62.75**	**5.35**	**32.33**	**586.36**
Inorganic						
1	Glass	0.33	6.54	0.30	1.81	1090.00
2	Electronic waste	0.04	0.70	1.60	9.67	21.88
3	plastic bags	0.07	1.30	4.10	24.77	108.33
4	Plastic container	0.23	4.66	3.00	18.13	77.67
5	Metals	0.35	7.06	0.10	0.60	3530.00
6	Ceramic	0.01	0.14	0.90	5.44	7.78
7	other plastic	0.11	2.10	0.30	1.81	350.00
8	construction material	0.02	0.34	0.60	3.63	4.15
9	Others	0.72	14.40	0.30	1.81	2400.00
	Total	**1.86**	**37.25**	**11.20**	**67.67**	**166.25**
	Net Total	**5.00**	**100.00**	**16.55**	**100.00**	**302.05**

CONCLUSION

In contrast, the result obtained during this research study is similar to those found in Kano, Maiduguri, Lagos and Port Harcourt etc. The solid waste is made of fifty major constituents this includes organic (53.18 % dry and 62.75 % wet season): food waste, vegetables, inert matter, textiles, wood and paper and Inorganic (46.28% dry and 37.25 % wet season) are: glass, electronics, plastic bags, plastic container, metals, other plastic, construction material, and others.

The average densities and per capita generations are dry season: 293.03 kg/m^3 & 0.25 Kg/person/day and wet season: 302.05 kg/m^3 & 0.27 Kg/person/day. Since the waste consuetude a higher percentage of organic waste, composting and gasification will be advantageous over the current practice of landfill, also the recycling of some portion of inorganic waste component such as plastic can also be beneficial in reducing the waste volume generated.

Finally the use of PPP (Public Private Participation) in waste management can also enhance the waste collection process and disposal, as currently being in used Kano which had started yielding an appreciable result.

REFERENCE

[1] **Alamgir M Donald *et. al* (2005).**Integrated Waste Management and Safe Disposal of Msw in Least Developed Asian Countries.
[2] **Babcock and Wilcox (2003).** Computational Fluid Dynamics in Waste to Energy Technology Pamphlet.
[3] **Bichi et. al. (2013).** Characterization of household solid wastes generated in Sabon-gari area of Kano in Northern Nigeria Vol. 1(4)
[4] **Dauda, M and Osita O (2003**). Re-use of solid waste in Maiduguri, Nigeria. International Conference Abuja 29th WEDC
[5] **EPDA (2001).** Environmental Protection Department Air Management Group.
[6] **Hameed *et al.* (2014).**Generation and Composition of Municipal solid waste in Muscat, Sultanate of Oman, journal of Elsevier Singapore APCBEE Procedia 10(2014) 96-102.
[7] **James, A. (1997)** .Riegels Handbook of Industrial chemistry.CBS Publishers and Distributors, India
[8] **JIEPA (2015).** Jigawa State Environmental Protection Agency Kazaure (2015)
[9] **LWMA (2009).** Lagos waste management authority Nigeria
[10] **Nabegu A.B (2010).** An analysis of Municipal Solid Waste in Kano Metropolis, Nigeria Journal of Human Ecology, 31(2): 111-119
[11] **Napoleon S.Kingsley O and Joan E. (2011).** mitigating the impact of solid waste in urban centre in Nigeria journal of human ecology 34(2): 125-133
[12] **NPCN (2006).** National population Commission Nigeria Kazaure
[13] **NPCN (2015).** National population Commission Nigeria Kazaure.
[14] **Oumarou MB *et al* (2012).** Characterization and Generation of Municipal Solid Waste in North Central Nigeria. International Journal of Modern Engineering Research Vol. 2:3669-3672
[15] **Port Harcourt (2009).** Rivers state environmental protection agency Nigeria Recycling and pollution control handbook Publisher- George Godwin Limited
[16] **T.Ch.Ogwueleka (2010).** Municipal solid waste characteristics and management In Nigeria. Iran J. Environ. Health Sci. Eng., 2009, vol. 6 No 3, pp: 173-180173
[17] **Tchobanoglous G theisen H, vigils. (1993).** Intergrated solid waste management Engineering principal and management issue. International Ed. Mc Gram. Hill book co. Singapore.
[18] **Thitame S. *et al,* (2010).** Characterization and Composition of municipal solid waste (MSW) generated in Sangamner city, District Ahmed nagar, Maharashtra India, Environment Monitoring Assessment 2010; 170:1-5
[19] **Wakjira LA (2007).** Household Solid waste generation rate and composition in two selected kebels of Adama town Addis Ababa University Unpublished Master's thesis.