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STUDIES ON THE EFFECT OF MUNICIPAL SOLID WASTE DUMP SITES IN OKIGWE MUNICIPAL, IMO STATE, NIGERIA

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ABSTRACT

Solid waste management is a growing problem in the world especially in a developing country like Nigeria. In Nigeria, the prevalence of Municipal Solid Waste (MSW) is alarming with its public health and environmental consequences. These have led to the formulation of different policies which often have proved ineffective. Improper environmental engineering and lack of executive will to punish offenders have converted most of the municipal street to refuse dumping sites. Sequel to the aforementioned, we identified 18 major waste dumps in Okigwe metropolis covering a land area of 36171.2m² estimated at ₦232,607,260. 12(66.7%) were found to disrupt movement of erosion while 6(33.3%) obstruct pedestrian and vehicle movement. All the dumpsites were found to harbour vectors of public health implications. Out of the 2059.094kg MSW characterized, 930.45kg (45.19%) were biodegradables while 1128.64kg (54.81%) were non-biodegradables. Among the biodegradable MSW, food waste recorded the highest weight 317.04kg (35.57%), while medical waste 5.42kg (0.61%) recorded the least. Wood, Fabric, Paper and Leather wastes recorded 96.76kg (10.86%), 155.22kg (17.42%), 255.41kg (28.66%) and 61.41kg (6.41%). Of the non-biodegradable MSW Polythene 325.9kg (28.91%) recorded the highest weight while Medical waste 5.48kg (0.49kg) recorded the least. Metal, Rubber, Glass and bottle, Ceramics, and Grit recorded 206.39kg (18.31%), 68.9kg (6.11%), 160.17kg (14.21%), 86.1kg (7.64%) and 274.5kg (24.35%) respectively.

Keywords: Municipal, Solid Waste, Dump.

INTRODUCTION

Municipal Solid Waste (MSW) could be defined as non-liquid and non-gaseous product of human activities that is regarded to be useless; it could take the form of biodegradable and non-biodegradable (Leton and Omotosho, 2004). It

involves any material arising from municipal human activities that the possessor has not yet discovered its importance or value.

Municipal solid waste management is an important part of the urban infrastructure that ensures the protection of the environment and human health (World Bank, 2002, 2003). The disposal of waste generated by human activities within a municipality is generally an urban problem. MSW disposal is a global concern, most especially in developing countries across the world as poverty, population growth, and high urbanization rates combine with ineffectual and under-funded governments to prevent efficient management of wastes (Doan 1998, Aderemi *et al* 2011). The accelerated growth of urban population with unplanned urbanization, increasing economic activities, culture and ignorance in developing towns and cities of Nigeria complicates the effort to adopt an improved solid waste management method, strategies, and services (Nabegu, 2010).

Proper management of Municipal Solid Waste dump is critical to the health and well being of urban residents (World Bank, 2003). Goal 7 of the 8 Millennium Development Goals is to ensure Environmental Sustainability (UNESCO, 2011). A very important issue that is crucial in realizing this goal is that of the need to develop and adopt effective strategies for Municipal Solid Waste Management. In Nigeria, several tons of Municipal Solid Waste are left unmanaged and uncollected in the street and roadsides. The impact of solid waste on health and environment has been an issue of global concern over the years (Goorah *et al* 2009; Kouznetsova *et al* 2007, Barlaz *et al* 2003). Solid waste causes environmental pollution through the introduction of chemical substances above the threshold limit into the environment. Various workers have demonstrated that solid waste introduces additional heavy metals into the surrounding soil and ground water (Nubi *et al* 2008, Uba *et al* 2008, Elaigwu *et al* 2007 and Ogungbe *et al* 2012). These wastes have equally been found to clog drains, create feeding and breeding ground for pests and disease vectors that spread diseases, and thus creates a myriad of related health, economic, social and infrastructural problems (Nabegu, 2010).

With no well-articulated and implemented waste management policy in Nigeria most growing and developing municipal are therefore faced with the reality of managing and controlling municipal solid waste. With no proper waste management strategy, MSW dumps are therefore increasing both in size and number.

Problem of poor waste management strategy exposes a community therefore to adverse economic, health, environmental and social consequences. Among others, the immediate environment will continue to suffer from uncontrolled release of methane (from anaerobic waste decomposition), contamination of underground water, and the spread of diseases by vectors (Schertenleib and Meyer, 1992).

MATERIALS AND METHOD

Study Area

The study area for this research work is Okigwe metropolis of Imo state, Nigeria. The study community lies within latitudes5^{o}4' and 6^{o}3'Northand longitude7^{o}10'and 735'East (Igbozurike, 1986). Okigwe has a tropical continental climate of distinct wet and dry seasons. The average humidity is about 70-85% during rainy and dry seasons, especially in the morning hours. Okigwe metropolis is a university community being the nearest town to Abia State University. Most residents are therefore either government worker or traders or students. Most of the indigenes are however subsistent farmers.

In Okigwe, waste dumps are located in positions where the eyes will never fail to see them and behold their ugly look. These tons of unmanaged and uncollected MSW littered on the streets and roadsides frustrate the serenity of the town with the buzzing sound of flies and the unbearable odour emanating from them. Like in most other Nigerian towns and cities where there is diversity of human activities due to teaming population, there is constant increase in waste output. There is therefore an urgent need to find sustainable and efficient solution to the MSW menace in the area

Waste Characterization and Studies

Eighteen major/regular Municipal Solid Waste Dumps (Loc. A to Loc. R) were identified, their dimensions were estimated using a measuring tape. The area of land covered by wastes was pegged to enable an accurate measurement of dimensions using the Brahmagupta formula as adopted by Dragutin Svrtan (2010).

Given as..... $A=\sqrt{(s-a)(s-b)(s-c)(s-d)}$

Where a, b, c and d are lengths of the four sides of the quadrilateral, and $s = (a + b + c + d)/2$

Equal volume of waste samples from the waste dumps were collected, characterized and weighed. Daily observations of the dumps were made to determine the dumps that were periodically burnt, obstructed movement of vehicles and pedestrian erosion (whenever it rained. The prevalence of rodents (rats) and cyclorhaphan flies were monitored through the use of baited traps and scoop nets respectively. The prices of the land covered with the waste dumps were calculated as fractions of the prices of adjourning plots.

RESULT

Table 1 shows the various locations and areas of land covered by waste dumps. It also shows the cost of land (per plot) in the various waste locations.

Table 1: Price of Land in the Different Waste Locations

Location	Price per Plot of Land (3400m²) (Naira)	Total Area of Land Covered by MSW Dump (M²)	Cost of the Area of Land Covered by MSW (Naira)
Loc. A (Slaughter Road)	25 million	1059.2	7,788,235
Loc. B (Ndiakwake Bridge)	25 million	1872.5	13,768,382
Loc. C (Ndiakwake Road II)	25 million	2272.2	16,707,382
Loc. D(Umuinnem Road)	15 million	2303.2	10,161,176
Loc. E (Umuokpara by City College)	25 million	976.1	7,177,205
Loc. F (Umuopkara by Assemblies)	25 million	1094.3	8,046,323
Loc. G (Owerri Road)	25 million	2151.3	15,181,382
Loc. H (Umuopkara by Assemblies)	25 million	1799.2	13,229,411
Loc.I(Winners Chapel Road)	25 million	709,7	5,218382
Loc. J (Umuchima Road)	25 million	4327.2	31,817,647
Loc. K (Bende Road)	15 million	1280.9	5,657,029
Loc. L(Bende Street 2)	15 million	1770.9	7,812,794
Loc. M (Ike Road by Army Lodge)	25 million	1670.9	12,286,029
Loc. N(Aba Road)	10 million	2970.2	8,735,882
Loc. O (Agiriga Road)	25 million	5312.6	39,063,235
Loc. P (Ubahu Road)	15 million	1316.7	5,808,970
Loc. Q (German Hill)	25 million	1800.4	13,238,238
Loc. R (Rev. Mann Street)	25 million	1483.7	10,909,558
Total		**36171.2m²**	**232,607,260**

The largest waste dump in the study area is the location O with the total area of 5312.6m².The least MSW dump (Location 1) covered an area of 709.9m². It can be seen that the 18 waste dumps studied covered a land area of 36171.2m² estimated at ₦232, 607,260 (See Table 1).

Similarly, rats as well as flies were caught around all the wastes in great numbers. 6(33%) of the waste dumps obstructed movement of vehicles and pedestrians and these have been responsible for many cases of traffic jam

(accounting for more fuel consumption there by causing more pollution) and accident. Out of 18 MSW Identified, 14 (77%) were regularly burnt and this releases more smoke to the local environment. A 12 (66.7%) of the waste dumps disrupts movement of erosion and thus have led to the creation of gullies, thereby making roads unmotorable. falling down of houses and other deadly consequences.

Table 2: Environmental Impacts of MSW Dumps in Okigwe

Impacts	No. of MSW Dumps
Obstruct the movement of vehicle and Pedestrian.	6 (33.3%)
Harbors and attract rodents and flies	18 (100%)
Disrupt the movement of erosion	12 (66.7%)

A total of 2059.094kg of MSW were characterized. Of this, 930.45kg (45.19%) were biodegradables while 1128.64kg (54.81%) were non-biodegradables. Among the biodegradable MSW, FW recorded the highest weight 317.04kg (35.57%), while MW 5.42kg (0.61%) recorded the least. WD, FB, PP and LTH recorded 96.76kg (10.86%), 155.22kg (17.42%), 255.41kg (28.66%) and 61.41kg (6.41%). Of the non-biodegradable MSW PE 325.9kg (28.91%) recorded the highest weight while MW 5.48kg (0.49kg) recorded the least. MT, RB, GB, CE, and GT recorded 206.39kg (18.31%), 68.9kg (6.11%), 160.17kg (14.21%), 86.1kg (7.64%) and 274.5kg (24.35%) respectively. The details are shown in Table 3.

Table 3: The Result of Waste Characterization of the Dumps

Location		Composition of Biodegradables							Composition of Non-biodegradables								
		WD	FB	PP	FW	LTH	MW	TBD	MT	RB	GB	PE	CE	GT	MW	TNB	TTW
A	%	12.1	5.2	2.6	15.7	4.1	2.5	42.2	10.0	7.2	10.8	4.1	10.4	13.1	2.2	57.8	100
	Kg	23	10	5	30	4	1	73	40	10	15	10	16	25	1	117	190
B	%	2.7	0.6	21.2	18.8	1.95	0	45.2	3.5	0	6.2	21.5	8.9	14.2	0.55	54.8	100
	kg	5.2	1.2	40.1	35.6	3.7	0	85.8	7.7	0	11.9	40.7	16.9	26.9	0	104.2	190
C	%	9.6	7.3	12.3	15.8	0.9	0	46.4	6.0	9.6	6.0	14.9	0.6	16.4	0.4	53.9	100
	kg	12.7	9.7	16.3	20.9	1.2	0	60.8	7.9	12.7	7.9	19.7	0.9	21.7	0	70.8	131.6
D	%	6.3	6.6	11.4	11.8	3.1	0.1	40	7.4	5.8	17.2	12.0	0	17.2	0.4	60	100
	kg	7.9	12.9	13.9	16.7	3.9	0.5	55	9.0	7.1	20.9	14.9	0	20.9	0.5	73.3	129.3
E	%	0.9	17.2	17.3	13.0	1.3	0	50	7.6	1.5	5.3	13.2	7.0	15.7	0	50.4	100
	Kg	2.3	40.7	40.9	30.7	4.2	0	119	3.2	3.7	12.7	40.7	16.7	15.1	0	92.4	235.9
F	%	3.5	2.9	12.9	20.3	2.0	0.35	41.9	15.9	2.8	9.3	25.3	2.0	10.4	0.35	58.05	100
	Kg	4.7	3.9	16.9	15.5	2.7	0.5	44.2	12.1	3.7	12.2	33.2	2.7	13.7	0.5	78.1	122.3
G	%	2.7	3.9	10.5	24.1	7.6	1.05	50.2	12.3	9.8	3.9	5.7	4.6	12.3	1.2	49.65	100
	Kg	4.7	6.7	17.8	40.9	12.9	1.85	85.3	20.9	16.7	6.7	9.7	7.9	20.9	1.85	84.65	169.95
H	%	1.0	2.4	4.2	14.4	1.2	0.28	24.5	25.7	1.7	12.4	13.8	2.4	19.2	0.22	76.02	100
	kg	1.7	3.9	6.7	22.9	1.9	0.45	39.4	40.7	2.4	19.7	22.9	3.9	30.4	0.45	120.4	158.3
I	%	3.3	5.0	20.8	16.1	1.6	0	47.2	6.6	0	1.8	31.6	0.3	12.5	0	52.8	100
	kg	4.2	6.3	26.1	20.2	2.1	0	59.5	8.3	0	2.3	39.7	0.4	15.8	0	66.5	125.85
J	%	7.5	10.5	23.4	12.3	1.9	0.24	57	13.9	0	10.2	8.9	1.0	8.9	0.26	43	100
	Kg	6.7	9.3	20.7	10.9	1.7	0.55	49	12.3	0	9.1	7.9	0.9	7.9	0.55	39.5	88.5
K	%	3.1	13.9	21.8	5.29	4.2	0	48.5	3.67	2.05	5.29	16.9	2.3	21.2	0	51.41	100
	Kg	2.9	12.9	20.2	4.9	3.9	0	45.3	3.4	1.9	4.9	15.7	2.2	19.7	0	47.8	93.15
L	%	2.51	18.3	10.8	12.6	5.67	0.70	50.5	3.42	2.77	10.0	22.7	6.08	3.57	0.88	49.16	100
	kg	1.9	13.9	8.21	9.54	4.29	0.22	38.6	2.59	2.1	7.6	17.2	4.6	2.7	0.28	37.07	75.63
M	%	3.0	5.6	5.9	19.4	5.9	0	40.4	18.6	1.0	9.4	8.6	0	22.1	0	59.6	100
	kg	1.76	3.2	3.4	11.1	3.4	0	23.1	10.6	0.6	5.4	4.9	0	12.6	0	34.1	57.2
N	%	12.2	3.28	9.2	18.1	3.2	0	45.9	12.2	1.0	3.21	18.1	2.91	16.6	0	54.02	100
	kg	4.9	1.32	3.7	7.3	1.32	0	18.5	4.9	0.6	1.3	7.3	1.2	6.3	0	21.6	40.14
O	%	2.6	8.1	13.8	24.3	2.2	0.62	51.6	5.1	7.8	3.1	23.2	1.7	6.2	0.68	48.38	100
	kg	1.4	4.3	7.3	12.9	1.2	0.35	27.4	2.7	4.2	1.67	14.3	0.9	3.3	0.35	27.42	54.87
P	%	12.0	7.2	5.0	15.9	5.0	0	45.7	11.2	5	23.1	7.7	1.5	5.8	0	54.2	100
	kg	7.6	4.6	3.2	10.1	3.2	0	29.0	7.1	3.2	14.6	4.9	1.0	3.7	0	34.5	63.2
Q	%	5.02	6.43	3.61	15.2	4.08	0	54.3	10.5	0	5.65	3.6	6.12	19.9	0	45.87	100
	kg	3.2	4.1	2.3	9.7	2.6	0	34.5	6.7	0	3.6	14.9	3.9	12.7	0	41.8	76.3
R	%	0	11.0	4.74	12.6	5.62	0	33.9	11.0	0	4.74	12.8	10.5	26.7	0	65.44	100
	kg	0	6.3	2.7	7.2	3.2	0	19.4	6.3	0	2.7	7.3	6	15.2	0	37.5	56.9
Total		**96.76kg**	**155.22kg**	**255.41kg**	**317.04kg**	**61.41kg**	**5.42kg**	**930.45kg**	**206.39kg**	**68.9**	**160.17kg**	**325.9kg**	**86.1kg**	**274.5kg**	**5.48kg**	**1128.64kg**	**2059.09kg**

Key:

TBD = Total of Biodegradable Wastes
TNB = Total of Non-Biodegradable Wastes,
TTW = Total of Biodegradable and Non-Biodegradable
GT = Grit
GB = Glass/Bottles
PE = Polyethene
MW = Medical Waste
WD = Wood
FW = Food Waste
LTH = Leather
MT = Metals
RB = Rubber
CE = Ceramics
FB = Fabrics
PP = Paper.

DISCUSSION

This study depicts that non-biodegradable waste is the major waste type found in the waste dumps, this result is similar to the 58.1% non-biodegradable waste reported by Eze and Asoadu (2003) in Onitsha metropolis and 65 % reported by Igbozurike (2003) in Owerri metropolis. This result however disagrees with observation of Onibokun *et al* (2000) (who recorded higher value of waste dumps in Accra, Ibadan, Daker, Abijan and Lusaka). These differences may be attributable to the role of the waste pickers and the seasons when these studies were carried out as well as to the industrial / economic status of the metropolis (neighborhood) involved.

The quantity, composition and rate of solid waste generation in Okigwe may not be unconnected with the increase in population, level of industrialization, socio-economic status of the residents and the new salary structure implemented by both the Federal Government of Nigeria and Imo State Government. The increased packages have to a great extent raised the purchasing power of most residents of Okigwe who are mainly government workers.

An estimated land area of 36171.2m² covered by the eighteen waste dumps is alarming. The economic value of the land also estimated at ₦232, 607,260 has proved that MSW dumps are of immerse adverse economic impact. This agrees

with the observation of Schertenleib and Meyer, (1992) who noted some adverse environmental impact of MSW while studying the menace of MSW in Washington DC.

Similarly World Bank, (2002) has noted that poor management of MSW which usually resulted in smelly surrounding discourages investors and tourists. Hence such municipality will be faced with poor living standard. It is indeed not unlikely that infrastructures and landed property sited near waste dumps depreciates in value as the size and volume of the waste dumps increase without good management.

William and Jude, (2002) attributed 25% cause of social unrest in Nigeria to MSW dumps. Dumps occur along the major access route and street ends, which are mainly private properties. William and Jude, (2002) further observed that the owners of the land which people have converted to MSW dumps often become militant in their bid to recover sell or build on the waste colonized land.

The work revealed that 6 (33%) of MSW obstruct vehicle and pedestrian movement, and was a major cause of road accident. The result is similar to the result of Ogunmodede *et al*, (2012) who associated the high occurrence of accidents to the prevalence of MSW.

While effort were not made to empirically determine the impact of MSW on health, many dangerous vectors of human disease were seen in the various waste dumps, this indeed agrees with the observation of World Bank (2002). The current situation of waste management in Okigwe does not fulfill the required national conditions for environmental protections. The weak financial status of the municipality and local authority that is responsible for managing dumpsites in the study area stand against getting modern solid waste collection, employment of waste experts and adoption of good waste management policy. Waste should be managed using internationally accepted standard in order to protect human health and the environment. Waste management in Okigwe presently has not reached the minimum standard for protection of health; it is therefore recommended that action should be taken immediately.

There is an urgent need to evacuate the major waste dumps identify during the study and also to introduce more effective waste collecting strategy. The strategy by Okigwe Town Planning Authority arresting and imposing fines on people who dumps waste in these waste dumps without providing alternate waste

dump system. People now dump their waste at night; a period when law enforcement agents have left the dump sites. There is therefore a need to provide an alternative waste collection system, since waste production is inevitable. Such strategy must include:

a. **Education on Waste Management Options Especially on Waste Reuse and Recycling**: To achieve this, there is need to conduct more research on the knowledge, attitude and practices of Okigwe residents. Understanding how people regard a problem such as waste management makes it easier to communicate with them about it and help them to see that the solution of the problem may indeed coincided with their interest, priorities and aspirations.

b. **Implications of Growing Waste Dumps on the Public Health and Serenity of the Metropolis:** To achieve this, more studies is equally needed to determine more empirically the human parasitic burden of flies and rodents that breed in the growing dumps. People are more likely to comply with rules when they understand the importance of the rules to their well being and aspirations.

The absence of a recycling plant for polythene or the non biodegradable waste in Okigwe calls for attention. The government should therefore make n effort to attract recycling plants to create the no undependable wastes. Such demand will surely reduce the volume of wastes discharged while creating jobs both for waste picker, vendors and employees of the companies. Until people see utility in their wastes, they may not be careful in waste dumping

Adogame (2009) recommended public-private intervention in Solid Waste Management in Lagos. This may be an option for Okigwe, since the incessant change of leadership in the Local Government Area Council, appointment of environmentally less concerned leaders coupled with the politicizing of money allocation to the Council may not allow efficient MSW disposal in the area.

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