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COMMUNITY WASTE MANAGEMENT AND ITS HEALTH IMPACT ON OBALENDE AND LAFIAJI VILLAGES OF LAGOS ISLAND

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ABSTRACT

Managing municipal solid waste in cities has become a serious challenge which could result in the accumulation of heavy metals in the environment. Against this background, the municipal solid waste management practices in peri-urban communities (Obalende and Lafiaji Village) of Lagos Island and the impact of heavy metals in soil were studied. This study aims at examining the present municipal waste management practices in Lagos Islandandhowthey can beimproved upon. Random sampling was used to administer 100 questionnaires to household while the different heavy metal concentrations in the soil samples were determined using Buck 200 Atomic Absorption Spectrophotometer (AAS). About 58 % of the respondents are aware of solid waste management while LAWMA (50%) and Cart pushers (40%) were the two main options for waste disposal. The wastes were mainly composed of food wastes, plastics/pet bottles and nylon. Although majority of the respondents (67%) have a waste bin/bag assigned to their houses, about 74% do not sort their wastes. The concentrations of the heavy metals (Co, Zn, Ni, and Mn) in the soil samples were higher in Obalende and Lafiaji village, where wastes were dumped indiscriminately on roadsides. SWOT analysis revealed the need for improving environmental awareness in order to minimize the threat of low sorting of wastes. Also, opportunities exist for recycling plastics/pet bottles and nylon while wastes from food materials could benefit agriculture through composing. This study suggests that more environmental awareness, policies and better administration are needed to improve the status of waste management in peri-urban communities of Lagos Island.

Keywords: Peri-Urban Communities, Waste Management, Heavy Metals, Health Impact, Lagos

INTRODUCTION

The increase disposal of solid waste in our environment has become a challenge in today's waste management programme. This is mainly due to the increasing generation of such solid waste and the burden posed on the municipal budget. In addition to the high costs, the solid waste management is associated with lack of understanding of different factors that affect waste management system (Dasgupta, 2013). Municipal solid waste management is an important issue in today's world as it deals with budget allocations of local municipality, public acceptance and adverse impacts on environment (Ramakrishna, 2013). In developing countries, a waste management system encompasses planning,

engineering, organization, administration, financial and legal aspects of activities associated with generation, growth, storage, collection, transport, processing and disposal in an environmentally compatible manner adopting principles of economy and aesthetics (Dasgupta, 2013). Lagos is experiencing rapid urbanization. This rapid increase in population leads to rapid industrialization, urbanization and economic growth, which are the main factors of increased solid waste generation worldwide (Bandara, 2013). The waste generated by urban residents is expected to get almost doubled from 3.5 million metric tons/day in 2002 to 6.1 million metric tons/day in 2025, and a total of $375 billion will be spent for its management in 2025 (Sawyer *et al.,* 2003). It has been a local government responsibility to provide the service of urban solid waste management. In developing countries, government makes budgets for solid waste management; however only small percent of the waste is managed (Simon, 2008). Therefore, management procedures of municipal waste in many developing countries are rather chaotic and need to be analysed and strengthened further (Bandara, 2013; Udochukwu *et al.,* 2017b).

Municipal solid wastes of developing countries often contains the wastes that is produced from residential and industrial (non-processed wastes), commercial and institutional sources with the exception of hazardous (which include medical, mineral and radioactive wastes) and universal wastes, construction and demolition wastes, and liquid wastes such as water, waste water, industrial processes (Tchobanoglous *et al.,* 2002). Furthermore, market wastes, yard wastes, street sweepings and few cases of liquid wastes as sewage sludge are also added to municipal solid waste categories (Simon, 2008). The composition of municipal solid waste is higher in most of its characteristics when compared to that of developed countries with respect to density, moisture content, organic matter and dust (Blight and Mbande, 1996). The local authorities are responsible for urban waste management in Lagos city and practice several methods of disposal such as open dumping, composting, land filling, incineration, direct and indirect recycling. However, due to some limitations such as high operation and management cost, poor understanding of the process, economically viable, environmentally friendly and socially acceptable methods are limited in use. Therefore, it appears that most of the waste disposal practices can adversely affect the environment, such as open dumping on land and water bodies, direct combustion and so forth. These poor methods leads to several environmental crises such as contamination of surface and groundwater, soil and air pollution and heavy metal contamination in particular (Sawyer *et al*., 2003; Udochukwu *et al*., 2017c).

Heavy metals are found in electrical wastes, municipal solid and from degradation of organic wastes (Esarru *et al*., 2003). They can also be found in the disposal of household wastes, hazardous wastes, non-hazardous industrial wastes and other chemical by products (Marine *et al*., 2005). Several studies have showed that collection, storage, transportation and final disposal of solid wastes are a major problem in urban cities and areas (Okot-okumu and Nyenje, 2011). Cities in East and North Africa as well as most

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developing countries are also facing the same problems. The main reason of these problems is attributed to the poor economy of these areas which accounts for the low achievement in solid waste management (Okot-okumu and Nyenje, 2011). Heavy metals are often referred to as trace metals, occurring naturally in low concentrations in organisms. They are not biodegradable and do not undergo ecological cycling (Duribe *et al*., 2007). Some metals are essential to life but they are toxic at thigh level of dose (Ukpebor and Unigbe, 2003). The accumulations of heavy metals in soil have since become a threat to vegetation and animals which ultimately affect the quality of human life through the food chain. This study focused on the community waste management and its health impact on Obalende and Lafiaji villages of Lagos Island. The major objective of this study is to investigate the existing municipal solid waste management practices in Lagos Islandandtorecognizefactors that areliableforineffectivemanagement.

MATERIALS AND METHODS

Study Area

The study area covered two (2) Wards in the Local Government Area of the State.

Ijeh in Obalende: and Lafiaji Village in Ilado/Eti-osa.

Study Approach

Data were collected through soil analysis and structural questionnaire. A sample size of 100 respondents for the questionnaires and two (2) composite soil samples were collected from each of the two sampling locations.

Questionnaire

Primary data sources were utilized to examine the waste management system in Lagos urban and suburb. The research design used for the questionnaire consisted mainly of two parts. In the first part, a group of research questions were formulated aiming at diagnosing the strengths, weaknesses, opportunities and threats of urban and suburb waste management in Lagos State. Second, a detailed SWOT analysis was performed based on the research questions developed. Answers to those questions were abstracted by analysing information obtained from questionnaires distributed randomly among residents of the sampled locations.

Soil Sample Collections

The survey carried took into consideration population, types of income and types of houses. The questionnaires were distributed randomly in the selected locations in Eti-Osa Local Government Area. A total of two (2) Soil samples were also collected in polyethene bags, carefully labelled according to the sampled area and taken to the laboratory in iceberg for soil physico-chemical and heavy metal analysis. The Ph, electrical conductivity, Lead, Cobalt, Copper, Zinc, Iron, Cadmuim, Nickel and Manganese were analysed (Udochuku *et al.*, 2017a)

Statistical Analysis

Analysis of variance (ANOVA) for completely randomised design was used to test the difference between the treatments. Means of significant differences were separated using Duncan's new multiple-range test. Differences were considered statistically significant at a P-value of <0.05. All statistical analysis was carried

out on SPSS version 23.0, IBM, USA. The data collected through the questionnaires was analysed using statistical methods such as simple percentages, charts (bar charts and pie charts). The simple percentages were computed using the equation:

$X/Y \times 100\%$

Where X= Number of observations

Y= Total population

100%= Total percentage

RESULTS

Table1: Soilpropertiesand heavy metalconcentrations insoil

Parameters	**Ijeh**	**Lafiajivillage**	**Control**
pH	7.850 ±0.05bc	7.400 ±0.10a	7.900±0.00bc
EC (µScm^{-1})	197.000±3.00d	584.500±4.50e	87.000±1.00a
Pb(mg/kg)	0.017 ±0.00c	0.033 ±0.00d	0.007 ±0.00a
Co(mg/kg)	0.050 ±0.04a	0.011 ±0.00a	0.005 ±0.00a
Cu (mg/kg)	5.442 ±0.00d	5.635 ±0.00e	2.926 ±0.01a
Zn (mg/kg)	7.517 ±0.00e	6.967 ±0.03d	3.745 ±0.05a
Fe(mg/kg)	49.022 ±0.01c	66.846 ±0.13e	20.151±0.01a
Cd (mg/kg)	ND	ND	ND
Ni(mg/kg)	0.036 ±0.00b	0.017 ±0.01a	0.015 ±0.00a
Mn(mg/kg)	0.034 ±0.00d	0.013 ±0.00bc	0.008 ±0.00a

ND-NOTDETECTED

Table 2: Percentage respondents by sex

Sex	Percentage
Male	58%
Female	42%

Table 3: Percentage respondent by age

Age group	Percentage
18-28	43%
29-39	36%
40-40	16%
51-61	1%
62 and above	3%

Table 4: Respondents by Family Size

Family size	Percentage
Living alone	9%
1 to 2	27%
3 to 5	43%
Above 5	20%

Table 5: Respondents Awareness of Waste Management

Have you ever heard of solid waste management?	
YES	58%
NO	42%
If YES, in what way?	
In School	27%
On Television	31%
In Public meeting	24%
On Radio	18%

Table 6: Type of Waste Generated

Types of Waste	Percentage
Nylon	24%
Paper/cardboard	8%
Metal/Aluminum	3%

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Plastics/pet bottles	30%
Food waste	34%
Others	1%

Table 7: House Hold with Waste Container

Responds	Percentage
YES	67%
NO	33%

Table 8: Respondents That Sort Their Waste

Responds	Percentage
YES	36.14%
NO	73.86%

DISCUSSION

The results of the physico-chemical analysis showed that the soil samples across the locations were slightly alkaline while the range of EC was much larger (Table 1). Increased EC has been associated with polluted soils andcompounds or elements such as nitrates, potassium, sodium, chloride, sulfate and ammonia (Zhang *et al.*, 2018). Higher EC in soil samples from rural communities as oppose to the urbancommunities suggest higher concentration of pollutants in the former. These pollutants mayinclude heavy metals. This conforms to the report of Iranpour et al. (2014) that heavy metalpollutioninsoilsisusually associatedwith higherelectricalconductivity. The highest concentration of most of the heavy metals was observed in Obalende.These were Co, Zn, Ni and Mn whileLafiajivillagehadthehighestlevelofCu andFe.This buttress theimproper waste management system observed in Lafiaji village, in which wastes aredumped indiscriminately on roadsides.

Heavy metal concentrations from the results were generally lower than permissible limits set by the European Union (EU) and United Nations Environment Programme (UNEP) for agricultural soils (David *et al.*, 2019). These limits are Fe 50,000mg/kg, Mn 2000mg/kg, Pb 100mg/kg, Zn 300mg/kg, Cd 3mg/kg, Co 50mg/kg, Cr 100mg/kg, Mn 50mg/kg. The concentrations of Pb varied between 0.01 and 0.04mg/kg while the range of values for Fe was 20.14 – 66.98 mg/kg. Both were lower than the permissible limits of 1.60 and 400 mg/kg recommended for soil by FEPA (1997). Also, the range of Cu and Ni, 2.92-5.64 and 0.01-0.04 respectively were lower than the limits of 10.10 mg/kg and 35 mg/kg, respectively (FEPA, 1999). The fact that cadmium was undetected in the soil samples also implies that it's muchlowerthanthe0.80mg/kglimitsetbyFEPA for Nigerian soil (FEPA, 1999). Compared to heavy metals concentration in soils from Odo-oba in Ogbomosho, (Adagunodo*et al.*, 2018), and electronic waste site (Jiang *et al.*, 2019), the levels of heavy metals in this study was much lower. However, there port in this study was similar to that of school playgrounds in Port Harcourt Metropolis, Rivers State (Okereke and Amadi, 2017). Cadmium is usually present in high concentration in soil ecosystems polluted with wastes from metal and mining industry (Šrut *et al.*, 2019). The undetectable level of Cd in the soil may be attributed to the area of sampling which were not close to mining industries or farmlands. The significantly

higher levels of Cu, Zn, Fe, Mn indicates additional source of the metallate in the studied soil which must have accumulated over time (Udochukwu *et al*., 2016a).

A total of 100 questionnaires were administered and 88 was recovered which amount to 88 %of the sampled population. The respondents consist of 58 % female and 42 % male which shows that women participate more in the study. The study also discovered that married people, between the age range of 18-50, educated and employed, living in either a two bedroom flat or in a self-contained apartment with the average household size of 3-5 persons generates more waste and the sampled population included all formal and non-formal residences in the sampled locations without distinction. Many socio-economic and other variables influence the rate ofwaste generation however, in this study; we assumed that all sections of different incomegroups havebeen covered during therandomsampling. The results in (Table 5) shows that 58% oftherespondents are aware of solid wastemanagement and they got to know about it either in school, on television, in public meetingsand on radio. Rahji and Oloruntoba, (2009), suggested that increasing the awareness of thepeoplemay haveapositiveimpactontheir attitudetowards theenvironment. From the study in (Table 6), it was discovered that food waste, plastic/pet bottles and nylonare mostly generated by the respondents and this was in line with Ogwueleka (2009), whoreported that solid waste in Nigeria are more corrosive, weighty and are saturated with waterthan those in industrialized nations, hence, a different solid waste management approach isrequired while Imam *et al* (2008) argues that since the waste composition in Abuja shows that a large percentage of the waste generated are organic in nature, compaction trucks may not be appropriatefor their disposal. The study also showed in (Table 7) that majority of the respondents (67 %) have a wastebin/bag assigned to their houses where they dump their waste and this implies that majority ofthem in the studied locations dispose their waste lawfully while minority dispose their waste unlawfully either on the roadside, gutter/canal or other illegal methods, a habit which will eventually results in health hazards in the sampled locations overtime.

CONCLUSION

Waste management requiresthe contributions from government, businessmen, politicians, religious organizations, civil servants and the public at large. All these must be brought together by government policy and legislation to work together to tacklewaste problems. Thus, to ensure the sustainability of Lagos state and other cities in Nigeria, there is a need for an effective solid waste management policy with a comprehensive and coordinated planning which will be combined withadequate legislation, fiscal provision, public involvement and awareness to bringabout the expected improvement in the quality of our urban space.

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