Assessment of Environmental Impact of Solid Waste Generation and Disposal in Sokoto Metropolis

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DOI: 10.29322/IJSRP.9.05.2019.p8945
http://dx.doi.org/10.29322/IJSRP.9.05.2019.p8945

Abstract- Population growths in urban centers in Nigeria have significantly increased the generation of wastes in urban areas. Inadequate waste services have led to illegal burning and dumping of wastes on open spaces, which is degrading the environment and creates profound public health concerns. This paper aimed to access the implication of illegal dumping of solid wastes in Sokoto metropolis, Sokoto State, Nigeria. A total of four hundred questionnaires were administered using systematic sampling on categories of respondents in the study area The researchers also visited the Sokoto state Urban and Regional Planning Board (SURPB) and the Sokoto State Environmental Protection Agency, (SEPA) who assigned the responsibilities of ensuring a cleaner and refuse-free environment in Sokoto metropolis. Secondary data also used to obtain information from review method; The results of the findings deduced that, several open spaces and even water channels are been used as dump sites in the study area. The composition of the solid waste in the metropolis contained mostly food waste, bottle glass waste, ashes, nylon, metal and cans, papers and wood. The research also revealed that, there is no legal authorized dumpsite in some part of the metropolis. The major environmental issues resulting from improper of solid waste in Sokoto metropolis are blocked of drainage channels during rainstorm causing flooding in the metropolis. The researcher found that people of the area suffered from malaria fever caused by mosquitoes that bread on the wastes and gutters occupied by such solid wastes. Other diseases include respiratory problems, typhoid, cholera, and meningitis. The solid waste may decomposed to emit methane and carbon gases which contribute to climate change. Therefore, the paper recommends that there should be a continued public enlightenment on the causes and danger of illegal dumping of waste and finally, a strong legislation with the severe action should be put in place and also recommended that available waste bin should be adequately provided.

Index Terms- Environmental Impact, Solid Waste, Generation, Disposal

I. Introduction

Solid waste disposal is one of the major environmental problems that developing countries are faced with. Health hazard, traffic congestion, unsightliness, unpleasantness and blockage of drainages are some of the problems caused by lack of efficient waste management practice in Nigeria. Solid wastes could be defined as non-liquid and nongaseous products of human activities, regarded as being useless. It could take the forms of refuse, garbage and sludge (Leton and Omotosho, 2004). Cities in Nigeria, being among the fast growing cities in the world (Onibokun and Kumuyi, 1996) are faced with the problem of solid waste generation According to Mansoor et al. (2005), "proper solid waste disposal is an important component of environmental sanitation and sustainability." A sustainable environment and improved waste management offer opportunities for income generation, health improvements and reduced vulnerability. This could hardly be attained in some of the developing countries, most especially in Nigeria because of non- readiness, uncoordinated and laissez faire attitude toward better ways of solid waste disposal methods in spite of their high rate of urbanization and growth in commercial and industrial activities (Afangideh et al., 2012). The situation of solid waste disposal methods in some of the Nigerian cities lives more to be desired as garbages of waste generated litter all nook and cranny of the towns and cities. In a study on municipal solid management in China, Dong et al. (2010) report that the amount of municipal solid waste generate increased tremendously from 31.3 million tons in 1980 to 212 million tons in 2006, and the waste generation rate increased from 0.50 kg/capita/day in 1980 to 0.98 kg/capita/year in 2006. According to them, the waste composition in China is dominated by the concentration of kitchen waste in urban solid waste which accounted for 60% of the waste stream. The report on municipal solid waste of Dong et al. (2010) in China further stressed that the total amount of municipal solid waste collected and transported was 148 million tons in 2006, of which 91.4% was land filled, 6.4% was incinerated and 2.2% was composted. The overall municipal solid waste treatment rate in China was approximately 62% in2007. In 2007, there were 460 facilities, including 366 landfill sites, 17 composing plants, and 66 incineration plants. The report of Dong et al. (2010) was able to throw more light on the waste generation and composition in the Asian continent most especially in China where the research was conducted. Several studies conducted in different parts of the world, particularly in major urban centers in Europe and United States of America; show that the types of waste generated and management techniques vary with the level of civilization, industrialization and socio-economic well-being of the nation involved (Herbert, 2007). However, the solid waste generated from industrial products, such as polythene bags, plastics from beverages, electronic materials, broken bottles and empty cartons, constitute hidden places for vector diseases. Also, offensive odor emanating from dumping sites constitutes environmental risks to human health. It is worrisome that much research on waste management has been conducted in Nigeria and

other developing countries. However, some of the studies do not adequately examine the environmental impact of waste disposal methods on human health which is the main focus of this research. The objective of this study is to Assess the types and components of solid waste generated in the study area and identify the environmental problems that ensued due to indiscriminate waste disposal and finally suggest better ways of handling the challenges of indiscriminate waste disposal particularly in terms of land requirement. This will give city planners and other stakeholders a chance to develop appropriate database for proper sanitation in urban environment with the aim to reducing the risk of urban residents from being vulnerable to outbreak of diseases which is inimical to human health.

1.2 Statement of the Problem

Ethically, the beauty of any environment lies in its good sanitary condition. This is so because, when an environment is clean, the lives of citizenry are not threatened by illnesses and other environmental related problems. Proper refuse disposal and management involve the dumping of wastes (solid, liquid or gaseous) from our homes, industries and public outfits for example hotels, hospitals and schools etc at a specific place or in government provided containers and the control and removal of refuse from places where they can cause hazards to a place where they are less hazardous to public and the environment. Sokoto metropolis, particularly Sokoto North and Sokoto South Local Governments, presents a ghastly picture; the neglect of filled refuse bins in recent time has its effect on the inhabitants. Many areas around the homes are littered with domestic refuse, garbage and other wastes.

Some of these wastes generated are harmful with negative impacts on our environment, land, water and air. To ensure a clean and safe environment, the Sokoto State Government established the then Sokoto Urban Development Authority (SUDA) which is now known as the State Urban and Regional Planning Board (SURPB), and the State Environmental Protection Agency (SEPA), to monitor the environmental quality and to ensure a refuse-free environment. However, despite the government's efforts at making the environment clean in the metropolis, people seem to be careless about their environment. Despite the provision of refuse bins/refuse bunkers by the government many people still prefer dumping refuse at places they considered convenient for them.

People seem not to be aware of the interrelatedness of dirty environment and diseases. Victims of environment related disease like malaria fever, typhoid fever, dysentery and others seem to be on the increase. Indiscriminate refuse dump affects quality of water and air of which the people seem not to be aware. Public Educational Programmes that enlighten the public on the implications of indiscriminate refuse dump are almost non-existent. Mass media seem not to be doing enough to create awareness about implications of indiscriminate refuse dump. It was against this background that the researcher intends to embark on this research to appraise the environmental problems of waste disposal in Sokoto metropolis, Sokoto State.

1.3 Aim and Objectives of the Study

Aim

The aim of the research is to assess environmental impact of solid waste generation and disposal in Sokoto metropolitan areas.

Objectives

The major objectives that will aid the realization of the ultimate goal are to:

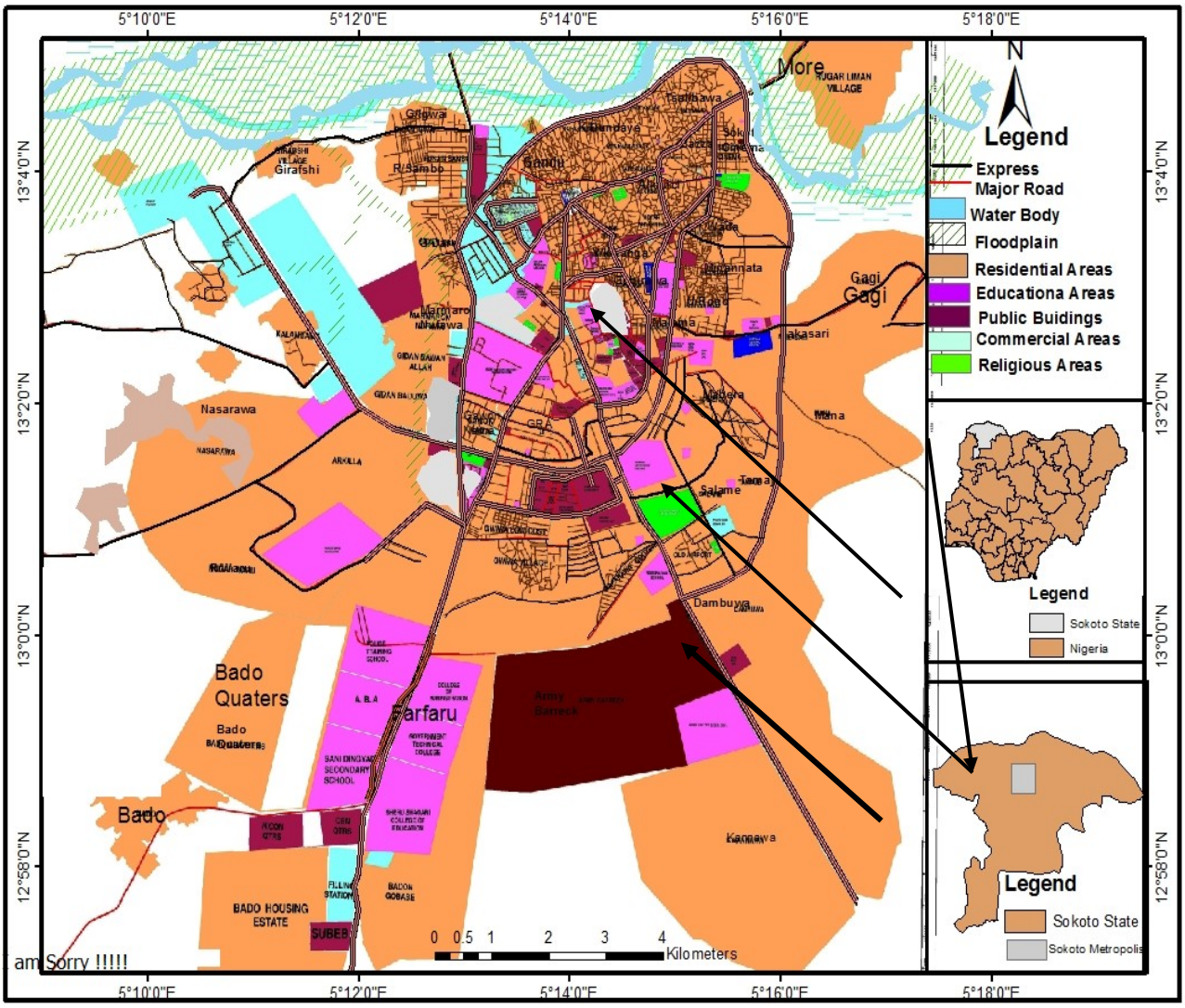
i. Assess the types and components of solid waste generated.
ii. Quantify the amount and composition of waste generated and disposed per ward in the area.
iii. Investigate the waste disposal methods in the study area.
iv. Identify the environmental problems that ensued due to indiscriminate waste disposal.
v. suggest better ways of handling the challenges of indiscriminate waste disposal particularly in terms of land requirements

II. Study Area

2.1 Location, Size and Population of the Study Area

Sokoto State is located to the extreme North-West of Nigeria between longitude 4°8'E and 6°54'E and latitude 12°N between and 13° 58'N. By its location, it shares boundaries with the Republic of Niger to the North, Kebbi State to the West and South-West, and Zamfara State to the East. The state covers a total land area of about 28,232.37 square kilometers. Sokoto metropolis comprises of two major local government councils, namely; Sokoto North and Sokoto South local government and parts of Dange Shuni, Kware, Bodinga and Wamakko local governments areas (Sokoto, 2006), (See, figure 1: map showing the study area). The total population of Sokoto metropolis was estimated at 485,483 people based on 2010 population projection with an average annual growth rate of 2.6% and with an average density of 1000 persons per kilometer square estimated (Abdullahi, A.M. (2007).

Figure 1: Map of the Study Area



Source: Arc GIS Generated by GIS Lab. Department of Geography UDUS, 2018

2.2 Climate

Sokoto metropolis has a tropical continental type of climate dominated by two opposing air masses. The Tropical Maritime wind from the south and Tropical Continental from the north, while the Tropical Maritime wind brings moist conditions and rainfall, the Tropical Continental brings cold, dry and dusty weather. The annual rainfall is about 550mm with a high peak in August. The dry season sets in first with the cold harmattan from October to March and a hot period comes in from April to the end of May when temperature reach 100 of (45°c) (Sani, 2012).

2.3 Vegetation

The vegetation of the area is Sudan savannah which consists of continuous grass cover and low proportion of trees. The trees have an average height between 20-15 feet, the grasses here are shorter and less luxuriant, and some trees are thorny while other has broad leaves of the species of guinea savannah. Trees are deciduous, shorter and more scattered as well as the area is generally hot. The natural vegetation is often disturbed especially due to continue farming, grazing and burning. Common trees in the area include baobab and locust been. Grasses and shrubs are also available and they serve as pasture to animals such as cattle, sheep and goats that are being reared in the area (Davis, 1982).

2.4 People of the Study Area

Sokoto metropolis is populated mainly by Hausa, Fulani, and Zabarmawa. With the colonial conquest in 1903 and the emergence of Nigeria as a political entity in 1914, many other ethnic groups from the south and north central of the country have migrated and taken permanent residence in the state. Although, the Ibos and Yoruba, top the list of southern migrants, one can find large numbers of almost all the over 250, other ethnic groups in Nigeria comfortably pursuing their legitimate business as employees of federal, state and private organization in the state. This multicultural situation is seen in the large number of registered cultural associations and ethnic groups meetings that take place on weekends in various locations of the state (Boyd, 1982).

III. METHODOLOGY

The researchers were used literature search, questionnaires, interview and personal observation. During observation a number of collection individual empting their wastes ware noted. The instruments were used in carried out the research include: pans, buckets, drums, hand gloves, GPS, Camera, and measuring tape. While the household wastes were measured with the aid of field co-researchers, they do the measurement of the households waste at the end of every week. Four major dumpsites dumped sites were selected from the four zones in the study area (Gidan Haki, Arkilla Gawon Nama and Gagi). On the other hand, a total of four hundred (400) questionnaires were administered to heads of the households selected in each of unit, and agencies responsible for solid waste management. These were done to determine the sources of waste, methods of waste disposal, and the effect of waste in the area.
Besides, principal component analysis was used to examine the factors affecting environmental health in the study area. These factors include, residential location, distance to public authorized waste dump site, awareness of risk involved in storing waste in the residence for a long period of time, type of waste generated, among others.

IV. RESULT

4.1 Sources of Solid Waste in Sokoto Metropolis

Sources	Percentages
Residential	**53.5**
Commercial	**36.9**
Industrial	**2.9**
Others	**6.7**
Total	**100**

Source field survey 2019

Table 4.1 revealed that residential wastes are the major sources of solid waste in the study area, accounting for 53.5%. Commercial wastes accounts for 36.9%, industrial wastes, and others with 8.9%. These responses indicate that the residents in the various zones yield the highest volume of solid wastes in the area. This is as a result of the dumping of wastes by household in the area.

4.2 Availability of Authorized Dumpsites in the Neighborhoods

Response	Total	Percentage
Yes	74	19
No	313	81
Total	**386**	**100**

Source field survey 2019

Considering the above table, 81% of the respondents stated that, there is no authorized dumpsites in their neighborhoods while, 19% have dumpsites around them. Similarly, information sourced from the interview with director of SEPA, revealed that, it is only people of Gawon Nama are using legal authorized dumping site among selected units. This forces most of the residents to indiscriminately dump their waste along the roads, behind school and houses, and even turning some water channels into dumpsites. It also observed that people in study area are not aware that, these illegal dumpsites are not legal proposed dumpsites for wastes disposal. In turn, government should create awareness via social media to enlighten the people on the danger of dumping solid waste in an open space,. In addition, government should provide bin and ensure that people make use of these authorized dumpsites

4.3 Methods of solid Waste Disposal in the Study Area

Methods of disposal	Gidan Haki (%)	Gawon Nama (%)	Arkilla (%)	Gagi (%)	Cumulative (%)
Burning	19	31	27	12	**22.2**
Direct dumping	54	50.2	47	61	**53.05**
Store in waste bin	3.2	6.2	9.8	2.1	**5.33**
Dig and bury	4.3	1.2	2.3	6.8	**3.7**
Land filling	5.2	1.7	4.3	15.2	**6.6**
Others	14.3	9.7	9.6	2.9	**9.12**
Total	**100**	**100**	**100**	**100**	**100**

Source field survey 2019

Open dumping with 53.05% is the major method of disposing and managing solid waste in Sokoto metropolis. Waste burning accounted for 22.2 %, store in waste bin 5.32%, dig and bury 3.7, land filling 6.6 and others account for 9.12. The implication of this is that most households dump their refuse on roads, streets, available open spaces, gutters, market areas and other illegal dumpsites. This may caused health hazards to the people living in this area. Traffic congestion and inaccessibility of roads also results from this act of dumping wastes on some major roads in the area. The burning, the problem with this method is the air, air

pollution and its inability to treat inorganic items of solid wastes such as, bottle, glass, metals, etc., It is evident from the table 4.2 that, 81% of the respondents have no authorized dumpsites in their neighbourhoods while, lack of authorized waste bin has resulted in the indiscriminate dumping of wastes by the residents, along major roads, behind houses and even turning the drainage system into dumpsites, as such resulted in the blockage of drainage channels thus, causing flood and pollution from the stench emitted from the illegal dumpsite

Fig: 2 Animals are feeding on open dumping wastes in Sokoto Metropolis

Source: field survey 2019

Fig: 3 Open burning of dumping Solid Waste in Sokoto Metropolis

Source field survey 2019

Fig: 4 Transportation of collected waste through open body trucks

Source field survey 2019

4.4 Distances to the Dump Sites

The distance to the disposal points were further determined and the result was presented in Table 4.4. It shows the distance of various disposal points in metres. About (19.7%) of the respondents have their disposal point located at a distance of 1- 50 metres in Gidan haki, (10.3%) in gawon nama, (9.4%) in Arkilla and (8.9%) in Gagi showing the proximity of the designated dumpsites in the area. At a distance of 51 -100metres, Gidan haki recorded (9.4%), Gawon nama,(7.0%), Arkilla,(6.1%) and Gagi,(3.3%).In Gidan haki and Gagi, (4.2%) of the respondents dispose their waste at a distance of 101-150 metres, and (3.3%)in Arkilla while has only (1.4%) of the respondents. It was also observed that in Gawon nama about (5.2%) dispose their refuse at a relative distance of 150 metres and above, while (3.8%) and (2.8%) disposed refuse in Arkilla and Gidan haki respectively. It is evident from the result that the farther the designated dump-sites, the lesser the use by the respondents. This shows that people are of the habit of dumping their refuse within a close range to their residence or where they carry out their daily activities due to distance apart and it accounts for huge heaps of accumulated refuse found along the road-sides, streets, and gutters. This further explains why people tend to disregard the use of designated Official dump-sites and create alternative points

4.5 Perceived effects of solid waste

Effects	Total	Percentage
Environmental despoliation	135	35
Health hazards	100	26
Economic	66	17
Social	85	22
Total	**386**	**100**

Source field survey 2019

Table 4.5 shows that, the major effects of waste disposal in Sokoto in metropolis are; environmental effects 35%, health hazard with 26%, and socio-economic effects with 22% and 17% respectively. These effects can cause the destruction of the environment, pollution of underground water and air pollution in places where solid waste are being indiscriminately burnt in open space. Dumping of solid waste in water channels can causes flooding problem. Flooding could destroy and lowers the yields from farms. Also, refuse on the roads may leads to the inaccessibility of such roads thus, leading to less mobility of the people in the area. While social impact was identified as unpleasant odor, Odors are developed when solid wastes are stored for long period of time on site between collection, in transfer station, and landfills. The formation of odor results decomposition of the readily decomposable organic components found in solid wastes.

Fig: 5 Blocked water channel due to Dumping Solid waste in Sokoto metropolis

Source: Field survey 2019

4.6 Diseases associated with solid waste.

Illness /diseases	**Total**	**Percentage**
Malaria	116	30
Typhoid	77	20
Cholera	77	20
meningitis	27	10
Respiratory diseases	78	20
Total	**100**	**386**

Source field survey 2019

Table 4.6 revealed that 30% of the respondents identified malaria fever as major disease associated with solid waste disposal, as a result of the mosquitoes that bread on the wastes and gutters. 20% of the respondents agree with respiratory problems which resulted from illegal burning of waste, while typhoid accounts for 20% which as a result of contamination of drinking water either on surface or underground by the improper disposal of solid wastes. Cholera and meningitis account for 10% and 20% respectively, which are as a result of contamination of food and water taken by the respondents.

V. Conclusion

Disposal of solid waste has constituted a serious environmental threat to human existence in urban centers in the developing countries of the world. But this is more pronounced in some of the urban centers in Nigeria due to the high rate of urbanization trends within the last 25 years. It is on this background that the present study was designed to assess the environmental impact of solid waste disposal methods on the inhabitants of Sokoto metropolis so that appropriate modern methods of solid waste techniques could be recommended for the city and other urban centers in Nigeria at large. Open dumping is the major method of disposing solid waste in Sokoto metropolis. Most households dump their refuse on roads, streets, illegal open spaces, culverts, market areas and other illegal sites. The burning, the problem with this method is the air, air pollution and its inability to treat inorganic items of solid wastes such as, bottle, glass, metals, etc., findings reveal that majority of Sokoto metropolis residents burn the waste generated in their households which constitutes serious environmental risk to human health as the smoke emanating from the burnings pollute the natural environment. Similarly, nonchalant attitudes toward prompt disposal of the solid waste also accounted for the significant proportion of the variance of the factors affecting environmental health in the city. It was discovered that residents less than fifty

metres from the dumpsite are most affected by the dumpsite. Hence they were victims of malaria, chest pains, diarrhea cholera, and irritation of the skin, nose and eyes. This state of health of respondents in this study can be linked to pollution from the dumpsite. It was also noted that the extent of air and water pollution is worse in the raining season as a result of offensive and disease-carrying odor, as well as ground water pollution. In the dry season, the smoke from the incineration of the dumpsite is an important source of air pollution for people living far away from the dumpsite

VI. Recommendations

I. There is the need to reassess all legislations regarding waste management with a view to stream lining them so that there is a comprehensive and clear role for all the agencies, various tiers of government, as well as the public including Non-Governmental Organizations (NGOs) and community associations.

ii. Continuous public enlightenment on the dangers of solid waste to the general public especially the female population.

iii. Landfills: Standard landfills (not the ordinary dug earth) should be constructed at specific locations to minimize the impacts of municipal solid waste. Landfills are engineered to protect the environment and prevent pollutants from entering the soil and possibly polluting ground water in one ways. The municipal solid wastes are synthetic liners like plastic to separate the landfill's trash from the land below it.

iv. Combustor: This involves the burning of municipal solid waste at extremely high temperatures to reduce waste volume, control bacteria, and sometimes generate electricity.

vi. Citizens should be made to pay a realistic fee for waste services in return for the guarantee that indeed these services will be provided.

vii. There should be effective and proper monitoring of solid waste disposal activities.

viii. Severe Sanction: Re-introduction and enforcement of monthly sanitation. This will assist in cleaning up the city.

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