Plastic Wastes and Environmental Deterioration in Sabon Lahi Rusai Naraguta 'B', Ward, Jos Plateau State, Nigeria

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ABSTRACT

Plastic waste has become a menace in our society with a lot of increasing challenges every day. This paper examined plastic wastes and environmental deterioration in Sabon Layi Rusai area of Naraguta 'B', ward Jos, Plateau State. The objectives are to examine the sources of plastic waste and to proffer strategies for solving the problem of environmental deterioration in study area. The methodology employed for this study was physical observation, oral interview and the review of related literature. Purposive random sampling technique was used to identify 40 houses under the study area. It is a good recommended sample size because it reflects the population of the study. The study revealed that indiscriminate disposal of wastes from plastics and plastic products cause hazardous negative impact on the environment, such as air pollution from burnt plastics, sewage system blockage leading to flooding, and aesthetic defacement of the built environment. The study therefore recommends that sufficient awareness programmes on the dangers of plastic in the environment be organized; improvement in proper plastic waste collection, treatment and disposal, among others.

Keywords: Deterioration, Environmental, Hazardous, Plastic wastes

1. INTRODUCTION

In Nigeria, one of the most pressing problems facing our cities is the disposal of huge quantities of solid waste, which accumulates in our urban areas (Ali, Vivan, Ombugadu, Wambai, Dahiru, Njila, & Mafuyai 2016). It also held that plastic waste has continued to escalate with increase in population, industrialization and urbanization (Onwuka & Ajator, 2018; Ajoku & Okoro, 2020) and ranks third component of solid waste stream after food and paper, (Ihesiulor & Ugoamadi, 2011; Ajoku *et al.*, 2020). It further held that an estimated amount of 180,000 metric tons of plastic and nylon waste are generated daily. These huge quantities of plastic products currently being marketed will ultimately find their way to the waste dump sites, thus creating a very serious problem at dump sites. This is evident based on the researches that have been carried out by Pavani and Rajeswari (2014); Ali *et al.,* (2016); Danladi, (2019) and Kehinde, Ramonu, Babaremu, & Justin (2020), who stated that over 60 million plastic sachet water bags are consumed and disposed of daily in Nigeria. This is critical to the health and well-being of urban residents around the world.

According to a UNEP (2005) report, open dumping is the crudest form of wastes disposal and it accounts for over 80% of waste disposal system in Nigeria. Indiscriminate disposal of wastes from plastics and plastic products causes hazardous negative impact on the environment such as aesthetic defacement of the built environment, sewage system blockage leading to flooding at times of heavy precipitation, air pollution through burning of plastics waste products. Burning of the plastic waste does not only get rid of it but produces carbon dioxide which is the major contributor of global warming (Onwuka *et al.,* 2018; Alabi, Ologbonjaye, Awosolu, & Alalade 2019; Danladi, 2019; Kehinde *et al.,* 2020).It also abuse arable soil for farm work, creates conducive environment for breeding mosquitoes and other disease-causing vectors and production of foul smells (Alabi *et al.,* 2019).

Also, the pursuit to achieve the Sustainable Development Goal (SDGs) 11 which aims *"to make cities and human settlements inclusive, safe, resilient, and sustainable,"* is of particular importance. This pursuit encourages policies and programmes for concrete actions, social inclusion and the creation of an urban identity that give rise to maximum social ties (United Nations [UN], 2019). Thus, Wash, Omar, Mohammed & Isa, (2022) affirmed that there must be a healthy, rich and adequately protected environment in order to have a healthy, prosperous society.

Contextual to this paper, plastics are synthetic or semisynthetic materials which could be molded into any object and still retain its plastic characteristic. The word plastic was coined from the Greek phrase *plasticos* that denotes the ability of materials to be shaped or moulded when there is change in temperature (Pavani *et al.,* 2014).Plastics have significant advantages over other materials (i.e. wood, ceramics, metals, etc.).They are light in weight, durable, versatile and resistant to moisture, chemicals and decays, yet these properties can bring challenges to waste managers in local and national authorities (Kehinde *et al.,* 2020).They are of extreme importance by their applications in human society, public health and medical uses. Such as water bottles, clothing, food packaging, electrical instruments, telephones, optical instruments, medical supplies (intravenous bags, disposable syringes, joint replacements, etc.) electronic goods, construction materials, and more (Pavani *et al.,* 2014; Ilyas, Ahmad, Khan, Yousaf, Khan, & Nazir, 2018; Alabi *et al.,* 2019).In addition, most plastics possess variety of colours which makes them used for decorative functions. Currently in Nigeria, there are more than a hundred plastic producing factories generating tons of plastic products used by people for variety of purposes. These generated plastic wastes which end up in solid waste stream constitute serious environmental challenge to municipal solid waste management authorities/agencies in most Nigerian urban Centre's (Kehinde *et al.,* 2020).

A number of researches conducted (in Ali *et al.,* 2016; Onwuka *et al.,* 2018; Zarma, 2018; Alabi *et al.,* 2019; Danladi, 2019; Ajoku *et al.*, 2020) reveal a considerable attention in literature on negative impact of plastic waste on the environment. For instance, Ali *et al.,* (2016) studied waste generation, collection and management pattern in Jos city of Plateau State, Nigeria, using survey method. The study revealed that 87.5% of waste generation is from residential, 32.8% being disposed in open space, 42% of the waste generated in the area is ashes and 76% of the waste generated is from domestic activity. The study revealed that open dumping and burning of refuse leads to air pollution, environmental degradation and eye-sore to public which affects urban beautification and safety of the entire urban landscape. The study recommended overhaul of both materials and methods from municipal solid waste collection and disposal in Jos city of Plateau State, Nigeria. Ajoku *et al.,* (2020) investigated issues relating to plastic waste and environmental sustainability in Obio /Akpor Local Government Area using descriptive survey. The study revealed major sources of plastic waste generation in the study area to include household, commercial and institutional. It distorts the aesthetic nature of the environment, blocks drains and silt canals, pollutes the air if burnt and destroys both aquatic and terrestrial life. The study recommended an integrated approach to recycling of plastic wastes. A literature review carried out by Alabi *et al.,* (2019) on public and environmental health effects of plastic wastes disposal revealed that indiscriminate disposal of plastics on land and open-air burning can lead to the release of toxic chemicals into the air causing public health hazards. Also, an estimated 8 million tons of plastic is yearly released into the ocean, leading to degradation of marine habitat which eventually affects aquatic organisms. However, not much research has been carried out to examine plastic waste and environmental deterioration in residential settlements.

In Sabon Lahi Rusai residential area of Jos metropolis, preliminary study reveals plastics are seen littered almost everywhere comprising of empty plastic bottles, take away plates and spoons, poly bags or Nylon bags, pure water sachet etc. (Plate 1a and 1b) and pose

a great challenge to the effort of achieving clean and safe environment. These wastes clog open gutters and drainages which in turn make it difficult for water to pass through, thus leading to flooding. This flood transports the plastic waste to the roads and streets constituting an eyesore and a source of danger to animals when eaten. Furthermore, heaps of these wastes create breeding ground for pests that spread diseases, and create a myriad of health-related problems. It was also discovered that the quality of the environment and human landscape value are deteriorating rapidly with little or no intervention from the government and individuals. Previous studies on the impact of plastics on the environment and public health in Jos has been documented by Ali *et al.,* (2016) and Danladi, (2019).

From the literature, there is an apparent gap that this paper attempts to bridge by examining plastic waste and environmental deterioration in Sabon Layi Rusai area of Naraguta 'B', ward Jos, Plateau State. Consequently, the objectives are to: (1) examine the sources of plastic waste in the study area (2) proffer strategies for solving the problem of environmental deterioration in study area.

| **a.** | **b.** |

Plate 1 (a) Clogging of gutters and drainage at study site, (**b**) Burning of plastic waste at study site

2. ZERO WASTE THEORY

The concept embodied in this study is the Zero waste theory introduced by California integrated waste management board in 2001 and adopted by San Francisco's department of the environment in 2002. With its ambitious goal of zero waste and policies, San Francisco reached a record-breaking 80% diversion rate in 2010, the highest diversion rate in any North American city (Ajoku *et al.,* 2020). Zero waste theory refers to waste management and planning approaches which emphasize waste prevention as opposed to end of pipe waste management. It is a whole system approach that for a massive change in the way materials flow through society, resulting in no waste. It provides guiding principles for continually working towards eliminating waste. Advocates say eliminating waste decreases pollution and can also reduce costs due to the reduced need for raw materials. Zero waste promotes reuse and recycling, prevention and product designs that consider the entire product life cycle. It strives for reduced materials use, use of recycled materials, use of increasing kind of materials longer product lives, reparability and ease of disassembly at end of life (Ajoku *et al.,* 2020). This study adopted this concept because government at all levels needs to create conducive and enabling environment that protects, promotes resource recovery and utilization as well as fostering sustainable development goals.

3. METHODOLOGY

This section describes the methodology used in this study. It describes the study location, study area and methods chosen for this study. Moreover, this part explains the method of data collection, population of the study, and sample size. As posited by Kumar, (2011) research is an intensive activity that is based on the work of others and generating new ideas to pursue new questions and answers.

3.1. Study Location - Jos Metropolis

Jos Metropolis (Figure 1) lies within latitudes 9°45'00''N to 09°57'00''N and longitudes 8°48'00''E to 8°58'00''E. Jos is the administrative capital of Plateau State, with a population of about 3,206,531 (National Population Commission, 2006). This is attributed largely to the unprecedented flux due to rural-urban and urban-urban migration fueled by insecurity in the state and elsewhere in Nigeria in the last two decades (Rikko, Pwajok, Namo & Habila, 2022). The study covered a part of Jos North Government Area (LGAs) with a population of about 437,217 people. At an altitude of 1,217m (3,993ft) above sea level, Jos enjoys a more temperate climate than much of the rest of Nigeria. The climate is the wet and dry type classified as tropical rainy climate and characterized by a mean annual rainfall of 1,250mm, peaking between July and August. The mean annual temperature is about 22°C but mean monthly values vary between 19°C in the coolest month of December and 25°C in the hottest month, April (Plateau State Ministry of Lands, Survey and Town Planning, 2019).
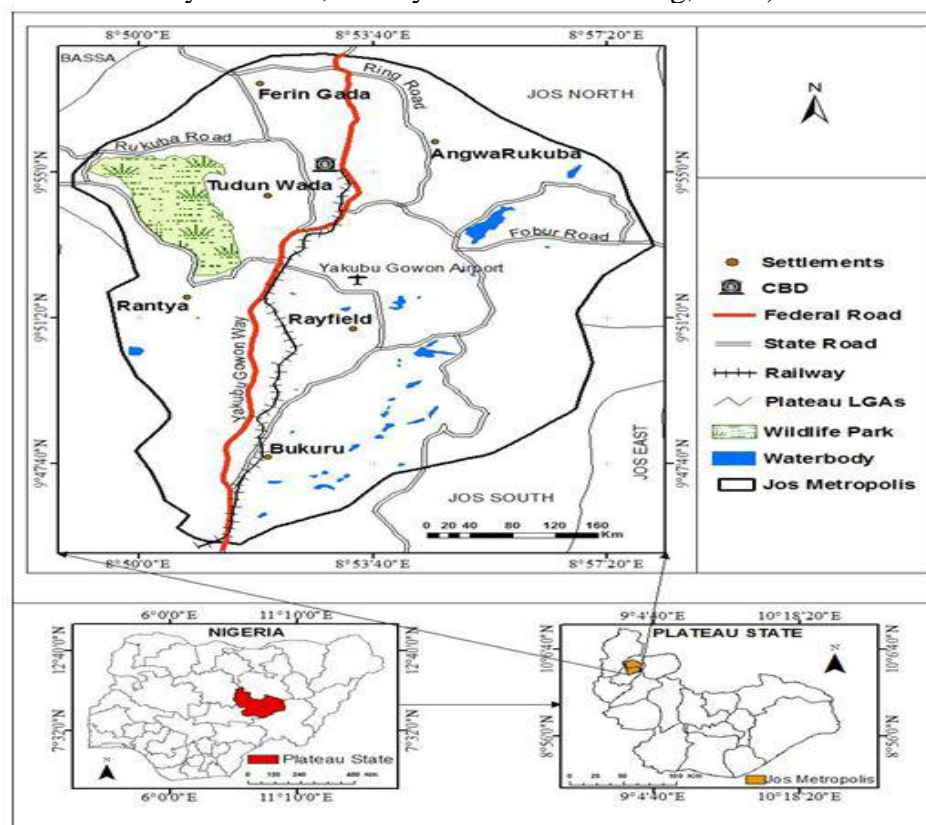

Figure 1: Location of Jos Plateau State in Nigeria (Source: Plateau State Ministry of Lands, Survey and Town Planning, (2019).

The city of Jos is the largest settlement in Plateau State. It owes its origin to the introduction of tin mining on the Jos Plateau and railway lines linking it with Port Harcourt and Lagos, thus bringing the area into the orbit of the world economy. The tin mining led to the influx of

migrants, mostly Hausas, lgbos, Yoruba's and Europeans who constitute over half of the population of the town, making it a highly cosmopolitan (Adzandeh, Akintunde & Akintunde 2015; Owonubi, 2017; Rikko *et al.,* 2022).

3.2. Study Area

This study was conducted in Sabon Layi Rusai, an urban-slum area of Farin Gada (N09° 57'33"/E008° 51'59"), Naraguta 'B' electoral ward of Jos North L.G.A. of Plateau State. It is one of the 20 political wards of Jos North Local Government Area (LGA) (NPC, 2006).The area is dominated by Muslims and foreigners (Umaru, 2016), and is accessed through the Farin Gada market road and the Zaria Road with poor setbacks and airspaces which would have helped in curbing any fire outbreak. Most of its inhabitants are of the middle and low social class, engaged majorly in trading and skilled labour (Artisan) activities.

3.3. Method of Data Collection

The methodology employed in this research was mixed methods (both qualitative and quantitative approach) (Ivankova, Creswell and Clark, 2007). While the research design adopted in this study is the case study approach. This research design was used because it sheds light on the unique characteristics of the housing units and their environment, and because it helps to compare the findings of this research with earlier studies. Data were drawn from primary and secondary sources. The secondary data involves the use of information already in existence and this was sourced largely through rigorous literature review.
Primary data used were acquired from physical observation, digital photography and interview methods. The study adopted purposive sampling technique. The selection of data-rich cases for a thorough analysis is the logic and power of purposeful sampling (Suri, 2011).

3.4. Population of the Study

Plateau State, has a total population of about 3,206,531 while Jos North has a population of 437,217 representing 13.64% with 303,592 housing units in the state hence, based on United Nations (UN) bench mark of 8 persons per household (Umaru,2016) there are 54,652.125 houses (approximately 54,653 house) in Jos North. According to INECs 2011 voter's register, Sabon Lahi Rusai is one of the 20 wards in Jos North with a total number of 29 polling units and 19,368 registered voters. Consequently, based on 8 persons per household format, there are 2421housing units in the study area.

3.5. Sample Size

The sample size for this study was calculated using the Taro Yamane's formula (1967) for sample size was used. The formula is expressed below:

$$SS = \frac{N}{1+N(e)^2}$$ ----------------------------------- Equation 1

Where:
        SS = Sample Size
        N = Total population under study
        e = Acceptable error size usually 0.05

$$SS = \frac{2421}{1 + 2421(e)^2}$$

SS = 399.8348 approximately 400

The sample size of housing units for Sabon Lahi Rusai was 400. The study purposely sampled 40 housing units from the sample population (one tenth of the sample size of housing units and their environment). It is a good recommended sample size (Creative Research System, 2012; Statistical and Technical Team, 2011) because it reflects the population of the study.

4. RESULTS AND DISCUSSION
4.1. Nature and Characteristics of the Study Area

Preliminary studies carried out on housing conditions and facilities reveal most houses are juxtaposed on a sloppy terrain making the vista of the environment unplanned, overcrowded and lacking in basic social infrastructure (Plate 2).The majority of housing are compounds; with single rooms, two rooms and three rooms that accommodate many families. Facilities such as toilets and bathrooms, kitchens were un-conducive and are shared by different families. Further observations reveal that the building form is rectangular in shape, old, and closely packed together with no spaces between adjoining buildings such that the roof of one building overlaps the other. This constitutes a safety risk especially with respect to fire outbreaks. The buildings are constructed from inferior building materials with low level of technology (Plate 2).The use of firewood and charcoal for cooking is prevalent; hence many of the buildings have their kitchens located in the backyard, except for the few ones that used kerosene stoves as supplement to cook at the passage or right in their rooms. This compares with the findings of (Ajayi, Oviasogie, Azzuh, & Duruji 2014; Wapwera, Akujuru & Angau 2016; Yakubu, 2017; and Bello, Ogunrayewa, & Hassan 2018) whose research revealed living conditions of slum dwellers is very poor. Significant environmental problems; include air and water pollution, open defecation by human and indiscriminate waste dumping of plastic bottles.

| a. | b. |

Plate 2: Clustered houses with solid waste disposed.

4.2. Access to utilities and sanitation

Residents here depend on well water from shallow hand dug wells, with some dependent on stream water, which are highly polluted, rain water, taps, and buying from water vendors - there is no main water supply. Yakubu, (2017) observed most untreated water sources in slum settlements have a high nitrate value attributed to latrines, sewage and refuse dumps. Also, this polluted water is directly used by farmers for irrigation along the stream channels (Plate 3 a & b).

| a. | b. |

Plate 3: Stream water used by residents for different domestic activities.

4.3. Sources of plastic wastes in the environment

Plastics have permeated every facet of human life and researchers such as Yakubu, 2017; Ilyas *et al.,* 2018; Alabi *et al.,* 2019; Danladi, 2019; Ajoku *et al.,* 2020; and Kehinde *et al.,* 2020 categorised the sources of solid waste (plastics) as residential, industrial, commercial, institutional, construction and demolition (C&D), medical, agricultural and other wastes. Table 1 shows the sources of waste, the waste producers and the types of material within each category. While Plate 4 shows the indiscriminate dumping of plastic wastes at study site.

4.4. Strategies for solving environmental deterioration from plastic wastes

The results of the studies carried out by Alabi *et al.,* (2019), Ali *et al.,* (2016), Onwuka *et al.,* (2018), and Danladi, (2019) in some residential, commercial and institutional areas of Nigeria have put forward some strategies for solving environmental deterioration from plastic wastes:

i.   Since the major sources of plastic waste generation in the study area are residential and commercial there is need to educate grassroots residents on the impacts of plastic wastes and the need for a healthy lifestyle should be employed for effective transitioning.

ii.   Also, there is the need for improvement in proper plastic waste collection, treatment and disposal. Inadequate management of landfills will make way for harmful chemicals in plastic wastes to leach into the environment, polluting the soil, air and underground water.

iii. There should be sufficient awareness of citizens on dangers of plastic in the environment through the mass media.

Government can introduce the 'wealth to waste scheme' where plastic wastes can be recycled and generate income as well as employment for the unemployed youths in the society.

Table 1: Sources of plastic wastes in the environment

Sources	Typical Producers	Types of Materials	% of Wastes in Nigeria	
			Min	Max
Residential	Single and multifamily dwellings	Plastic bottles, water bottles, plastic cutlery, plates, jerry cans, salad dressing, biscuit trays, straws and salad domes	49.0	78.9
Commercial	hotels, Restaurants, Market, office building	Plastic chair Milk bottles, juice bottles, Chemical/ detergent, bottles, crates, Potato chip bags, Agricultural pipes	14.4	28.3
Institutional	School Hospital, Prison, Government buildings	Frisbees, e-wastes, CD cases	5.8	
Construction /Demolition	New construction sites, Road repairs, Renovation sites, demolition	Garden hose, Wall cladding, Roof sheeting,	Low awareness of C&D wastes in Nigeria	
Medical waste	Hospitals. clinics, nursing Homes	Intravenous bags, Disposable syringe, Medical supplies, Gloves	In many parts of Nigeria still collected with MSW	
Agricultural	Crops, orchards, Vineyards, farms, Dairies.	Spoiled food wastes, rice husks, cotton stalks, Coconut shells, Hazardous wastes	Low awareness of agricultural wastes in Nigeria	
Other wastes	Street cleaning, landscaping, parks, beaches, wastewater treatment.	Wide range of materials depending on source	0.3	1.9

Source: Collated from Yakubu, (2017); Ajoku *et al.,* (2020); and Kehinde *et al.,* (2020).

a.   b.

Plate 4: Indiscriminate dumping of municipal solid waste (plastic bottles) at study site

5. CONCLUSION

Based on the results of the study, it was established that plastic wastes generation has indeed presented negative impacts such as environmental pollution, poor public health on the residents of Sabon Lahi Rusai area of Naraguta 'B', Ward, Jos Plateau State. The secondary data reviewed related generally to the current state of solid waste management in Jos metropolis particularly the study site. Interview conducted revealed plastic waste (PET and LDPE plastic)

is a problem to life and the environment as a result of poor waste management and exposure to toxic chemicals used in the production of plastics. Also, goal (3, 6, 9, 11, 12, 14, and 17) of the sustainability development goals (SDG's) for the environment is not guaranteed if there is continuous rapid increase in the production and indiscriminate disposal of plastics with no alternative.

Based on the findings of this study, it was recommended as follows;

i. Awareness should be created to help the populace (particularly rural dwellers) know the implications of plastic waste in the environment and how to reduce the amount of plastic packaging they are used to.

ii. Government of Plateau State should make it as a matter of policy that more environmentally friendly practices be introduced to monitor proper disposal of plastics waste. These include provision of waste collection bins and containers, placed at vantage areas within the locality.

iii. Jos Metropolitan Development Board (JMDB) of the State, should embark on more awareness of citizens on environmental sanitation in line with the mandatory month-end sanitation exercise and enforcement of penalties to defaulters.

For transitioning to zero plastic and alternative(s) to plastics there is need to set up an inclusive framework for plastic waste management in Jos metropolis. Input from key stakeholders such as low-and-middle income businesses, would be sought.

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