

Solid Waste Management Practice and Challenges in Sapele, Delta State, Nigeria

¹Ohwofasa Wilson Onokohwomomo and ²Biose Ekene

¹Department of Urban and Regional planning,
Faculty of Environmental Sciences,
University of Delta, Agbor,
Delta State

²Department of Environmental Management and Toxicology,
Faculty of Life Sciences,
University of Benin,
Benin City,
Nigeria

²ORCID No.: 0000-0002-6776-8001
Email: ekene.biose@uniben.edu

Abstract

Sustainable healthy living conditions depends on effective waste management. The aim of this study is to evaluate solid waste management practices and challenges in Sapele, Delta State, Nigeria. Three communities were administered three hundred questionnaires which were pre- tested and refined. The results shows that 56.7% of respondents are male while only about 43.3% are female and 70% of household heads are married. Organic waste/food waste had the highest percentage of 96.7% followed by plastic (90%). Empty can drinks recorded the highest percentage with (100%) across the study area. A Majority (73.3%) of the respondents strongly agreed and agreed that inadequate service coverage by waste managers could lead to waste management problems while 13.3% were undecided. 73.3% of the respondents strongly agreed and agreed that lack of trained personnel by waste managers could lead to waste management problems. A Majority (80%) and (83.3%) of the respondents strongly agreed and agreed that lack of vehicles and vehicle /equipment breakdown of waste managers could lead to waste management problems. 72% and 66.7% of the respondents strongly agreed and agreed that the lack of enforcement measures by government agencies and poor cooperation by government agencies on waste managers could lead to waste management problems. 86.7% of respondents considers that environmental degradation from solid waste affects their families while 96.7% of respondent agreed that waste litter the road, land and public area. Sapele locals require health education as well as regular garbage collection facilities at authorized final dump locations. These will encourage rigorous adherence to proper and appropriate waste management procedures among them.

Keywords: Solid waste management, Waste managers, municipal solid waste, recycling

INTRODUCTION

Municipal solid wastes refer to wastes of different aetiological backgrounds and are usually considered unwanted materials from a particular process or system, and meant to be discarded after use owing to their being considered not useful to that particular process or system (Amukali *et al.*, 2020). Solid waste management is associated with the control of the processes of generation, storage, collection, transfer, transport, processing and disposal of

*Author for Correspondence

solid wastes in a manner that is in accordance with the best principles and practices of public health, economics, engineering, conservation, aesthetics and other environmental considerations and which is responsive to public attitude (Agbesola, 2013; Amukali *et al.*, 2020). In Nigeria, indiscriminate disposal of waste, particularly in urban areas, has not only reduced the aesthetic value of the environment but has led to the outbreak of infectious diseases like cholera, malaria, dysentery and diarrhoea (Coker *et al.*, 1998; Odiana and Olorunfemi 2020).

The collection, transportation, processing, disposal, management, and monitoring of waste products are all referred to as waste management. The term usually relates to materials produced by human activity and the process is generally undertaken to reduce their effect on health, the environment or aesthetics (Adogu *et al.*, 2015). According to estimates, the average Nigerian produces 0.49 kg of solid garbage each day, with households and commercial establishments accounting for approximately 10% of the nation's total urban waste load (Lawal, 2004). Of this, about two-thirds of wastes are dumped indiscriminately on the streets and in the drains thus posing serious environmental health hazards (Lawal, 2004). Furthermore, poor waste management and disposal could lead to various diseases, infections and infestation and these include fly-transmitted diseases like myiasis, diarrhea and typhoid; rodent-transmitted diseases like Lassa fever plague, leptospirosis, murine typhus (Obionu, 2007). Also gases like methane, carbon-dioxide, hydrogen sulphide and mercury vapour emitted from landfill sites can constitute air contaminants and pollution (Adogu *et al.*, 2015). A further issue with appropriate waste management is the lack of storage space in certain homes, which causes trash to accumulate all around the house and is made worse by the absence of drainage systems in such homes. Even where the drains are available they are either constructed without a gradient or not properly maintained as they are clogged or blocked with sand or other debris thus preventing sewage drainage (Adogu *et al.*, 2015).

Solid wastes can be classified in a number of ways, or specifically on the bases of certain criteria; (Aguoru and Alu, 2015; Amukali *et al.*, 2020). Solid wastes can also be classified based on source including: municipal solid wastes, industrial solid wastes, agricultural solid wastes, mining and mineral wastes, construction and demolition wastes, healthcare wastes, radioactive (nuclear) wastes as well as human and animal wastes (Amukali *et al.*, 2018). Municipal solid waste, on the other hand, appears to receive greater attention as one of the most problematic and frequent waste materials in our daily lives.

Solid waste management challenges and issues are of immediate importance in metropolitan areas, particularly in fast-urbanizing cities like Sapele in Delta State. However, it has been observed that the majority of homes are having difficulty managing their garbage. Garbage accumulates day after day because there is no garbage management. Given that the disposal of waste in economies that are developing is a continual obstacle as a result of inadequate institutions and guidelines, including regulations pertaining to the environment, prolonged underfunding and accelerated industrialization and urbanization, the situation in Sapele, Delta State, is no different. As a result, it is crucial to assess solid waste management practices and difficulties in Sapele, Delta State, in Southern Nigeria.

MATERIALS AND METHOD

Description of the Study Area

Sapele is a town in Delta State, Nigeria, and a Local Government Area (LGA). Sapele Local Government Area lies between latitude 5° 52' 46.9128" N and longitude 5° 42' 1.9116" E (Orhorhoro *et al.*, 2017). The city was formerly a modest business village that has expanded

into a growing trading community. Sapele LGA has an estimated population of 298,310 people (NPC, 2010) with the Urhobo ethnic group making up the majority of the population. The Urhobo language is extensively spoken in the LGA, while Christianity and traditionalism are widely practised religions. Trade is an important component of the Sapele LGA economy, with the area hosting a number of markets, including the Sapele main market, which attracts buyers and sellers of a variety of commodities. Farming is also thriving in the LGA, with food and income crops such as oil palm and rubber cultivated locally. Fishing, logging, and craft production are other key economic enterprises in Sapele LGA (Uyigüe and Agho, 2007). Three (3) communities namely: Green Egbedi, Okpe and Ugbeyiyi in Sapele LGA, Delta State Nigeria were used as the study area in this research work. Figure 1 shows the map of Sapele Local Government Areas.

Microclimate of the study area

For the most portion of the year, the region experiences moderate rainfall and humidity. The climate is humid, and there are two distinct seasons: dry and rainy. The dry season lasts from November to April and is characterised by the chilly "harmattan" dusty atmosphere created by the northeast breeze. The rainy season runs from May through October, with an unexpected dry spell in August, but it frequently rains even during the dry season. With an annual rainfall of 2673.8 mm, the climate is tropical equatorial. Throughout the year, temperatures are high and rather consistent. The average annual temperature in the region is 32.8 °C. The warmest months' average monthly temperatures range from 28 °C to 33 °C, while the coolest months' average monthly temperatures range from 21 °C to 23 °C. The relative humidity pattern corresponded to the rainfall pattern stated above. During the wet season, high values (above 95%) were observed. In the dry season, the high daily relative humidity values ranged from 86.5 to 92.0% and occurred between 2100 and 2400hrs and later from 0100 to 0800hrs (Okumagba and Ozabor, 2014; Orhorhoro *et al.*, 2017).

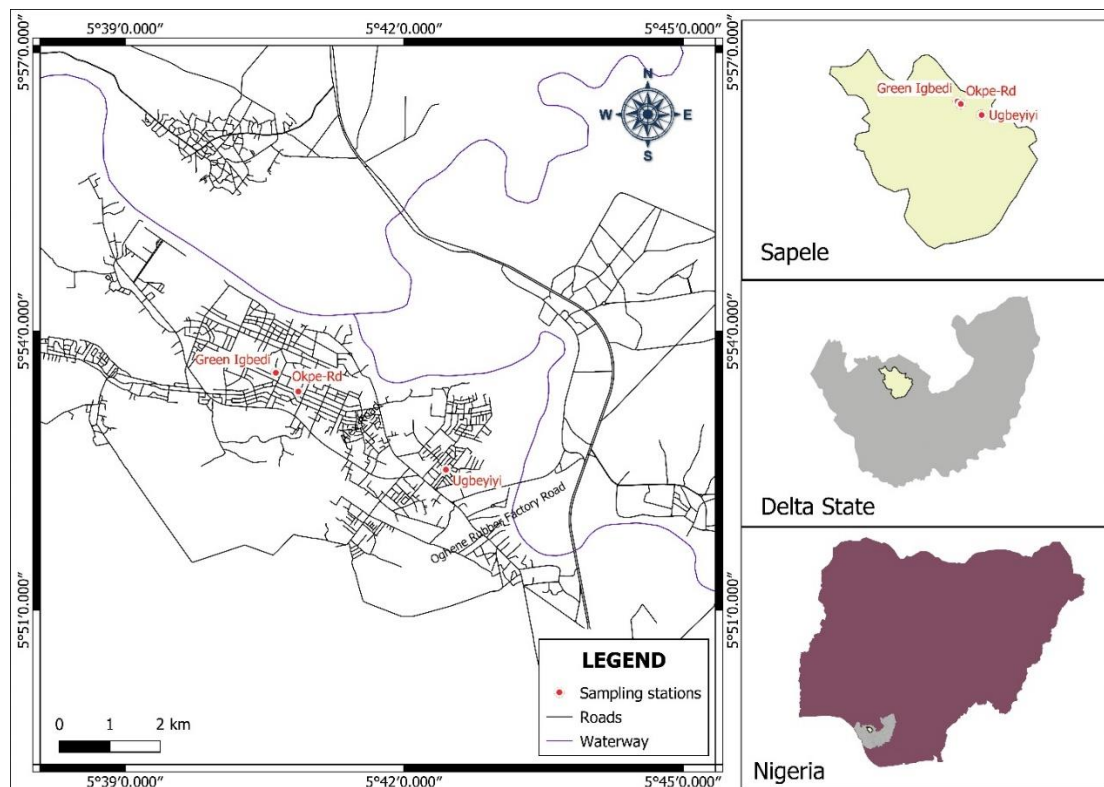


Figure 1: Map of Sapele Local Government Areas showing the study area.

Methodology

The objective of the research was to evaluate waste management practices and the status of solid waste management in three communities in Sapele Local Government Area. Waste characterization method of Bernache-Perez *et al.*, (2001) which was employed and described by Oyelola and Babatunde (2008) in (Okeniyi and Anwan, (2012) were used in this study. The approach includes an examination of the qualitative method employed. The study made use of both primary and secondary data sources, with the primary source involving direct data collection. by the use of a close-ended questionnaire to determine public opinion on incentives to sort waste into bins at source, level of awareness, general assessment of the efforts and level of enforcement of waste disposal guidelines while conference proceedings, newspapers, journals, books, online sources, and other published documents were used as secondary data sources. The study was a descriptive cross-sectional study that used structural questionnaires prepared, pre-tested, and used in the survey procedure. The study population included people (both males and females) in the study area who are familiar with the concepts of trash generation and disposal. Participants had to be residents of the area and household members willing to voluntarily engage in the study to meet the inclusion criteria. Non-locals and those who chose not to participate were excluded.

Data Collection and Design

The data for this study were acquired by the distribution of questionnaires to 300 respondents in the study locations which were distributed equally within the sampled areas. The first section of the questionnaire requested demographic information such as age, gender, marital status, family size, educational level, occupation, and income status. The second component involved gathering information from respondents about the physical makeup of solid waste, as well as solid waste collection and disposal techniques. The third section sought information on the problems found in the management of solid waste, the respondents' level of concern about solid waste concerns, awareness of the environment, and the repercussions of solid waste. During the study, a variety of activities such as desktop review, observation in the field, and acquiring primary and secondary data from sources were used to present conclusions on the environmental and public health impact of inadequate management of solid waste in the region under study.

Data analysis

Microsoft Excel 2013 and the Statistical Package for Social Sciences (SPSS) version 16 were used to analyze the data in this study. The mean of each respondent was calculated by counting the number of occurrences of demographic features of respondents from the administered questionnaires, after which the data was coded and totalled up at various locations. The percentage values and p-values using the chi-square goodness of fit are also presented. A 5% threshold of p-value was chosen as a guideline for establishing the significance of the associations, with $p > 0.05$ indicating no significant difference and $p < 0.05$ showing a significant difference.

RESULTS AND DISCUSSION

Demographic Characterization of Respondents

Table 1 shows the demographic characteristics of respondents in the study area. The sex of respondents in this study shows that 56.7% of respondents are male while 43.3% are female. This indicates that over half of the household heads interviewed are males who are married with children and this conforms to the cultural settings of the study area where societies are largely patrilineal (Ogah *et al.*, 2020). The result of this study is similar to the study of Ogbonna *et al.*, (2018) who recorded that 65.23% of respondents are males while 34.77% are females from

thirteen local government areas in Lagos state. Akpen and Aondoakaa, (2009) recorded 52.5% of respondents to be females while 47.5% are males and Kabiru, (2017), recorded 44% of respondents are males while 56% are females in Kano metropolis. Although the result shows more male representation, there is no clear indication as to whether an individual's gender greatly affects his or her ability to manage waste (Igbinadolor *et al.*, 2019).

Akpen and Aondoakaa, (2009), reported that married life affects family size which in turn influences consumption patterns and waste generation and management. Married individuals prefer African-inspired meals and consume less packaged food with associated wastes such as cellophane substances, whereas single individuals consume greater packaged meals with attendant wastes such as cellophane materials. The marital status of respondents indicated that 70% of household heads are married, 16.7% are single and 13.3% are widowed/divorced. This suggests that household sizes will be large, which will have a direct impact on the quantity and type of trash generated in the region under study. The result of this study is similar to the study of Ogah *et al.*, (2020) who recorded that 71% of household heads are married while 29% are single, Igbinadolor *et al.*, (2019) recorded a higher number of married respondent with 57.23% and 42.77% are singles. However the result of this study is different from the study of Akpen and Aondoakaa, (2009) who recorded a higher number of respondents with 45.9% who are single, 45.5% are married, 2.6% are separated, 4.5% are widows/widowers while 2.5% are celibate.

This study reveals that a substantial sum of respondents have obtained a high level of learning among respondents in certain areas of Sapele in this study as about 73% of respondents had more than 12 years of education (tertiary education), while the remaining group of respondents had primary education (26.7 %). The result of this study is similar to the work done by Adogu *et al.*, (2015) who recorded 8.2% of respondents without formal education, 11.6% with primary education, 19.9% with secondary education 60.3% with tertiary education. According to Margaret Banga's research on household understanding of solid waste segregation in urban Kampala, only roughly 17.5% of respondents had completed university education, 43.8% had completed secondary school, and 30.5% had completed primary education.

Table 1: Demographic Characterization of Respondents

Variables	Green Egbedi	Okpe Road	Ugbeyiyi Quarters	Frequency (n=300)	Percentage (%)	p-value	
Sex							
	Male	70	60	40	170	56.7	p>0.05
	Female	30	40	60	130	43.3	
Status							
	Married	80	60	70	210 ^a	70.0	p<0.001
	Single	10	30	10	50 ^b	16.7	
	Widowed	10	10	20	40 ^c	13.3	
Age							
	18-30	10	10	0	20 ^c	6.7	p<0.001
	31-40	10	40	20	70 ^b	23.3	
	41-50	30	20	50	100 ^a	33.3	
	51-60	50	30	30	110 ^a	36.7	
Formal Education							
	Primary	20	10	50	80	26.7	p>0.05
	Secondary	30	50	40	120	40.0	
	Tertiary	50	40	10	100	33.3	
Household size							
	≤ 4	30	60	20	110 ^a	36.7	p<0.05
	5-6 persons	40	20	60	120 ^a	40.0	
	≥ 7	30	20	20	70 ^b	23.3	
How Long you lived in the Area							
	3-4 years	10	10	10	30 ^c	10.0	p<0.001
	5-6 years	40	10	20	70 ^b	23.3	
	7-8 years	10	20	20	50 ^a	16.7	
	10 years above	40	60	50	150 ^a	50.0	
Ever heard of SW							
	Yes	80	90	100	270	90.0	p<0.001
	No	20	10	0	30	10.0	
Monthly income							
	≤ # 30,000	10	0	0	10 ^c	3.3	p<0.001
	# 30,000 - 50,000	20	10	0	30 ^b	10.0	
	≥ # 50,000	70	90	100	260 ^a	86.7	

No significant difference ($p > 0.05$), * $p < 0.05$ (significant difference) ** $p < 0.01$ (highly significant difference) *** $p < 0.001$ (very high significant difference)

Note that similar letters (superscripts) denote outcomes that are not significantly different from one another ($P > 0.05$).

According to Scott and Williams (1994), educational level is a significant factor in responsible consumption, with those with higher education levels putting in more effort in recycling activities. The substantial percentage of awareness (90%) of handling trash in this survey could be attributed to respondents' overall high educational status. High-income earners consume more packaged products that give rise to a higher percentage of non-biodegradables (inorganic materials) like metals, plastics, and glass/ceramics (Ogwueleka, 2009). This was found to be true as a higher percentage of the inorganic materials were influenced by the income rate (Abur *et al.*, 2014). Most households have less than 5 members or no more than 6-10 people. Large families generate more waste than small families (Akpen and Aondoakaa, 2009). The research region is dominated by families of 5-6 people, accounting for around 40% of the population, followed by households of 4 people, accounting for 36.7%. Given the research's unequal family sizes, it is projected that the amount of garbage generated will be large, as the percentage of households with 5-6 and 7 people accounts for 63.3% of the study

area. The average monthly income of those who participated in this study was determined to be ₦ 50,000 with around 86.7%, however, approximately 10% and 3% of respondents earn less than ₦ 30,000 - 50, 000 and ₦ 30,000, respectively. The income status of a people is an instrumental factor in demanding for goods and services (Akpen and Aondoakaa, 2009).

Physical Components of Household Solid Waste

By percentage composition of solid waste in this study (figure 2 and 3), food waste accounts for the greatest proportion of material waste generated. Akpen and Aondoakaa, (2009) and Orhorhoro *et al.*, (2017) recorded similar household solid waste composition in Gboko and Sapele respectively. Correspondingly, the finding from this study agrees with the work of Igbinomwanhia *et al.* (2012) that reported seventy-eight (78%) percentage composition of food waste in Benin metropolis, Owamah, *et al.* (2015), Eisa and Visvanathan (2002), reported percentage composition of 77% and 87% of food waste for municipal solid waste characterization in Nigeria.

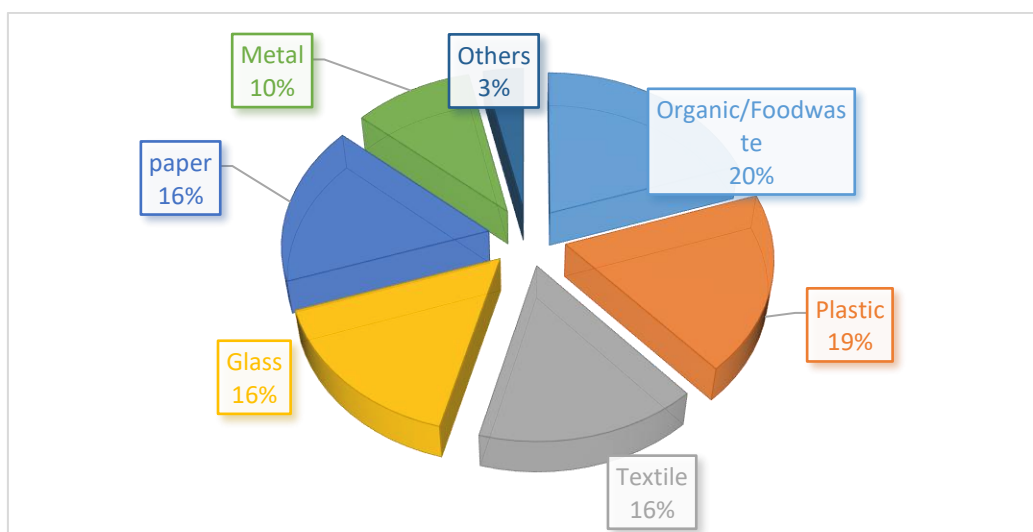


Figure 2: Percentage composition of household waste in the study area

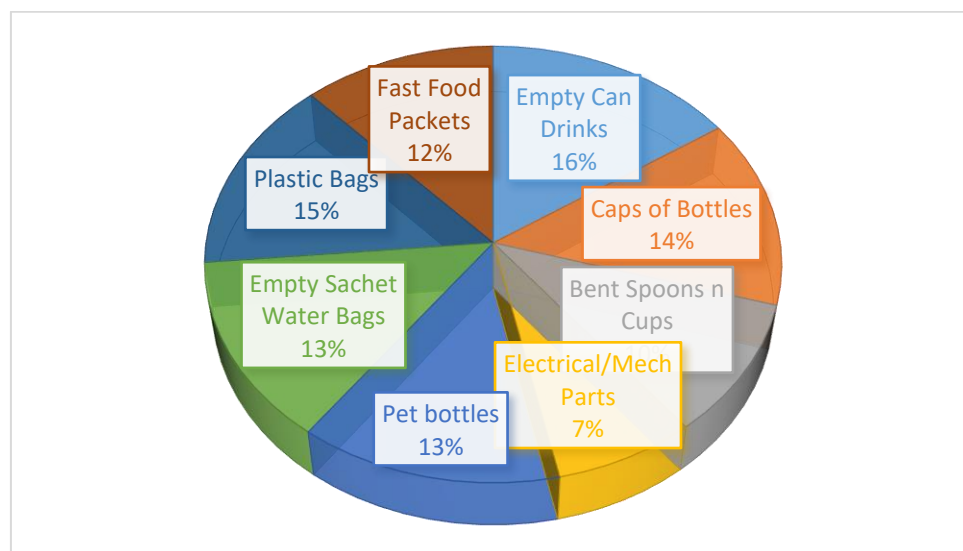


Figure 3: Percentage composition of municipal solid waste in the study area

Abur *et al.*, (2014) also had similar results in their study when they observed that the highest percentage (56.2% and 52.0%) of solid waste from their study was food/putrescible materials for wet and dry seasons in Abuja. The other composition are plastics (7.4% and 2.85%;

glass/ceramics (7.6% and 1.42%); metals (2.6% and 0.71%); paper (10.0% and 12.46%) and rubber (10.2% and 3.56%) (Abur *et al.*, 2014). This implies that composting/biodegradation can be employed for waste disposal, with fertilizer derived as the result. This report is in-line with previous research work by Hoornweg *et al.*, (1999) where they found out that waste from stream are over 50% organic materials in developing countries. Separate works in Bandung and Indonesia have shown that residential waste is composed of 78% and 81% decomposable materials (Cointreau, 1982). The quantity of non-biodegradable materials in the described waste constitution in this research has substantiated the fact that trash disposal through landfill facilities solely is not an environmentally friendly alternative for the collected materials. A more suitable and sustainable waste disposal system should also include waste recycling to re-utilize plastics materials (Okeniyi and Anwan, 2012).

Knowledge of Respondents about the Problems Encountered Towards Solid Waste Management Services

Table 2 shows the knowledge of respondents about the problems encountered towards solid waste management services in the study area.

Table 2: Problems Encountered Towards Solid Waste Management Services

Variables	Green Egbedi	Okpe Road	Ugbeyiyi Quarters	Frequency (n=300)	Percentage (%)	p-value
Inadequate Services Coverage						
SA	40	40	40	120 ^a	40.0	p<0.001
A	40	20	40	100 ^a	33.3	
U	20	10	10	40 ^b	13.3	
D	0	20	0	20 ^b	6.7	
SD	0	10	10	20 ^b	6.7	
Lack Service Quality						
SA	50	40	30	120 ^a	40.0	p<0.001
A	40	30	50	120 ^a	40.0	
U	10	10	20	40 ^b	13.3	
D	0	20	0	20 ^b	6.7	
SD	0	0	0	0	0.0	
Lack of Trained Personnel						
SA	50	20	0	70 ^b	23.3	p<0.001
A	40	50	60	150 ^a	50.0	
U	10	20	40	70 ^b	23.3	
D	0	10	0	10 ^c	3.3	
SD	0	0	0	0	0.0	
Lack of Vehicles						
SA	40	20	20	80 ^b	26.7	p<0.001
A	50	50	50	150 ^a	50.0	
U	10	10	10	30 ^c	10.0	
D	0	5	20	25 ^c	8.3	
SD	0	0	0	0	0.0	
Lack of Enforcement measures						
SA	30	30	40	100 ^a	33.3	p<0.001
A	40	30	50	120 ^a	40.0	
U	10	20	10	40 ^b	13.3	
D	0	20	0	20 ^b	6.7	
SD	20	0	0	20 ^b	6.7	
Rapid Urbanization Outstripping Service Capacity						
SA	60	30	40	130 ^a	43.3	p<0.001
A	20	40	50	110 ^a	36.7	
U	0	10	0	10 ^c	3.3	
D	10	10	10	30 ^b	10.0	
SD	10	10	0	20 ^b	6.7	

SA- Strongly Agree, A-Agree, U-Undecided, D-Disagree, SD-Strongly Disagree,

No significant difference ($p > 0.05$), * $p < 0.05$ (significant difference) ** $p < 0.01$ (highly significant difference)

*** $p < 0.001$ (very high significant difference)

Note that similar letters (superscripts) denote outcomes that are not significantly different from one another ($P > 0.05$).

According to Ogwueleka (2009), solid trash collection is the responsibility of state and local government environmental protection agencies. Informal collectors, on the other hand, charge a fee for their services. In this study, respondents' knowledge of problems encountered with solid waste management services in the study area was pretty similar in all factors asked. A majority (73.3%) of those polled in the research area strongly agreed and agreed that inadequate service coverage by waste managers could lead to waste management problems while 13.3% were undecided.

Humans have been seen to dump waste at any vacant plot, public space, river or burn it in their backyard, thereby polluting the air as less than 60% of municipal solid waste generated is collected in developing countries (Ogwueleka, 2003). The results of this study are relatively similar to the study of Ogah *et al.*, (2020) who recorded that 70.9% of heads of household observed that the services rendered by Nasarawa State Urban Development Board is inefficient. 73.3% of the respondents strongly agreed and agreed that a lack of trained personnel by waste managers could lead to waste management problems while 10% were undecided. Abur *et al.*, (2014) opined that due to the increasing rate of waste generation, private contractors are also involved in the waste collection for a fee. As a result, private solid waste collection operators coexist with the official garbage collection service, just as they do in other Nigerian cities. Private contractors are assigned to specific parts of town. Privately owned businesses have been shown to have higher efficiencies than the government agency, but they are not properly monitored or governed by the government agency, which worsens the situation. Dishonesty on the part of some of the contractors, as well as late payment by the government, exacerbates the situation. The findings in this study is in agreement with the study of Adogu *et al.*, (2015) who observed that about 91.4% of respondents do not have licensed waste management firm in their area. To make matters worse, almost all of the respondents (96.1%) in the survey had no official waste management training, and 95.0% did not have a waste management plan/policy issued by their local government zone. This unfortunate situation is an indication of the lack of political will and commitment towards such important statutory function and activity of the local governments (Ogola *et al.*, 2011), aggravated by a total absence of a plan for storage, collection, transportation and final disposal of waste in the area (Adogu *et al.*, 2015)

A majority (80%) and (83.3%) of the respondents strongly agreed and agreed that lack of vehicles and vehicle /equipment breakdown of waste managers could lead to waste management problems while 10% were undecided as respondents reported during recognizance survey that heaps of waste remain for several days to weeks in their household before they are evacuated. Due to restricted funds, government organizations do not have the capacity to handle the increasing solid waste (Ogola *et al.*, 2011). Babayemi and Dauda, (2009) opined that lack of advanced technology, facility for separation/sorting at source, strength of solid waste management policy and enforcement, environmental education and awareness and income status of individuals among others, are factors affecting solid waste scenario in Nigeria.

Respondents' Concerns about the Issues of Solid Waste on the Environment

The result of this study shows that 90% of respondents were concerned about environmental pollution, and 86.7% of respondents were concerned about the health impacts of solid waste (figure 4). Ogwueleka (2009) opined that open dumps in urban areas provide harborage for disease-causing organisms, bacteria, insects and rodents. The above findings were in agreement with the work of Pate, (2012) and Aliyu, (2015) who discovered that poor solid waste disposal in many Nigerian cities is responsible for many environmental and health problems, that is associated with solid waste management. The result of this study is consistent with the findings of Foday, (2012) who observed that households are not happy with regard to living closer to solid waste disposal sites as they complained about sickness, odors, insect vectors as well as rodent breeding places. Akpen and Aondoakaa, (2009) opined that the delay in the removal of wastes from points of collection constitutes a potential source of pollution. For example, surface runoff pollutes groundwater and stream waters. Aside from the delays in evacuation, public education programs to educate the people on the importance of preserving the quality of the environment have not been successful.

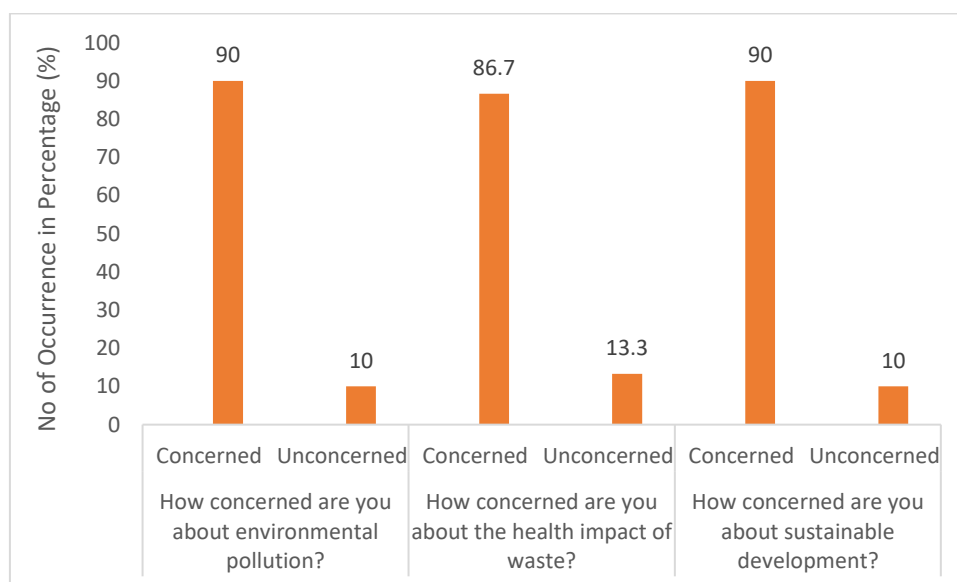


Figure 4: Respondents Concerns about the Issues of Solid Waste on the Environment

Respondents Perception on Waste Management Practices and Awareness of the Environmental Impacts of Solid Waste

Waste reduction revolves around strategies like reuse, reduce and recycle and this help to minimize the amount of waste generated and consequently disposed-off into the environment (Omofonmwan and Esegibe, 2009). The respondent perception on waste management practices and awareness on the ecological impact of solid waste expressed in Table 3 shows that 80% of respondents are aware of incineration and recycling as a waste management practices respectively, 63.3% of respondents are aware of re-use while 46.7% of respondent do not know about waste management practices. Despite most respondents' belief in the feasibility of waste reduction measures, the majority still believe that trash reduction should be the sole responsibility of respective waste management organizations or governments, not theirs. The majority of the homeowners who relied on implementing trash reduction techniques stated that they did so by trading recyclables to paper factories and burning other materials in green spaces in their neighbourhood.

The majority of respondents held the belief that waste products were useless and should be disposed of as quickly as possible. Many respondents did not believe in trash reduction and

recycling initiatives, hence knowledge regarding 'waste-to-wealth' strategies was quite low in the study area. This could be due to a lack of provisions for mechanized waste recycling gadgets in the study area as suggested by a similar study (Isa, 2005), thus predisposing respondents to the erroneous belief in outright disposal of such wastes into the environment. Furthermore, this same phenomenal belief was observed in similar studies in Lagos, Lagos State (Adewole, 2009) and Owerri, Imo State (Nkwocha *et al.*, 2011) both in Nigeria. According to the findings of this study, 53.3% of respondents agreed to solid waste recycling, while 66.7% are willing to organize waste into separate bags for collection. Residents of Sapele may have reduced the amount of waste generated before disposing of it into the environment, as opposed to the minority (20%) of respondents who are unwilling to segregate rubbish into separate bags for collection. The percentage of the participants willing to separate waste demonstrates an increase in waste management awareness in the research location. A study in South Africa recorded a similar finding that waste collected is not sorted into recyclables or non-recyclables and is all disposed of at the final dumpsite with no sorting (Ogola *et al.*, 2011). A recycling programme could be introduced by the authorities as studies have shown that 60% of waste generated in households can be recycled if a proper waste recycling system is put into place (Adogun *et al.*, 2015).

Table 3: Respondents Perception on Waste management Practices and Awareness on the Environmental Impacts of Solid Waste

Variables	Green Egbedi	Okpe Road	Ugbeyiyi Quarters	Frequency (n=300)	Percentage (%)	p-value
Are you aware of the following SW disposal practices?						
Incineration	70	80	90	240	80.0	p>0.05
Recycling	70	80	90	240	80.0	p>0.05
Re-use	40 ^b	70 ^a	80 ^a	190	63.3	p<0.05
Don't know	60	40	40	140	46.7	p>0.05
Have you ever heard of the importance of recycling?						
Yes	40	60	80	180	60.0	p<0.05
No	60	40	20	120	40.0	
If Yes, Do you agree to solid waste recycling						
Yes	40	50	70	160 ^a	53.3	p<0.001
No	10	40	10	60 ^b	20.0	
Not sure	50	10	20	80 ^b	26.7	
If a recycling programme is set up, will you be willing to separate waste into separate bags for collection purpose						
Yes	50	70	80	200 ^a	66.7	p<0.001
No	40	20	0	60 ^b	20.0	
Not sure	10	10	20	40 ^b	13.3	

No significant difference (p > 0.05), *p < 0.05 (significant difference) **p < 0.01 (highly significant difference) ***p<0.001 (very high significant difference)

Note: Similar letters (superscripts) indicate values that are not significantly different from each other (P>0.05)

A majority (96.7%) of respondents agreed that waste litter the road, land and public area, 90% of respondents agree that health problems can be associated with waste management, 100% of respondents in this study indicates that the presence of dark flowing water and mosquitoes are associated with the problems related to poor waste disposal methods/practices while 96.7% and 83.3% of respondents in this study indicates that the presence of odour and scavengers are associated with the problems related to poor waste disposal

methods/practices in the study area. Adogu *et al.*, (2015) recorded that 99.3% of respondents specified that waste management promotes good health and a healthy environment. According to Akpen and Aondoakaa (2009), improper solid waste management has the potential to cause flooding, which also supports the spread of diseases, contamination of ground and surface waters, air pollution, and land pollution, and can affect the aesthetics of a community. It could potentially cause a traffic accident if waste is placed on streets and highways.

CONCLUSION

Good disposal of waste is critical to long-term healthy living conditions. Sapele people require health education, regular garbage collection, and designated final dump sites. These will motivate them to strictly adhere to proper and suitable waste management techniques. It is thus suggested that appropriate public awareness campaigns, maintenance on existing equipment, proper waste legislation, staff training and re-training, financial delivery, sustainable equipment, regular waste collection and disposal, service expansion to cover more Sapele residents, and community active engagement in the collection and disposal of waste should be fostered as a way to achieve environmentally friendly solid waste handling as recycle and composting facilities be setup

REFERENCES

- Abur, B. T., Oguiche, E. E and Duvuna, G. A. (2014). Characterization of Municipal Solid Waste in the Federal Capital Abuja, Nigeria, *Global Journal of Science Frontier Research: H Environment and Earth Science*, 14(2): 1-7
- Adewole A. T. (2009). Waste management towards sustainable development in Nigeria: A case study of Lagos state. *International NGO Journal*, 4(40): 173-179
- Adogu, P. O. U., Uwakwe, K. A., Egenti, N. B., Okwuoha, A. P. and Nkwocha, I. B. (2015). Assessment of Waste Management Practices among Residents of Owerri Municipal Imo State Nigeria, *Journal of Environmental Protection*, 6: 446-456
- Agbesola, Y. O. (2013) Sustainability of Municipal Solid Waste Management in Nigeria: A case study of Lagos. An M.Sc Thesis in Water and Environment Sciences, Department of Thematic Studies Linkoping Universitat
- Aguoru, C. U. and Alu, C. A. (2015). Studies on Solid Waste Disposal and Management Methods in Makurdi and its Environs, North Central Nigeria. *Greener Journal of Environmental Management and Public Safety*, 4(2): 019- 027
- Akpen, G. D. and Aondoakaa, S. C. (2009). Assessment of solid waste management in Gboko Town, *Global Journal of Environmental Sciences*, 8(2): 71 - 77
- Amukali, O. (2019). Effects of Wastes from Auto-mechanic Workshops on Concentrations of Heavy Metals in Soils and Plants in Yenagoa Metropolis, Nigeria. A Ph.D Dissertation submitted to The Post Graduate School of Niger Delta University, Amassoma, Bayelsa State, Nigeria. 278p
- Amukali, O., Bariweni, P. A., Sophia, M. J. and Imaitor-Uku, E. E. (2020). People's Perception and Participation in Solid Waste Management in Ndokwa West Local Government Area, Delta State, Nigeria. *International Journal of Natural Resource Ecology and Management*, 5(3): 108-114
- Babayemi, J. O. and Dauda, K. T. (2009). Evaluation of Solid Waste Generation, Categories and Disposal Options in Developing Countries: A Case Study of Nigeria, *J. Appl. Sci. Environ. Manage*, 13(3): 83 - 88
- Bernache-Perez, G., Sanchez-Colon, S., Garmendia, A. M., Dávila-Villarreal, A. and SánchezSalazar, M. E. A. (2001). *Waste Management and Research*, 5: 413-424.

- Cointreau, S. J. (1982). Environmental management of urban solid waste in developing countries: A project guide. Urban Development Technical paper No 5. The World Bank, Washington, DC.
- Coker, A. O., Ogunlowo, O. O. and Sangodoyin, A. Y. (1998). Managing Hospital Waste in Nigeria. 24th WEDC Conference: Sanitation and Water for All.
- Eisa, M. and Visvanathan, C. (2002). Municipal solid waste management in Asia and Africa. A comparative analysis. Cleaner Production and Environmental Management Branch, United Nations Industrial Development Organization. Vienna, Austria, 69: 11-25
- Hoornweg, D., Thomas, L. and Otten, L. (1999). Composting and its applicability in developing countries. Urban waste management working paper series 8. Washington, DC; World Bank.
- Igbinadolor, I. J., Jerumeh, T. R., Jerumeh, E. G. and Ohemu T. L. (2019). Current Status of Solid Waste Management Strategies in Akure Municipality, Ondo State. *International Journal of Innovative Human Ecology and Nature Studies*, 7(4):40-51
- Isu, B. A. (2005). The Pains of Waste. A Paper Presented at the Workshop Organized by Committee on Vital Environmental Resources for Teachers/Students, Eghosa Anglican Grammar School, Benin City, 1-6
- Kabiru, M. Y. (2017). Environmental and Public Health Impact of Poo-solid Waste Disposal in Kano Metropolis Nigeria, *Texila International Journal of Public Health*, 5(4): 1-11
- Lawal, A. S. D. (2004). Composition and Special Distribution, Solid Waste Collection Points in Urban Katsina, Northern Nigeria. *The Environmentalist*, 24: 62-64
- Momoh, J. J. and Oladebeye, D. H. (2010). Assessment of awareness, attitude and willingness of people to participate in household solid waste recycling programme in Ado-Ekiti, Nigeria. *Journal of Applied Sciences in Environmental Sanitation*, 5(1): 93-105
- National Population Commission of Nigeria (web), National Bureau of Statistics (web). <https://www.manpower.com.ng/places/lga/240/sapele> Assessed 30th July, 2023.
- Obionu, C. N. (2007). Primary Health Care for Developing Countries. 2nd Edition, Publishers Institute for Development Studies, University of Nigerian Enugu Campus, Enugu, 183-284
- Odiana, S. and Olorunfemi, I. (2021). An Overview of Solid Waste in Nigeria: Challenges and Management, *Jordan Journal of Earth and Environmental Sciences*, 12(1): 36-43
- Ogah, A. T., Alkali, M. and Opaluwa, O. D. (2020). Efficiency of solid waste management methods in Karu Local Government Area, Nasarawa State, North Central, Nigeria. *World Journal of Advanced Research and Reviews*, 08(02): 318-329
- Ogbonna, A. C., Mikailu, A. and Jiya, G. S. (2018). Municipal Solid Waste Management in African Cities. A Case Study of Lagos State, Nigeria. *Malaysian Journal of Civil Engineering*, 30(1): 1-12
- Ogola, J. S., Chimuka, L. and Tshivhase, S. (2011). Management of Municipal Solid Wastes: A Case Study in Limpopo Province, South Africa, *Integrated Waste Management*. I: 92-112
- Ogwueleka, T. C. (2009). Municipal solid Waste Characteristics and Management in Nigeria. *Iran Journal of Environmental Health, Science and Engineering*, 6(3): 173-180
- Okeniyi, J. O. and Anwan, E. U. (2012). Solid wastes generation in Covenant University, Ota, Nigeria: Characterization and implication for sustainable waste management. *Journal of Environmental Science*, 3(2): 419-424
- Okumagba, P. O. and Ozabor, F. (2014). The Effects of Socio-Economic Activities on River Ethiope. *Journal of Sustainable Society*, 3(1): 1-6
- Omofonmwan, S. I. and Esegbe, J. O. (2009) Effects of Solid Waste on the Quality of Underground Water in Benin Metropolis, *Nigerian Journal of Human Eco.*, 26(2): 99-105

- Orhorhoro, E. K., Ebunilo, P. O. and Sadjere, G. E. (2017). Determination and Quantification of Household Solid Waste Generation for Planning Suitable Sustainable Waste Management in Nigeria. *International Journal of Emerging Engineering Research and Technology*, 5(8): 1-9
- Owamah, I. H., Izinyon, O. C. and Igbinewekan, P. (2015). Characteristics and quantification of solid waste generation in the Niger Delta Region of Nigeria: a case study of Ogbe-Ijoi community in Delta State, *Journal of Material Cycles and Waste Management*, 19(1): 366-373
- Oyelola, O. and Babatunde, A. I. (2008). Characterization of domestic and market solid waste at source in Lagos metropolis, Lagos, Nigeria. *African Journal of Environmental Science and Technology*, 3(12): 430-437
- Saleh, A. and Ahmed, A. (2019). Solid Waste Management Practice and Challenges in Gashua, Yobe State, Nigeria. *Nigerian Journal of Environmental Sciences and Technology*, 3(2): 298-303
- Scott, D and Willits, F. K. (1994). Environmental Attitude and Behaviour. A Pennislavia Survey. *Environmental and Behaviour*. 26 (1): 239-260
- Uyigue, E. and Agho, M. (2007). Coping with Climate Change and Environmental Degradation in the Niger Delta of Southern Nigeria. Community Research and Development Centre (CREDC). pp 46-82
- Zhu, D., Asanani, P. U., Zuurbrugg, C., Anapolsky, S. and Mani, S. (2008). Improving Municipal Solid Waste Management in India: A sourcebook for policy makers and practitioners, The World Bank Washington DC. 1-190.