



# ASSESSMENT AND CHARACTERIZATION OF PLASTIC POLLUTION IN TWO COASTAL SITES IN LAGOS NIGERIA: IMPLICATIONS FOR ENVIRONMENTAL MANAGEMENT AND PUBLIC AWARENESS.

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## ABSTRACT

Plastics, synthetic organic polymers derived from oil or gas, have become ubiquitous due to their versatility. However, their excessive use has led to a significant global issue: marine litter. This pollution poses severe threats to marine life and coastal environments, creating a critical environmental challenge with widespread effects on ecosystems, human health, and economies. Coastal cities like Lagos, Nigeria, are particularly affected due to rapid population growth, urbanization, and inadequate waste management. In Lagos, the communities of Makoko and Ilaje were studied for their plastic pollution levels. These areas face high plastic waste accumulation, exacerbated by insufficient waste management infrastructure and urban runoff. The study involved both physical sampling of plastics and surveys to understand local plastic usage, disposal practices, and awareness of pollution impacts. In Makoko, the majority of plastic waste consists of polyamide (nylon) at 48%, followed by plastic bottles at 36%. A significant portion of respondents (52%) admitted to improper plastic waste disposal, reflecting serious deficiencies in waste management practices and low awareness of environmental impacts. Conversely, Ilaje primarily deals with polyethylene terephthalate (PET), making up 62% of the waste, largely due to the high consumption of bottled products. Both communities demonstrate a pressing need for improved waste management systems and better public education on plastic pollution. The study advocates for enhanced infrastructure, effective recycling programs, and public awareness campaigns. It also recommends implementing the "Polluter Pays Principle" to encourage responsible plastic disposal and recycling, which is crucial for mitigating environmental and health impacts, promoting sustainable urban development, and reducing plastic pollution in coastal regions.

**Keywords:** *Zoos, Bush Meat, Education, Research, Post-Pandemic, Coastal pollution.*

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## INTRODUCTION

Plastic pollution has become a persistent global environmental problem, with significant implications for marine ecosystems, human health, and the economy. The world's population is congregating closer to the coasts, working, living, and taking vacations, and they are also directly witnessing the biggest and most spectacular plastic waste wave in history. Ten years into this century, the amount of plastic manufactured will surpass that of the previous century combined. There are many different kinds and forms of plastic pollution, but it generally refers to the buildup of plastic items in the environment that negatively impacts human health or wildlife habitat (Reddy *et al.*, 2014). A negative impact on lands, waterways, and oceans can result from plastic waste. Since plastics are widely utilized by people and are reasonably priced and long-lasting, there is a strong correlation between plastic pollution and these factors (Reddy *et al.*, 2014).

Materials and products classified as plastics are composed of various high molecular-mass polymers (Babayemi *et al.*, 2018). Because of their low cost, minimal maintenance, low weight, and ease of production, they have many uses across time and space. The amount of plastic used in a wide variety of items has increased dramatically in recent decades. From 1.5 million tons (Mt) year in 1950 to 245 Mt annually in 2008, plastics global production surged. It has been estimated that by 2050, the world's plastic production might triple (Green paper, 2013). Plastic waste management, and recycling in particular, is a global problem that is made worse in African nations with weak waste management infrastructure (Wang *et al.*, 2015). Plastic waste has the potential to be recovered and recycled (Wang *et al.*, 2015). But the amount of plastics being disposed of in landfills and dumpsites is larger than ever, and recycling is not keeping up with the rate at which virgin plastics are manufactured (Merrington, 2017). A greater portion of marine litter is made up of plastic, which is a major and expanding global environmental concern (Dussud *et al.*, 2017). 10% of the 6.1 billion plastic tons produced globally are expected to wind up permanently deposited in the world's oceans (Wichels *et al.*, 2017). One significant obstacle in the pursuit of sustainable development is the plastic dilemma. The capacity to use resources while keeping future generations in mind. According to the Brundtland Commission, to ensure that no one is left behind, stakeholders must engage with the environment differently to use resources with future generations in mind. Addressing these environmental challenges is a significant worldwide challenge, notwithstanding their loftiness. The strain is much greater in developing nations due to inadequate infrastructure, poorly implemented policies, and a persistent lack of resources that make it difficult to take the environment into account in a sustainable manner. However, it has been demonstrated that developing nations are disproportionately affected by the negative effects of environmental unsustainability because of inadequate mitigation and adaptation measures. Out of all the various plastics made, high-density polyethylene (HDPE) and polyethylene terephthalate (PET) are recycled the most. The other kinds are more difficult and, in certain situations, only useful once before becoming a nonbiodegradable part of the environment (Yalwaji *et al.*, 2022).

With an estimated 201 million people living there in 2019, more than half of all West Africans, Nigeria is the most populated country in both Africa and West Africa (World Bank 2022). Fifty-seven percent of the population resides in coastal areas, and the remaining half-lives in urban areas (Jambeck *et al.*, 2019). Nigeria's economy, which is categorized as lower middle-class, is seen as a significant emerging market both in Africa and internationally. The 36 states that make up the federal republic are joined by the Federal Capital Territory, which is home to Abuja, the nation's capital.

With an estimated population of approximately 24 million, Lagos is the most populated coastal metropolis in Africa (Lagos Bureau of Statistics, 2016). Nigeria is the biggest oil producer in Africa; its oil and gas industry contributes roughly 10% of GDP, and its petroleum exports make up over 86% of all export earnings (OPEC 2021). In the WACA region, Nigeria is the sole producer of resin. 486 kt of resin (325 kt PE, 96 kt PP, 65 kt PET) were manufactured in 2018 and 498 kt (322 kt PE, 101 kt PP, 75 kt PET) were produced in 2019.

However, the nation is a net importer of plastics, which are normally derived from oil in their basic form (naphtha). According to UN Comtrade 2019, Nigeria imported \$1.7 billion worth of plastics in total, including net imports of all major plastic resins (PE, PP, PS, and PVC). Nigeria has a strong plastic manufacturing industry thanks to its high consumption of primary plastics, or resins. Market statistics state that Nigeria's plastic manufacturing increased quickly, from 120 kt in 2007 to a predicted 513 kt in 2020, at a pace of 13.9 percent annually (Statista, 2021). Nigeria is the world's largest producer of olefins and is a net importer of resin.

Less than 12% of plastic trash in Nigeria is recycled, according to studies on plastics recovery (Babayemi, & Dauda 2009). According to reports, Nigeria has eight finished plastic waste recycling facilities and eighteen more that are in various phases of completion (Down to Earth, 2021). Cement kilns and incinerators equipped with heat recovery, for instance, cannot currently convert waste into electricity. Approximately 80% of the plastic garbage is disposed of in landfills and dumpsites (Babayemi, & Dauda 2009).

One of the cities in Nigeria and the world with the fastest rate of growth is Lagos State (LBS, 2010). Lagos, sometimes known as a "city" by its locals, is Nigeria's commercial hub, with 7,878 people living there per square kilometer (Demography World Urban Areas, 2021). Because of its ports and the largest concentration of multinational corporations among its manufacturing areas, the city is significant to its bordering states (Phillips and Horwood, 2007). With 20 local government areas and a population of 15,388,000, the Lagos metro area's population in 2022 increased by 3.54% from 2021 (Macrotrends, 2023). The population, urbanization, and industrialization of Lagos State are all growing every day. The issue of plastic pollution in coastal areas is becoming increasingly prevalent worldwide, and Lagos, Nigeria, is not an exception. Plastic garbage is widely used and poorly managed, which has a negative influence on the city's coastal waters. Underpinned by credible references, this analysis offers insights into the types, causes, and ecological effects of plastic pollution in Lagos's coastal waterways. Urban runoff, industrial discharges, and inappropriate waste disposal methods are the main causes of plastic pollution in Lagos's coastal waters. Lagos produces a significant quantity of plastic waste due to its dense population of approximately 20 million people. Plastics leak into the coastal environment as a result of poor waste management infrastructure, which makes the issue worse (Babayemi, & Dauda 2009). The coastal waters of Lagos are home to a variety of plastic garbage, including microplastics, plastic bags, packing materials, and polyethylene terephthalate (PET) bottles. Because of their small size and capacity to be consumed by marine life, microplastics in particular present a serious risk of bioaccumulation and possible translocation up the food chain (Jambeck *et al.*, 2015). Makoko and Ilaje, coastal towns in Lagos, Nigeria, are severely affected by marine debris and plastic pollution as a result of poor waste management, urban runoff, and neighborhood-based businesses including fishing and unofficial trading. Makoko dubbed the "Venice of Africa," is plagued with home garbage dumped straight into the lagoon and plastic debris that finds its way into the waterways from the heavily populated city (Adelekan & Fregene, 2015). Similarly, the absence of official trash collection infrastructure and

pollution from adjacent industrial activity affect Ilaje (Adelekan & Fregene, 2015). Significant environmental and health issues plague both areas, such as the destruction of marine ecosystems, the threat to marine life, and negative effects on the local economy and public health (Gall & Thompson, 2015). Government laws, community-based programs, and clean-up efforts that enhance waste management and increase environmental consciousness are all used to try to lessen these problems (Nwafor, 2020).

In Nigeria, adequate information on the types and quantities of plastic and polymers is needed to improve plastic management and offer incentives and policies that are both appropriate and effective. Nigeria is sixth in the world for the release of plastic marine litter; rivers are a source of this pollution (Babayemi, & Dauda 2009). Therefore, there is an urgent need for developing countries like Nigeria to manage waste plastics more effectively.

## **MATERIALS AND METHODS**

### **Description of the study area**

Two coastal areas in Lagos, Nigeria, identified as Ilaje Community and Makoko Community, were the primary focus of the study upstream of the Lagos Lagoon. These communities suffer significantly from plastic pollution and marine waste due to inadequate waste management, urban runoff, and local economic activities like fishing and informal trade. Description of the study area. The rationale for the choice of the sites was based on information in the literature

### **Makoko Community**

Makoko is a riverbank community in the Yaba local government area of mainland Lagos, located at latitude 6°29'46.06" N and longitude 3°23'34.69"E. The Third Mainland Bridge borders it to the south, the Lagos Lagoon to the east, Ebute-Meta to the west, and Iwaya and the University of Lagos to the north. Originally settled by the Ilajes and Eguns in the early nineteenth century, Makoko is also home to a small number of Yorubas, Igbos, and other ethnic groups. With an estimated population of 100,000, the municipality has several obstacles, especially heavy floods during the wet season due to its partially waterlogged topography. Environmental and infrastructure problems plague the town, including limited access to necessities like homes, schools, healthcare facilities, and roadways. The majority of the homes are made of fragile materials, which increases the community's susceptibility. The socioeconomic makeup of the population and the surrounding environment draw attention to the difficulties experienced by the urban poor, who have little ability to change their situation.

### **Ilaje (Bariga) Community**

The research was conducted on Adedoyin Oshibanjo Street in Bariga, Lagos, which is roughly located at latitude N6°31'48.56761 and longitude E3°24'0.86576. In Lagos State, southwest Nigeria, there is a suburban neighborhood called Bariga that is part of the Somolu local government area. It shares boundaries with the Lagos Lagoon on the east, Mushin Local Government on the west, and the Lagos Mainland and Kosofe Local Government Areas on the north and south, respectively. There is a sizable Yoruba, Igbo, Hausa, and other ethnic group population in this varied community.

**Table 1:** Identified Plastic Polluted Hotspot Areas in Sampled Areas

| Site             | Identified Plastic Polluted Hotspot Areas | Coordinates  |
|------------------|---|--------------|
| Ilaje Community  | a   | 6°31'54.23"N |
|                  |   | 3°24'1.24"E  |
|                  | b   | 6°31'46.79"N |
|                  |   | 3°24'1.79"E  |
|                  | c   | 6°31'35.66"N |
|                  |   | 3°24'1.38"E  |
|                  | d   | 6°31'40.74"N |
|                  |   | 3°24'5.77"E  |
|                  | e   | 6°31'23.45"N |
|                  |   | 3°23'43.71"E |
| Makoko Community | a   | 6°29'42.73"N |
|                  |   | 3°23'9.93"E  |
|                  | b   | 6°29'29.88"N |
|                  |   | 3°23'43.69"E |
|                  | c   | 6°29'41.49"N |
|                  |   | 3°23'42.89"E |
|                  | d   | 6°29'51.90"N |
|                  |   | 3°23'45.92"E |
|                  | e   | 6°30'3.63"N  |
|                  |   | 3°23'41.75"E |

Table 1, lists specific locations within two communities where plastic pollution has been identified. For each site, the table provides the coordinates of multiple hotspot areas labeled from 'a' to 'e'. The coordinates are given in degrees, minutes, and seconds format, indicating the precise locations of plastic pollution within these communities. These hotspot areas have higher concentrations of plastic pollution due to their proximity to waterways, as shown in Plate 1.





**Plate 1:** Sample Map showing the two study sites and hotspot areas around them



## SAMPLING METHODS

### Sampling Design

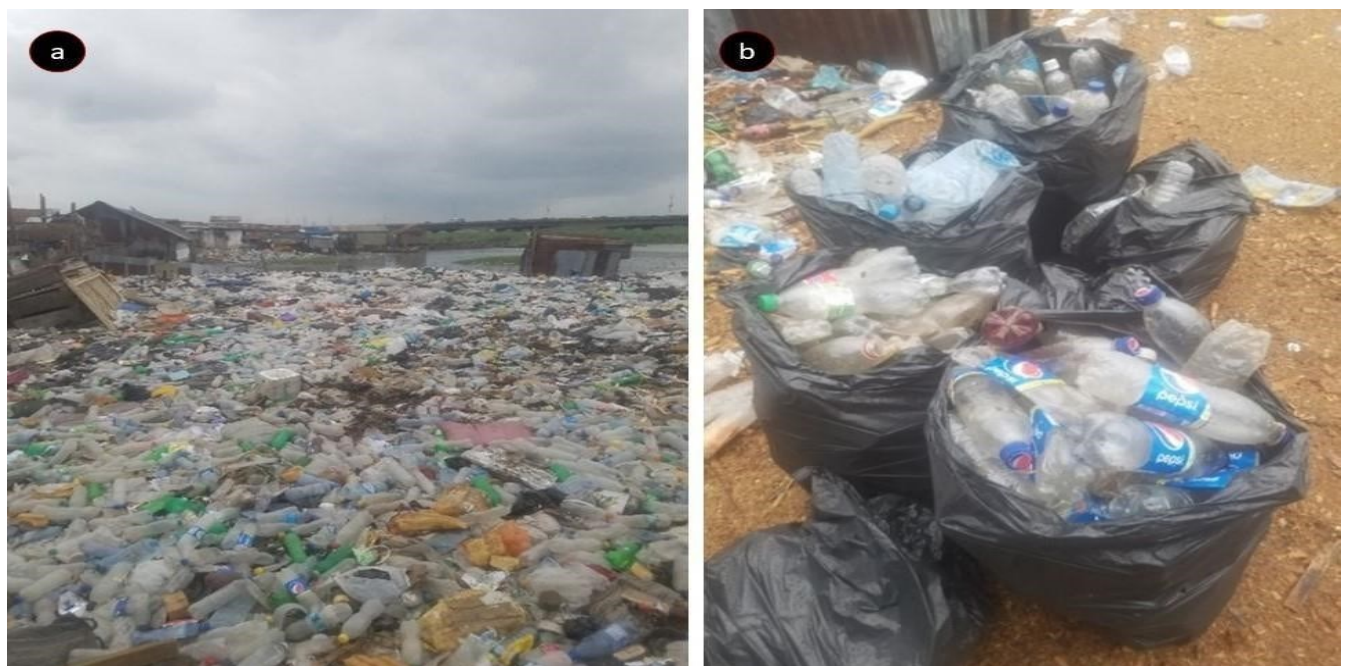
Various plastics were collected randomly at both study sites in bin bags weighing 1kg each. 4 bags of plastics were collected daily for 5 days per site. The total of plastics collected at Ilaje and Makoko were 792 and 708 respectively. These collected plastics were then sorted according to their various types. The plastics were collected from May 2024 during the wet season. To ensure that newer types of plastics were not deposited after the initial sampling period, follow-up visits were conducted at the sites to ascertain this.

### Use of Questionnaires

The primary data of this study were obtained from questionnaires. A total of 200 questionnaires; 100 questionnaires per study site were administered to people living within the vicinity of both sites to access their most used plastic items, their disposal methods of the used plastics, and their level of awareness of plastic pollution and its impact on the environment. To determine the reliability index of the questionnaire for this study, content validity by expert review was done to ensure it comprehensively covers the topic. A pilot test with a smaller sample was conducted to assess the clarity, consistency, and stability of the questions

### Statistical Analysis

The collected questionnaire data was analyzed using Microsoft Excel 2016. This analysis was instrumental in evaluating the quantity and types of plastics used, understanding the disposal methods employed by residents, and assessing the level of awareness regarding plastic pollution issues within the community. The combination of physical sampling and survey data provided comprehensive insights into plastic usage patterns, disposal behaviors, and community perceptions related to plastic pollution in both the Ilaje and Makoko neighborhoods.



**Plate 2:** (a) A section of Ilaje community before the exercise; (b) Plastic waste collected after the exercise in Ilaje Community



**Plate 3:** (a), (d), and (e) plastic collection in Ilaje community; (b) collection and sorting of plastic waste in makoko community; (c) plastics waste found on the water during the exercise in makoko community; (f) plastics waste found on the water during the exercise in Ilaje community



## RESULTS

### DEMOGRAPHY OF THE RESPONDENTS AT MAKOKO

**Table 2:** Demography of the sampled respondents

| Questionnaire Parameters  | Makoko Community | No of Response | Percentage (%) | IlaJe Community | No of Response | Percentage (%) |
|---------------------------|------------------|----------------|----------------|-----------------|----------------|----------------|
| Age                       | 13-20            | 45             | 45.0           | 13-20           | 45             | 45.0           |
|                           | 21-30            | 21             | 21.0           | 21-30           | 25             | 25.0           |
|                           | 31-40            | 25             | 25.0           | 31-40           | 20             | 20.0           |
|                           | 41-50            | 9              | 9.0            | 41-50           | 10             | 10.0           |
|                           | 51 and above     | 0              | 0              | 51 and above    | 0              | 0.0            |
| Sex of Respondents        | Male             | 40             | 40.0           | Male            | 65             | 65.0           |
|                           | Female           | 60             | 60.0           | Female          | 35             | 35.0           |
| Educational qualification | Primary level    | 30             | 30.0           | Primary level   | 35             | 35.0           |
|                           | Secondary level  | 55             | 55.0           | Secondary level | 50             | 50.0           |
|                           | Tertiary level   | 10             | 10.0           | Tertiary level  | 10             | 10.0           |
|                           | Graduate         | 5              | 5.0            | Graduate        | 5              | 5.0            |

In the Makoko community study, respondents' ages ranged from 13 to over 50, with the majority (91%) falling between 13 and 40 years old. This age distribution highlights the significant presence of youth in the community and their key role in shaping its social and economic dynamics. Women represented a higher proportion of respondents (60%), emphasizing important gender dynamics within the community. This suggests the need to explore potential gender-specific challenges or roles that women may face. Additionally, 85% of respondents had completed primary and secondary education, pointing to the community's literacy rates and their implications for individual empowerment, economic participation, and overall development.

The study revealed that 45% of respondents were aged 13-20, 25% were aged 31-40, and no participants were over 50 years old. This demographic breakdown provides insight into the community's age structure, indicating a concentration of youth and young adults in the study population.

In the Ilaje community, two distinct patterns emerged from the survey. In one scenario, female respondents made up 60% of the total, while males accounted for 40%. Additionally, 55% of these respondents had completed secondary education. In a different scenario within the same community, males predominated, representing 65% of the total participants. The educational attainment was comparable to the previous scenario, with a notable portion having finished secondary education. The age distribution revealed that 45% of respondents were in the 13-20 age group, and 20% were in the 31-40 age group. These findings highlight the variability within the community, showcasing different gender distributions and age profiles among the surveyed populations, as detailed in Table 2.

**Responses on Plastics use and disposal**

In the Makoko community, nylons are the most commonly used plastic material, accounting for about 48% of total plastic usage, followed by plastic bottles at 36%. Plastic cups, buckets, and spoons have lower usage rates, with 8%, 6%, and 2% respectively. Conversely, in the Ilaje community, plastic bottles dominate, making up approximately 62% of the total plastic usage, with nylons at 30%. Plastic cups, buckets, and spoons each contribute a similar small percentage of 6%. Although plastic bottles and nylons are the most prevalent types in both communities, their proportions vary as illustrated in Table 3.

**Table 3:** Responses of the most used plastics at Makoko and Ilaje

|                            | Makoko    |                | Ilaje Bariga |                |
|----------------------------|-----------|----------------|--------------|----------------|
| Most used plastic material | Frequency | Percentage (%) | Frequency    | Percentage (%) |
| Plastic bottle             | 36        | 36.0           | 62           | 62.0           |
| Plastic cup                | 8         | 8.0            | -            | -              |
| Plastic bucket             | 6         | 6.0            | 3            | 3.0            |
| Plastic spoon              | 2         | 2.0            | 3            | 3.0            |
| Nylons                     | 48        | 48.0           | 30           | 30.0           |
| Total                      | 100       |                | 100          |                |

In Makoko, 24% of residents recycle and reuse their plastic products, while 26% dispose of their waste by placing it in bins. Alarminglly, 52% of respondents admit to discarding their waste carelessly on the ground. None of the respondents reported burning their plastic waste. In contrast, only 16% of people in the Ilaje community reuse their plastic items, and 47% dispose of their waste in bins.

Additionally, 37% of participants in Ilaje also acknowledge leaving their waste on the floor after use. Similar to Makoko, none of the respondents in Ilaje burn their plastic waste (Table 4).

**Table 4:** Responses on mode of Plastics Disposal at Makoko

| Method of disposal          | Makoko community |                | Ilaje community |                |
|-----------------------------|------------------|----------------|-----------------|----------------|
|                             | Frequency        | Percentage (%) | Frequency       | Percentage (%) |
| Throw into the bin          | 26               | 26             | 47              | 47             |
| Reuse and Re-cycle          | 22               | 22             | 16              | 16             |
| Throw on the floor (litter) | 52               | 52             | 37              | 37             |
| Burn                        | 0                | 0              | –               | –              |
| <b>Total</b>                | <b>100</b>       |                | <b>100</b>      |                |

#### Issues considered to be of Environmental threat facing the study area by the respondents

Data analysis from the Makoko community indicates that 54% of respondents believe the primary issue with plastic usage is that it generates litter, while 24% consider its impact on landfill space to be the main problem. Only 6% link plastic usage to animal deaths, and 16% do not view it as a serious concern. In contrast, in the Ilaje neighborhood, a larger proportion 65% regards litter production as the main issue associated with plastic use, with 20% citing its effect on landfill space. Just 5% of participants connect plastic usage to animal fatalities, and 10% do not see it as a hazard at all (Table 5).

**Table 5:** Responses on biggest concern of plastics pollution at Makoko

| Concerns                     | Makoko community |                | Ilaje Community |                |
|------------------------------|------------------|----------------|-----------------|----------------|
|                              | Frequency        | Percentage (%) | Frequency       | Percentage (%) |
| It Creates Litter Problem    | 54               | 54             | 65              | 65             |
| It Uses Space in Land Fills  | 24               | 24             | 20              | 20             |
| It Can Make Animals Die      | 6                | 6              | 5               | 5              |
| It Is Not a Problem (Threat) | 16               | 16             | 10              | 10             |
| <b>Total</b>                 | <b>100</b>       |                | <b>100</b>      |                |

Table 6 reveals that most respondents in the Makoko area, 77%, do not believe that plastics can cause aquatic species to become entangled or suffocated and eventually die. Conversely, only 23% of respondents think that plastics might pose a threat to marine life in Makoko. Similarly, in the Ilaje region, 71% of respondents share this view, while 29% disagree, believing that plastics can harm aquatic organisms through entanglement and suffocation.

**Table 6:** Perception of Effect of Plastic Debris on Aquatic Organisms

| <b>Can plastic debris cause entanglement? and kill marine organisms</b> | <b>Frequency of Response (s)</b> | <b>Percentage (%)</b> | <b>Frequency of Response (s)</b> | <b>Percentage (%)</b> |
|---|----------------------------------|-----------------------|----------------------------------|-----------------------|
| Strongly agree  | 13                               | 13                    | 14                               | 14                    |
| Agree   | 10                               | 10                    | 15                               | 15                    |
| Disagree  | 47                               | 47                    | 57                               | 57                    |
| Strongly disagree   | 30                               | 30                    | 14                               | 14                    |
| <b>Total</b>  | <b>10</b>                        | <b>100</b>            | <b>100</b>                       | <b>100</b>            |

The majority of individuals, about 92%, are unaware of the amount of plastic they generate annually, while only 8% are informed. In this study, around 62% of respondents do not understand the environmental harm caused by plastic, whereas 28% are aware of its impacts. Additionally, 77% of people do not support waste management organizations like LAWMA in cleaning up waste, while 33% do. Most respondents (94%) believe the government should be responsible for reducing plastic waste in the environment, with only 6% disagreeing. Regarding local initiatives, only 28% of participants support them, while 72% do not. Additionally, 54% of respondents prefer using paper bags, compared to 46% who favor plastic bags (Table 7).

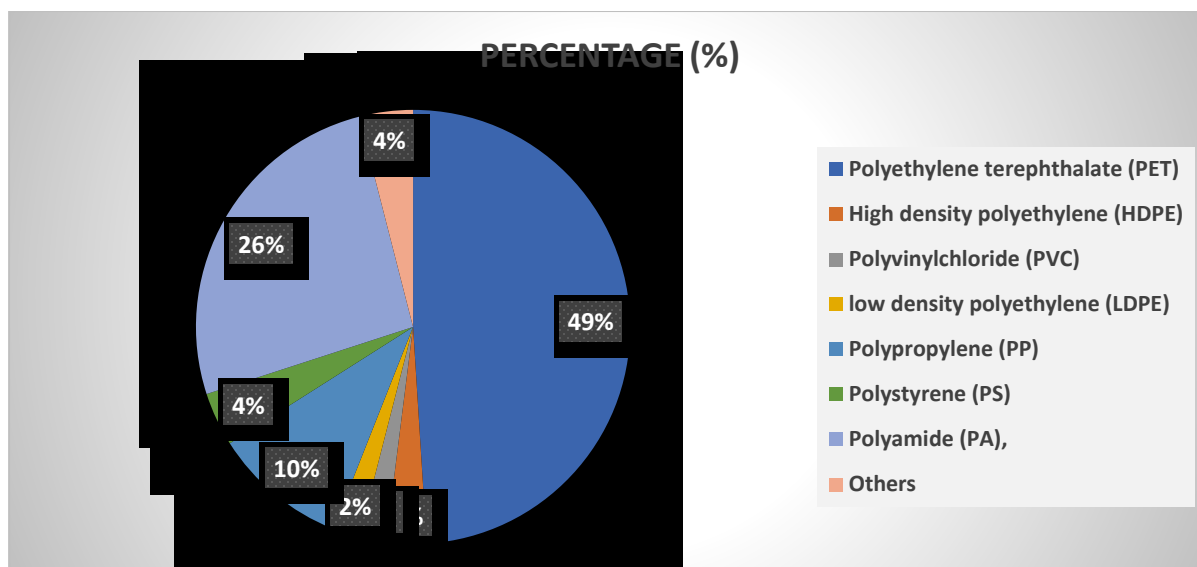
**Table 7:** Responses to the questionnaire as regards to plastics waste management

| <b>Questions</b>   | <b>Yes (%)</b> | <b>No (%)</b> | <b>Yes (%)</b> | <b>No (%)</b> |
|--|----------------|---------------|----------------|---------------|
| Are you aware of how much plastic you generate in a year?                    | 8              | 92            | 14             | 86            |
| Are you aware of the environmental effects' plastic is causing in the world? | 28             | 62            | 23             | 56            |
| Is there a local plastic recycling scheme in your area?                      | 22             | 78            | 36             | 64            |
| Do any waste management authority come to do sanitation here?                | 33             | 67            | 90             | 10            |
| Do you think government should be responsible` to help reduce plastic waste? | 94             | 6             | 64             | 36            |
| Do you prefer to use alternatives such as paper bags?                        | 54             | 46            | 69             | 31            |
| Any campaign to reduce plastic pollution in your area?                       | 28             | 72            | 15             | 86            |



### Distribution and Comparison of plastics types in both study sites

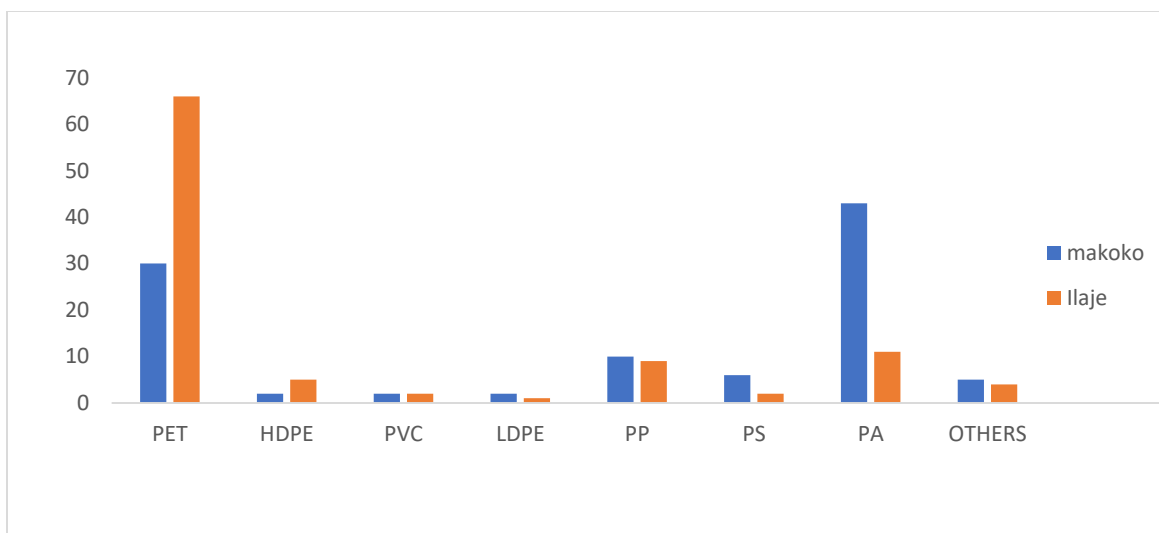
Figure 1 depicts the distribution of different types of plastics observed at both sites. Polyethylene terephthalate (PET) predominates, comprising 49% of the total plastic materials. This is succeeded by polyamide (PA) at 26% and polypropylene (PP) at 10%. Polystyrene (PS) constitutes 4%, with the residual plastics, classified as 'others,' representing 2% of the total.



**Figure 1:** Showing the distribution of the total plastics found on the both sites

Figure 2 illustrates significant differences in the distribution of various types of plastics between the Makoko and Ilaje sites. At Ilaje, polyethylene terephthalate (PET) is the most common plastic, comprising 66% of the total plastics collected. In contrast, PET constitutes only 30% of the plastics at Makoko, indicating a notably higher prevalence in Ilaje. High-density polyethylene (HDPE) is also more prevalent in Ilaje, making up 5% of the plastics, compared to just 2% at Makoko. Both sites have an equal share of polyvinylchloride (PVC), with each site showing 2% of this type of plastic.

Low-density polyethylene (LDPE) is marginally more prevalent in Makoko, comprising 2% of the total plastics, compared to 1% in Ilaje. Polypropylene (PP) is relatively evenly distributed, representing 10% of the plastics in Makoko and 9% in Ilaje. In contrast, polystyrene (PS) and polyamide (PA) exhibit substantial variations: PS constitutes 6% and PA 43% of the plastics in Makoko, whereas PS accounts for only 2% and PA 11% in Ilaje. The 'Others' category comprises 5% of the plastics in Makoko and 4% in Ilaje, suggesting a greater diversity of less common plastics in Makoko. Ilaje demonstrates a higher concentration of polyethylene terephthalate (PET) and high-density polyethylene (HDPE), while Makoko has a larger proportion of miscellaneous plastics. Both sites exhibit similar levels of polypropylene (PP) and polyvinyl chloride (PVC).



**Figure 2:** The comparative analysis of the two study sites

## DISCUSSIONS

The study revealed that polyamide (nylon) was disproportionately prevalent in the Makoko community, accounting for a significant portion of the plastic waste, in contrast to other types such as PET, HDPE, PVC, LDPE, PP, and PS. This finding is consistent with survey responses indicating a strong preference for nylon-based products in the area. Polyamide's dominance can be attributed to its widespread use in packaging, especially for sachet water and wrappers. Nylon is favored due to its affordability, cleanliness, and convenience compared to alternatives like newspapers and natural leaves. This preference is supported by (Le *et al.*, 2024), who highlight the role of low-cost, single-use plastics in coastal pollution. The substantial presence of nylon waste in Makoko is also influenced by disposal practices. Over half of the respondents admitted to improper disposal of their plastic waste, with many littering their used plastics on the ground. This aligns with Ferronato, N., & Torretta, V. (2019), which indicates that inadequate waste management infrastructure often leads to improper disposal and increased pollution. The improper disposal contributes significantly to the accumulation of nylon waste in coastal areas, exacerbating environmental pollution.

The study also highlighted a significant lack of awareness among the Makoko population regarding their plastic waste generation and its environmental impacts. A large proportion of respondents were unaware of the volume of plastic they produce annually and the detrimental effects of plastic pollution. This finding mirrors the results of Omoyajamo et al (2019) on Public Awareness, Knowledge, Attitude and Perception on Microplastics Pollution Around Lagos Lagoon who identify a gap in public awareness as a critical factor in the persistence of plastic pollution. Despite the widespread ignorance, there was strong consensus among respondents that the government should take responsibility for managing plastic waste. This sentiment is reinforced by Rahmandoust, *et al.*, (2023), emphasizing the need for effective governmental intervention in waste management. The study indicates that improved government policies and infrastructure could play a crucial role in addressing the issues identified and reducing plastic pollution.

In contrast, the Ilaje community demonstrated a different plastic waste profile, with PET being the most prevalent type of plastic waste. Plastic bottles, which are commonly used for beverages, were identified as the primary

contributor to plastic waste in Ilaje. This finding is consistent with the research by Thompson *et al.* (2009), which highlights the widespread use of plastic bottles and bags due to their convenience. The difference in plastic waste profiles between Makoko and Ilaje underscores the influence of local consumption patterns and waste management practices. While Makoko shows a higher prevalence of nylon due to its use in wrappers and sachet water, Ilaje's higher PET waste reflects a different set of consumption habits and packaging preferences. This variation is supported by Aligbe (2021), who note that local consumption patterns significantly impact the types of plastics found in waste streams. The findings from both communities highlight the need for targeted waste management strategies and public education campaigns

## CONCLUSION

Pollution has a profound and multifaceted impact on our resources, affecting them in ways that may not be immediately apparent. Despite being an inevitable consequence of our burgeoning population and advancing technology, its detrimental effects on resources are undeniable. Notably, pollution disrupts water quality, jeopardizing the well-being of aquatic ecosystems and hindering the sustainable utilization of water resources. However, with careful management, its adverse effects can be mitigated.

In order to achieve this, the following recommendations are suggested to curb the effects of pollution in the sampled coastal areas.

- Education; making people aware of the problem is the first step.
- Recycling of plastics and restriction of solid waste entry using barriers
- Polluters' Pay Principle: Agreed to by most environmental experts as the best way to tackle pollution.

Whoever causes pollution should have to pay to clean it up, one way or another. It could mean that shoppers should have to pay for their plastic grocery bags, as is been done in some countries to encourage recycling and minimization of waste. The whole scenario calls for concerted efforts by all for a cleaner and safer environment and for the world to be a better place to live.

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