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INVESTIGATION OF MICROPLASTIC CONTAMINATION IN WASTE DUMP SOIL FROM MINNA METROPOLIS IN NIGER STATE AND SCREENING OF INDIGENOUS MICROORGANISMS FOR BIODEGRADATION AS POTENTIAL MITIGATION STRATEGY

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ABSTRACT
The pervasive issue of microplastic contamination has emerged as a critical environmental concern, necessitating comprehensive investigations into their presence and distribution, particularly in terrestrial environments such as dump sites. This study aimed to examine the prevalence and characteristics of microplastics in various dump sites in Minna, analyzing their types, sources, and potential impacts on the environment and human health. Microplastics were extracted and identified through the density separation method. The identified microplastics varied in sizes with Gbeganu area having the smallest size of microplastics (1-5mm), the most dominant colour was white, comprising of fragments and spherical shapes, primarily originating from plastic packaging, textile products, and industrial wastes. *Micrococcus* sp., *Bacillus* sp., *Staphylococcus* sp., and *Pseudomonas* sp. were isolated from the dump sites, However, *Bacillus* sp., *Pseudomonas* sp., and *Micrococcus* sp. exhibited the potential to degrade microplastics with weight loss of 6%. The spectrophotometric analysis revealed 0.069nm to 0.285nm ABS in 0-18 days. Therefore, this investigation underscores the necessity for improved waste management strategies and regulatory measures to mitigate microplastic pollution.

Keywords: Microplastics, Environment, Bacteria, Degradation, soil

INTRODUCTION

A significant portion of solid waste comprises materials produced by human activities that may contain substances of potential value. However, effective waste management practices are essential to ensure the safety of products derived from sewage sludge or municipal solid waste, both for human health and the environment. Globally, the generation of solid waste is on the rise due to several factors. One major factor is population growth, as larger population leads to increased consumption and, consequently, higher waste production. Additionally, rapid urbanization contributes to higher waste volumes because urban centers tend to generate more waste than rural areas due to the concentration of people, roads, industries among others (Edo *et al.,* 2024). Economic growth and industrialization further exacerbate this trend, as they introduce new lifestyles and consumption patterns characterized by higher usage of goods, single-use products, and extensive packaging materials. While developed nations have made considerable efforts to recycle and reduce wastes, the situation is more challenging in developing countries, where infrastructure and waste management systems are often insufficient. Furthermore, climate change and extreme weather events also contribute to waste generation, such as through the release of untreated sewage into water bodies (Glavič, 2021; Edo *et al.,* 2024).

Solid wastes, particularly plastics, is an emergent pollutant in the environment which takes longer time to degrade, these large plastics over time reduce into different sizes as a result of physical, chemical and biological processes which then result in the formation of microplastics (Lyu *et al.,* 2024). Microplastics are plastics smaller than 5 millimeters, they have become an ever-present environmental pollutant, which has caused global concern because of their persistence and potential adverse effect on human health and the ecosystem at large (Zhao *et al.* 2023). This microplastics pose a very significant risks on the environment and human health due to their pervasive nature and potential for bioaccumulation and toxicity (Ghosh *et al.,* 2024). These particles can penetrate soil, water sources and biota, potentially entering the food chain. Recent studies have unveiled that the significant source and reservoir of this contaminants are terrestrial ecosystem especially dump sites (Abdullah *et al.,* 2023).

Dump sites, where waste materials pile up and decompose gives a unique and detailed environment for studying microplastic pollution (Bharath *et al.,* 2024). There is a heterogeneous mixture of industrial, municipal and agricultural waste on such site, which can serve as both source and sink for microplastics. The degradation of large debris of plastics through biological, physical and chemical processes put up to the generation of microplastics (Shi *et al.,* 2023), while the diverse nature of dump sites contributes to their occurrence and movement (Bharath *et al.,* 2024).
Microplastics in dumpsite are usually found near human settlements enabling the potential for microplastic exposure to wildlife, domestic animals and humans. Microplastics can leach from dump sites into water and soil systems and can have an adverse effects on the environment, affecting the quality of water, soil health and food safety (Al Mamun *et al.,* 2023). This research employs a multidisciplinary approach, combining field sampling, laboratory analysis and statistical methods to determine the prevalence microplastics in terrestrial environment. The research was aimed at providing substantial information on the source and type of microplastics in the environment which can positively influence waste management by focusing on the isolation, identification and screening of microplastics degrading bacteria from different dump site in Minna, Niger State.

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MATERIALS AND METHODS

Study Area

The study areas were made up of three different dumpsite locations in Gbeganu, Kpagungu, and Fadikpe, in Bosso Local Government, Niger State, Nigeria. Gbeganu is an area in Minna Niger State covering 16.389 hectares situated along the Minna-Bida expressway. The dump site is located close to a stream in Gbeganu called "Shanu river" running through the South-Western part of the area. This area lies within 227546.056"E, 1061858.331"N and 228471.065"E, 1061331.973"N. Kpagungu is located at latitude 9° 35'55.00" N and longitude 6°32'00.00" E. Fadikpe has a latitude of 9°36'59 N and longitude 6°31'14 E, both having dump sites close to a stream running through the north-eastern part of the area which the residents of the area use that stream for various types of activities such as swimming, bathing, washing, fishing, irrigation farming, source of water for cement-block industries. Some factories are also located very close to that stream. Inhabitants of these places are mostly civil workers, traders, fishermen and farmers. Figure 1 shows the Nigerian Map indicating Niger State (in red colour). It also shows the three locations for this study area (Gbeganu, Kpagungu and Fadikpe).

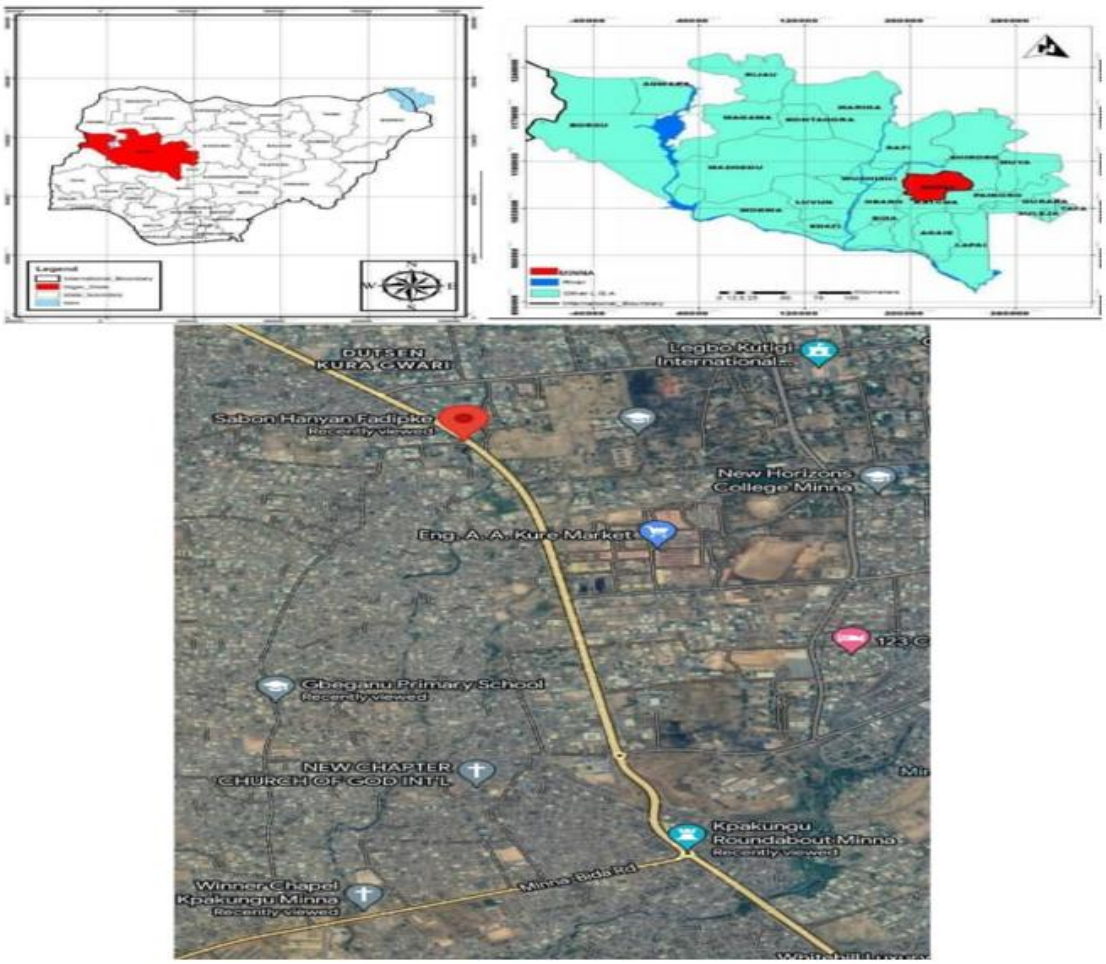

Figure 1: Map of Niger State highlighting the three different sample locations

Collection of Soil Samples

Soil samples (2 kg, per site) were collected 20 meters apart from three different points in each location using a hand auger of 10 cm in diameter and 5 cm in height. The samples were collected from three different depths from 0 - 5 cm, 5 - 10 cm, and 10-15 cm (Themba *et al.,* 2024). Following random sampling technique at three locations within each area ensured representative sampling, with similar samples homogenized to form composite samples. A total of 54 samples were collected (all in triplicates). The samples were transported to the Microbiology Laboratory of Federal University of Technology, Minna for further analysis.

Physicochemical variables

At each site, the temperature (°C), conductivity (µs/cm) pH, moisture content (%), bulk density (g/cm3), total organic carbon (%), and total organic matter (%) were measured using a portable multi-parameter handheld meter.

Preparation of soil samples

All samples were properly cleaned to remove plant roots and other debris, weighed and placed in an oven to dry at 60 °C for 48 hours. The dried samples were sieved using 5 mm sieve mesh to remove larger debris. This was followed by the 2 mm sieve mesh to obtain a coarse sample and the 1 mm sieve mesh to obtain a fine sample

for homogenization (Mbedzi *et al.,* 2020). Samples collected from the sampling sites were evaluated separately for the presence of microplastics.

Extraction of microplastics from soil samples

Density separation

Density separation method was employed for the quantitative analysis of microplastics. The samples were mixed with 30 % w/w NaCl solution with density of 1.2 g/mL and the mixture was stirred for 2 minutes and kept overnight. This was done to facilitate the flotation of low-density plastic particles (Mbedzi *et al.,* 2020). The supernatant was carefully collected into another beaker for the digestion of organic matter.

Dissolution of organic matter

The supernatant was poured into labelled 750 mL clean glass beakers and mixed with 70 mL of 30 % stabilized hydrogen peroxide. (H_2O_2) to facilitate digestion of the soil organic matter over a 24-hour period. The digested mixture was then filtered through a pore size of 1 micrometer to remove H_2O_2 (Barrows *et al.,* 2018). This was followed by the microplastic density separation process using 500 mL of $ZnCl_2$ solution with a density of 1.68 g cm^{-3}. The samples were stirred vigorously to release particles that were trapped between the soil particles and to facilitate suspension in solution. The mixtures were covered to avoid contamination and left to settle overnight (Themba *et al.,* 2024).

Filtration

The mixtures were subsequently filtered through a 2 μm Whatman cellulose membrane filter paper (Themba *et al*., 2024) to separate the microplastics from the liquid. The filtrate and the filter paper were then dried and individually placed in a labelled petri dish for viewing under the microscope (compound Olympus dissecting microscope at x200 magnification). The visible microplastics were sorted out based on the type, size and colour (Nkosi *et al.,* 2023).

Quantitative analysis

Quantitative analysis of microplastic was carried out by counting the number of microplastics with a digital stereo microscope (scmos05000KPB, SCMOS, China) at 20-800 magnification. All microplastics were classified by shape (fragment, fiber, film, and sphere) and color (black, red, green, blue, yellow, white, and transparent), and size (diameter; mm).

Quality control measures

To reduce microplastic contaminants from sampled soil and the risk of microplastics loses from soil samples, procedures recommended by Steiner *et al.* (2024) was followed in which all the equipment used were thoroughly cleaned with pre-filtered deionized water and 35 % ethanol, rinsed and sonicated, dried in an oven and sealed with aluminum foil to avoid contamination. Furthermore, air conditioners in the laboratory were switched off to minimize the potential risk of airborne microplastic contamination. The apparatus used for analysis were devoid of plastic and were covered with aluminum foil. Care was taken to prevent contamination throughout the density separation, filtration, sieving, digestion, transportation, characterization and identification. Laboratory coats were worn by personnel to prevent further contamination during microplastic extraction and microbial isolation. Samples were analyzed in triplicates.

Isolation and identification of bacteria associated with the microplastics

Serial dilution

Six (6) sterile test tubes were filled with 9 ml sterile water, 1 g of the soil sample that contains microplastics was weigh and poured into a test tube containing 9 ml of water, the mixture was stirred and kept in a test tube rack. A syringe was used to collect 1 ml from the mixture and dispensed into the second test tubes, this was done for the rest test tubes. 1 ml from the last test tube was removed to make it even with the rest already containing 9 ml each. The steps were repeated for the other sample locations (Ranjani *et al.,* 2024).

Pour plate method

Two hundred and fifty miles of nutrient agar was prepared in a sterile conical flask. From dilution six (6), 0.1 ml was collected using a sterile syringe and dispensed on a sterile petri dish under aseptic technique. The nutrient agar was dispensed into the petri dish and swirled gently for even distribution and allow to gel. This was repeated for the other sample locations. The plates were labeled appropriately for easy identification and was placed in an Incubator for 24 hours at 37 °C (Aryal *et al.,* 2021).

Subculture

Nutrient agar was dispensed into sterile petri dishes and allowed to gel. A wire loop was flamed and was used to pick a colony of choice from the parent culture into new plate and streaked. The plate was covered and labeled. This process was repeated for other colonies from each location into a new plate containing nutrient agar and was incubated at 37 °C for 24 hours to get pure cultures which was then stored in sterile slant bottles containing nutrient agar for further analysis. All procedures were done under aseptic conditions to avoid contamination (Bruslind, 2021).

Characterization and identification of isolates

The organisms were characterized and isolated using the various biochemical tests according to the method described by Saleem *et al.* (2025).

Screening for plastic degradation

One gram (1 g) of the plastic from the dump sites soil was weighed and dispensed into conical flasks containing 50 ml Mineral Salt Broth. The plastics were meant to serve as a carbon source for the bacteria. This was then autoclaved at 121 °C for 15 minutes at 15 psi for sterilization (Razak *et al.,* 2024) and was allowed to cool to room temperature. A wire loop was used to pick a little portion of the bacterial culture for inoculation into to the Mineral Salt Broth in different conical flasks. These were incubated at 37 °C for the period of 18 days in a shaker incubator. The absorbance was determined using spectrophotometer at every 3 days interval for 18 days. After 18 days, the mineral salt broth was dispensed gently into a bowl and the plastics were removed using gloves to avoid self-contamination. The plastics were washed gently with distilled water and also with 70 % ethanol to remove any bacteria that was attached to the surface, and allowed to dry. A weight balance was used to measure for the residual weight. The percentage weight loss was calculated using the formula:

% Weight reduction = $\frac{wi-wf}{wf}\ x\ 100$

Where *wi* = Initial weight of microplastics (g), and *wf* = residual

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weight of microplastics (g).
The data were further processed to determine the rate constant of microplastic degradation using the First-order Kinetic Model as shown below:

$$\text{Rate constant } (K) = -1/t\left(\ln \frac{wf}{Wi}\right)$$

Where *K* = First-order rate constant for MPs uptake per day, t = time in days, *wf* = Final weight of residual MPs (g), and *wi* = Initial weight of MPs.
Following the generation of the MPs removal rate constant, the Half-Life ($t_{1/2}$) was calculated as shown below:

$$t_{1/2} = \frac{\ln(2)}{k}$$

Where t = time, ln (2) = 0.69, and *K* is the rate constant.

RESULTS

Extraction of microplastics

The plastics were sorted out according to shape (fragment, round, spherical, beads and pellets), colors (blue, green, orange, white, lilac and peach) and sizes (1 mm-7 mm) for each sample location. The total number of plastics gotten from each sample location includes: Kpakungu (154 pieces), Gbeganu (130 pieces) and Fadikpe (200 pieces). Plate 1 shows the extraction processes of the plastics from soil samples to the screening process.

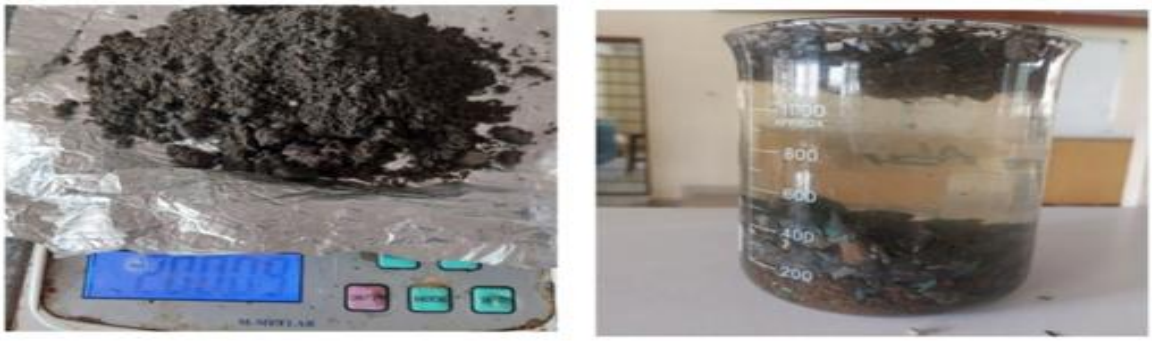

Plate I. Extraction and screening process of plastics from soil sample obtained from three (3) different locations in Minna

Physicochemical parameters of the three dumpsite locations

Table 1: Mean (±standard deviation) of physicochemical variables measured from Fadikpe, Gbeganu and Kpakungu dumpsite
The physicochemical parameters of the three dumpsite which are the pH, Temperature, Moisture Content, Bulk Density, Total Organic Carbon and Total Organic Matter are shown in table 1

Parameters	Fadikpe	Gbeganu	Kpakungu
Conductivity (µs/cm)	151±0.7	121±0.3	132±0.2
pH@25 °C	7.60±0.2	7.90±0.1	7.70±0.1
Temperature (°C)	27.5±0.5	27.1±0.1	26.5±0.3
Moisture Content (%)	1.37±0.5	0.74±0.1	1.06±0.1
Bulk Density (g/cm^3)	2.10±0.3	2.10±0.2	1.96±0.3
Total Organic Carbon (%)	2.49±0.1	2.53±0.4	4.39±0.5
Total Organic Matter (%)	4.47±0.1	4.38±0.2	7.59±0.2

Microplastic abundance

The abundance of microplastics by shape, size and colour was estimated from the 3-sampling locations. The average abundance of microplastics in the soil samples obtained from the 3 sampling locations was 161particles/kg. The highest microplastic abundance was observed in Fadikpe, with 200 particles/kg, while the lowest was at Gbeganu, with 130 particles/kg of soil (Figure 1). The soil sample of Fadikpe showed a relatively high abundance of microplastics compared to the other locations in Kpakungu and Gbeganu. This could be because lots of commercial activities take place in Fadikpe and the high population of residents in the area. Moreover, the area was formally a waste dump site.

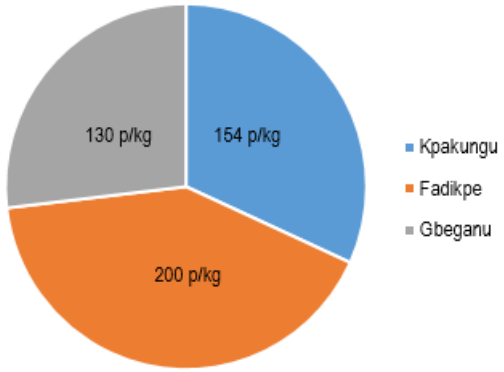

Figure 1: Pie Chat representation of the abundance of microplastics in the 3 sampling locations

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The distribution of microplastics abundance with respect to size in Kpakungu, Gbeganu and Fadikpe is shown in Figure 2. –Figure 4. From the graphs, it is revealed that the size of microplastics particles extracted from the soil samples ranged from 1 - 7 mm in diameter with Gbeganu having the smallest size (1-5 mm).

Figure 5 and Figure 6, present the abundance of microplastics according to their shape, and colour in Gbeganu, Kpagungu and Fadikpe. With respect to their shape, (spherical, and fragments), in all three locations. Fragments were found to be the most abundant microplastics particles with the highest from Fadikpe (120 pieces) and the lowest from Gbeganu (25 pieces). The colour of the microplastics from the 3 sample locations includes: blue, green, white, orange, peach, lilac. The most abundant colour of microplastics were white (120 pieces) while the least colour were orange (5 pieces).

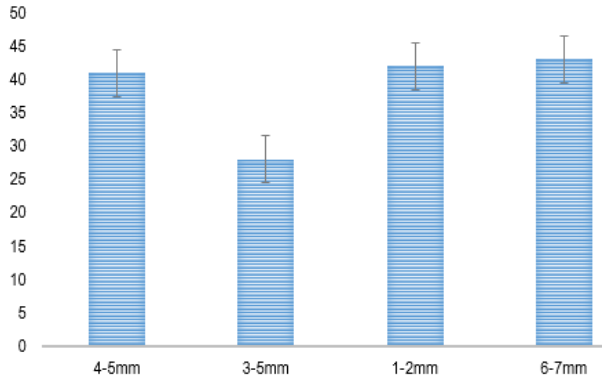

Figure 2: Size distribution of the microplastics from Kpakungu dump Site

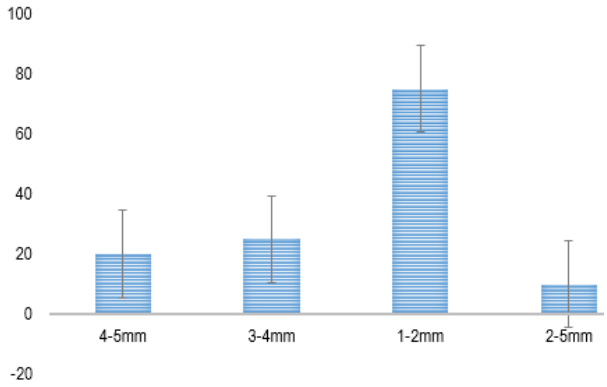

Figure 3: Size distribution of the microplastics from Gbeganu dump site

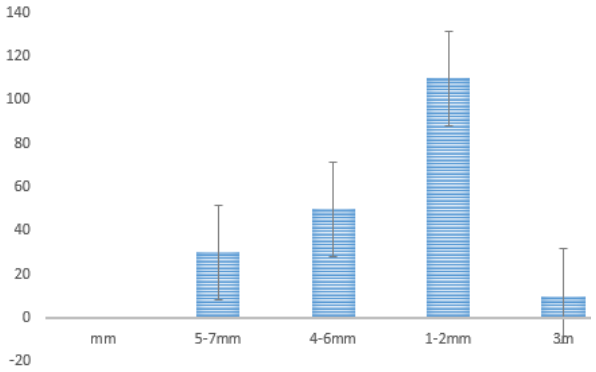

Figure 4: Size distribution of the microplastics from Fadikpe dump site

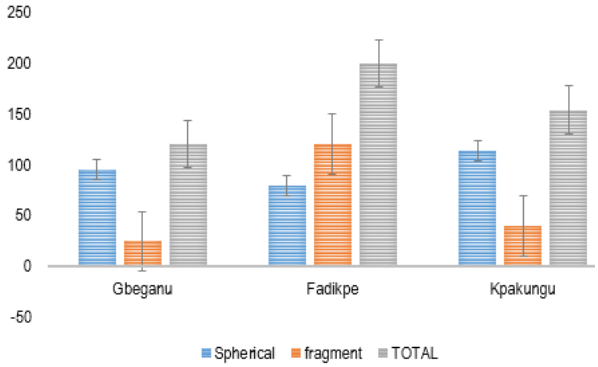

Figure 5: Shape distribution of the microplastics from the three dump site

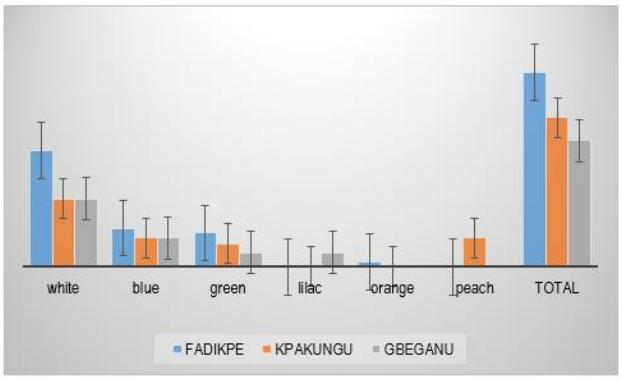

Figure 6: Colour distribution of the microplastics from the three dump site

Isolation of bacteria from soil samples

The bacteria isolates were obtained from the soil samples collected from the three (3) different location of dump sites polluted with plastics (Kpakungu, Gbeganu and Fadikpe) in Minna, Niger State. The samples were brought to microbiology laboratory following aseptic techniques. After plating and incubation was done, observations were made using gram staining method and also it was viewed under the microscope. After studying the microscopic and macroscopic characteristics of the bacteria isolates, it was suspected to be *Staphylococcus* sp, *Bacillus* sp *Pseudomonas* sp and *Micrococcus* sp.

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Table 2: Identification of microplastics degrading bacteria

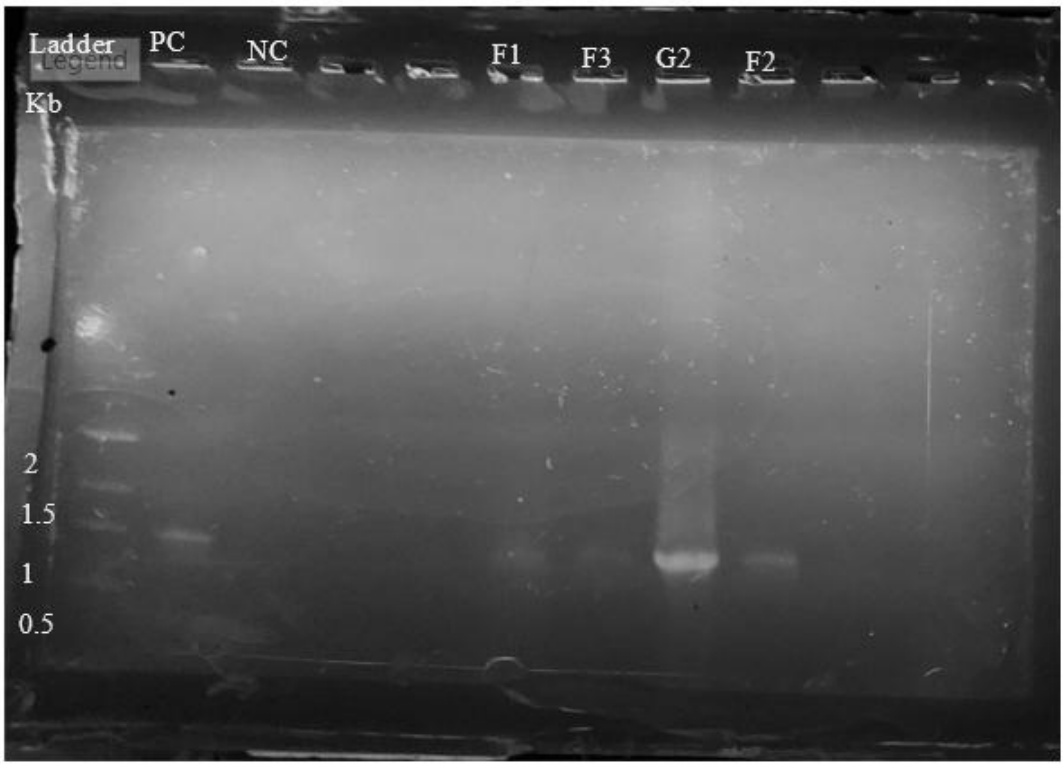
Bacterial isolates	Gram reaction	Shape	CAT	IN	MR	VP	UR	CT	CO	LAC	GAS	M	Suspected organisms
F1	+	Cocci	+	-	-	-	+	-	-	+	-	-	*Staphylococcus sp*
F2	+	Cocci	+	-	-	-	+	-	-	+	-	-	*Staphylococcus* sp
F3	+	Rods	+	-	-	+	-	+	-	-	-	+	*Bacillus* sp
G2	-	Rods	+	-	-	-	-	+	-	-	-	+	*Pseudomonas* sp
G3	-	Rods	+	-	-	-	-	+	-	-	-	+	*Pseudomonas* sp
K1	+	Cocci	+	-	-	+	+	-	-	-	-	+	*Micrococcus* sp
K2	+	Rods	+	-	-	+	-	+	-	-	-	+	*Bacillus* sp

Keys: F1-F3 (microorganisms from Fadikpe)
G1-G3 (microorganisms from Gbeganu)
K1-K2 (microorganisms from Kpakungu)

Table 3: Bacterial DNA concentration and purity

S/N	Samples	[DNA](ng/µL)	A260/280	A230	Suspected Organisms
1	F1	370.4	2.12	2.01	*Staphylococcus sp*
2	F3	10.0	1.71	0.36	*Staphylococcus* sp
3	G2	1914.5	2.09	2.12	*Bacillus* sp
4	F2	22.4	1.51	0.31	*Pseudomonas* sp
5	G3	66.8	2.02	8.48	*Pseudomonas* sp
6	K2	14.9	2.13	-2.23	*Micrococcus* sp
7	K1	102.6	1.89	1.91	*Bacillus* sp

Keys: F1-F3 (microorganisms from Fadikpe)
G1-G2 (microorganisms from Gbeganu)
K1-K2 (microorganisms from Kpakungu)



Keys: F1-F3 (microorganisms from Fadikpe)
G2 (microorganisms from Gbeganu)
PC (Positive Control)
NC (Negative Control)

Plate II: Gel electrophoresis of Organisms Isolated from the sample locations

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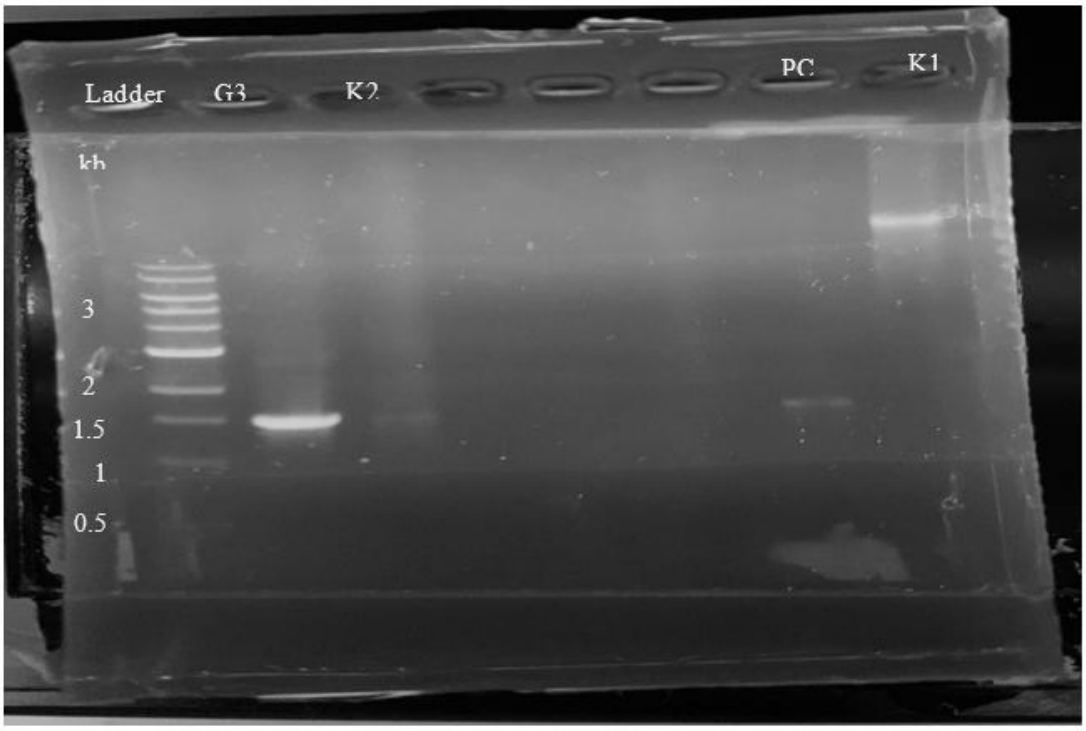

Keys: G3 (microorganisms from Gbeganu)
K1 (Organisms from Kpakungu)
PC (Positive Control)

Plate III: Gel electrophoresis of Organisms Isolated from the sample locations

The Optical density (OD) of the bacteria during the biodegradation studies is illustrated in line graph figure 7. At day 0 the microorganisms have a lag phase, during this phase, bacteria prepare for rapid growth by synthesizing necessary enzymes and adjusting their metabolic pathways. The lag phase typically involves the colonization of microplastic surfaces by microorganisms and the initial breakdown of additives or easily accessible components of the plastic. This phase is characterized by a slow increase in microbial biomass and no significant increase in the optical density (OD) of the culture as they undergo a process of adjustment and adaptation to the new medium.

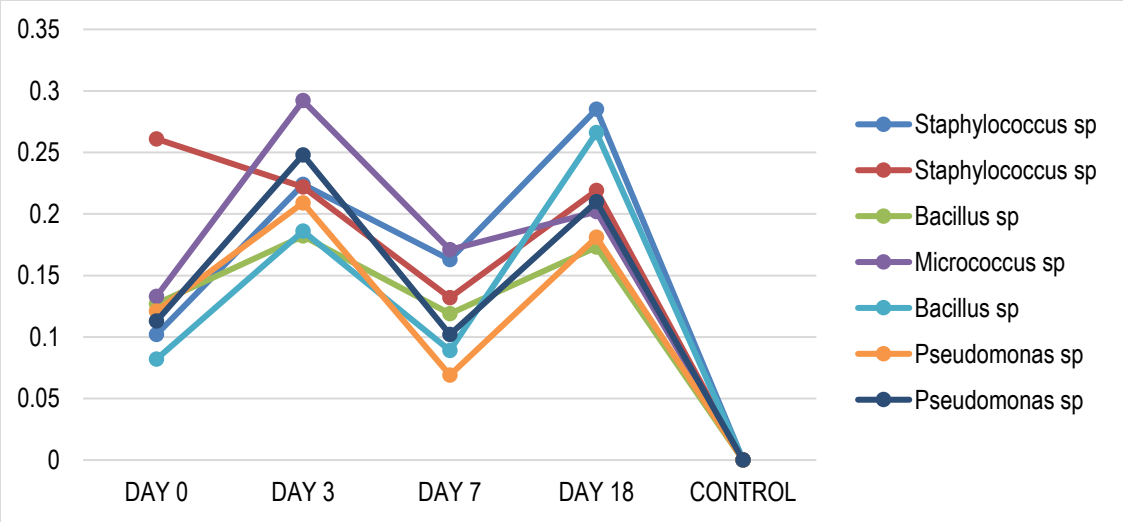

Figure 8: Line graph indicating absorbance of the bacteria done using spectrophotometer

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Table 3: Shows the Weight loss, rate constant and generation time for the suspected organisms

Suspected organisms	Initial weight (g)	Final weight (g)	Weight loss (%)	Rate constant (gram/seconds)	Half-life (days)
Staphylococcus sp	1	1	0	0	0
Staphylococcus sp	1	1	0	0	0
Bacillus sp	1	0.94	6.34	0.0034	202
Micrococcus sp	1	0.97	3.09	0.0017	406
Bacillus sp	1	0.98	2.04	0.00113	611
Pseudomonas sp	1	0.98	2.04	0.00113	611
Pseudomonas sp	1	0.98	2.04	0.00113	611

The weight loss rate of the microplastics by the strains of the potentially efficient microplastics degrading bacteria increase with the increase in the number of days with *Bacillus* sp having the highest percentage of weight loss (6.34%) followed by *Micrococcus* sp (3.09%). A higher rate constant indicates faster biodegradation, *Bacillus* sp has the highest rate constant value (0.0034g/s) followed by *Micrococcus* sp (0.0017g/s) while *Pseudomonas* sp has the lowest rate constant value of (0.00113g/s). The half-life of microplastics during biodegradation by bacteria is a critical parameter that reflects the time required for half of the microplastic mass to be degraded. A shorter half-life indicates faster biodegradation, meaning microplastics are broken down more quickly. This is beneficial for reducing environmental persistence and potential harm, with *Bacillus* sp having the shortest half-life of 202 days and *Pseudomonas* sp has the highest half-life of 611 days.

DISCUSSION

The soil pH was neutral across the three locations which ranges from 7.60±0.2 to 7.90±0.1. Mills (2020) stated that during the decomposition, organic acids may be produced, but these acids are often neutralized by minerals in the waste or the soil beneath the dump, leading to a more neutral pH while the higher temperature was observed in all three locations 26.5±0.3 to 27.5±0.5.Thiscould have been because of the decomposition of organic material which generates a significant amount of heat. This exothermic process leads to elevated temperatures within the waste mass, which can subsequently raise the temperature of the surrounding soil. Research indicates that waste temperatures can exhibit distinct trends in the three locations following the placement of fresh waste layers. A study assessing the effects of different types of plastic incorporation on soil temperature found that microplastics can act as heat retainers, potentially leading to adverse impacts on soil microbial activity(Zhao *et al.,* 2021).The low moisture content observed is due to high temperature and the type of waste disposed at the dumpsites, mostly composed of dry materials like plastics, papers, and textiles with low moisture content (Peter *et al.,* 2019).Fadikpe and Gbeganu have higher bulk density than Kpakungu, this indicates that more waste is being disposed of in both Fadipke and Gbeganu than Kpakungu dumpsite. Kpakungu dumpsite has the highest total organic carbon (4.39±0.5) this implies that the location has more organic materials being disposed of at that location than the other two dumpsites as this result correlates with the total organic matter of the Kpakungu dumpsite which was also higher (7.59±0.2) compared to the two locations.

The size of microplastics plays and important role in their interaction with the biotic environment and a long-term threat to the ecosystem. The size of microplastics with the highest distribution across the three dumpsite is between 1-2 mm suggesting larger microplastics in dumpsite. It can also be inferred that due to continuous degradation of the large microplastic particle, smaller secondary particles are being generated (Upadhyay *et al*., 2021). Larger microplastics are found in refuse which are then reduced because of environmental degradation to smaller microplastics in leachate. The dominant shapes of microplastics found in the dumpsites were fragment and microbeads which also conforms with the work of (Upadhyay *et al.,* 2021). The colour of microplastics is useful in determining the potential of microplastics as well as potential contamination. The abundance of microplastics in terms of colour were white which is similar with the work of Sholokhova *et al.* (2023).

The presence of microplastics in the three waste dumpsite soils is a significant environmental concern that could pose a detrimental threat to the environment as their presence could change the water retention capacity of the soil thereby, making it more susceptible to drought and flooding. The microplastics present could also leach harmful chemicals such as heavy metals, plasticizers, and flame retardants into the soil, and disrupt microbial communities.
Microplastics in the dumpsite soil can be absorbed by plants, entering the food chain through crops consumed by both humans and animals. Livestock that graze on contaminated soil may ingest these microplastics, leading to potential health risk. The microplastics in the dumpsite soil could also be transported by rain and erosion into nearby rivers, groundwater, and lakes, increasing aquatic pollution. Contaminated groundwater can spread the plastic particles to wider ecosystems and to drinking water supplies. Unlike organic matter, microplastics do not degrade easily and can persist in the soil for years, where they can accumulate, making cleanup efforts challenging and costly.

The results of this study have shown that the different dumpsites have different bacterial load caused by the volume of waste dumped at these sites; and this goes to show that dumpsites are naturally endowed with diverse species of microbes. Microorganisms play an important role in the degradation of plastic. Microbial communities Aggregates on the solid surface resulting in the formation of biofilm (Sooriyakumar *et al.,* 2022). Abiotic, chemical and physical properties of the polymer, determines the degree of the degradation process (Van Sebille *et al.,* 2015). In the depolymerization process, two (2) types of enzymes are involved actively, i.e. intracellular and extracellular depolymerases. During the process of degradation, Exo-enzymes from the microorganisms breaks down complex polymer into smaller molecules of short chain, such as dimmers, monomers, and oligomers, which are smaller, thereby enabling it to pass through the semipermeable

outer membrane of the microbes, and then utilised as carbon and energy sources. Bacteria serves a primary function of colonization which lures other organisms such as diatoms, fungi, etc. which leads to the desorption, absorption and fragmentation of polymer chain (Li *et al.,* 2024).

In this study, the suspected bacteria isolates were *Staphylococcus* sp, *Bacillus* sp, *Micrococcus* sp and *Pseudomonas* sp. It was observed that *Staphylococcus* sp, *Bacillus* sp and *Pseudomonas* sp had the highest level of occurrence, while the least level of occurrence was *Micrococcus* sp. About 90 microbial genera were reported to degrade plastics due to the fact that microbial community composition varies in regions (Chee *et al.,* 2010). Reports on polyethylene degradation shows that, *Pseudomonas* sp formed most viscous and flocculent biofilms on the surface among other species in the period of three weeks. It was assumed that the bacteria selectively utilized the basal nutrients when they got depleted in the polyethylene medium thereby acting on the plastics as their source of nutrient. *Pseudomonas* sp. strain accounted to 20% weight loss of polyethylene test in 120 days (Yang *et al.,* 2014). Another report by Lv *et al*. (2024) *Pseudomonas* sp accounted for 21 % when compared to other different bacteria genera associated with plastic degradation. However, this report was in contrast with the results obtained from this study as the weight loss of *Pseudomonas* sp was 2.04% in 18 days. Another report revealed that PE biodegradation by *Pseudomonas* sp. could be achieved by the modulation of hydrophobic interactions, thereby resulting in an increased bacterial attachment and formation of biofilm thereby increasing polymer degradation (Yang*et al.,* 2014; Lou *et al.,* 2020).

Pseudomonas sp, accounted for 20 % weight loss of microplastics during the biodegradation process other bacterial species were also found to be effective in the degradation process of plastics which also depends on isolation sites, this aligned with the work of Pikoli *et al.* (2022). Though in this study *Bacillus* sp has the highest percentage of weight loss of 6.34% this also indicates that microorganisms isolated from landfill has the potential for degrading microplastics.

Conclusion

Despite profound efforts to limit the use of dumpsite, dumpsite remain the most popular method to handle solid wastes. The abundance and characteristics of microplastics varied across different regions. Microbeads and fragments are the most dominant microplastic shapes. Degradation and fragmentation of microplastics seem to generate secondary microplastics in dumpsite. Microorganisms isolated from dumpsite has the capability of microplastics degradation which can be utilized as an ecofriendly mitigation strategy for these emergent pollutants. Hence, it is very essential to keep assessing and monitoring the surroundings of dumpsites.

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