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Levels Of Polycyclic Aromatic Hydrocarbons in Apparanbie Creek, Niger Delta, Nigeria, Nine (9) Years After Chronic Pollution

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Abstract- ***This study levels of polycyclic aromatic hydrocarbons in Apparanbie Creek, Niger Delta, Nigeria, 9 years after chronic pollution was conducted in November, 2025. A randomized block experimental design was used. Composite soil samples were collected from three (3) sampling stations and were analyzed for polycyclic aromatic hydrocarbons (PAHs) using standard laboratory method. Sediment analysis revealed detectable levels of PAHs at all sampling stations, demonstrating the persistence of hydrocarbon contamination despite the time elapsed since pollution. Station A recorded the highest sediment PAH concentration (6452.961 mg/kg), followed by Station B (4706.071 mg/kg), while Station C recorded the lowest PAH concentration (2925.477 mg/kg). The study underscores the need for continued monitoring, effective pollution control, and active restoration strategies to enhance long-term recovery of mangrove ecosystems in the Niger Delta***

Index Terms- Polycyclic, Aromatic, Hydrocarbons.

I. INTRODUCTION

Background of the Study

PAHs are persistent organic pollutants composed of multiple fused aromatic rings. They are hydrophobic, resistant to degradation, and can accumulate in sediments for long periods, posing long-term ecological risks to mangrove vegetation and associated organisms (Zabbey *et al*., 2017). Chronic exposure to PAHs has been linked to reduced mangrove growth rates, altered species composition, and delayed ecosystem recovery.

Apparanbie Creek, located within the Niger Delta, experienced prolonged exposure to petroleum-related pollution in the past, resulting in significant mangrove degradation. However, following reduced pollution pressure and natural attenuation processes, signs of vegetation regrowth have been observed over the years. Evaluating the recovery of mangrove ecosystems after pollution is essential for understanding ecosystem resilience, guiding restoration efforts, and informing environmental management policies (Alongi, 2020). This study, therefore, analysis the sediment PAH contamination levels.

Statement of the Problem

The Apparanbie creek was subjected to chronic pollution due to artisanal crude oil refinery activities (Gijo and Alagoa, 2023). Even after nine years, the crude oil is still persistent in the creek. Hence, this research was conducted to evaluate the levels of these polycyclic aromatic hydrocarbons in the sediments of the creek.

Scope of the Study

This study is limited to Apparanbie Creek in the Niger Delta region of Nigeria. The research focuses on the analysis of polycyclic aromatic hydrocarbons (PAHs) concentration in sediment samples as indicators of residual petroleum pollution.

Aim and Objectives of the Study

The aim of this research is to assess the levels of polycyclic aromatic hydrocarbons (PAHs) in the sediments of Apparanbie creek, Niger Delta, Nigeria. The specific objective of the study is:

1. To determine the levels of polycyclic aromatic hydrocarbons (PAHs) in the sediments of Apparanbie creek.

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II. MATERIALS AND METHODS

Study Area

This study was carried out in Apparanbie Creek, Niger Delta, Nigeria. The Niger Delta lies approximately between latitudes 4°30′–6°30′ N and longitudes 5°00′–8°00′ E and represents one of the largest wetland ecosystems in Africa.

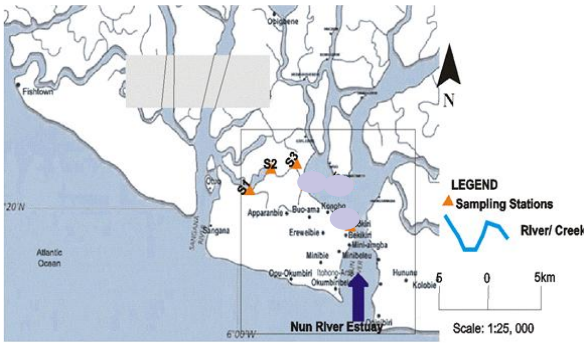

Figure 1: Map of the Study Area.

Description of Sampling Stations

Sampling station 1

This sampling station was established close to a defunct artisanal refinery established in Apparanbie Creek around Apparanbie community. The Global Positioning System (GPS) coordinates of station 1 are N4^{0}21'35.3484" and E6^{0}1'46.9128". The site currently has red mangrove vegetation. Composite soil samples were collected for analysis.

Sampling station 2

Sampling station 2 is situated adjacent to sampling station 1, in Apparanbie creek. The sampling station is located on latitude of N4^{0}21'54.4212" and a longitude of E6^{0}2'7.5804".

Sampling station 3

This sampling station was established on one of the defunct makeshift oil refineries in Apparanbie Creek. The GPS coordinates of this sampling station are latitude N4^{0}21'44.5644" and longitude E6^{0}2'20.2272". Composite soil samples were also collected here for analysis.

Sample Colllection

A randomized block experimental design was used during this study. Composite sediment samples were collected from three sampling stations (Station A, Station B, and Station C). At each sampling station, sediment samples were collected using a soil auger at a depth of 0-15 cm, representing the biologically active zone of mangrove sediments. Samples were placed in pre-cleaned polythene nylon, transferred into labeled airtight containers, and stored in a refrigerator to minimize chemical alteration. All sampling equipment was thoroughly cleaned between stations to prevent cross-contamination.

Laboratory Analysis of Polycyclic Aromatic Hydrocarbons (PAHs)

The extracted samples were analyzed using Gas Chromatography (GC) equipped with a flame ionization detector for the quantification of PAH compounds.

III. RESULTS

Sediment Polycyclic Aromatic Hydrocarbon (PAH) Concentrations

The concentrations of polycyclic aromatic hydrocarbons (PAHs) in sediment samples collected from the three sampling stations are presented in Table 4.3. The results indicate that Station A recorded the highest sediment PAH concentration (6452.961 mg/kg), followed by Station B (4706.071 mg/kg), while Station C recorded the lowest PAH concentration (2925.477 mg/kg).

Table 4.3: Sediment PAH Concentrations at the Sampling Stations

STATION/PAHs	STATION 1 (mg/kg)	STATION 2 (mg/kg)	STATION 3 (mg/kg)	MEAN & STAND. DEV.
Naphthalene	198.869	318.799	205.249	240.972±67.474
Acenapthylene	752.252	--	586.959	446.404±388.276

Acenapthene	594.143	1054.319	352.211	666.891±354.120
Fluorene	-	--	--	--
Anthracene	873.746	727.648	317.128	639.507±290.678
Phenanthrene	452.154	881.193	211.876	515.074±337.207
Anthracene	--	173.453	487.133	220.195±245.712
Pyrene	526.547	416.317	--	314.288±276.404
Benzo (a) anthracene	794.130	274.572	473.425	514.043±261.192
Chrysene	812.146	192.132	291.197	431.825±332.083
Benzo (b)fluoranthene	--	--	--	--
Benzo(k) fluoranthene	774.658	374.463	--	383.040±387.361
Benzo(a) pyrene	--	293.175	--	97.725±169.228
Indeno(1,2,3-cd) pyrene	674.315	--	--	224.772±389.257
Dibenz(a,h) anthracene	--	--	--	--
Benzo(g,h,i)prylene	--	--	--	--
TOTAL	6452.961	4706.071	2925.477	

IV. DISCUSSION

Sediment analysis revealed the continued presence of PAHs across all sampling stations, with the highest concentrations recorded at Station A and the lowest at Station C. The persistence of PAHs nine years after pollution highlights the long-term retention of hydrocarbons in mangrove sediments, particularly under anaerobic conditions that slow microbial degradation (Zabbey and Uyi, 2022). Although the recorded PAH levels were lower than those reported for severely polluted sites, their presence remains ecologically significant, as even low concentrations of PAHs can exert chronic toxic effects on mangrove roots and associated microbial communities.

V. CONCLUSION

The study has shown that the polycyclic aromatic hydrocarbons (PAHs) are persistent in the sediments of Apparanbie creek even after nine (9) years.

VI. RECOMMENDATIONS

Based on the findings of this study, the following recommendations are proposed:

1. Strict Pollution Control and Enforcement:
Environmental regulations governing oil exploration, transportation, and waste disposal should be strictly enforced to prevent future petroleum spills and illegal refining activities within the creek and its surroundings.

2. Sediment Remediation Measures:
Active remediation of contaminated sediments, such as bioremediation and phytoremediation, should be implemented in heavily impacted areas to accelerate hydrocarbon degradation and improve sediment quality.

REFERENCES

[1] Alongi, D. M. (2015). The impact of climate change on mangrove forests. Current Climate Change Reports, 1(1), 30–39.

[2] Alongi, D. M. (2020). Global significance of mangrove blue carbon in climate change mitigation. Science, 349(6250), 1327–1332.

[3] Gijo A. H. and Alagoa K. J. (2023). The concentration of heavy metals in the sediments of the river nun estuary, around Akassa, Niger Delta, Nigeria. Int. Res. J. Biological Sci. Vol. 12(1), 10-15.

[4] Zabbey, N., & Uyi, H. (2022). Mangrove ecosystem recovery following oil pollution in the Niger Delta: Implications for management. *Ocean & Coastal Management*, 221, 106110.

[5] Zabbey, N., Sam, K., & Onyebuchi, A. T. (2017). Remediation of mangrove forests impacted by oil spills in the Niger Delta.

Environmental Science and Pollution Research, 24, 2946–2958.