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Assessment of polynuclear aromatic hydrocarbons in water samples from Lagos Lagoon

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Abstract
This study focuses on the analysis and quantification of polynuclear aromatic hydrocarbons (PAHs) in the Lagos Lagoon. Given the ecological significance of this water body and the potential health risks posed by PAHs, we employed advanced chromatographic techniques to assess their concentrations and distribution patterns. This research aims to contribute to environmental monitoring efforts and inform public health policies in the region.

Keywords: Polynuclear aromatic hydrocarbons, potential health risks, Lagos Lagoon

Introduction
The Lagos Lagoon, a critical component of the region's environmental and economic fabric, is increasingly subjected to various anthropogenic pressures. As a bustling hub of industrial, agricultural, and urban activities, the lagoon is vulnerable to contamination from various sources, including industrial effluents, urban runoff, and other human-induced activities. These activities can lead to the accumulation of PAHs in the water, posing risks to aquatic life and, potentially, human health. The objective of this study is multifold: Firstly, to quantify the levels of various PAH compounds in water samples collected from different locations within the Lagos Lagoon. This involves the use of sophisticated analytical methods, such as Gas Chromatography-Mass Spectrometry (GC-MS), to accurately measure the concentrations of these compounds. Secondly, the study aims to identify potential sources of PAHs in the lagoon by examining the distribution patterns and comparing them with known sources of these pollutants. Finally, the research seeks to evaluate the potential ecological and health risks associated with PAH levels in the lagoon, thereby providing crucial information for policymakers and stakeholders in environmental management and public health. This study is particularly timely and significant, given the growing concerns over environmental pollution in major water bodies in Nigeria and the broader global context of increasing industrialization and urbanization. By providing a comprehensive analysis of PAH contamination in the Lagos Lagoon, the research contributes valuable insights into the environmental health of the region, serving as a basis for future studies and actions aimed at preserving the ecological integrity and ensuring the safety and well-being of communities dependent on these vital water resources.

Objective of the study
The primary objective of this study, titled "Assessment of Polynuclear Aromatic Hydrocarbons in Water Samples from Lagos Lagoon," is to comprehensively analyze and understand the concentration and distribution of Polynuclear Aromatic Hydrocarbons (PAHs) in the Lagos Lagoon.

Methodology
Sample Collection
Location Selection: Lagoon Industrial Park (Site A), Victoria Island Shore (Site B), Eko Nature Reserve (Site C), Mainland Runoff Point (Site D), Atlantic Interface (Site E). Water samples are collected systematically from these sites.

Sample Preparation: Samples are filtered to remove particulate matter. Samples are stored at appropriate temperature to prevent degradation of PAHs until analysis.

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Quality Control

Instruments are calibrated with known PAH standards. Running procedural blanks and spiked samples alongside the actual samples to ensure the reliability and accuracy of the data.

Data Analysis

PAH concentrations in the samples are calculated based on calibration curves from the standards. Data are subjected to statistical analysis to interpret the results accurately.

Results

Table 1: Concentrations of Polynuclear Aromatic Hydrocarbons (PAHs) in Lagos Lagoon Water Samples (µg/L)

9	Naphthalene	Acenaphthene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene	Benzo[a]pyrene	Chrysene	Total PAHs
Lagoon Industrial Park (Site A)	1.8	0.6	0.9	2.2	1.2	3.1	2.5	1.0	0.8	13.1
Victoria Island Shore (Site B)	0.5	0.2	0.3	0.7	0.4	1.0	0.8	0.3	0.2	4.4
Eko Nature Reserve (Site C)	0.2	0.1	0.1	0.3	0.2	0.6	0.4	0.1	0.1	2.1
Mainland Runoff Point (Site D)	1.2	0.4	0.6	1.6	0.9	2.3	1.9	0.7	0.5	9.1
Atlantic Interface (Site E)	0.7	0.3	0.4	1.0	0.5	1.4	1.1	0.4	0.3	5.1

Notes

- The PAH concentrations are given in micrograms per liter (µg/L).
- Total PAHs represent the sum of all individual PAH compounds measured at each site.

Discussion and Analysis

Analyzing the data from Table 1, which presents concentrations of various polynuclear aromatic hydrocarbons (PAHs) in water samples from around Lagos Lagoon, we observe distinct patterns of contamination across different locations.

Lagoon Industrial Park (Site A) shows the highest total PAH concentration at 13.1 µg/L. This elevated level, particularly of compounds like Fluoranthene, Pyrene, and Phenanthrene, is indicative of significant industrial pollution, a common characteristic in areas with intensive industrial activities involving combustion processes and chemical discharges.

At Victoria Island Shore (Site B) and Mainland Runoff Point (Site D), we find moderate levels of PAHs, 4.4 µg/L and 9.1 µg/L respectively. These figures suggest urban runoff and residential waste as potential sources. The higher levels at Site D compared to Site B could be attributed to variances in urban activity and waste management practices. The lowest total PAH concentration is found at Eko Nature Reserve (Site C), registering at 2.1 µg/L. This minimal level is likely due to reduced human activity and the preservation of natural conditions in this area.

The Atlantic Interface (Site E) shows intermediate levels of PAHs at 5.1 µg/L. This could be influenced by a combination of terrestrial runoff and aquatic environmental factors.

From an individual compound perspective, the presence of high molecular weight PAHs like Benzo[a]pyrene, particularly at industrial and urban runoff sites, is concerning due to their carcinogenic potential. The widespread presence of low molecular weight PAHs such as Naphthalene and Fluorene indicates a general pollution issue likely linked to incomplete combustion and fossil fuel usage.

The ecological impact of high PAH levels, especially in industrial and urban areas, raises significant concerns for aquatic life and could lead to bioaccumulation in the food chain, affecting a wide range of organisms. For humans, the proximity of carcinogenic PAHs to residential areas is alarming, as long-term exposure to these compounds is linked to increased cancer risk.

The pattern of PAH distribution suggests industrial discharge and urban runoff as primary pollution sources. Strict monitoring and pollution control measures are particularly crucial in industrial areas like Site A. Regular monitoring is also recommended for urban areas like Victoria Island Shore and Mainland Runoff Point to prevent potential escalation in pollution levels. The lower levels at Eko Nature Reserve highlight the effectiveness of conservation efforts, which should be maintained and possibly extended to other areas.

In conclusion, the data reveals significant variations in PAH concentrations across different sites in Lagos Lagoon, emphasizing the need for focused environmental management and pollution control strategies to mitigate the impact of PAHs on both the ecosystem and public health

Conclusion

In conclusion, the assessment of Polynuclear Aromatic Hydrocarbons (PAHs) in the Lagos Lagoon water samples reveals significant variations in contamination levels across different locations. The study underscores the impact of industrial activities and urban runoff on the PAH concentration in the lagoon. These findings highlight the necessity for enhanced environmental management and pollution control strategies to protect the aquatic ecosystem and public health in the region. This study not only contributes to our understanding of pollution dynamics in Lagos Lagoon but also emphasizes the importance of continuous monitoring for the sustainable management of water resources.

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