Assessment and Distributions of Phthalates Esters (PAEs) in Groundwater at Gbagi General Market in Ibadan

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Being a MSc Thesis Presentation Submitted to the Department of Chemical Sciences, Faculty of Natural and Applied Sciences, Lead City University, Ibadan, Oyo State, Nigeria

In Partial Fulfillment of the Requirements for the Award of Master of Science Degree (MSc) in Environmental and Analytical Chemistry

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Certification

This is to certify that **Bayonle Bukunmi OPALADE** with matric number **LCU/PG/006540** carried out this research work titled "**Assessment and Distributions of Phthalates Esters (PAEs) in Groundwater at Gbagi General Market in Ibadan**" in the Department of Chemical Sciences (Chemistry Unit), Faculty of Natural and Applied Sciences, Lead City University, Ibadan, Oyo State for the award of Master Degree (MSc) in Environmental and Analytical Chemistry and that this work has not been previously submitted.

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(Head of Department)

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Dedication

This work is dedicated to God Almighty for making all my endeavors a success.

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Without the research facilities offered by the Faculty of Natural and Applied Sciences at Lead City University Ibadan, my research could not have been completed.

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Even though the above-mentioned institution and persons have assisted in the process of this research work, I alone stand responsible for the errors, if any found in the work.

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Abstract

Phthalate esters (PAEs) are emerging contaminants widely used in plastics and consumers products. Their persistence, bioaccumulation potential, and endocrine disrupting properties pose significant risks to environmental and human health. This study assessed the concentrations, spatial distribution, and associated health risks of selected PAEs in groundwater around Gbagi General Market, Ibadan, Nigeria. A total of 8 groundwater samples were collected and analyzed using High-performance liquid chromatography (HPLC). The targeted PAEs includes diethyl phthalate (DEP), dibutyl phthalate (DBP), benzyl butyl phthalate (BBP), dimethyl phthalate (DMP), and di-(2-ethylhexyl) phthalate (DEHP). Results showed that DEHP had the highest mean concentration of 5.73 µg/L, followed by DBP at 2.65 µg/L, BBP at 1.12 µg/L, DEP at 0.07 µg/L, and DMP at 0.03 µg/L. Several samples exceeded the World Health Organization's permissible limit for DEHP in drinking water (8 µg/L), with one sample recording as high as 12.8 µg/L. Spatial analysis revealed contamination hotspots near plastic waste dumps and drainage channels within the market. The cancer risk assessment revealed that although the estimated carcinogenic risks (CR) for both adults and children were within the acceptable range defined by (USEPA) threshold of 1×10^{-6} to 1×10^{-4}, children exhibited higher lifetime cancer risks compared to adults. DEHP a known probable human carcinogen, was the dominant contributor to the overall cancer risk, primarily through oral ingestion. This study demonstrates the significant chemical burden posed by PAEs in urban groundwater, likely due to improper plastic waste disposal and intense commercial activity. The findings call for urgent regulatory intervention, improved market sanitation, and public awareness. It also provides essential baseline data for environmental health surveillance and supports development of policies targeting groundwater safety in Nigeria's commercial centers.

Keywords: Phthalates, Bioaccumulation, Persistence, groundwater, Gbagi Market.

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List of Acronyms

Abbreviation	Meaning
AT	The Average Lifespan
BW	The Body Weight
C	The Concentration of the Pollutant in Water
CDI	The Chronic Daily Intake
ED	The Exposure Duration
GC	Gas Chromatography
HPLC	High-Performance Liquid Chromatography
LC	Liquid Chromatography
HQ	The Hazard Quotient
IR	The Water Ingestion Rate
LOD	Limit Of Detection
LOQ	Limit Of Qualification
PAEs	Phthalate Esters
BBP	Benzyl Butyl Phthalate
DAP	Diallyl Phthalate
DBP	Dibutyl Phthalate
DIBP	Diisobutyl phthalate
DiDP	Diisodecyl Phthalate
DiNP	Diisononyl Phthalate
DMEP	Bis(2-methoxyethyl) Phthalate
DMP	Dimethyl Phthalate
DnOP	Di-n-octyl Phthalate

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DNP	Dinonyl Phthalate
DnPP	Di-n-pentyl Phthalate
DOP	Dioctyl Phthalate
DPhP	Di(2-propylheptyl) Phthalate
DPP	Di-n-propyl Phthalate
DPrP	Dipropyl Phthalate
DBEP	Dibutoxy Ethyl Phthalate
DCHP	Dicyclohexyl Phthalate
DEEP	Diethoxyethyl Phthalate
DEHA	Di(2-ethylhexyl)Adipate
DEHP	Di(2-ethylhexyl)Phthalate
DEP	Diethyl Phthalate
DHP	di-n-hexyl Phthalate
DHxP	dihexyl Phthalate
DMPP	di(4-methyl-2-pentyl) Phthalate
EDCs	Endocrine Disrupting Chemicals
EPA	Environmental Protection Agency
PAEs	Phthalate Esters
TPMBP	tris(2-methylbutyl) Phosphate
R	The Carcinogenic Risk
RF	The Exposure Frequency
RfD	The Reference Dose Of The Contaminant
SF	The Slope Factor
WHO	World Health Organization

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