Co-occurrence and Exposure Assessment of Parabens and Heavy Metals in Groundwater Sources in Two Rural Communities in Nigeria

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Certification

This is to certify that Oluwakemi Abiola AKINTOBI with matric number LCU/PG/002351 carried out this research work titled "Co-occurrence and Exposure Assessment of Parabens and Heavy metals in Groundwater Sources in Two Rural communities in Nigeria" 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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Ighodaro O.M (Ph.D.)
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Date

Dedication

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

Acknowledgement

I humbly acknowledge the Management of Lead City University and Chemical Science Department.

My thanks go to my mentor and able supervisor Dr. Olumuyiwa Ogunlaja for his patience, encouragement, monitoring, proof-reading and tutoring. I appreciate my HOD, Dr. O.M Ighodaro and also to all my Lecturers and the Laboratory Technologists in the Department of Chemical Science, Lead City University for their guidance and tutelage. I equally salute the non-academic staff.

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

Abstract

The constant release of contaminants of emerging concern (CEC) such as parabens and heavy metals into groundwater systems is becoming of great concern due to their numerous negative effects on plants, human and animal health since groundwater is a major source of water supply. In this study, ten (10) randomly selected groundwater sources from two communities were investigated for the concentrations of parabens and heavy metals. Preparation of samples for parabens was done using Solid Phase Extraction (SPE) while analysis was carried out on LC-UV. Instrumental analysis was carried out for heavy metals using Perkin Elmer Inductively Coupled Plasma-Optical Emission Spectrometry optima 8000 (ICP-OES), Shimadzu. The trend of total concentrations of parabens was EtP < PrP < MeP < BuP with values ranging from 30.14 to 400.08 µg L^{-1}. The toxicity of parabens to aquatic organisms was in the order algae < fish < daphnia. In addition, the concentrations of heavy metals such as Fe, Al, Co, Cr and Pb were observed to exceed WHO permissible limits of 0.3, 0.2, 0.01, and 0.05 mg L^{-1}. Furthermore, human health risk assessment data revealed that target carcinogenic risk (TCR) values for heavy metals in children and adults were higher than the permissible limit of 1.0×10^{-4} and were in the order of Ni > Cr >Pb. Conclusively, the human health assessment results from this study revealed that consuming water from these sources is not safe for the dwellers of both communities.

Keywords: Groundwater, Parabens, Heavy metals

Word Count: 240

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List of Acronyms

Abbreviation	Meaning
ICP-OES	Inductively Coupled Plasma Optical Emission Spectroscopy
SPE	Solid Phase Extraction
HPLC-UV	High-Performance Liquid Chromatography- Ultra-Violet Spectroscopy
HQ	Hazard Quotient
HI	Hazard Index
WHO	World Health Organization
USEPA	United States Environmental Protection Agency
UL	Upper Intake Level
CDI	Chronic Daily Intake
RDA	Recommended Daily Allowance