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MATRIC NUMBER: CHE/21/3498

DEPARTMENT: CHEMISTRY

SPECIALIZATION: ANALYTICAL/FORENSIC CHEMISTRY

THESIS TITLE: FORENSIC INVESTIGATION AND EVALUATION OF HOSPITAL WASTE IMPACT ON WATER AND SOIL IN SELECTED LAGOS HOSPITALS

Abstract

The environmental and health risks of deficient hospital medical waste management, notably storage rule underpublicized. Hospital waste, with its complex composition, poses significant threats to ecosystems and human health. This study assesses pharmaceutical contamination of soil and water near four hospitals, correlating it with their compliance with Medical Waste Storage Rules.

Thirty-five water and sixteen soil samples, including controls, were collected from four hospitals, adhering to strict sampling protocols. Samples represented near-waste and distant reference sites for comparison, while considering seasonal variations. Water and soil samples were analyzed for pH, temperature; Dissolved Oxygen (DO), Total Dissolved Solids (TDS), electrical conductivity, moisture content, organic matter, trace metals (Cd, Cr, Ni, Mn, Pb, Cu, Zn), and pharmaceutical residues (Ciprofloxacin, Paracetamol, Bromazepam). The research design incorporated preliminary surveys and Global Positioning System (GPS) mapping. In-situ measurements and analyses for physical parameters, Atomic Absorption Spectroscopy (AAS) for metals, High Performance Liquid Chromatography (HPLC) for pharmaceutical residues) were conducted. Data obtained underwent descriptive (standard deviation, charts, tables, maps) and inferential (correlation, regression, Tukey's, ANOVA with $p < 0.05$) analyses. Pathogen identification after isolation relied on morphological and biochemical traits. Soil organic matter and moisture were quantified via loss on ignition and oven-dry methods, respectively.

Contamination mapping proximal to waste storage exhibited elevated indices for water pH, DO, temperature, trace metals, and pharmaceutical residues. Also, the contamination index (Cd) in water was notably high across the four hospitals. Pharmaceutical residue analysis detected Ciprofloxacin ($8.73 \pm 10.40 \mu\text{g/ml}$) and Bromazepam ($2.47 \pm 3.88 \mu\text{g/ml}$) at levels not significantly different from WHO standards, while Paracetamol ($3.49 \pm 1.75 \mu\text{g/ml}$) was significantly higher than the recommended WHO limit. Water samples exhibited extremely low DO levels ($< 2 \text{ mg/L}$), elevated trace metal concentrations, including Cd ($0.069 - 0.159 \text{ mg/L}$), Cr (0.026 mg/L), Ni ($0.297 - 0.388 \text{ mg/L}$), and Pb ($0.936 - 0.995 \text{ mg/L}$), with a contamination factor > 100 . The pH was consistently acidic ($4.33 - 6.46$), and temperatures were high ($25.7 - 35.8^\circ\text{C}$). A positive correlation ($r = 0.015$) was observed between groundwater pH and stagnant water puddles. TDS values were lower than WHO limits. Soil quality assessment across the four hospitals indicated no statistically significant trace metal contamination, with concentrations of Zn ($1.44 - 6.51 \text{ mg/kg}$), Pb ($0.65 - 0.66 \text{ mg/kg}$), Cd (0.011 mg/kg), and Cu ($0.003 - 0.03 \text{ mg/kg}$). However, electrical conductivity varied widely ($224 - 3,522 \mu\text{S/cm}$), indicating potential salinity concerns. The soils were consistently acidic (pH $5.5 - 6.5$), with temperature and moisture content fluctuating significantly and organic matter $< 2\%$. All four locations showed pharmaceutical contamination, with Ciprofloxacin ($15.03 \pm 6.53 \text{ mg/kg}$), Bromazepam ($128.06 \pm 54.19 \mu\text{g/ml}$), and Paracetamol ($142.85 \pm 93.41 \mu\text{g/ml}$) at significantly higher levels than WHO standards. This study revealed hospital waste storage sites as significant public health hazards due to improper handling, adversely affecting both populace and ecosystem. Stringent enforcement of medical waste regulations across Lagos State health facilities is crucial to mitigate environmental and health risks, including soil and water pollution.