ISSN(O): 2320-5407 | ISSN(P): 3107-4928
International Journal of Advanced Research
Publisher's Name: Jana Publication and Research LLP
www.journalijar.com
ISSN NO. 2320-5407

REVIEWER'S REPORT

Manuscript No.: IJAR-55403

Title: POLLUTION AND HEALTH RISKS RELATED TO HEAVY METAL CONTAMINATION OF WATER RESOURCES IN THE KOKO RIVER WATERSHED IN THE CITY OF KORHOGO (NORTH OF CÃ"TE D\'IVOIRE)

Recommendation:
Accept as it is

Rating	Excel.	Good	Fair	Poor
Originality		√		
Techn. Quality			√	
Clarity		√		
Significance		√		

Reviewer Name: Dr. Manju M

Date: 23-12-2025

Detailed Reviewer's Report

1. Background and Need for the Study
Surface waters in northern Côte d'Ivoire are increasingly affected by urban growth, agriculture, and artisanal mining. These activities release trace metals into rivers through runoff and wastewater discharge. Heavy metals persist in aquatic environments and can bioaccumulate in living organisms. Since surface water is widely used for drinking and irrigation, contamination poses serious risks. Assessing metal pollution is therefore essential for protecting ecosystems and human health.

2. Rationale for Selecting the KOKO River System
The KOKO River and its tributaries flow through Korhogo city and receive diverse anthropogenic inputs. Urban settlements, agricultural lands, and informal waste disposal contribute pollutants. Artisanal mining activities in nearby areas further intensify metal inputs. Seasonal rainfall enhances metal transport into surface waters. These factors make the KOKO River an ideal site for pollution assessment.

3. Geographical and Climatic Features of the Study Area
Korhogo lies in northern Côte d'Ivoire and experiences a tropical climate. Distinct rainy and dry seasons influence river flow and contaminant dilution. During rainfall, surface runoff transports metals into water bodies. Reduced flow during dry seasons may increase metal concentration. These climatic conditions strongly affect surface water quality dynamics.

4. Importance of Surface Water for Local Communities
Surface water from the KOKO River is used for domestic, agricultural, and recreational purposes. Local populations rely on it for drinking, bathing, and irrigation. Contamination directly threatens public health and food safety. Agricultural use may also introduce metals into crops. Hence, water quality evaluation is critical for community wellbeing.

ISSN(O): 2320-5407 | ISSN(P): 3107-4928

International Journal of Advanced Research

Publisher's Name: Jana Publication and Research LLP

www.journalijar.com

REVIEWER'S REPORT

5. Selection of Trace Metals for Investigation

Eight trace metals—Hg, As, Cd, Cr, Cu, Ni, Pb, and Zn—were selected for analysis. These metals are common pollutants in urban and mining-affected regions. Some are essential nutrients at low levels but toxic at higher concentrations. Others, such as Pb, Cd, and Hg, are non-essential and highly toxic. Their assessment provides a comprehensive pollution profile.

6. Toxicological Significance of Selected Metals

Lead, cadmium, and mercury are known for severe neurological and renal toxicity. Arsenic, chromium, and nickel are associated with carcinogenic effects. Copper and zinc, though essential, can cause health problems at elevated levels. Chronic exposure may lead to long-term diseases. Understanding their concentrations is vital for risk evaluation.

7. Sampling Design and Collection Period

Surface water samples were collected from the KOKO River and four tributaries in July 2019. Sampling during the rainy season captured maximum runoff influence. A Niskin bottle was used at 15 cm depth to represent surface conditions. Multiple sites ensured spatial coverage. This design enhanced data representativeness.

8. Sample Preservation and Handling Procedures

Strict protocols were followed to avoid contamination during sampling. Samples were immediately acidified with nitric acid to stabilize dissolved metals. Acidification prevented adsorption and precipitation of metals. Samples were stored at 4°C prior to analysis. These measures ensured sample integrity and accuracy.

9. Analytical Methods for Metal Determination

Metal concentrations were analyzed using an atomic absorption spectrophotometer (HACH DR 6000). Calibration was carried out using certified standard solutions. The method provided high sensitivity for trace-level detection. Analytical procedures followed international standards. This ensured reliable and reproducible results.

10. Spatial Distribution of Trace Metals

Metal concentrations varied among sampling locations, reflecting different pollution sources. Tributaries showed distinct contamination patterns compared to the main river. Hg, As, Cd, Cr, Cu, Ni, and Zn remained relatively low. Lead consistently showed elevated concentrations. Spatial variation highlighted localized anthropogenic impacts.

11. Comparison with WHO Drinking Water Standards

Measured metal concentrations were compared with World Health Organization guidelines. Most metals complied with permissible limits, indicating acceptable quality. Lead concentrations exceeded WHO standards at all sites. Elevated Pb levels raise serious health concerns. Guideline comparison helped identify priority pollutants.

12. Identification of Pollution Sources

Agricultural runoff containing fertilizers and pesticides contributes trace metals. Artisanal mining introduces mercury and lead into surface waters. Domestic wastewater and solid waste dumping increase contamination. Vehicular emissions near roads also add lead. These combined sources influence water quality.

ISSN(O): 2320-5407 | ISSN(P): 3107-4928
International Journal of Advanced Research
Publisher's Name: Jana Publication and Research LLP
www.journalijar.com

REVIEWER'S REPORT

13. Heavy Metal Pollution Index (HPI) Assessment

HPI was used to evaluate overall heavy metal contamination. All calculated HPI values were below the critical value of 100. This indicates low cumulative metal pollution. Despite elevated Pb, overall contamination remained limited. HPI provided a simplified pollution overview.

14. Heavy Metal Evaluation Index (HEI) Results

HEI values for all sites were below 10, indicating low pollution levels. HEI reflects cumulative metal concentrations relative to standards. The results confirmed limited overall metal stress. However, HEI does not reflect individual metal toxicity. Therefore, health risk analysis was necessary.

15. Water Quality Index (WQI) Evaluation

WQI values were below 50 at all sampling locations. This classification indicates excellent surface water quality. WQI integrates multiple parameters into a single value. It is useful for general water assessment. However, it may mask toxic metal risks like lead.

16. Human Exposure Pathways Considered

Health risk assessment focused on ingestion and dermal contact routes. These pathways are relevant for drinking, bathing, and recreational use. Both adults and children were evaluated separately. Children were considered more vulnerable. Exposure parameters followed standard risk models.

17. Non-Carcinogenic Risk Assessment Methodology

Non-carcinogenic risks were evaluated using hazard quotient and hazard index. HQ values were calculated for individual metals and exposure routes. HI represented combined risk from multiple metals. Values below 1 indicate acceptable risk. This method assessed potential health effects.

18. Non-Carcinogenic Risks from Most Metals

Hg, As, Cd, Cr, Cu, and Ni showed HI values below 1. This suggests low probability of adverse non-carcinogenic effects. Both adults and children were within safe limits. Dermal exposure posed minimal risk. These metals currently present limited health concern.

19. Non-Carcinogenic Risks Associated with Pb and Zn

Pb and Zn exhibited HI values exceeding 1 in both age groups. Ingestion contributed more to risk than dermal contact. Tributaries showed higher risk levels than the main river. Continuous exposure may affect neurological and metabolic functions. These metals require immediate attention.

20. Carcinogenic Risk Assessment Approach

Carcinogenic risks were assessed for As, Cd, Cr, Ni, and Pb. Risk values were calculated using standard slope factors. Acceptable limits range from 10^{-6} to 10^{-4}. Values above this range indicate potential cancer risk. This assessment identified long-term health threats.

21. Carcinogenic Risks in Children

Children exhibited higher carcinogenic risk values than adults. Ni, Cd, and Cr exceeded acceptable limits in all samples. Lead ingestion also posed significant cancer risk. Higher intake rates and lower body weight increased vulnerability. Children face serious long-term health implications.

22. Carcinogenic Risks in Adults

ISSN(O): 2320-5407 | ISSN(P): 3107-4928
International Journal of Advanced Research
Publisher's Name: Jana Publication and Research LLP
www.journalijar.com

REVIEWER'S REPORT

Adults showed elevated carcinogenic risks mainly from Ni and Cr. Cadmium ingestion also posed potential cancer risk. Although lower than in children, risks remain concerning. Prolonged exposure may intensify health effects. Risk reduction strategies are essential for adults.

23. Environmental and Public Health Implications

Despite low pollution indices, health risk assessments revealed serious concerns. Lead and carcinogenic metals pose significant long-term threats. Surface water should not be used untreated for domestic purposes. Integrated pollution control strategies are required. Continuous monitoring is essential.

24. Study Objectives, Scope, and Significance

The study evaluated traces metal distribution, pollution indices, and health risks in surface waters. It focused on eight toxic metals and key exposure pathways. Seasonal variation and ecological risks were beyond the scope. Findings provide baseline data for policymakers. The study supports improved water management and public health protection.