



ASSESSMENT OF HEAVY METALS CONCENTRATION IN THE WATER OF RUMUOLUMENI CREEK, RIVERS STATE, NIGER DELTA NIGERIA

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Abstract

This research was aimed at assessing the concentration of heavy metals in water of Rumuolumeni Creek. Sampled stations established were four and water samples were taken for the period of three months (January to March 2022). Instrument used for the analysis of heavy metal concentration in water were Atomic Absorption Spectrophotometer (AAS) model AA320N. ANOVA was used to calculate mean and standard deviation while statistical significance was assessed at 0.05 probability level using Turkey tests. The result of heavy metals concentration in water showed that Zn 2.078 ± 0.583 to 2.229 ± 0.626 mg/l, Pb 0.01 ± 0.08 to 0.16 ± 0.13 mg/l, Cu 5.04 ± 1.13 to 6.75 ± 1.18 mg/l, Ni 0.01 ± 0.01 to 0.02 ± 0.01 mg/l. The results were compared with other researcher's previous work. The results shows signs of contamination in Zn and Ni while Pb and Cu showed signs of pollution, so it is recommended that Rumuolumeni Creek is not safe for aquatic lives and people making use of the water from the creek, it is necessary to apply pollution control measures immediately to avoid farther extinction of aquatic lives and damager of health issues for those bathing the water and fishing in the creek.

Keywords: Heavy metals; water; Pollution; Rumuolumeni Creek.

INTRODUCTION

Heavy metals are natural part of the earth's crust. In modern times, anthropogenic source of heavy metal pollution has been introduced into the aquatic ecosystem through industrial activities. Heavy metals can enter a water body through industrial and consumer's wastes or even from acidic rain breaking down soils and releasing heavy metals into streams, lakes, rivers and ground water (Raymon et al., 2011). For the purpose of this research, we are concentrating on four (4) heavy metals. These are Lead (Pb), Nickel (Ni), Zinc (Zn), and Copper (Cu).

Lead (Pb) is one of the nonessential trace elements that are toxic to aquatic lives at elevated concentrations. Lead is rarely found in its elemental state (Pb⁰) in nature, but more commonly occurs in its monovalent (Pb¹⁺), divalent (Pb²⁺), and tetravalent (Pb⁴⁺) states (Lai, 2010). All soluble compounds of lead are poisonous, the toxic effect increases as solubility increases, solubility of lead increases with acidic of the medium, therefore acidified streams and lakes due to leaching or rain would magnify a lead poisoning of aquatic life. (Annabi et al., 2013).

Large amount of lead exposure may lead to blood anaemia, severe stomach ache, muscle weakness and brain damage. Lower levels of exposure may affect a child's mental and physical growth leading to learning disabilities and seizures (Ideriah et al., 2012). Lead poisoning affect every part of the body's organ system especially the nervous system, bones, teeth, kidneys, cardiovascular immune and reproductive system (Obasi & Akudinobi, 2020). Hearing loss and tooth decay have been linked to lead exposure as well as cataracts.

Nickel is a chemical element with the symbol (Ni) and atomic number 28, found in period 4 and group 10. It is released into the air by power plants and trash incinerators, it settles to the ground after reacting with raindrops, part of the waste water stream can also end up in surface water containing nickel (Opaluwa et al., 2012). Human get exposed to nickel via breathing polluted air, eating nickel contaminated food and drinking nickel contaminated water or smoking cigarettes. One can as well as get exposed through the use of jewelries (singare & Sidky, 2012).

Copper is found at low concentrations in most marine, estuaries and freshwater. Copper is an essential trace element requiring by most aquatic organism, but the concentrations are not much higher than those that allow optimum growth of algae. Copper stimulates growth of some of the aquatic organism like chlamydomonas spp, it is generally assumed that the free hydrated copper ion (Cu^{2+}) together with copper hydroxyl species are the most toxic inorganic substance to aquatic organism, copper is readily accumulated by plants and animals (Agamy, 2012). Bioconcentration factors ranging from 100- 26,000 have been recorded for various species of fishes, copper can be toxic to some sensitive fish species and is highly toxic to many in vertebrate species, even for more tolerant species, chronic copper used, can damage gills, kidneys, Spleen and also depress the immune system (Siti et al., 2018).

Zinc is a chemical element with the symbol Zn and atomic number 30. Zinc is a slightly brittle metal at room temperature and has a silvery-greyish appearance when oxidation is removed. It is the first element in group 12 and belongs to period 4 of the periodic table. A zinc deficiency will increase the following problems, such as delayed growth in children, a loss of appetite, changes in taste, a higher risk of infections, fertility problems, diarrhea, problems with wound healing, eye and skin lesions, problems with thinking (Alougi 2010).

MATERIALS AND METHOD

Description of Study Area : The investigation of this study took place at Runuolumeni Creek of Obio/Akpor local government area of Rivers State, Nigeria. Runuolumeni community is one of the communities in Obio/Akpor local government area in Ikwerre land, Rivers State. It is an industrial area made of oil companies, full of business activities, and sand dredging. It can be assessed through Wimpey road to Tombia water-side, Rivers State, Nigeria. Runuolumeni Creek is located between latitude 4.8 08916N and longitude 6.92 8917E. The creek is part of new Calabar River; it has linked to Choba River and Bonny Estuarine (Vincent-Akpu & Nwachukwu, 2016). The primary occupation of Runuolumeni indigenes are farming and fishing. The community creek serves mainly for fishing, sand dredging and route for traveling to other neighboring communities. The creek is dominated by red mangroves (*Rhizophora racemosa*), little species of black mangrove (*Avicennia germinans*), and white mangrove (*Laguncularia racemosa*). 65% of Runuolumeni Creek is made up of brackish water, mangrove swamps and mangrove Forest (Anaero-Nweke et al., 2018). Some of the

indigenous youths of Runuolumeni community involved themselves into buying and selling of illegal refined crude oil in the creek. This business led into oil spill on the water surface of the creek.

Sample Stations

In Rumuolumeni Creek, four sampling stations were established and coordinate of the stations were taken with hand-held GPS equipment, Gramin extrex. The map was plotted using the coordinate of each station (Figure 3.1)

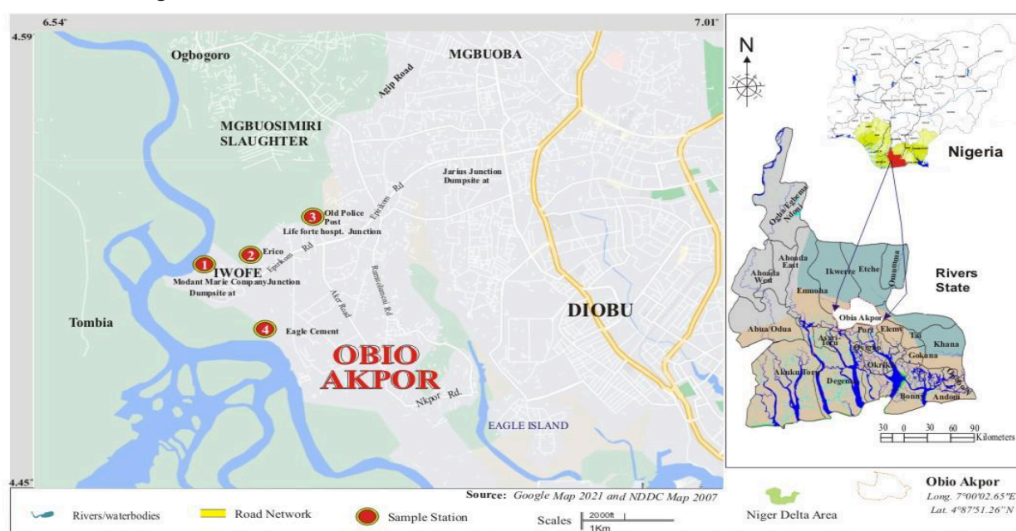


Figure 3.1 Map showing sampled stations of Rumuolumeni Creek

Water Sample Collection

Water samples were collected at about 4 to 5cm depth below the water surface from four (4) stations in well labelled 50Cl plastic container, and were kept in a cooler filled with ice block before transporting it to the laboratory for analysis.

Laboratory Analysis

Heavy Metal Analysis of Water Samples

Thoroughly mixed samples were taken in an evaporating silica dish and acidified to methyl orange concentration, 5ml concentration of H_2SO_4 , and HNO_3 was added, 2mL of H_2O_2 was added also to reduce chromate (if any). Mixed samples were evaporated by 10ml of water and mixed with 5m concentration of HNO_3 with the purpose to transfer into 125ml conical flask. The content was not allowed to dry during digestion. 1-2 ml of concentrated HNO_3 was further added to dissolve the remaining residue, and a few glass beads were also added to prevent bumping, and 50ml of distilled water was added. Solution was boiled to dissolve the solids and then filtered through the sintered glass crucible. The filtrate was transferred to a 100ml volumetric flask and made up to the mark with distilled water. Atomic Absorption Spectrophotometer was used to analyze the concentration of heavy metals with hollow cathode lamps of different metals and a flame of air-acetylene. The calibration curves were constructed using standard solution of the metal ions by following the procedure given in

the manual using appropriate detectors in the wavelength range suitable for the concentration range. The calibrations are precise and accurate as demonstrated.

Data Analysis

The result of the samples was analyzed using origin-pro version 9.9.0.225 package. Analysis of variance (ANOVA) was used to calculate the mean and standard deviation, statistical significance were assessed at 0.05 probability level using Turkey tests.

RESULT

The result of this study was presented in Table 1 and 2 respectively.

Table 1 Variation of Heavy Metal Concentrations in Water Samples from Rumuolumeni Creek. Mordant marine to Eagle cement.

Station	Heavy metal concentrations in water			
	Zinc (Zn)	Lead (pb)	Copper (Cu)	Nickel (Ni)
Mordant marine	^B 2.375±0.151	^B 0.10±0.02	^B 5.26±0.81	^D 0.01±0.00
Erico 2	^D 1.466±0.100	^{BC} 0.07±0.02	^A 7.76±0.81	^C 0.01±0.00
Old police post	^C 2.001±0.135	^C 0.04±0.01	^B 4.58±1.02	^B 0.01±0.00
Eagle cement	^A 3.124±0.209	^A 0.21±0.07	^B 5.31±0.84	^A 0.03±0.00
P ≤	0.001	0.001	0.001	0.001

Superscripts with the same alphabet are not significantly different (Tukey tests, p<0.05)

Table 2. Monthly Variation of Heavy Metal Concentration in Water Samples from Rumuolumeni Creek January to March 2022

Month	Heavy metal concentration in water samples			
	Zinc (Zn)	Lead (pb)	Copper (Cu)	Nickel (Ni)
January	^A 2.229±0.626	^A 0.01±0.08	^{AB} 5.46±1.51	^A 0.01±0.01
February	^A 2.078±0.583	^A 0.13±0.10	^B 5.04±1.13	^A 0.01±0.01
March	^A 2.423±0.680	^A 0.16±0.13	^A 6.75±1.18	^A 0.02±0.01
P=	0.414	0.334	0.009	0.472

Superscripts with the same alphabet are not significantly different (Tukey tests, p<0.05)

DISCUSSION

Water cannot be separated from the human life and daily activities, due to its importance to the human life. Water is said to be an aspect or part of living organisms including humans. Water is needed in homes/agricultural activities, industries, e.t.c. This importance of water is what led into investigation to know how healthy water in this creek can be.

The investigation of the studies carried out on heavy metal concentrations in water by Davies & Ekeperusi (2021) at new Calabar River in Southern Nigeria and report of Ekpote et al., (2019) at Silver River, Southern Ijaw, Bayelsa State Nigeria, shows significant difference and higher values from the results of heavy metals in the Rumulomeni Creek. In Rumuolumeni Creek zinc and copper has the highest concentration in water across the four sampled stations. So the high concentrations of zinc and copper in Rumuolumeni Creek may be as a result of industrial and commercial (abattoir) activities around the creek (Alloway, 2013). Based on the results obtained from this study it obvious that water from Rumuolumeni Creek is contaminated with zinc and copper, in which activities of industries residing in the area need to be monitored and pollution control measures need to be observe carefully to avoid farther contamination or pollution.

The results of lead and nickel showed low concentrations which agreed with the report of Nwineewii & Edem (2014) at Okrika and Eleme Creek.

So it necessary to monitor wood burning , crude oil combustion , agricultural discharge and domestic effluent around the creek, which may help to increase nickel concentration in the creek if overlooked.

CONCLUSION

Zn, Pb, Cu and Ni, were assessed in water samples of Rumulomeni Creek and has provided reliable information and data on the pollution status of Rumuolumeni creek, Rivers state, Niger Delta, Nigeria. The concentrations of heavy metals identified in the water samples from the creek are variables. Zn and Cu were higher than the values of Pb and Ni, which can lead to pollution if proper measures to reduce the contaminants are not taken immediately.

This data or research can serve as a guide for researchers and environmental managers to protect aquatic lives and discourage future anthropogenic inputs as further increase may lead into extinction of aquatic lives in the creek and risky the health of people using the creek as their primary source of water.

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