

Assessment of Heavy Metal Concentration in Surface Water in Evwreni Town, Delta State

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Abstract – This study was designed to determine the concentration of heavy metals in samples of surface water collected randomly from within and around Evwreni Town, Delta state. Ten samples of the surface water were collected and taken to the laboratory for physicochemical properties analysis. The pH value ranged between 6.0 to 6.5. the Conductivity, between 106 to 217 μ s/cm, TDS was 61.3 to 87.9 and TH ranged between 84.1 to 143. The heavy metal concentration were as follows: Pb ranged from 0.001 to 0.005, Cu from 0.3 to 0.5, Fe from 0.4 to 0.9, Zn 0.2 to 0.6, Cr5 0.01 to 0.05 Co. from BDL to 0.04 and Ni from 0.01 to 0.04. All the concentration values for the heavy metals were lower than the set maximum acceptable concentration by WHO.

Keywords- Heavy metals, Physicochemical, Surface water, Evwreni town etc.

I. INTRODUCTION

Surface water (rivers, streams, lakes and dams and wells) can serve as sources for drinking water. Water has always been a subject of great interest to man since it is essential to human survival. In thousand villages across the globe unsafe water from heavy metals contamination is causing death and fatal diseases (Khan et al, 2000).

The problem associated with lack of adequate water resources in the country threatens to place the health of about 40 million people at risk (WHO 2004) Heavy metal trace elements may come from natural source, leached from rocks and soils according to their geochemical mobility or as a result of human land occupation and industrial pollution (APHA, 2005).

These elements have been associated with environmental degradation, poor water quality (Wongsasuluk, et al, 2014) and different human diseases (Mico, et al, 2006) due to their toxicity at very low dose.

1. Heavy metals Heavy metals are metals with highly atomic weight and a density much greater (at least 5 times) than that of water, for instance, the specific gravity of As, Cd, Fe, Pb and Hg is 5.7, 8.7, 7.9, 11.3, and 13.5 respectively (Lide, 1992)

Heavy metals are natural constituents of the earth crust and since they cannot be degraded or destroyed, they are considered persistent environmental pollutant. Generally heavy metals pollution originated from anthropogenic sources, such as untreated domestic and industrial waste water discharges, accidental chemical spills, direct soil waste dumping and residues from some agricultural inputs (Tchounwou et al 2012).

Heavy metals in form of arsenic and arsenical compounds are exceptionally toxic and harmful to human health. (Afrusiyab et al, 2013). They are found in effluents and leaches from metallurgic industries, glasswares and ceramic industries, dye, pesticide and fertilizers manufacturing industries, petroleum refining and other chemical industries.

Contamination of surface water by heavy metal is a serious ecological problem as some of them like Hg and Pb are toxic even at low concentrations, are non-degradable and can bio-accumulate through food chain (Kar et al, 2008). The heavy metals related most often to human poisoning are lead, mercury, arsenic and cadmium. Other heavy metals such as copper, zinc and chromium, are actually required by the body in small amounts (Goyer et al, 2001). Though Fe, Cu and Zn are essential micro-nutrients, they can be detrimental to the physiology of living organisms at higher concentration (Nair et al, 2010).

II. MATERIALS AND METHODS

The methods employed for this study are sampling and laboratory analysis. A detailed field sampling exercise was carried out, while laboratory analyses of the surface water samples were carried out at Vicklin Laboratory, Ozoro.

1. Study area- This study was conducted in Evwreni town, in Ughelli North Local Government Area. It is an oil producing community, with 14 oil wells and compressor stations operated by the SPDC, which produces 15,000 barrels of crude oil daily. Evwreni has six major quarters namely- Urhevwe, Uruekpo, Uvwotie, Okpawha, Ogbudu and Uneni. The population of its census is not definite, but is among the largest

communities in Ughelli North Local Government Area. It is 154.6 Km by road to Port Harcourt and 45.3Km to Warri.

2. Sample Collection and Analysis -Ten samples of surface water were collected randomly from different locations in Ewreni town: Unenurie 1, Unenurie 2, Oviede, Orovwo, Uwheru, Location, Echekepa, Ibriji, Ohpori-nama-into a sterilized container and transported to the laboratory for further study within 6 hours of sample collection.

3. Physiochemical Analysis-The pH were determined using Jenway pH meter. Taste and odour were physically determined. Conductivity was determined using conductivity meter (aquopro Model AP-Z). The total dissolved solids (TDS) were analyzed using Hanna (TDS) meter. Total hardness was determined using titration method with EDTA.

III. DETERMINATION OF HEAVY METALS

Complete digestion of surface water sample was carried out with nitric acid in a fume chamber. The surface water samples were analyzed for Pb, Cu, Fe, Zn, Cr, Co and Ni. The Atomic absorption spectrophotometer (model spectrumlab ST-AAS-02, series AA spectrophotometer with gravities furnace, Uk) instrument was used to detect the heavy metal. The concentrations of heavy metals were expressed as mg/l for the surface water.

Statistical Analysis-SPSS (version 22) one way-ANOVA and Duncan multiple range test were used to evaluate the significant difference ($P < 0.05$) in the concentration of the different studied metals with respect to the different site. A probability at level of 0.05 or less was considered significant. Mean \pm STD was estimated.

IV. RESULTS AND DISCUSSION

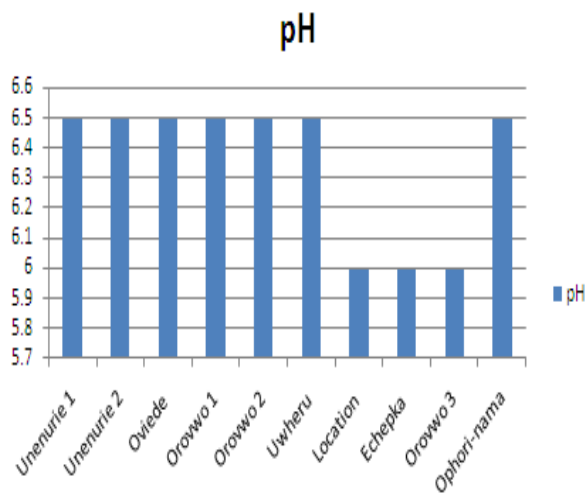
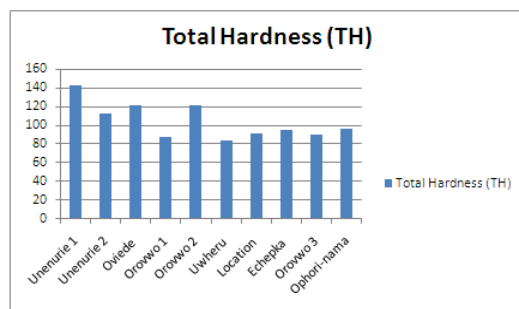
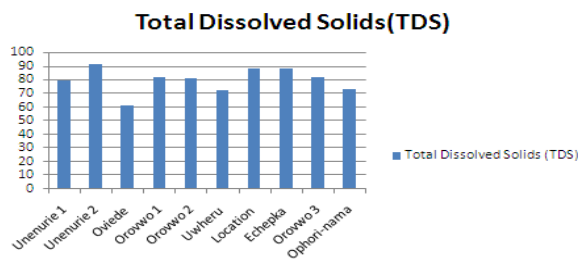
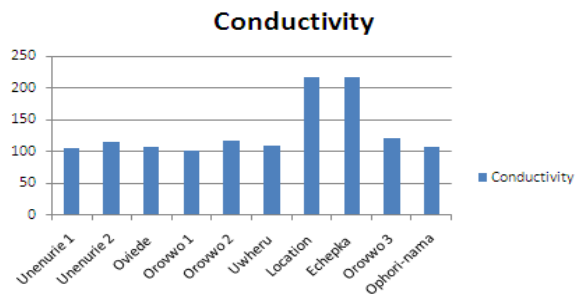


Table 1 Physical properties; pH and conductivity of the surface water.

Sample	Appearance	Taste	Odour	PH	Conductivity	TDS	TH
Unenurie 1	Cloudy	Tasteless	Foul	6.5	106	79.1 \pm 0.1	143.0 \pm 0.2
Unenurie 2	Cloudy	Tasteless	Foul	6.5	116	91.1 \pm 0.1	113.0 \pm 0.3
Oviede	Cloudy	Salty	Odourless	6.5	107	61.3 \pm 0.3	121.3 \pm 0.7
Orovwo 1	Cloudy	Salty	Foul	6.5	102	82.0 \pm 0.2	88.4 \pm 0.9
Orovwo 2	Cloudy	Tasteless	Foul	6.5	117	81.2 \pm 0.3	121.3 \pm 0.7
Uwheru	Cloudy	Tasteless	Odourless	6.5	110	72.5 \pm 0.2	84.1 \pm 0.7
Location	Cloudy	Tasteless	Foul	6.0	217	87.9 \pm 0.2	92.2 \pm 0.3
Echekepa	Cloudy	Tasteless	Odourless	6.0	217	87.9 \pm 0.2	95.2 \pm 0.3
Orovwo 3	Colourless	Salty	Odourless	6.0	122	82.1 \pm 0.2	91.3 \pm 0.9
Ophori-nama	Cloudy	Tasteless	Foul	6.5	108	73.4 \pm 0.1	97.3 \pm 0.2
PL (WHO)	Colourless	Tasteless	Odourless	6.5 – 9.5	900 μ s/cm	100	500



On the organoleptic assessment, sample 9 was colourless while the rest were cloudy. Sample 3, 4 and 9 were salty while the others were tasteless. Sample 3, 6, 8 and 9 were odourless while others were foul. For the PH values, samples 7, 8 and 9 were 6.0 slightly below WHO permissible limit (6.5 – 9.5) while others were 6.5. PH values. The conductivity were found to be between 106 to 217µs/cm.

All the values were below the maximum permissible limits of 900µs/cm set by the WHO standard. The TDS was found to be between 613 and 87.9. All the values were below the WHO maximum permissible limit (900µs/cm). The TH falls within the range of 84.1 and 143.0 and all the sample of surface water were below the maximum permissible limit set by WHO (2006).

V. HEAVY METAL IN THE SURFACE WATER

Heavy metal concentrations of the different samples of Surface water are as illustrated in Table 2 The metals concentrations were in the following order: Pb>Cu>Zn>Cr>Co>Ni in various surface water from Ewvreni, Ughelli North Local Government Area.

Table 2 Mean ± STD of heavy metal concentration (mg/l) in sampled surface water from Ewvreni.

Sample	Heavy metal concentration in mg/l						
	Pb	Cu	Fe	Zn	Cr	Co	Ni
Unenurie 1	0.001±0.2	0.3±0.1	0.7±0.1	0.2±0.4	0.04±0.1	79.1±0.1	143.0±0.2
Unenurie 2	0.001±0.0	0.3±0.1	0.7±0.1	0.2±0.2	0.02±0.1	91.1±0.1	113.0±0.3
Oviede	0.005±0.2	0.5±0.0	0.9±0.1	0.2±0.2	0.01±0.0	61.3±0.3	121.3±0.7
Orowwo 1	0.002±0.3	0.5±0.1	0.7±0.4	0.2±0.4	0.03±0.2	82.0±0.2	88.4±0.9
Orowwo 2	0.005±0.1	0.5±0.0	0.9±0.1	0.2±0.2	0.01±0.0	81.2±0.3	121.3±0.7
Uwheru	0.001±0.2	0.5±0.0	0.4±0.1	0.6±0.3	0.01±0.2	72.5±0.2	84.1±0.7
Location	0.002±0.2	0.4±0.0	0.6±0.2	0.4±0.1	0.03±0.0	87.9±0.2	92.2±0.3
Echepka	0.002±0.2	0.4±0.0	0.6±0.2	0.4±0.4	0.02±0.0	87.9±0.2	95.2±0.3
Orowwo 3	0.003±0.2	0.2±0.1	0.6±0.1	0.3±0.1	0.05±0.1	82.1±0.2	91.3±0.9
Ophori-nama	0.001±0.3	0.5±0.0	0.5±0.2	0.2±0.1	0.01±0.1	73.4±0.1	97.3±0.2
PL (WHO)	0.01	2.00	3.00	3.00	1.05	100	500

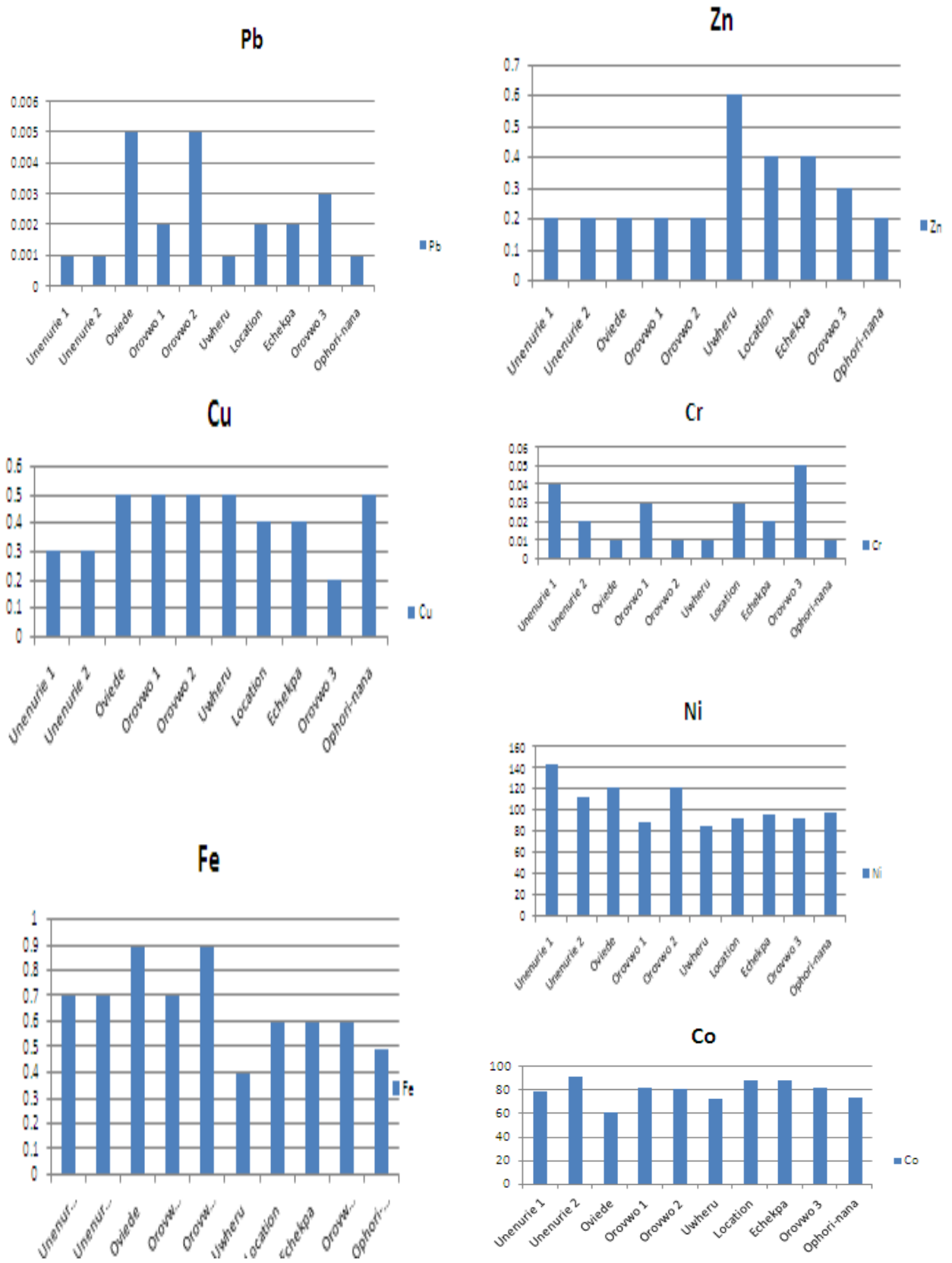


Fig.1 Frequency distribution of chromium in water sample.

PL: Permissible, limits according to WHO (2006). Data's shown are statistically different at $P < 0.05$ Level. BDL- below detected limit. The difference in the concentration of the heavy metal content of the various surface water samples shows significance. The mean \pm STD values of the measured metals (Pb, Fe, Zn, Cr, Co and Ni) were as shown in table 2 for the surface water samples.

The Pb concentration measured, ranged from 0.001 to 0.05. The Cu concentration measured, was between the range of 0.2 to 0.5. That of Fe measured concentration was between the ranges of 0.5 to 0.9.

The Zn concentration was in the range of 0.2 to 0.6. The Cr concentration was between 0.01 and 0.05. That of Co. was in the range of BDL to 0.3. The concentrate of Ni was between the range of 0.001 to 0.004. All the metal levels measured were lower than the permissible limits recommended per metal by WHO (2006).

VI. CONCLUSION

The surface water (rivers and streams) studied, is the common source of drinking water for the farmers. The heavy metal concentrations analyzed were all below and within the maximum acceptable concentration set standard by WHO (2006). That surface water with odour and salty taste should be treated for drinking. Hypertensive patients should be properly informed, in order to avoid constant intake of those surface water with salty taste.

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