

## A Study of Lead (Pb) in Water of Ovia-Ngwu Stream within the Urban Community in Awgu Town, Enugu State, Nigeria.

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### ABSTRACT

Lead (Pb) screening in water at Ovia-Ngwu stream in Awgu Town, Enugu State was carried out. Three water samples were collected from three different points. The first was from the source, the second from the middle and the third from the bottom (end). The total lead (Pb) concentration was determined using atomic absorption spectrometer. The result confirmed the presence of lead (Pb) in the stream, but the metal level according to the world health organization is less than the permissible level of lead for human consumption. Therefore, the water was confirmed fit for drinking. In conclusion, it was suggested that the presence of the metal would be attributed to discharge of car exhaust fumes and other leaded petroleum products from the surrounding.

Keywords: Lead, water, stream, urban and community.

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### INTRODUCTION

The agency for toxic substance and disease registry (ATSDR) is mandated by the comprehensive environmental response, compensation, and liability act of 1980 (CERCLA or Superfund) as amended by the superfund amendments and reauthorization act of 1986 (SARA) to perform public health assessments for all sites on the national priorities list (NPL). [1] Data from health assessment for the first 951 sites show that metals and volatile organic compounds were the contaminants most often detected, and these commonly migrated from disposal areas to groundwater. [2]; [3].

Lead occurs naturally in the environment. However, most lead concentrations that are found in the environment are a result of human activities. Do to the application of lead in gasoline, an unnatural lead-cycle has consisted, In car engines, lead is burned, so that lead salts (chlorines, bromines, oxides) will originate. These lead salts enter the environment through the exhausts of cars. [4], [5], [6] The large particles will drop to the ground immediately and pollutes soil or surface waters, the smaller particles will travel long distances through air and remain in

the atmosphere. Part of this lead will fall back on earth when it is raining. This lead Cycle caused by human production is much more extended than the natural lead-cycle. It has caused lead pollution to be a worldwide issue. Lead is one out of four metals that have the most damaging effects on human health. It can enter the human body uptake of food (65%), water (20%) and air (15%). Lead can enter (drinking) water through corrosion of pipes. This is more likely to happen when the water is slightly acidic.[7] That is why public water treatment systems are now required to carry out p<sup>H</sup>- adjustments in water that will serve drinking purposes. For as far as we know, lead fulfils no essential function in the human body, [8] it can merely do harm after uptake from food, air or water. Lead can cause several unwanted effects, such as:

- Disruption of the biosynthesis of haemoglobin and anaemia.
- A rise in blood pressure,
- Kidney damage.
- Miscarriages and subtle abortions.
- Disruption of nervous system.
- Brain damage.

- Declined fertility of men through sperm damage.
- Diminished learning abilities of children.
- Behavioural disruptions of children, such as aggression, impulsive behavior and hyperactivity.

Lead can enter a foetus through the placenta of the mother. Because of this it can cause serious damage to the nervous system and the brains of unborn children. [9]; [10],

**Aim of the Study**

To determine the concentration of lead (Pb) in Ovia-Nwgu stream in Awgu Town, Enugu State using Atomic Absorption Spectrometer. To determine the P<sup>H</sup> of the water samples.

**Methodology**

**Area of the Study**

Ovia-Nwgu stream is located in Awgu local government area in Enugu Sought Geopolitical zone, Enugu State. The source of the stream is located beside the National Youth Service corps (NYSC) orientation camp in Awgu Local Government Area. And it is channelled down to the closed villages through a heavy gutter. [11] The stream has being into existence for the past years which has been serving as a drinking water source for the villagers.

**Preparation of Sample Bottles**

Ten (10) high density polyethylene bottles were purchased from CONRAWS (Nig) limited at No2 presidential road, Enugu. The bottles were washed following a standard procedure to clear contamination.

They were thoroughly washed with 2 molar nitric acid. It was later raised three times with distilled water, dried and kept in an air container to avoid contamination.

**Sample Collection**

Three (3) water samples were collected from three different areas at Ovia-Nwgu stream in Awgu town, Enugu State. These samples were collected on 23<sup>rd</sup> November 2012. The first sample was collected from the water source. The second and the third samples was collected in-between each other that is up and down stream. The pH of the water samples were

**Significance of the Study**

To know if there is presence of lead (Pb) in the water samples. If any, it will serve as an environmental monitoring so that the villagers will be aware of the poisonous metal contained in the water and will look for another alternative drinking water.

**Limitation/Scope of the Study**

This research work is limited to the determination of concentration of lead (Pb) and the P<sup>H</sup> value in Ovia-Nwgu stream in Awgu Town, Enugu State.

The second one is time constraint because work required time to meet the expect target of the research as our programme has a stipulated period of time.

**MATERIALS AND METHOD**

determined using batch sampling process [12].

**Sample Treatment**

After collection of the three water samples from three different places, 2 molar nitric acid was added to each of the samples to preserve from bacteria attack. These samples were kept inside the air tight container filled with ice block to maintain a temperature range of 0~4°c and as well as to prevent contamination.

**Preparation of Standards**

Stock solution: A stock solution can be defined as a solution of any element that is diluted with low concentration of its salts for a particular purpose

**PROCEDURE:**

PbCl<sub>2</sub>, M.wt = 207 + 35.5x2 = 278g  
Convert 207g which is the atomic mass of lead (Pb).

$$= 207 \times 100\text{mg}$$

$$= 207000\text{mg}$$

This implies that:

$$207000\text{mg} \rightarrow 278\text{g}$$

$$100\text{mg} \rightarrow$$

$$\frac{100\text{mg}}{070000\text{mg}} \times \frac{278\text{g}}{1} = \frac{278}{2070} = \underline{0.13\text{g}}$$

This implies that 0.13g of PbCl<sub>2</sub> was dissolved in litre of distilled water to give 100ppm of stock solution containing lead. Where 20ppm, 10ppm, and 1ppm were used as the standard.

**Sample Analysis**

The atomic absorption spectrometer (AAS) was switched on, and allowed to warm for 30 minutes at a wavelength of 218nm. 20ml of the water sample was measured and it introduced into the cuvette and 20ml of distilled water was also measured and poured into the cuvette. The distilled

water was used as a control, after each of every sample was analyzed. The reading for absorbance of each sample was noted. The atomic absorption spectrometer (AAS) was operated in a right process and absorbance and concentration calibration curve was given using beer-lambert's law [13].

**RESULT AND DISCUSSION**

**Table 1: Result of the analysis**

S/N	Sample Description	Standards in mg/l	Campspec	
			Absorbance	Concentration x (mg/l)
1	Sample 1	20ppm	0.047	0.889
2	Sample 2	10ppm	0.057	1.082
3	Sample 3	1ppm	0.110	2.090

The table above shows the confirmatory results for lead (Pb) determination in Ovia-Ngwu stream.

The graph shows the Calibration curve of absorbance against concentration which obeys beer-lambert's law.

The mean concentration (x)

$$\bar{X} = \frac{\sum x}{n}$$

$$= \frac{0.889+1.082+2.090}{3} = 4.0613$$

$$= 1.3537\text{mg/l aprox.}$$

**Standard Deviation (S.D)**

$$S.D = \sqrt{\frac{\sum (X - \bar{X})^2}{n-1}}$$

**Table 2**

S/N	Sample	Concentration x(mg/l)	(x-x)	(x-x) <sup>2</sup>
1	Sample 1	0.889	0.8371	0.7007
2	Sample 2	1.082	1.0301	1.0611
3	Sample 3	2.090	2.0381	4.1539

$$S.D = \sqrt{\frac{\sum (X - X)^2}{n-1}}$$

$$= \frac{\sum(0.7007 + 1.0611 + 4.1539)}{3-1}$$

$$= \frac{5.9157}{2}$$

S.D = 2.9579 aprox

$$V = \sqrt{2.9579}$$

V = 1.4355mg/L aprox.

Where  
 S.D = Standard deviation  
 X = The mean  
 X - The concentration values.  
 N = Number of the given samples

Σ = summation  
 Σx = summation of the concentration values.

V = variance.

3 3

**Percentage of Lead in each Sample**

**Sample 1**

$$\frac{0.7007}{3} \times 100/1 = \frac{70.07}{3} = 23.35\%$$

**Sample 2**

$$\frac{1.0611}{3} \times 100/1 = \frac{106.11}{3} = 35.35\%$$

**Sample 3**

$$\frac{2.0381}{3} \times 100/1 = \frac{203.81}{3} = 67.93\%$$

**Total Percentage of Lead**

$$= 23.35 + 35.37 + 67.93$$

$$= 126.6$$

**Table 3 :The pH values for water samples of Ngwu Stream**

Sample description	P <sup>H</sup> values	Mean P <sup>H</sup>
Sample 1	7.0	7.0+7.8+8.1 3
Sample 2	7.8	
Sample 3	8.1	= 7.63

The results from the table show that the water sample is a weak base. Sample 3 has the highest value of P<sup>H</sup> range whereas sample 1 has the lowest value.

**DISCUSSION**

The table one (1) shows the concentration of lead (Pb) in Ovia-Ngwu Stream, The highest value from the table is the sample three which has the concentration value of 2.090mg/l. its high value may be attributed to the predominant activities going on in the area such as mechanic work-shop and filling station beside the stream. The mean and standard deviation of lead (Pb) concentration from the graph

is 1.3537mg/l and 2.9579mg/l respectively. [14] This shows that the water is fit for drinking according to the permissible value of lead given by the world health organization. And the P<sup>H</sup> of the water sample is a weak base. In conclusion, from the graph, it was seen that the absorbance concentration curve was a straight line obeying beer-lambert's law.

**CONCLUSION**

Lead (Pb) content was determined in Ovia-Ngwu stream, Awgu Local Government Area, Enugu state. From the analytical result, it was shown that the concentration level of lead content in Ovia-Ngwu stream is not up to lethal level

of lead (Pb) evaluated by the world health organization which is given as 0.05mg/kg. Therefore, [15] the water is not harmful and is considered fit for human consumption.

**RECOMMENDATIONS**

The work is recommended to the indigenes of Awgu town and the none indigenes in general to sensitize them on the need for the treatment of Ovia-Ngwu stream. Educate them on the appropriate ways of domestic waste disposal method. [16] The government should set up laws

to regulate industries to ensure proper treatment of effluent before discharging them into water ways. Hence, if all the above stated measures are employed, it will help to reduce the amount of lead (Pb) entering the Ovia-Ngwu stream.

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