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THE BACKGROUND CONCENTRATION OF SOME HEAVY METALS AT NYSC ORIENTATION CAMP LAYOUT, KATSINA

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ABSTRACT

An anthropogenic activities leads to the presence of heavy metals in an environment which lead to environmental pollution. The area has become gradually engage with various waste such as animal waste, refused dump, spilling of petrol, kerosene, engine oil etc which can introduces the trace heavy metals. The research of background concentration of various heavy metals in soil samples taken from the NYSC orientation camp layout, which is situated in Katsina state, Nigeria, at latitudes of 643.7 m to 798.5 m and longitudes of 18 21I32IIE to 18 28I37II, was conducted. At intervals of 100 m, soil samples were taken from the locations, and each 100 m was divided into 10 m. (A1A10). In order to determine the concentration of the five examined heavy metals, a flame atomic absorption spectrophotometer (FAAS) was used (Co, Cr, Pb, Cd, Cu). The locations have an average heavy metal concentration of:- 0.16009, 0.55449, 0.02804, 0.00231, and 0.10406 ppm Respectively. Significant differences were observed by comparing the mean concentration of the heavy metals in the study areas with world health organization (W.H.O) threshold limit, national and international studies and it was suggested that the samples were not contaminated with the heavy metals. But the metals were detected and there is no need for immediate implementation and remediation measures by the relevant authority. It was and recommended that industries, factories and filling station should not be located at the area in order to minimize human activities so as to maintain stable environment free from pollutants.

Keywords: heavy metals, background concentration, flame atomic absorption spectrophotometer

INTRODUCTION

Heavy metals have been defined as those metals with higher atomic number and weight (Norman,1981); large group element with an atomic density of greater than 6g/cm3 which are both biologically and industrially important (Alloway,1995); any metallic chemical element that has relatively high density and is toxic or poisonous at low concentration (Holdig, 2004

Any metallic chemical element that has relatively high density and is toxic or poisonous at low concentrations has been referred to as a heavy metal (Holdig, 2004). Heavy metals are defined as those metals with higher atomic number and weight (Norman, 1981); large group elements with an atomic density of greater than 6g/cm3 that are both biologically and industrially important (Alloway, 1995); (passed up the food chain to humans).

Aluminized, arsenic, cadmium, chromium, cobalt, lead, manganese, mercury, nickel, selenium, tin, vanadium, zinc, platinum, and other heavy metals were among the more than 20 that were known (WHO, 1996b).

They come in several forms, includingminerals found in soil, rocks, and sand; encapsulated in organic or inorganic compounds; or affixed to airborne particles.

Due to an exponential rise in the usage of heavy metals and/or their compounds in industrial and agricultural activities, human exposure to heavy metals has increased significantly over the past 50 years. Heavy metals are naturally present in soil at trace levels (ppb to ppm).

For instance, the average amount of metals in American soil is 0.2 mg/kg of cadmium, 11 mg/kg of lead, and 18 mg/kg of nickel (Fepa, 1999).

However, the concentration of these metals varies significantly by geographic location and soil type.

Thus, the geographical and temporal variations in the geochemical background, the potential for contamination, and other considerations are used to estimate threshold limit values (TLV) for metals in soil.

effects of the deep geological structure and other geochemical processes, natural anomalies that are orders of magnitude above baseline values without anthropogenic contamination, and the outcome of monitoring analysis of metals group are some examples of the findings (Sipos and Pokas, 2008).

An anthropogenic activity leads to the presence of heavy metals in an environment which lead to environmental pollution. There is concern all over the world as the accumulation of metals increases the direct and indirect risk to human being The study area was within Katsina metropolis and was located relatively far from main town ship in order to develop the areas by expanding town but due to rapid population growth it has now been merge with Katsina main town. The settlements around the areas include schools, hospitals, business centers, filling station, minor roads etc. The soil of the two areas is now being expected to have trace of heavy metals due to anthropogenic activities taking place. The area has become densely engage with various waste such as animal waste, discarded rusted iron materials, refused dump, spilling of petrol, kerosene and engine oil e.t.c which can introduces the trace heavy metals. These waste may expose the corps members and near by residents such as home and school children, scavengers etc to undue burden of toxic metals and may also affect the people of the area through contamination if it succeed in polluting ground water which can extensively be used in Katsina town for various activities such as domestics, irrigation and construction or are washed by rain and transport through Water channels which is located at lower altitude than the soil.Several researches have reported that anthropogenic activities have contaminated soil with heavy metals (Onianwa and Fakayode, 2000; Martly et al., 2004; Kachenko and Sinhh, 2006; Ngo et al., 2009).

The estimation of hazard indices through the determination of toxic metals will help in environmental monitoring and

protection, strategic planning as well as protection of human health. This work will also provide a baseline data of the elementary and toxic metals concentration level of the developing area. This data can further be utilized in future planning by government against environmental pollution and potential threats to human health due to radon, other form of toxic heavy metals. If the toxic heavy metals concentration level of the areas is above acceptable level, then this research will therefore provide useful information on the elemental safety of settlement around the area. This study therefore proposes to determine the levels of heavy metals such as Cr, Cd, Cu, Pb and co. in soil sample collected from NYSC orientation camp lay out in katsina metropolis, Nigeria.

MATERIALS AND METHODOLOGY

The following material were used in carrying out the research:- polythene bag, measuring tape, beakers measuring cylinder, hand gloves, hoe, plastic container, indelible ink, masking tape, tissue paper, volumetric flask, boiling tube, spatula, petridish, GPS and spectrophotometer.

With a hoe, soil samples were taken over a distance of 100 meters, 10 meters apart, and transferred to polythene bags.

All soil samples were ground with a mortar and pestle, sieved, and stored for chemical analysis after being air dried at standard laboratory temperature.

Spatula and a weighing scale were used to extract 0.5g of each sample.

It was transferred to a fume-cup board for digestion after being put in a Teflon beaker.

The digestion was completed using concentrated nitric acid and concentrated perchloric acid in a 2:1 ratio, after which it was placed in an oven and kept at 200°C.

The mixture was allowed to cool for an hour before the residue was leached with 5 cm3 of 20% HNO3.

filtering the digested sample

RESULTS AND DISCUSSION

The Concentration of Heavy Metals in Nysc Orientation Camp Layout Katsina,

Table 1 shows the concentration of heavy metals (Co, Cr, Pb, Cd, Cu.) present in a soil samples (A1-A10) collected from NYSC orientation Camp layout katsina.

The mean concentration, minimum, maximum, standard deviation, range and standard error for cobalt (Co) are:- 0.16009, 0.11930, 0.021269, 0.0705, and 0.00726 respectively. For Chromium are:-0.55449, 0.00460, 1.9650, 0.72572, 1.9579, and 0.229494 respectively. For Leadare :- 0.02804,0.00210, 0.09170, 0.03038, 0.0896, and 0.009607 respectively. For cadmium are:-0.00231, 0.00030, 0.00740, 0.00192, 0.0071, and 0.00071 for Cupper are:-0.10406, 0.00010, 0.99510, 0.31313, 0.995, 0.09902 respectively.

Table 1

S/N	PARAMETERS	COBALT (ppm)	CROMIUM (ppm)	LEAD (ppm)	CADMIUM (ppm)	COPPER (ppm)
1	MEAN	0.160090	0.554490	0.028040	0.00231	0.10406
2	MINIMUN	0.119300	0.004600	0.002100	0.00030	0.00010
3	MAXIMUM	0.189800	1.962500	0.091700	0.00740	0.99510
4	STANDARD.D	0.021269	0.725720	0.030380	0.00192	0.31313
5	STANDARD.E	0.006726	0.229494	0.009607	0.00065	0.09902
6	RANGE	0.070500	1.957900	0.089600	0.00710	0.99500

Table 2: The concentration of the current study in (ppm) is compared to previous national and international studies.

Co (ppm)	Cr (ppm)	Cd (ppm)	Pb (ppm)	Cu (ppm)	References
267	1674	-	1387	-	Olayiwola,2013
-	475.5	1.0	205	185.7	Ahmad *etal*,2015
32.5	301.6	8.8	152	144.8	Rahib *et al*, 2015
17.03	9.57	3.47	127.83	226.80	Boadu, 2014
0.16009	0.55449	0.02804	0.00231	0.10406	This work result

Threshold Limit of the World Health Organization.

The World Health Organization threshold limit for the study element is displayed in table3 below.

Table 3.

Heavy metals	Pb (ppm)	Zn (ppm)	Cu (ppm)	Cd (ppm)
WHO recommended Threshold limit(ppm)	**100**	**200**	**30**	**3.00**

Source- WHO (1996b)

Table 4: The Concentration of Heavy Metals in Nysc Orientation Camp Layout Katsina.

S/N	SAMLE CODE	COBALT CO	CROMIUM CR	LEAD PB	CADMIUM CD	COPPER CU
1	A1	0.1645	0.0118	0.0302	0.0016	0.0018
2	A2	0.1898	0.0843	0.0021	0.0016	0.0014
3	A3	0.1788	0.0046	0.0177	0.0023	0.9951
4	A4	0.1551	0.0569	0.0917	0.0030	0.0001
5	A5	0.1838	0.0556	0.0719	0.0020	0.0173
6	A6	0.1480	1.9625	0.0094	0.0017	0.0136
7	A7	0.1193	0.5491	0.0021	0.0003	0.0021
8	A8	0.1645	1.3787	0.0125	0.0018	0.0049
9	A9	0.1568	0.1255	0.0313	0.0014	0.0014
10	A10	0.1403	1.3159	0.0115	0.0074	0.0029

Table 4. shows the concentration of heavy metals (Co, Cr, Pb, Cd, Cu.) present in a soil samples (A1-A10) collected from NYSC orientation Camp layout katsina.

Cobalt (CO)

Figure 1, show the concentration and presence of cobalt as a heavy metallic element in a soil samples (A1-A10), collected from NYSC layout orientation camp

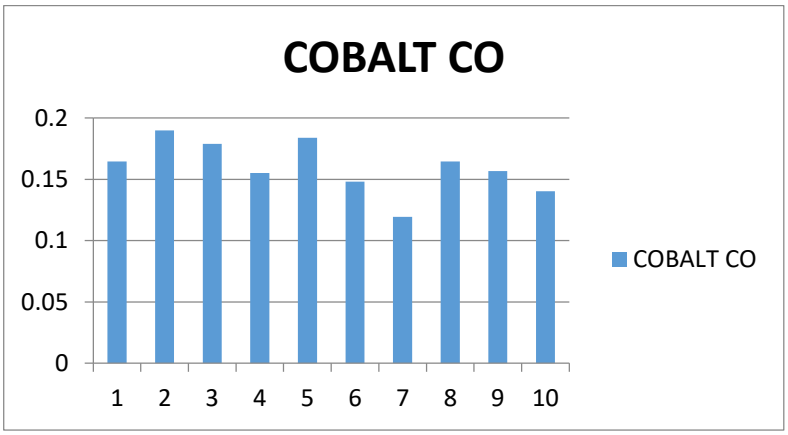

Figure 1: concentration and presence of cobalt as a heavy metallic element in a soil samples (A1-A10)

Cromium (CR)

Figure 2, show the concentration and presence of chromium as a heavy metallic toxic element in a soil samples (A1-A10), collected from NYSC layout orientation camp.

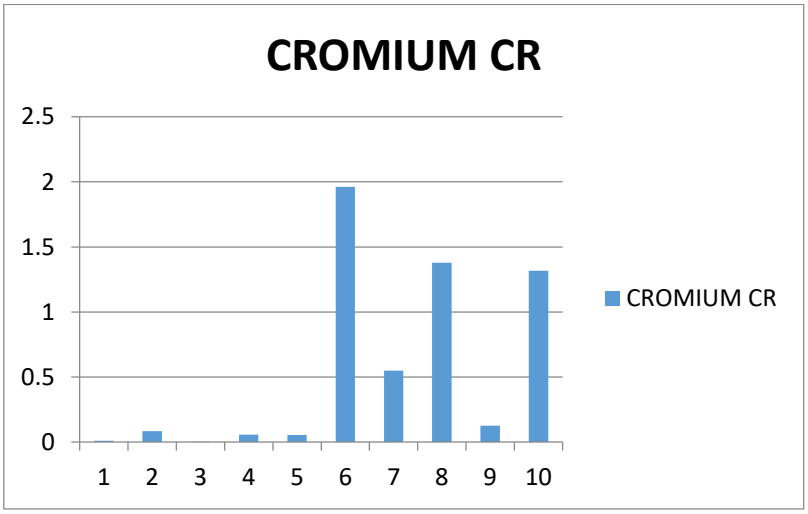

Figure 2: concentration and presence of chromium as a heavy metallic toxic element in a soil samples (A1-A10)

Lead (PB)

Figure 3, show the concentration and presence of lead as a heavy metallic toxic element in a soil samples (A1-A10), collected from NYSC layout orientation cam

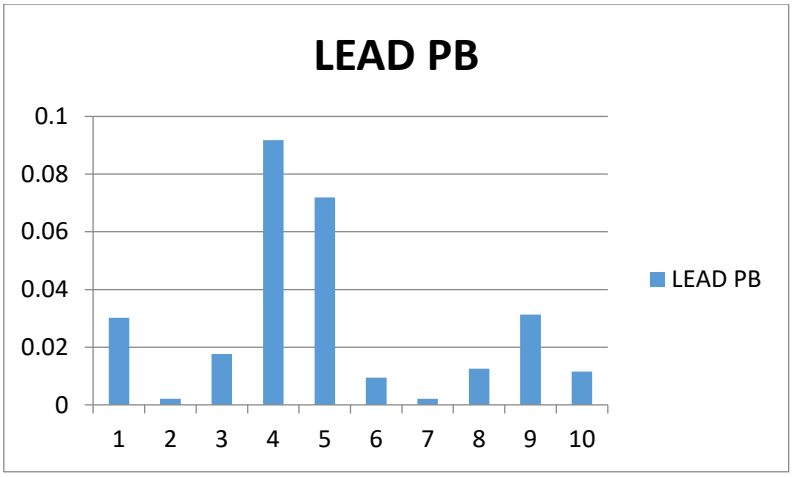

Figure 3: concentration and presence of lead as a heavy metallic toxic element in a soil samples (A1-A10)

Cadmium (CD)

Figure 4, show the concentration and presence of cadmium as a heavy metallic toxic element in a soil samples (A1-A10), collected from NYSC layout orientation camp

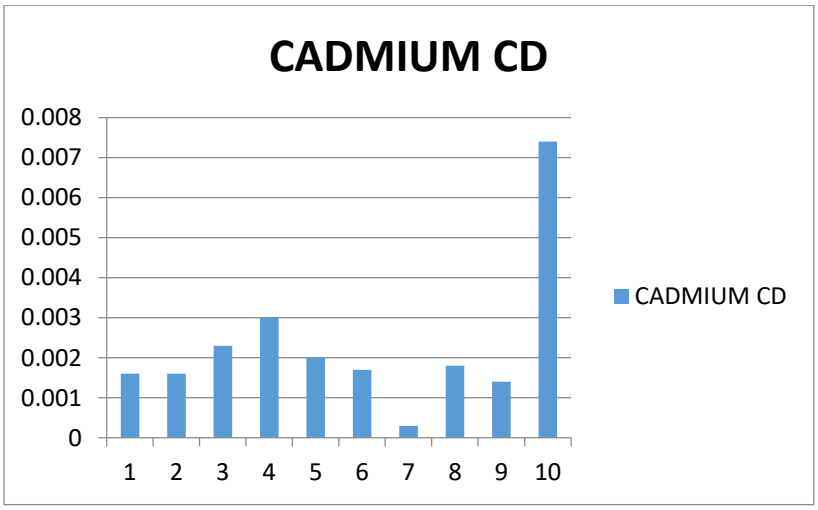

Figure 4: concentration and presence of cadmium as a heavy metallic toxic element in a soil samples (A1-A10)

Copper (CU)

Figure 5, show the concentration and presence of cupper as a heavy metallic toxic element in a soil samples (A1-A10), collected from NYSC layout orientation camp

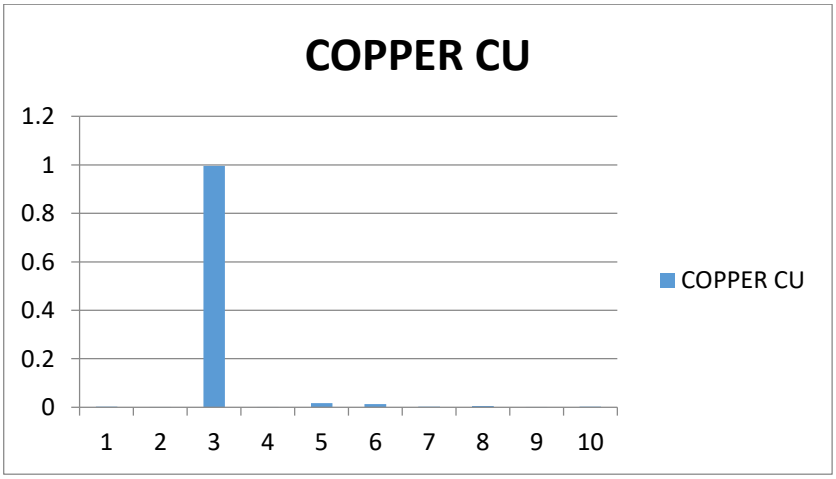

Figure 5: concentration and presence of cupper as a heavy metallic toxic element in a soil samples (A1-A10)

The Mean Concentration of the Studied Metals

Figure 6 below, show the mean concentration of those elements (Co, Cr, Pb, Cd, and Cu) as a heavy metallic toxic element in a soil samples (A1-A10), collected from NYSC layout orientation camp. It also shows that Chromium is having the highest concentration in the area.

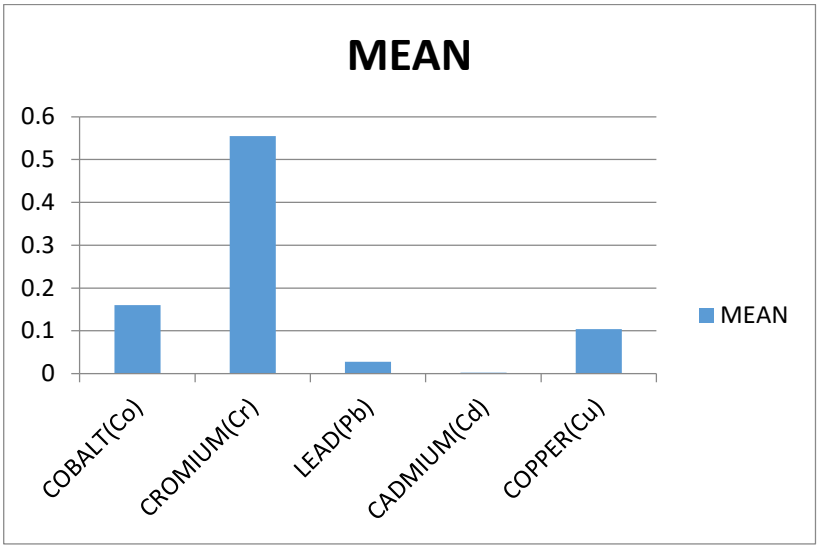

Figure 6: mean concentration of those elements (Co, Cr, Pb, Cd, and Cu) as a heavy metallic toxic element in a soil samples (A1-A10)

General Comparison of the Result with W.H.O Guidelines, National and International Requirement

The mean concentrations of the five selected metals are sho wn in Table 2. According to this research, lead has the lowe st mean concentration of 0.00231 ppm and chromium has the highest mean concentration of 0.5549 ppm

Additionally, it displays the average concentration of the sa me metals from related studies.

The results of other similar researchers who studied heavy m etals were compared to the obtained mean amounts in the tar get area.

Olayiwola (2013) used standardized techniques to examine s amples of soil and vegetation for the presence of heavy meta ls.

Iyaka et al. (2012) examined the occurrence of lead, copper, nickel, and zinc using flame atomic absorption in top agricul tural soils near ceramic and pharmaceutical industrial sites in Niger State, Nigeria.

Spectrophotometry

CONCLUSION

A flame atomic absorption spectrophotometer was used to m easure the concentration of heavy metals (Co, Cr, Pb, Cd, an d Cu) in soil samples taken from the NYSC orientation camp layout.

The acquired result was contrasted with the WHO threshold limit and the findings of national and international investigat ions.

Comparatively, it is abundantly obvious that the concentratio n of the chosen heavy metals in the study region did not abo ve the threshold limit of the World Health Organization (W. H.O.) standards, national and international requirement, but all the metals were discovered at legal concentration.

As a result, there are no reports of heavy metal contaminatio n in the area.

In line of the aforementioned, it is strongly advised against l ocating businesses and factories there in order to stabilize.

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