UMYU Scientifica, Vol. 2 NO. 1, March 2023, Pp 133 – 139
https://doi.org/10.56919/usci.2123.016
ISSN: 2955 – 1145 (print); 2955 – 1153 (online)
A periodical of the Faculty of Natural and Applied Sciences, UMYU, Katsina

ORIGINAL RESEARCH ARTICLE

Analysis of Some Heavy Metal Background Concentration at Dandagoro Quarters, Katsina, Katsina State, Nigeria.

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ABSTRACT
Human activities lead to the accumulation of heavy metals in an environment which make environment to be polluted. The research area has become stepwise engage with various waste such as refused dump, animal waste, engine oil, kerosene, spilling of disel etc which can introduce the trace heavy metals. Heavy metals are environmental threat for soils, are also dependent by plant and life of living organism. As the risk of exposure to heavy metals increases for humans directly or indirectly. The study of Analysis of Background Concentration Some Heavy Metals in soil samples extracted from Dandagoro Quarters, Katsina, Katsina State, located at latitude 37°91^{I}74^{II} to 76^{II}E and the longitude 13°8^{I}24^{II}N was carried out. At intervals of 100 m, soil samples were collected from the study area, and each 100 m was divided into 10 m. (B1-B10). In order to determine the concentration of the five examined heavy metals (Cr, Cu, Cd, Pb and Co,), a flame atomic absorption spectrophotometer (FAAS) was used. The locations have an average heavy metal concentration of 0.240, 0.110, 0.093, 0.002 and 0.001(ppm) respectively. Differences were seen by comparing the mean concentration of the heavy metals in the target areas with world health organization (W.H.O) threshold limit, national and international related studies and it was reporeted that the samples were not contaminated with the heavy metals. But the metals were presence and there is no need for urgent intervention and remediation measures by the authority. It was recommended that, factories, gas station and manufacturing industries should not be located at or near the area in order to reduced human activities so as to make environment stable and free from pollutants.

ARTICLE HISTORY
Received January 08, 2023
Accepted February 27, 2023
Published March 30, 2023

KEYWORDS
AAS, Heavy metals, Environmental threat, Threshold limit, W.H.O And pollution.

INTRODUCTION

Heavy metals have been defined as those metals with higher atomic number and weight (Samaila *et al,2022*); large group element with an atomic density of greater than 6g/cm^3 which are both biologically and industrially important (Alloway, 1995); any metallic chemical element that has relatively high density and is toxic or poisonousat lowconcentration (Holdig, 2004).

Heavy metals are deleterious due to their long biological halflives, non-biodegradable nature, and their ability to accumulate in different body parts (Kamkara *et al,* 2021). Heavy metals are defined as those metals with higher atomic number and weight (Samaila et al, 2022); 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, coba lt, lead, manganese, mercury, nickel, selenium, tin, vanadi um, zinc, platinum, and other heavy metals were among t he more than 20 that were known (WHO, 1996).

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

An anthropogenic activity leads to the accumulation of heavy metals in an environment which lead to environmental pollution (Samaila *et al,* 2022*)*. Food is the major source of ingestion heavy metals in humans, particularly all categories of vegetables.One of the most essential aspects of food quality assurance is the assessment of heavy metal contamination ofthe food items (Rafi & GowdaT, 2017). 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 situated relatively far from main town ship in order to raise the areas by expanding town but due to quick population increase it has now been merge with Katsina main town. The settlements around the areas include schools, hospitals, business centers, filling station, minor roads

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How to cite: Samaila, A., Bello, S., Salele, S. and Iliyasu, S. R. (2023). Analysis of Some Heavy Metal Background Concentration at Dandagoro Quarters, Katsina, Katsina State, Nigeria. UMYU Scientifica, 2(1), 133 – 139. https://doi.org/10.56919/usci.2123.016

etc. The soil of the areas is now being expected to have trace of heavy metals due to human activities taking place**.** The area has become densely engage with various waste such as spilling of engine oil and petrol, animal waste, rusted iron materials, refused dump, , kerosene and diesel e.t.c which can introduces the trace heavy metals. These waste may expose the people living in the area 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. Human being has been exposed to heavy metals for an immeasurable time. Rapid increase in population, coupled with other factors such as urbanization, rapid industrial development, mining and agriculture. It result in huge accumulation of waste and pollutants which end up in water bodies such as dams, streams and lakes thereby polluting them (Shamsuddin *et al* ., 2018).

The estimation of hazard indices through the determination of toxic metals will help in environmental monitoring and protection, strategic planning as well as human health protection. 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 use in future planning by government against environmental contamination 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, Cu, Cd, Pb and Co. in soil sample extracted from Dandagoro quaterst, katsina metropolis, Nigeria.

MATERIALS AND METHODS

Polythene Bag, meter rule, tape, hand auger, hand gloves, drilling machine, permanent marker, masking tape, candle wax, plastic container, sieve, hydraulic pressure, gamma spectrometry system (sodium iodide activated with thallium), sulphuric acid (concentrated), nitric acid (concentrated), perchloric acid (concentrated), hydrochloride acid (concentrated), distilled water, sieve, filter paper, spatula, funnel, 100mL volumentric flask, boiling tube, block digester and spectrophotometer (Samaila *et al, 2022*).

Sample Collection

The area was measured by tape to be 100m, and then was partitioned into 10 grid which was leveled B1-B10 in the area and the soil sample was collect from each grid according to depth using meter rule and digging hoe. The distance were 0-10, 10-20, 20-30, 30-40, 40-50, 50-60, 60-70, 70-80, 80-90, 90-100(m). and in each one grid making total of 10 samples.

Sample Preparation and Analysis

The soil samples were sieved, air dried at the customary laboratory temperature, and then crushed with a mortar and pestle before being kept for chemical analys is. (Samaila *et al,* 2022).

Spatula and a weighing scale were used to extract 0.5g of each sample.It was taken to a fume-cup board for digestion after being put in a Teflon beaker.

Concentrated nitric acid and concentrated perchloric acid were used to do the digestion in a 2:1 ratio, following which it was transferred to an oven and kept at 200°C. After allowing the mixture to cool, the residue was diluted with 5 cm of 20% HNO. After being digested, samples were filtered and deionized water was added to make up to 100mL. The atomic absorption spectrometer handled a blank determination but without a sample. After that, samples were dissolved and aspirated into a Unicam Solar A.A.S 969 model atomic absorption spectrometer for the analysis of metals. In a manner identical to that described above, a blank determination was also performed, but without a sample. Each element's measured absorbance and associated concentration were used to plot a calibration graph. The calibration curve was used to calculate the metal concentration. (Samaila *et al, 2022).*

RESULTS AND DISCUSSION

Table 1 shows the concentration of heavy metals (Cd, Cu, Co, Cr, Pb) in the samples(B1-B10) collected from Dandagoro quarters Katsina state.

It was observed that Cobalt (Co) has the highest mean concentration (0.240 ppm) and the widest range (1.011 ppm) among the elements analyzed. Chromium (Cr) has the second highest mean concentration (0.110 ppm) and range (0.722 ppm). Lead (Pb) has a lower mean concentration (0.093 ppm) and range (0.198 ppm) compared to Cobalt and Chromium.
Cadmium (Cd) and Copper (Cu) have the lowest mean concentrations (0.002 ppm and 0.001 ppm, respectively), with very narrow ranges (0.003 ppm and 0.002 ppm).The results provide insight into the average concentrations, variability, and spread of the elements in the analyzed sample.

Table 1: Concentration of Heavy Metals Collected Dandagoro Quarters Katsina State.

S/N	PARAMETERS	Cobalt Co (Ppm)	Cromium Cr (ppm)	Lead Pb (ppm)	Cadmium Cd (ppm)	Copper Cu (ppm)
1.	MEAN	0.240	0.110	0.093	0.002	0.001
2.	MINIMUM	0.002	0.003	0.013	0.000	0.000
3.	MAXIMUM	1.013	0.725	0.211	0.003	0.002
4.	STANDARD DIVIASION	0.281	0.218	0.070	0.001	0.001
5.	STANDARD ERROR	0.089	0.069	0.022	0.000	0.000
	RANGE	1.011	0.722	0.198	0.003	0.002

The Table 2 shows the Comparison of the result of present study in (PPM) with other national and international study result.This research results displayed a significant decrease in the concentrations of Cr, Cd, Pb, and Cu by comparing with different studies. It is worth noting that the values reported in the research conducted by Samaila et al. (2022) and this current research are considerably lower than the values reported by Ahmad et al. (2015) and Rahib et al. (2015). These variations could be attributed to different sampling locations, analytical methods, or changes in environmental conditions over time. It is important to consider the specific context and methodologies employed in each study to gain a comprehensive understanding of the differences observed. By comparing the result with W.H.O threshold limit in table c, it shows that the concentration of the current research is within the range of the limit.

Table 2: The Concentration of this Study in (Ppm) in Comparison with the Result of Related Research

Cr (ppm)	Co (ppm)	Cd (ppm)	Pb (ppm)	Cu (ppm)	REFERENCE
475.5	-	1.0	205	185.7	Ahmad *etal*,2015
301.6	32.5	8.8	152	144.8	Rahib *etal,2015*
0.55449	0.16009	0.02804	0.00321	0.1046	Samaila *etal,2022*
0.110	0.240	0.002	0.093	0.001	This research result

Table 3: The World Health Organization threshold limit for the study

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

Source: WHO (1996b)

Sampling Locations: The table below shows the longitude, latitude and altitude of the study area.

Table 4: Sampling Locations

S/N	SAMPLE CODE	LATITUDE	LONGTITUDE	ALTITUTE
1	B1	12.935303, 12°56^{I}7.092^{II}N	7.64061666, 7°,38^{I}45.66^{I}E	533.50m
2	B2	12.93530833, 12°56^{I}7.11^{II}N	7.6460466666, 7°,38^{I}45.768^{I}E	531.30m
3	B3	12.9352933334, 12°567.056^{II}N	7.6460516667, 7°,38^{I}45.786^{I}E	541.20m
4	B4	12.935235, 12°56^{I}6.846^{II}N	7.646083333, 7°,38^{I}45.9^{II}E	534.80m
5	B5	12.935225, 12°56^{I}6.746^{II}N	7.646073332, 7°,38^{I}45E	544.20m
6	B6	12.9352933334, 12°567.056^{II}N	7.6460516667, 7°,38^{I}45.786^{I}E	545.30m
7	B7	12.9352933334, 12°567.056^{II}N	7.6460516667, 7°,38^{I}45.786^{I}E	547.20m
8	B8	12.9352933334, 12°567.056^{II}N	7.6460516667, 7°,38^{I}45.786^{I}E	555.10m
9	B9	12.9352933334, 12°567.056^{II}N	7.6460516667, 7°,38^{I}45.786^{I}E	556.20m
10	B10	12.9352933334, 12°567.056^{II}N	7.6460516667, 7°,38^{I}45.786^{I}E	558.30m

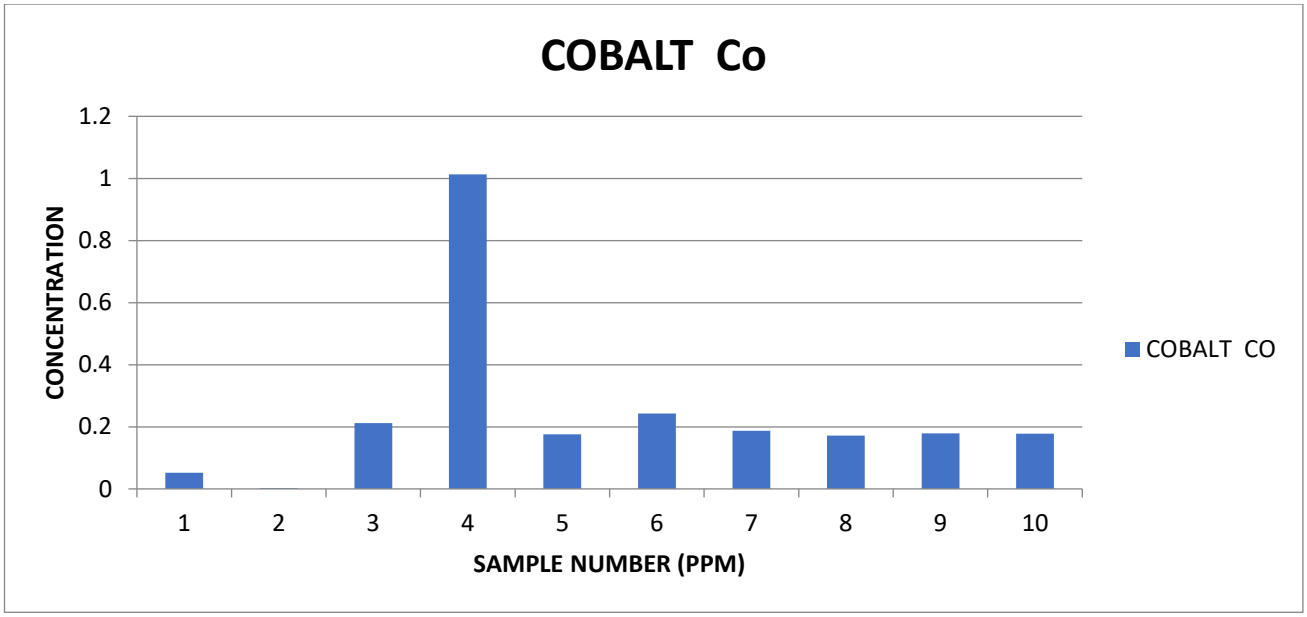

Figure 1: The concentration of cobalt (Co) presence in soil sample collected from Dandagoro quarters.

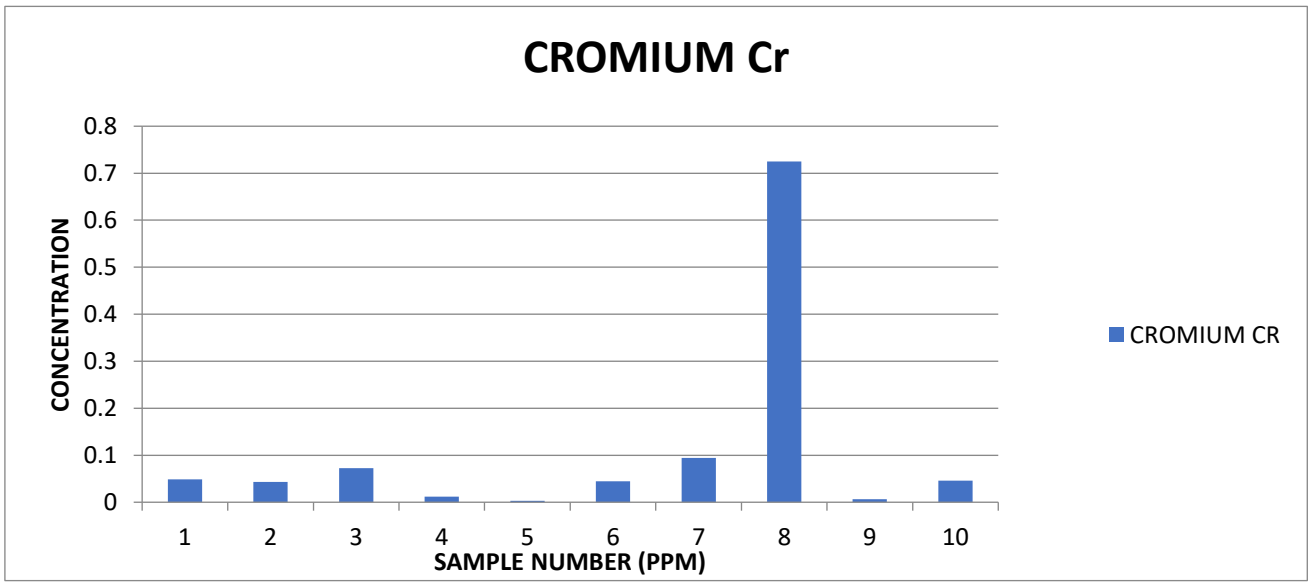

Figure 2: The concentration of cromium (Cr) presence in the soil sample collected from Dandagoro quarters.

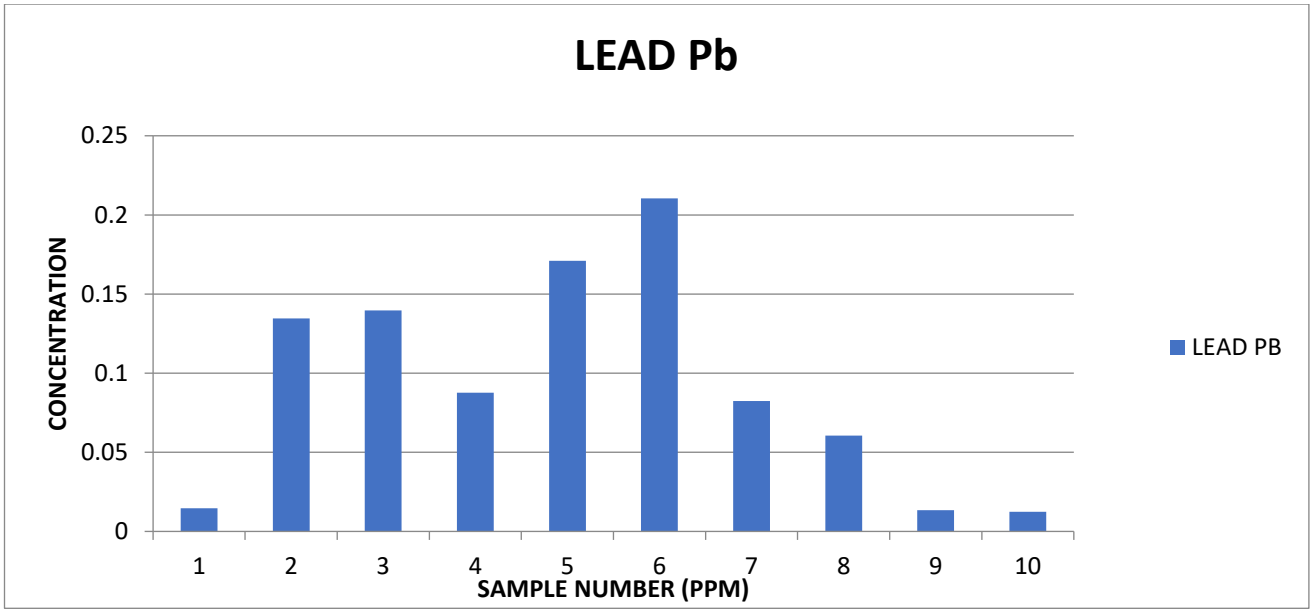

Figure 3: The level of concentration of lead (Pb) presence in soil sample collected from Dandagoro quarters.

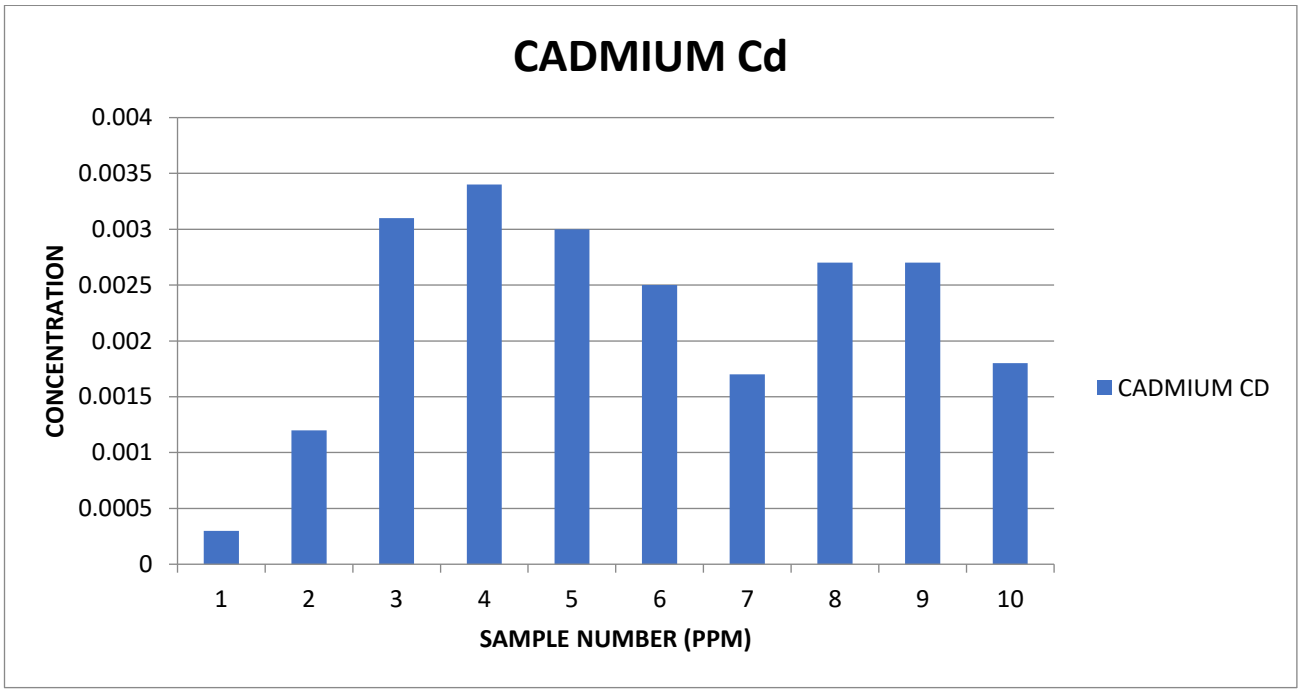

Figure 4: The level of concentration of cadmium (Cd) presence in soil sample taken from Dandagoro quarters.

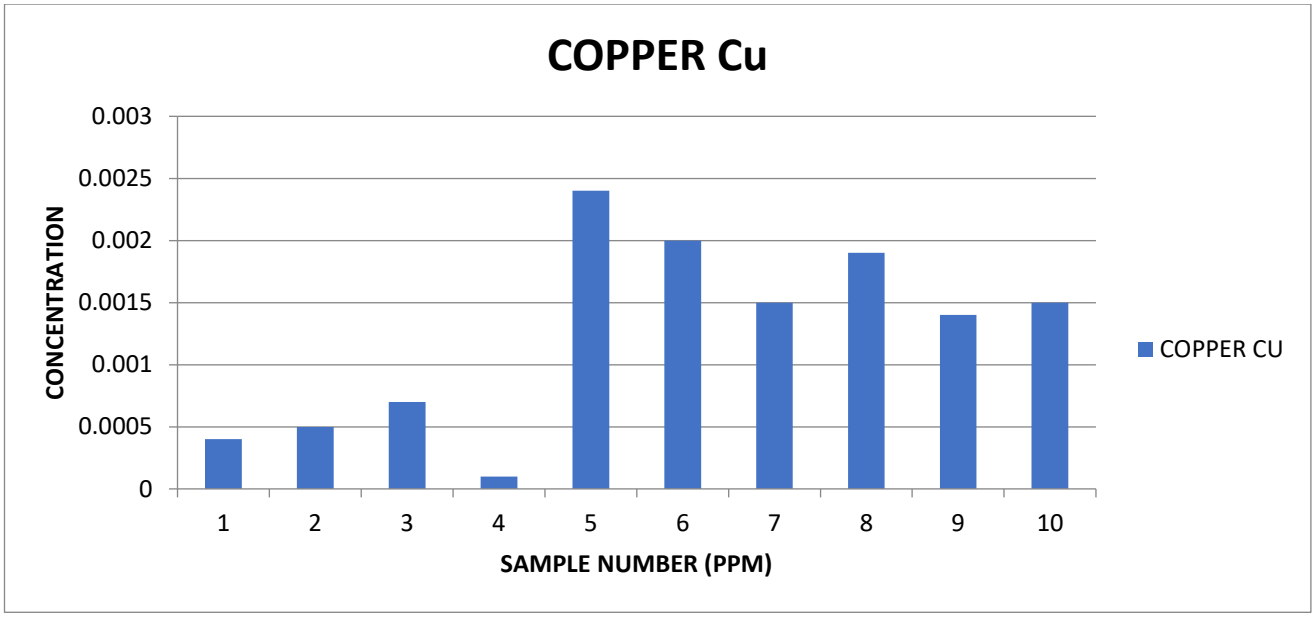

Figure 5: The level of concentration of copper (Cu) and its presence as heavy metallic element in soil sample collected from Dandagoro quarters

Cobalt had the maximum concentration in all the samples followed by Cr, Pb, Cd, and Cu, which are all in different values and indicated that these heavy metals were presence in the area but in small quantity which is not threat to the environment. Also the values of Co and Cr were at small quantity. The results show that the background concentrations of the selected heavy metals(cr, cu, cd, pb and co) in Dandagoro are at low level therefore it did not exceeded the thresh hold limit.

CONCLUSION

A flame atomic absorption spectrophotometer was used to measure the concentration of heavy metals (Cr, Cu, Cd, Pb and Co,) in soil samples collected from Dandagoro quaters. 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 pollution in the area. In line with above, it is strongly advised against locating businesses and factories there in order to stabilize environment.

REFERENCES

Ahmad K, Khan ZI, Ashfaq A, Ashraf M, Yasmin S (2015) Assessment of heavy metal and Metalloid Levels in Spinach(Spinacia oleracea) grown in waste soil of Sarghoda ,Pakistan . *Pak J Bot* 46(5) :1805-1810 **[Crossref]**

Alloway B.J. (1995). Heavy metals in soils 2 nd edition, Blackie academic and professional, Glasgow, pp. 500.

Federal Environmental Protection Agency (FEPA) Guidelines and standards for environmental pollution control in Nigeria. Decree 58 of 1988; p.238. **[Crossref]**

Kankara, U. M., Rabiu N., Nuraddeen N. G., Jamila M. K. and Umar M. K. (2021). Assessment Of Heavy Metal Concentration In Vegetables Dried Along Funta-Danja Highway Katsina State, Nigeria. *Fudma journal of science.* 5(1):467-471 **[Crossref]**

Holding BV (2004). Heavy metals (http:www.Lenntech.Com/heavy metals.htm).

Nielsen, S. (2010). *Food analysis laboratory manual.* New York, USA: Springer. **[Crossref]**

Olayiwola Olajumoke Abidemi 2013, Accumulation and contamination of heavy metals in soil and vegetation from industrial Area of Ikirun, Osun state, Nigeria, Global journal of pure and Applied chemistry Research Vol.1 Issue No.1 pp.25-34, june.2013. Public Health, 2(1), 24–29. **[Crossref]**

Rafi, M., & GowdaT, P. (2017). Determination of heavy metal analysis in vegetable samples of Bengaluru and Tumukur some market places, Karnataka, India (issue 4).

Rahib Hussain, Seema A. Khattak, Muhammad Tahir Shah, Liaqat Ali (2015): Multi statistical Approaches for Environmental geochemical Assessment of pollutant in soil of Gadon Amazai Industrial Estate, Pakistan j soil sediments (2015) 15:1119-1129. **[Crossref]**

Suleiman, B., B G, M., & Babangida, B. (2017). Total Excess Lifetime Cancer Risk Estimation from Enhanced Heavy Metals Concentrations Resulting from Tailings in Katsina Steel Rolling Mill, Nigeria. Journal of Material Science & Engineering, 06(03). **[Crossref]**

Samaila, A. Bello, S., Iliyasu, S. R. and Sani, M. (2022). The background concentration of some heavy metals at nysc orientation camp layout katsina. Fudma journal of science. **[Crossref]**

Shamsuddin, I. M., Yahaya, K. M., & Shawai, S. A. A. (2018). Determination of level of the concentration of some heavy metals in water from Jibiya dam, Katsina state. MOJ Biorg Org Chem , 2 (5), 243-245.

Sultana, M. S., Rana, S., Yamazaki, S., Aono, T., Yoshida, S., & Kanan, S. (2017). Health risk assessment for carcinogenic and non-carcinogenic heavy metal exposures from vegetables and fruits of Bangladesh. Cogent Environmental Science, 3(1), 1291107. **[Crossref]**

Uba, S., Ajibola, V.O.,Adeosun, O.S., Ikeh, D.C., Mikail, A.H., Awe, J.O.2 and Ruma, M .M.3(2021). Quantitative Assessment Of Pollution Status Of Heavy Metals In The Water From Mairua Dam, Faskari Lga, Katsina State, Northwestern Nigeria. Bayero Journal of Pure and Applied Sciences, 14 (2):95-100. **[Crossref]**

Uba, S.,Mohammed, R. M., Ado, F. M., Abubakar, S., & Isyaku, S. (2020). Risk Assessment of Selected Heavy Metals in Water and Sediment of Shika Dam, Zaria, Nigeria. SLU Journal of Science and Technology , 1 (1), 95-111.

World health organization (WHO) (IPCS) (1996).Environmental health criteria 171: Diseal fuel and trace element in soil WHO, Geneva. Pp 343.

Yusuf Abdulrashid And NuraddeenAbdurrahman.(2020). Assessment of some heavy metals in drinking water consume within katsina metropolis). **[Crossref]**