American Journal of Engineering Research (AJER)
e-ISSN: 2320-0847 p-ISSN : 2320-0936
Volume-6, Issue-12, pp-243-246
www.ajer.org
Research Paper Open Access

Assessment of As, Cr And Zn Concentrations In Dust Around Ririwai Tin Mine, Kano State North Western Nigeria.

Abdulllahi M.A.[1], Garba N.N.[2], Gaiya S.[1]
Department of Applied Science CST Kaduna Polytechnic, Kaduna Nigeria.
Department of Physics A.B.U. Zaria, Nigeria.

ABSTRACT: *Mining is a global industry undertaken by people for its economic benefits of wealth creation and employment. However, non-optimal management operations results in environmental degradation and negative health impacts on miners and mining community. In this study, the concentration levels of As, Cr and Zn in dust around Ririwai tin mine was carried out using instrumental neutron activation analytical (INAA) technique. The results shows that the mean concentrations of As, Cr and Zn in dusts across the study area were 4.25 ± 0.19 mg/kg, 43.44±1.80 mg/kg and 162.92 ± 5.43 mg/kg respectively. Zn have the highest concentration in all the locations followed by Cr with As having the lowest concentration in all locations. The concentration of As and Cr are within the world wide average values of 5.00mg/kg, 100.0mg/kg and 50.0mg/kg reported by USEPA for As, Cr and Zn respectively. While the concentration of Zn is 3 times higher than the worldwide average value which will poses a serious health concern in the study area.*
Keywords: *Concentration, Neutron Activation Analysis, Dust, Mining*

Date of Submission: 01-12-2017 Date of acceptance: 21-12-2017

I. INTRODUCTION

Mining and industrial processing were among the main sources of heavy metal contamination in the environment. Mining activities, through milling operations coupled with grinding, concentrating ores and disposal of tailings, along with mill wastewater provide obvious sources of heavy metal contamination of the environment [1] [2]. It is therefore, not surprising that the degree and e pollution as a result of human activities has been one of the main topics studied in environmental geochemistry. Many heavy metals and radionuclide's (radioactive contaminants) occurred naturally in the earth's soil. While trace amounts of heavy metals are not harmful to humans some even being necessary in our diet, accumulation over time can cause serious illness [3]. Heavy metals can have toxic effects on humans when they contaminate the soil or the ground water pollutant [1] [2].

Moreover, many metal ions play dual roles in the human physiology; some are essential for life while most of them are toxic at deviated concentrations [4].Ions such as sodium, potassium, magnesium and calcium are essential to sustain life. Additional metals such asmanganese, iron, cobalt, copper, Zinc, chromium, vanadium, selenium and molybdenum are also essential for optimal growth, development and reproduction. These metals function mostly as catalysts for enzymes activity in human bodies but become toxic when their concentration becomes excessive. In addition to the mercury, lead, cadmium, silver aluminum, arsenic and barium [5]. Epidemiological studies in recent years have indicated a strong association between the occurrences of several diseases in humans, particularly cardiovascular disease, kidney related disorders, neurocognitive effects and various forms of cancer and the presence of toxic trace metals [6].Heavy metals can cause health problems at higher exposures and destroy aquatic organism when leached into water bodies [5] [7]. Metals contamination in aquatic environmental has received huge concern due to their toxicity, abundance and persistence in the environmental and subsequent accumulation in the aquatic habitats [8].

Heavy metal residues in contaminated habitats may accumulate in microorganisms, aquatic flora and fauna, which in turn may enter the human food chain and result in health problems like the lead poisoning problems in Zamfara State that kills more than 400 children [9].

Several health problems such as respiratory disease, neoplasm/cancer, chronic hypertension, mental health and genetic impact among miners and mining communities have been reported in many countries [10]. The major

cause of these disease can be attributed to the heavy metal contamination and naturally occurring radioactive materials [11].In this work the concentrations of As , Cr and Zn were determine in dusts collected around Ririwai Tin mine Kano State, Nigeria using instrumental neutron activation analytical techniques.

II. MATERIALS AND METHOD

Dust samples were collected on filter papers mainly within the mines inside an active pits using air sampler. The locations where the samples were collected are presented in Table 1.

Table 4.1: Sampling locations

S/No	North	East	Elevation
1	10^0 44′ 35.3″	008^0 45′ 16.4″	856m
2	10^0 44′ 36.7″	008^0 45′ 15.8″	856m
3	10^0 44′ 33.8″	008^0 45′ 17.8″	856m
4	10^0 44′ 32.3″	008^0 45′ 21.0″	858m
5	10^0 44′ 30.3″	008^0 45′ 27.0″	862m
6	10^0 43′ 48.2″	008^0 44′ 57.1″	896m
7	10^0 43′ 49.1″	008^0 44′ 53.4″	894m
8	10^0 43′ 48.5″	008^0 44′ 53.0″	895m
9	10^0 43′ 50.2″	008^0 44′ 58.7″	892m
10	10^0 43′ 49.5″	008^0 44′ 59.2″	894m

The filter paper containing the samples were wrapped in a polyethylene bag and then placed in $7cm^3$ rabbit capsules. The polyethylene bag and rabbit capsules containing the samples were cleaned by soaking in 1:1 HNO_3 (Nitric acid) and then washed with de-ionised water in order to eliminate every contamination prior to sample irradiation in addition two blank filter papers were also analyzed [12].The concentrations of element of interest from the collected and prepared samples were investigated using neutron activation analytical technique (NAA) with the Nigeria Research Reactor 1 (NRR1) No NRR1/DS/JC/09/16 at the Centre for Energy Research and Training, Ahmadu Bello University, Zaria.

III. RESULTS AND DISCUSSION

Dust samples were collected from 10 locations and analysed using instrumental neutron activation analytical (INAA) technique. It was found ~~out~~ that the concentrations of the analysed elements varied from one location to another, inferential statistics was used to compare the concentrations of As, Cr and Zn across the sampling location. One way ANOVA with 5% level of significance was applied for the analysis. The mean concentrations of As, Cr and Zn are presented in Table 2.

Table 2: Concentration of As, Cr and Zn in mg/kg

S/No.	Sample I.D	As (mg/kg)	Cr (mg/kg)	Zn (mg/kg)
1	Rp1	0.61± 0.10	52.80 ± 1.80	215.00 ± 7.00
2	Rp2	0.28 ± 0.05	47.30 ± 1.60	306.00 ± 6.00
3	Rp3	0.34 ± 0.02	21.00 ± 1.50	111.00 ± 7.00
4	Rp4	0.27 ± 0.06	43.90 ± 1.40	142.00 ± 4.00
5	Rp5	0.15 ± 0.01	37.60 ± 1.70	142.71 ± 7.00
6	Rp6	0.49 ± 0.12	40.20 ± 1.90	92.10 ± 0.22
7	Rp7	1.29 ± 0.20	33.60 ± 1.40	80.90 ± 3.90
8	Rp8	3.39 ± 0.34	62.70 ± 2.60	194.00 ± 9.00
9	Rp9	5.60 ± 0.63	32.60 ± 1.80	233.33 ± 3.20
10	Rp10	30.10 ± 0.40	62.70 ± 2.30	112.20 ± 7.00
	Mean	4.25 ± 10.19	43.44 ± 1.80	162.92 ± 5.43
	Maximum	30.10 ± 0.63	62.70 ± 2.60	306.00 ± 9.00
	Minimum	0.15 ± 0.01	21.00 ± 1.40	80.90 ± 0.22
	Standard Deviation	8.778569 ± 0.192616	12.67716 ± 0.368782	68.53087 ± 2.437871

3.1 Arsenic (As)

From table 2, it can be observed that, the concentration of As ranged between 0.15 to 30.10 mg/kg with a mean value of 4.25 ± 0.19 mg/kg which is less than 5.00mg/kg world average value and it fall within the world range of 1-50 mg/kg as reported by [13].

3.2 Chromium (Cr).

The mean concentration of Cr was found to range between 21.00 - 62.70 mg/kg with a mean value of 43.44 ± 1.80 mg/kg which is within the recommended world average and range values of 100 mg/kg and 1-100 mg/kg respectively.

3.3Zinc (Zn)

The mean concentrations of Zn in the dusts samples analysed was found to be 162.92 ± 5.43mg/kg with a range values of 80.90 to 306.00 mg/kg. The mean concentration of Zn in the study is higher than the world average value of 50.00 mg/kg reported in soil by USEPA Fig. 1 compared the concentration of As, Cr and Zn in all locations.

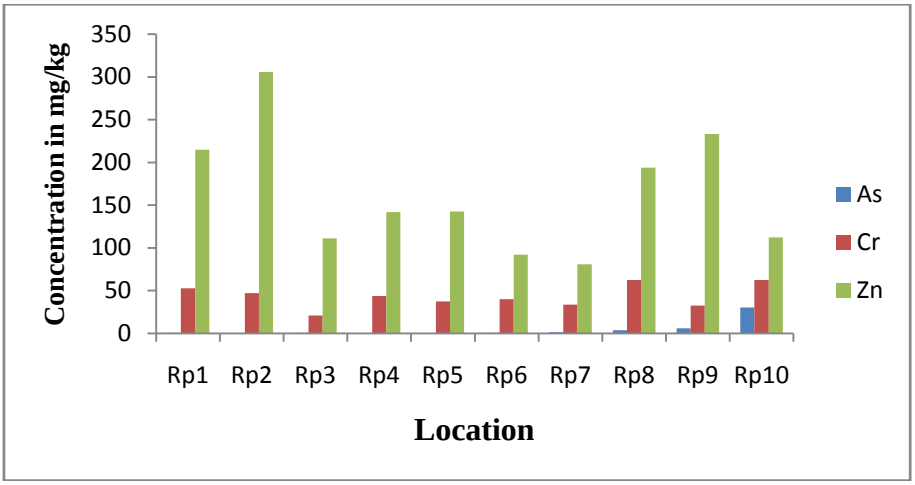

Fig. 1: Plot of Concentrations against locations

IV. CONCLUSION

The concentrations of As, Cr and Zn in dust around Ririwai tin mine of Kano state Nigeria were investigated using INAA technique. The results shows that Zn with mean concentration of 162.92 ± 5.43 mg/kg is higher in all locations across the mine followed by Cr with mean concentration of 43.44 ± 1.8 mg/kg while As with mean concentration of 4.25 ± 0.19 mg/kg has the lowest concentration in all the locations.

The ANOVA (0.0070.05) shows that there is a significant difference in the relative abundance of the various metals. In other words some metals were more abundant than others in all the locations. The concentrations of As, Cr and Zn obtained in this study indicated that As and Cr are with the world wide average value and range of 5.00mg/kg and 100.00mg/kg for As and Cr respectively. However the concentration of Zn obtained in this study is higher than the world average values of 50.00mg/kg therefore the higher concentration of Zn in the study area pose health hazard.

REFERENCES

[1]. Ayodele J.T and Mohammed, S.S. 2011.Zinc Speciation in maize and soils *Res. J. Chem. Sci.1(4), 98 – 108*.
[2]. Kabala C and Singh B.R. (2001). Fractional mobility of copper, lead and zinc in soil profiles in the vicinity of a copper smelters. *J. Environ. Qual. 30 485 – 492*.
[3]. Kashem M.A. and Singh B.R., (1998). Heavy metal contamination of soil in vegetation in the vicinity of industries in Banglesh, *Water, Air and Soil pollution*, 115, 347–361.
[4]. Mohammed S.S. and Mohammed M.B., (2012). Analysis of dumpsite soil pH in selected dumpsite of Kaduna metropolis, Nigeria, *I.Res. J. Environment*, 1(3), 55-57.
[5]. Chiroma T.M Ebewele, R.O and Hymore F.K. 2012. Level of Heavy metals (Cu, Zu, Pb Fe and Cr) in Bush green and Roselle irrigated with treated and untreated sewage water. *Int. Res. J. Envrionment Sci. 1(4), 50 – 55*.
[6]. Sharma R.K., Agrawal M. and Marshall F., 2000. Heavy metal Contamination of soil and vegetable in suburbam areas of Voranasi, India, *Ecotoxico. Environ. Safety*, 66, 258–266.
[7] Abdullahi M.A Mohammed, S.S. and Mshelia M.S 2013. Distribution of Cr Zn and Pb in soil along the bank of River Kaduna Nigeria. *Int. Res. J. Environmental Sci. 2(7) 64 – 68*.
[8] Boamponsem, L. K., Adam, J. I., Dampane, S.B, Owusu-Ansah, E. and Addae, G. (2010). Heavy Matals, Lavel in Stream of Tarkwa gold mining areas of Ghana, *J. Chem. Pham res*, 2 (3): 504-527

[9] Galadima, A. and Garba, Z. N. 2012. Heavy metals pollution in Nigeria; Causal and consequences. Elixer pollution (45) 7917-7922.
[10] WHO (1999): Hazard prevention and control in the work environment. Air borne dust WHO/SDE/OEH/199.14,Geneva.
[11] ICRP (1994): Protection against Rado -222 at home and at work publication 6 5, Ann. ICRP 2 3, 2 Pergamon Press, Oxford and New York.
[12] Jonah S.A. Umar I.M. Oladipo. M.O.A Balogun G.I and Adeyemi D.J. (2006) Standardization of NIRR- 1 irradiation and counting facilities for instrumental Neutron Activation Analysis Centre for Energy Research and Training, Ahmadu Bello University Zaria Pp. 818 - 822.
[13] U.S Environmental Protection Agency 1992 Ground\ water issue. EPA/540/5- 92/018.

*Abdulllahi M.A.1,"Assessment of As, Cr And Zn Concentration In Dust Around Ririwai Tin Mine, Kano State North Western Nigeria..” American Journal of Engineering Research (AJER), vol. 6, no. 12, 2017, pp. 243-246.