THE EXPERIMENT
INTERNATIONAL JOURNAL OF SCIENCE AND TECHNOLOGY

ISSN-2319-2119

RESEARCH ARTICLE

O.A. Ekpete et al, The *Experiment, Mar, 2013 Vol. .8(1), 450-455*

HEAVY METAL DISTRIBUTION IN SOIL ALONG IWOFE RUMUOLUMENIROAD

ABSTRACT

The levels of Pb^{2+}, Zn^{2+}, Cd^{2+} and Cu^{2+} in soil along Iwofe Rumuolumeni, Port Harcourt, Rivers State of Nigeria was determined to assess the impact of automobile emissions on the soil. The soil samples were digested using $10cm^3$ of 40% hydrofluoric acid and $1cm^3$ of 70% perchloric acid mixture. The soil mean values obtained for Pb^{2+}, Cd^{2+}, Zn^{2+}, and Cu^{2+} were 1.472 ± 1.314, 0.056 ± 0.003, 3.995 ± 1.922, 1.426 ± 1.124 respectively. In this study the following trend of heavy metal contamination was established Zn^{2+}> Pb^{2+}> Cu^{2+} >Cd^{2+}. For all the samples studied concentrations of the metals were distinctly higher than the control site indicating enrichment of heavy metal on the soil as a result of automobile emissions on the busy roads. Result in the present study does not indicate any serious pollution compared to WHO permissible limit.

KEYWORDS: Heavy metal, soil, leaves, pollution, bioaccumulation.

INTRODUCTION

Pollution of the environment with toxic metals has increased dramatically since the onset of the industrial revolution as reported by Voegelan et al., (2003). Soil pollution by heavy metals such as cadmium, lead, chromium, copper and zinc is a problem of concern. Although heavy metals are naturally present in soil contamination and comes from local sources: mostly industry (non-ferrous industries, but also power plants and iron, steel and chemical industries).

Rashad and Shalaby (2007) posits that agriculture (irrigation with polluted waters, sewage sludge and fertilizer, especially phosphates, contaminated manure and pesticide and pesticide containing heavy metals), waste incineration, combustion of fossil fuels and road traffic, long – range transport of atmospheric pollutants adds to the metals in the natural environment. In recent years, it has been shown that lead levels in soil and vegetation have increased considerably due to traffic pollution, especially from usage of leaded petrol and exhaust combustion (Ano et al., 2007; Onde et al., 2007; Osakwe, 2009).

Sutterland (2000) stated that the problem worsens as daily traffic increases. Cement dust has been shown to adversely affect the soil and exhibit elevated pH levels. Cement industry also plays a vital role in the imbalances of the environment and produces air pollution hazards. It was well documented that work done on the composition of soil around cement factories has shown that there were very high levels of chromium, silica, iron and calcium with contamination levels decreasing dramatically with distance from the factories Asubojo, et al., (1991); Mandre et al.,(1998).Nigerian soil has being bio accumulated by most heavy metals resulting to serious disease infection to crops, animals and human beings. The auditing and monitoring of metals in the environment (soil, water and food) are fast becoming essential aspects of pollution studies. This study is one of such attempt to analyse the Rumuolumeni, ObioAkpor Local Government Area. This study will act as baseline data information on the environmental impacts of automobile emission and cement particles on agricultural soil.

MATERIALS AND METHODS

The study area Rumuolumeni in ObioAkpor Local Government Area of Rivers State is located between latitude 4.8^oN and longitude 6.9^oE. It is very busy connecting Wimpey road to Tombia waterside and other mid dense industrial and sparsely populated areas in Rivers State. It constitutes the following areas (1) big tree junction, (2) Nkpor junction, (3) Aker/Okocha road, (4) Eagle cement factory and (5) Ignatius Ajuru University of Education.

THE EXPERIMENT
INTERNATIONAL JOURNAL OF SCIENCE AND TECHNOLOGY

ISSN-2319-2119

RESEARCH ARTICLE
O.A. Ekpete et al, The *Experiment, Mar, 2013 Vol. .8(1), 450-455*

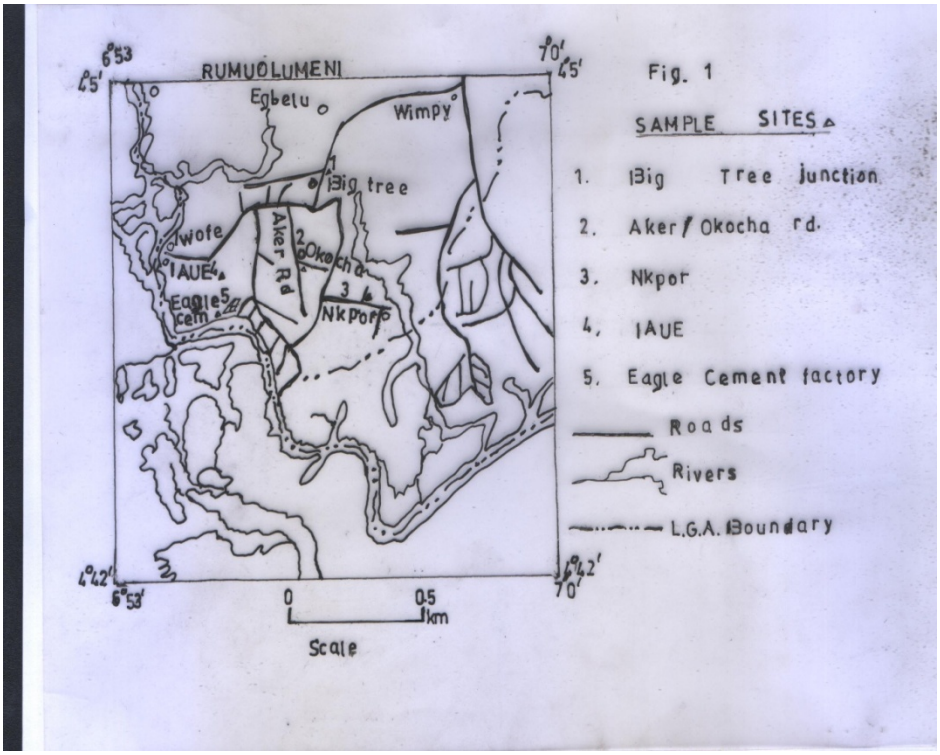

Fig 1.1: Map showing the soil sample location around Rumuolumeni.

PREPARATION OF SOIL

Topsoil samples of 0-30cm depth from five (5) different sampling locations chosen were taken. The samples were collected with a hand auger (a stainless steel crew) and hand spade and were placed in a clean polyethylene bags to avoid contamination. The samples were well labelled. The soil samples were sun dried for two weeks, sieved with a 2µm sieve, ground and stored in plastic vials.

CHEMICAL ANALYSIS

The soil samples were digested using $10cm^3$ of 40% hydrofluoric acid and $1cm^3$ of 70% perchloric acid mixture Osakwe (2009). All the samples were analysed for their metal ion contents using Atomic Absorption Spectrophotometer (AAS) equipped with deuterium background correction devise. All reagents used in the analysis were of analytical grade. Quality control was measured by the use of triplicate and standard reference materials and procedural blanks.

THE EXPERIMENT
INTERNATIONAL JOURNAL OF SCIENCE AND TECHNOLOGY

ISSN-2319-2119

RESEARCH ARTICLE

O.A. Ekpete et al, The *Experiment, Mar, 2013 Vol. .8(1), 450-455*

RESULTS AND DISCUSSION

Sites	Pb^{2+}	Cd^{2+}	Zn^{2+}	Cu^{2+}
Big tree junction	0.669	0.064	6.417	2.369
Nkpor village junction	1.619	0.049	2.670	0.046
Aker/Okocha road	2.375	0.089	5.103	2.723
Eagle cement factory	2.624	0.071	4.214	1.321
Mean	1.472	0.056	3.995	1.426
Standard deviation	± 1.314	± 0.033	±1 .922	±1 .124
Control	0.072	0.0013	1.559	0.672

TABLE 1: Concentration of heavy metals (mg/kg^{-1}) in the soil samples including their means and standard deviations.

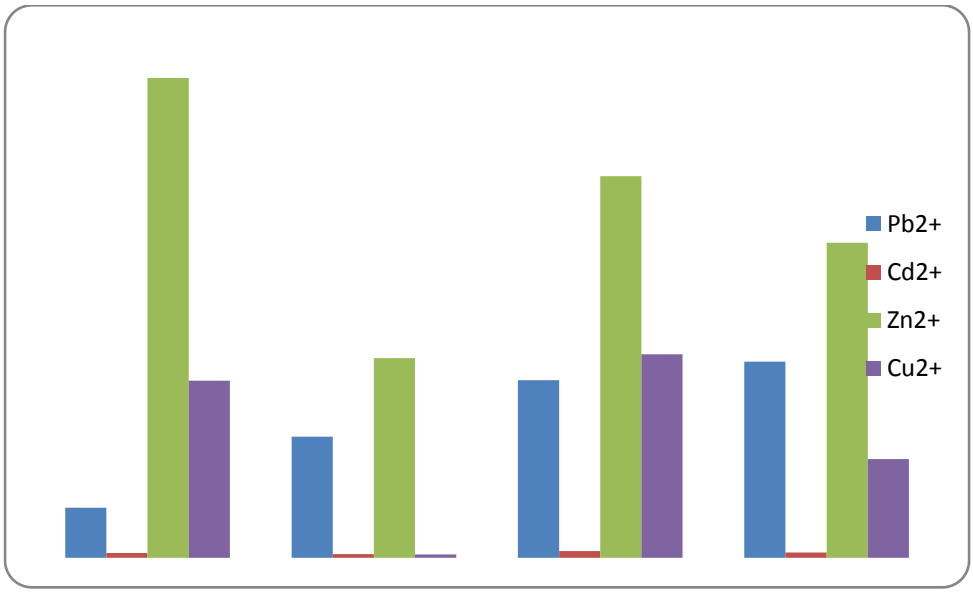

Figure 1. Bar chart representation of the distribution of heavy metals in the selected soil samples.

THE EXPERIMENT
INTERNATIONAL JOURNAL OF SCIENCE AND TECHNOLOGY

ISSN-2319-2119

RESEARCH ARTICLE
O.A. Ekpete et al, The *Experiment, Mar, 2013 Vol. .8(1), 450-455*

Metal	Highest permissible level	Maximum permissible level
Pb	0.05	0.1
Cd	0.005	0.01
Zn	5.0	15.0
Cu	0.05	1.5
Fe	0.1	0.3
Cr	0.02	0.05
Ni	0.5	6.5

Table 2: World Health permissible limits for some heavy metals in ppm

Table 1 (Figure 1) show the content of heavy metals in the soil of the selected area. The investigation of the total contents of heavy metals in the soil was restricted to top soil 0-30cm. Previous studies showed that surface soils are better indicators of metallic burdens Oyewale and Funtu (2002); Amusan, et al., (2005). Zinc ion (Zn^{2+}) had the highest concentration level in all the sites studied. The concentration ranged between 2.670 to 6.417mg/kg with a mean value of 3.995 ± 1.922. The highest concentration was recorded at the big tree junction followed by Aker/Okocha road before Eagle cement and Nkpor village. The high concentration of zinc ion (Zn^{2+}) is expected since it readily hydrates and combines with other metals to form its ores. Similar concentration level of Zn^{2+} as observed in this study has been reported by Eddy *et al*., (2006).

The lead ion (Pb^{2+}) and copper (Cu^{2+}) concentration levels ranged between 0.669 to 2.624mg/kg and 0.046 to 2.723mg/kg respectively with mean values of 1.472±1.314 for lead and 1.426± 1.124 for copper. The levels of lead and copper observed were lower than those reported by Eddy *et al*.,(2006) and Osakwe (2009). The relatively low concentrations observed could be attributed to low agricultural activities, automobile emission and lack of heavy wind dispersion around the located sites. Cadmium ion Cd^{2+} concentrations ranged between 0.049 to 0.089mg/kg with mean value of 0.056 ± 0.033. The values of lead, cadmium, zinc and copper were all lower than the values obtained from the control site. The concentration levels of cadmium observed were lower compared to those reported by Madejon*et al*., (2002), Sezgin et al., (2003) and Oviasogie and Ofomaja, (2007). The World Health Organization (WHO) permissible limits for these metals are shown in Table 2.

CONCLUSION

In this study the following trend of heavy metal contamination was established $Zn^{2+} > Pb^{2+} > Cu^{2+} > Cd^{2+}$ for the soil samples studied. Zn^{2+} was found to be very much higher than all the other elements. It can be concluded that there is low impact of automobile exhaust emission on these soil around the selected location. The result from this study does not indicate any serious pollution or contamination risk on the selected soil. The relatively moderate concentration should be checked to determine when bioaccumulation occurs.

THE EXPERIMENT
INTERNATIONAL JOURNAL OF SCIENCE AND TECHNOLOGY

ISSN-2319-2119

RESEARCH ARTICLE
O.A. Ekpete et al, The *Experiment, Mar, 2013 Vol. .8(1), 450-455*

REFERENECES

1. Amusan, A .A. Ige, D.V and Olawale, R. (2005). Characteristic of soils and crops uptake ofmetalsin municipal waste dump sites in Nigeria. J.Hum. Ecol., 17 (3): 167-171.

2. Ano, A.O. Odeoma, S.A and Ekwueme, P.O. (2007). Lead and cadmium levels on soils and cassava(Manihotesculentagrantz) along Enugu – Port Harcourt express way in Nigeria. Electronic Journal of Environmental Agricultural and Food Chemistry.
3. 5:2024-2031.

4. Asubojo, O.I. P.O. Aina, O.F.Oluwole, W. Arshed, O.A. Akanle and Spyrou N.M. (1991). Effects of cement production of the elemental composition of soils in the neighbourhood of two cement factories. Water Air Soil Pollution. 5758: 819 – 828

5. Eddy, N.O. Odoemelan, S.A and Mbaba, A. (2006). Elemental compositions of soil in some dump sites. Electronic Journal of Environmental agricultural and Food Chemistry. 5 (3): 1015- 1031.

6. Madejon, P. Murilo, J. Carera, F. and Lopez, R. (2002). Bioaccumulation of As, Cd, Cu, Fe and Pb in wild grasses affected by the aznal mine spill (SW Spain). Sci, Total Environ. 290: 105 -120.

7. Mandre, M. Ots, K. Rauk, J and .Tuulmets I. L. (1998). Impacts of air pollution emitted from the cement industry on forest bioproduction. Oil shale.15: 354 -364.

8. Onde, S. S. Dursun, S. Gezgin and A. Demibas (2007). Determination of heavy metal pollution in grass and soil of city green area (Konya, Turkey). Polish Journal of Environmental Study. 16 (1): 145: 154

9. Osakwe, S.A. (2009). Heavy metal distribution and bioavailability in soils and cassava (Manihotesculentusgrantz) along Warri – Abraka expressway Delta state Nigeria. Journal of Chemical Society of Nigeria 34 (1): 211-217.

10. Oviasogie, P.O and Ofomaja, A. (2007). Available Mn, Zn, Fe, Pb and physicochemical changes associated with soil receiving cassava mill effluent. Journal of Chemical Society of Nigeria 32(1): 69-73.

11. Oyewale, O.A and I.I. Funtu (2002). Lead, copper zinc levels in soils along Kaduna- Zaria high way Nigeria. Global Journal of Environmental Sciences 1: 7-13.

12. Rashad, M. and Shalaby, E.A. (2007). Dispersal and deposition of heavy metals around two municipal solid Waste (MSW) dump sites, Alexandra, Egypt. American –European Journal of Agricultural and Environmental Science 2 (3): 204-212.

13. Sezgin, N Ozcan, H. Demir, G. Nemlioglu, S and Bayat C. (2003). Determination of heavy metal concentrations in street dusts in Istanbul. 339: 657-659.

14. Sutterland, R.A.(2000). Depth variation in copper, lead and zinc concentrations and mass Enrichment ratios in soils of an urban watershed.Journal of Environmental Quality. 29: 1414 – 1422.

15. Voegelan, A. K. Barmetter and R. Kratzscmar (2003). Heavy metals release from contaminated soils, comparism of column leaching and batch extraction results. Journal of environmental quality 32: 865 - 875.

O.A. Ekpete; and C. Festus

Department of chemistry, Ignatius Ajuru University of Education, Port Harcourt, Nigeria
E-mail: oekpete@yahoo.com