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Short Communication

DETERMINATION OF HEAVY METALS IN SOIL IN THE VICINITY OF A DUMPSITE IN KETAREN GWARI, MINNA

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ABSTRACT
In recent years, pollution in large areas of land by heavy metals and chemicals has become a major concern. The discharge of these effluents would also change the physico – chemical characteristics of the soil in turn results in decreased soil microbial activity and soil fertility, and yield losses. The presence of distinguishing pollutants not only affects the soil edaphic characters but also the ecosystem. The Atomic Absorption Spectrophotometry was used to analyze soils from Ketaren Gwari area of Minna for possible heavy metal contamination due to dumping of refuse and mechanic activities. The mean concentration of the six metals ions for this study was found to be in the following order: Fe>Cu>Zn > Pb>Cr. The level of Ni was found to be below detectable limit. The results showed that heavy metal contamination in the sub-surface soil samples is not high compared to background levels.

KEYWORDS: Soil, Heavy Metals ions, Pollution, Refuse, Health, A.A.S.

INTRODUCTION
Solid waste handling and disposal is a major environmental problem in many urban centers in Nigeria. In a few cases, the municipal wastes, mostly garbage and wastes from food processing plants, metals, glass, ceramic and ashes are incinerated or simply dumped. Many studies have shown that heavy metals (metals and metalloids with an atomic density greater than 6g /cm^3) from these wastes can accumulate and persist in soils at environmentally hazardous levels (Alloway, 1996; Amusan, *et al*, 2005; He, *et al*., 2004; Vijayalakshmi, *et al*., (2011) and Ojanuga *et al*, 1996). Refuse dumpsites constitute a source of heavy metal pollution to both soil and aquatic environments.
At Ketaren Gwari wastes are dumped recklessly with no regards to environmental implications. In some dumpsites wastes are burnt in the open and ashes abandoned at the sites. The burning of wastes often results in getting rid of the organic materials, oxidation of metals and hence leaving the ash richer in metal contents. After the processes of oxidation and corrosion, these metals will dissolve in rain water and leach into soil from where they could be picked up by growing plants thereby entering the food chain (Ebong *et al*, 2008). In these locations, the presence of dumpsites causes non-point-source pollution. Proximity of a large number of mechanics plying their trade in the vicinity of the dumpsites could also be a source of heavy metal pollution. The objective of this study was to assess the status of heavy metals in refuse dumpsite soils with the assumption that heavy metal concentration in excess of critical levels could lead to agronomic and environmental problems.

MATERIALS AND METHODS
Ketaren Gwari area of Minna was chosen for this study. This site represents a peri-urban center with mechanic workshops and dumpsites. Sub surface (15-30cm) soil samples were collected with the aid of a shovel and then placed in clean polyethylene bags. The samples were taken at 5m spacing diagonally (south-easterly) beginning from the dumpsite. Control samples were taken 50m from the dumpsite. The samples were then transported to the laboratory for analysis. The soil samples were air dried, crushed and passed through a 2mm sieve. 1g each of the sieved soil sample was digested in 20 cm^3 of a 4:1 mixture of concentrated HNO_3 and $HClO_4$ acids by heating in a fume cupboard until a clear solution was obtained. The digest was made up to 100 cm^3 and used for analysis, The concentrations of metals in digested soil samples were determined using Atomic Absorption Spectrophotometer.

RESULTS AND DISCUSSION
The summary table of total heavy metal content of the 15 – 30 cm sub soil from the dump sites and control sites is shown in Table 1. The investigation of the total content of heavy metals in the soils was restricted to the sub surface soil since sub surface soils are better indicators of plant available metal uptake. and not a major indicator of metallic burdens (Nyangababo and Hamya, 1986; Amusan, *et al*, 2005). The results show that soils from the control sites do not differ significantly in their content of total metals studied except for total Cu. Result obtained also show that soils from dumpsites recorded fairly higher metal concentrations than their corresponding levels at the normal control site. The high values of heavy metals were in agreement with the results obtained from similar studies by Amusan *et al* (2005), and could be attributed to the availability of metal containing wastes at dumpsites.
For the dumpsite soil samples, the mean concentration of the metals for this study were found to follow in the order; Fe>Cu>Zn > Pb>Cr. The Concentration of Ni was found to be below detectable limit. The mean range of Cu in the soil ranged from 0 to 32.4 mg/kg. This could be from engine wear, thrust bearings, bushing and bearing metals, which are common in the mechanic sites in the study area. However some studies show much higher contamination levels of Cu (Ndiokwere, 1984; Ho and Tai, 1988), but the

results obtained falls within 18.00 and 1.48 mg/kg reported by Kakulu (2003) and Awofolu (2005) respectively in a similar study.

TABLE 1. Heavy metal contents (mg/kg) of soils from Ketaren Gwari Dumpsite

	Metal ions concentration					
Sampling sites	Cu	Pb	Fe	Zn	Cr	Ni
1	0.00	0.00	18.80	2.55	0.10	ND
2	6.00	0.10	24.00	12.00	0.10	ND
3	7.00	0.05	24.40	16.60	0.15	ND
4	32.00	0.50	32.00	17.20	0.40	ND
5	32.40	0.80	30.00	14.80	0.40	ND
6	0.00	0.00	15.00	2.90	0.10	ND
7	2.50	0.82	28.40	13.40	0.50	ND
8	19.00	0.03	29.00	12.20	0.10	ND
9	5.40	0.40	27.60	14.00	0.30	ND
10	18.00	2.00	28.40	12.80	0.20	ND
11	13.50	0.70	28.40	14.00	0.40	ND
12	27.00	1.50	30.40	18.00	0.50	ND
13	17.00	0.30	26.80	1.20	0.30	ND
14	8.00	0.00	24.80	11.00	0.20	ND
15	9.00	0.40	24.00	10.00	0.20	ND
16	9.00	0.40	24.00	10.00	0.20	ND
Minimum	0.00	0.00	15.00	1.20	0.10	
Maximum	32.40	2.00	32.00	18.00	0.50	
Mean	12.86	0.50	26.00	11.42	0.26	
Std. Deviation	10.51	0.57	4.39	5.13	0.14	
Control						
1	3.70	0.00	22.80	2.40	0.15	ND
2	7.00	0	22.40	2.90	0.18	ND
3	8.00	0.2	26.80	2.70	0.20	ND
4	13.00	0.4	28.40	9.00	0.30	ND
Minimum	3.70	0.00	22.40	2.40	0.15	
Maximum	13.00	0.40	28.40	9.00	0.30	
Mean	7.93	0.15	25.10	4.25	0.21	
Std. Deviation	3.85	0.19	2.96	3.17	0.07	

ND = not detectable

Pb contents in soil ranged from 0.00 to 2.00 mg/kg. Pb was lower than EU upper limit of 300 mg/kg (EC, 1986) and was at lower concentrations than the maximum tolerable levels proposed for agricultural soil, 90 – 300 mg/kg (Kabata- Pendias and Dudka, 1991). The observed highest Pb concentration at site 10 suggests long accumulation of some level of Pb, probably from batteries and some discharges from the cottage industries from the area. The Pb obtained in the present study did not exceed substantially reported background values of 25 mg/kg Pb in soil (Canadian Environmental Quality, 1992).

Iron concentration ranged between 22.40 and 28.40 mg/kg. The result in Tables 1 also revealed that Fe had the highest concentration among all the metals investigated. This could be attributed to the abundance of Fe – containing wastes in the environment (Ebong *et al* 2008) from mechanic activity.

The concentration of zinc in soil samples ranged from 1.20 to 18.00 mg/kg. The value of Zn obtained in this study is similar to the reported value of 4.75 – 16.16 mg/kg in 'uncontaminated' soil (Alexander and Pasquini, 2004) and soil in other areas of the country (Harrison et al., 1980).

Chromium concentration in the dumpsite soil samples ranged from 0.1 to 0.5 mg/kg. The low presence of Cr in this area as compared to mean values of 81.00 kg/mg obtained by Ebong, *et al*, (2008) indicates that the metallurgic, tanning and plating Industries *etc* which use chromium on a daily basis are not common in the area. Cu. On the other hand ranges from 0.00 to 32.40mg/kg possibly from mechanic activity.

CONCLUSION

From the present study, it is evident that the soil from the dump site of Ketaren Gwari area of Minna contains low concentrations of heavy metals as compared to other studies. However, the continuous use of this area as a dumpsite may lead to heavy metals build up in soils to undesirable levels; especially from automobile mechanic activity which could increase the risk of serious environmental pollution in the future.

REFERENCES

Alexander, M. J.and Pasquini, M. W. (2004) Chemical properties of urban waste ash produced by open burning on the Jos Plateau: Implications for agriculture, *Sci. Total Environ*., 319 (1-3): 225-240.

Alloway, B. J. (1996) *Heavy Metal in Soils*. Halsted Press, John Wiley & Sons Inc., London

Amusan, A. A ; Ige, D.V. and Olawale, R. (2005) Characteristics of Soils and Crops' Uptake of Metals in Municipal Waste Dump Sites in Nigeria. *J. Hum. Ecol*., 17(3): 167-171

Awofolu, O.R. (2005) A survey of Trace metals in vegetation, soil and lower animals along some selected major and Roads in metropolitan city of Lagos. Environmental monitoring and Assessment*,* 105: 431-447.

Canada Council of Ministers of the Environment. (1992) 'Canadian Environmental Quality for Contaminated Sites'. Report CCME EPCC, Winnipeg, Manitoba.

Ebong, G. A; Akpan, M. M. and . Mkpenie, V. N. (2008) Heavy Metal Contents of Municipal and Rural Dumpsite Soils and Rate of Accumulation by *Carica papaya* and *Talinum triangulare* in Uyo, Nigeria. *E-Journal of Chemistry* Vol. 5, No. 2, pp. 281-290 http://www.e-journals.net

European Commission (EC) (1986) European Commission, Office for Official publications of the European Communities, Luxembourg, Council Directive 66/278/EEC on the protection of environment, and in particular of soil, when sewage sludge is used in agriculture.

Harrison, R. M.; Laxen D. P. H and Wilson, S. J. (1981) Chemical associations of lead, cadmium, copper and zinc in street dusts and roadside soils. *Environ. Sci. Tech.* 15: 1378-1383.

He, Z.L., Zhang, M.K., Calvert, D.V., Stoffella, P.J, Yang, X. E. and Yu, S., (2004) Transport of heavy metals in surface runoff from vegetable and citrus fields. *Soil Sci. Soc. Am. J.,* 68, 1662-1669.

Ho, I. B and Tai, K. M. (1988) Elevated levels of lead and other. Metals in Roadside Soil and Grass and their use to monitor Aerial metal Depositions in Hong Kong. *Environ Pollut*, 49: 37-51.

Kabata-Pendias, A. and Dudka, S. (1991) Trace metal contents of Taraxacum officinale dandelion as a convenient environmental indicator.Environ. *Geochem. Health,* 13(2): 108-113.

Kakulu, S. E. (2003) Trace metal concentration of roadside surface soil and tree bark a measurement of local atmosphere pollution in Abuja, Nigeria. *Environ. Monit. Assess.* 89(3): 233-242.

Ndiokwere, C. L. (1984) A study of heavy metal pollution from motor vehicle emission and its effect on roadside vegetation and crop in Nigeria. *Environ. Pollut*. 7: 35-42.

Nyangababo, J.T. and Hamya, J.W. (1986) The deposition of lead, cadmium, zinc and copper from motor traffic on *Brachiaria enimi* and soil along a major Bombo road in Kampala city. *Intern. J. Environ. Studies*, 27: 115 -119

Ojanuga, A.G., Lekwa, G. and Okusami, T.A. (1996) Distribution, classification and potentials of wetland soils of Nigeria Monograph No. 2, Soil Science Society of Nigeria. 1-24.

Vijayalakshmi. S., Riyaz Ahmad Rather & Kathiravan. G. (2011) HPTLC Analysis of Stress Induced Metabolites in *A. terreus* From Polluted Sites. *IJSN. Vol*. 2(1): 59-62.