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Heavy Metals in Soils of auto- mechanic shops and refuse dumpsites in Makurdi Nigeria

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ABSTRACT: Dumpsites soil samples in Apir and North Bank Auto- mechanic workshop locations in Makurdi, the Benue State capital located on latitude 7^0 44'N and longitude 8^0 32'E of the Equator situated in a valley in north central Nigeria, 100m above sea level, were collected and analyzed for content of selected heavy metals. These locations were chosen for investigation, being the major mechanic workshops sites in Makurdi; and most mechanic workshop waste are made up of metals. Atomic Absorption Spectrophotometer (UnicamSolaar32 model) was used for analyzing the digested soil samples for heavy metal content. Mean concentrations of the selected heavy metals in the dumpsite soil at Apir were 0.003 mg/Kg, 0.2414 mg/Kg, 0.2552 mg/Kg, 0.1882 mg/Kg and 0.0210 mg/Kg for Cd, Cr, Cu, Pb and Ni respectively while in North bank the mean concentrations were 0.0178 mg/Kg, 0.2688 mg/Kg, 0.1869 mg/Kg, 0.5701 mg/Kg and 0.2431 mg/Kg for Cd, Cr, Cu, Pb and Ni respectively .The results from both locations were higher than their controls indicating a clear case of pollution. Heavy metals from the wastes were suspected to be the feeding source in the soils. Such a situation could be regarded as "unsafe" as these metals are eventually taken up by plants and subsequently get into the food chain. Ground and surface water quality is also threatened as these heavy metals get leached and washed into them, making the water unfit for human consumption. Advocacy of waste disposal and its effects with legislation are recommended. This study is important to the host communities of the auto-mechanic locations as a source of awareness of the environmental effects of refuse dumpsite soils. It will also form a baseline of the environmental effects of indiscriminate dumping of refuse. Previous studies have not recognized auto-mechanic shops dumpsites and it will make for research in this area. @JASEM

KEYWORDS: Heavy metals, pollution, auto-mechanic shops, waste dumpsites

Human activities create vast amount of various wastes and pollutants, the release of these materials into the environment sometime cause serious health problems. Waste is any substance, solution mixture or article for which no direct use is envisaged but which is transferred for processing, dumping, elimination by incineration or other methods of disposal (Yakowitz, 1988).

In most instances, waste is dumped recklessly with no regards to environmental implications, while in some dumpsites, waste are burnt in the open and ashes abandoned at the sites. The burning of these wastes gets rid of the organic materials leaving the metal contents. After the process of oxidation and corrosion, these metals dissolve in rainwater and leach into the soil from where they are picked up by growing plants thereby entering the food chain (Harrison and Chirgawi, 1989). In Nigeria, leachates from refuse or waste dumpsites constitute a source of heavy metal pollution to both soil and aquatic environment (Odukoya et al, 2007 and Oni 1987).
According to Bishop 2000, amongst all the classes of solid waste that pose the greatest threat to life, due to the potential of polluting the terrestrial, aquatic and aerial environments, heavy metals have been of great concern in the last decades because of their health hazards to man and other organisms when accumulated within biological systems (Ash and Lee, 1980).

Studies have revealed that waste dumpsites can transfer significant levels of toxic and persistent metals into the soil environment (Alloway, 1996; Cobb et al 2000; Olajire and Ayodele, 1996 and Udosen et al 2006). Eventually these metals are taken up by plant parts and transfer same into the food chain (Benson and Ebona, 2005). The objective of this study therefore was to determine the chemical content of Cd, Cr, Cu, Pb and Ni in dumpsites soils within the two major mechanic sites in Makurdi metropolis and their fate in order to assess the human health and ecological rises associated with these waste dumpsites.

MATERIALS AND METHOD

Six waste dumpsites were mapped out at Apir and North bank auto mechanic workshops within Makurdi metropolises. Three of the dumpsites were at Apir auto-mechanic workshop while the other three were at North bank auto mechanic workshops. At Apir and North bank auto-mechanic workshop, a control site was identified out of the refuse dumpsites for sampling of surface soils. The waste dumpsites were about 20 meters from each other, while the control sites were about 50 meters away from the refuse dumpsites. Soil samples were collected from the waste dumpsites during the rainy season (between the months of June and August 2008) at Apir and North-bank mechanic sites in Makurdi.
Surface soil samples (0-15cm depth) were sampled by hand auger (2.5 cm diameter) from the three refuse wastes dumpsites at Apir and North bank auto-mechanic workshops in Makurdi. Each soil sample comprised of a composite of three sub samples obtained from a 1x1 metre square. The soil samples

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were collected on the field in clean polyethylene bags with tight plastic clips. The bags were labeled properly on the field and then taken to the laboratory.

In the laboratory the soil samples were air dried for 12 days. These samples were then crushed and sieved through a 2mm mesh sieve to obtain fine particles. 1.0g of each of the air dried and sieved soil samples were weighed with a digital weighing balance (SUNTEX MODEL) into 250 cm^3 beakers. They were then digested in an acid mixture of concentrated 5.00mL HNO_3, 10.00mLHF and 1.00mL $HC10_4$. The contents were then evaporated to dryness over a water-bath (Cairney, 1993). The residues were dissolved in 10.00ml of 4.0M HCl, warmed and transferred into a 50.00mL standard volumetric flask. They were then made up to the 50.00mL marked with deionised distilled water.

The concentrations of Cu, Cd, Cr, Pb and Ni in the digested soil samples were determined using Atomic Absorption Spectrophotometer (AAS) UNICAM SOLAAR32 model, at the National Institute for Chemical Research Technology, Zaria. Before the analysis, the digested soil samples were preserved in a refrigerator. The analytical precision was confirmed with triplicates throughout the study.

RESULTS AND DISCUSSION

The mean concentration of heavy metals analyzed for both Apir and North bank auto-mechanic shops refuse dumpsites soils and controls soils sites are indicated in Tables 1 and 2 respectively. Results obtained revealed higher concentration of heavy metal from refuse dumpsites soils as compared to their control soil site samples. This result is in accordance with the earlier one recorded from similar studies by Amusan et al (2005). This could also be attributed to the availability of metal containing wastes at dumpsites which are eventually leached into the underlying soils.

The mean content of Cd in the refuse dumpsite soils in Apir and North bank auto-mechanic shops are presented in Tables 3 and 4 respectively. All the same, the Cd content at the North bank location (Table 4) was slightly higher than that at Apir (Table 3). This enhanced level of Cd could be attributed to the dumping of PVC plastics, nickel-cadmium batteries, motor oil and disposal sludge on the dumpsites (Jarup, 2003, Ebong et al , 2008). The result of Cd concentration recorded in this study disagrees with the earlier one obtained in a similar study by Uba et al (2007) who reported higher concentration of Cd in refuse dumpsites soils. Nevertheless, this result conforms to that of Myung (2008).

Table 1: Mean Heavy metal concentration in soils around Apir auto- mechanic shop refuse dumpsites in Makurdi metropolis

Heavy metals concentration in mg/kg					
Dumpsites	Cd	Cr	Cu	Pb	Ni
I	00.50	50.80	23.34	04.86	03.40
II	00.54	50.58	97.12	40.12	03.94
III	00.76	43.44	32.68	67.34	05.28
Control	00.62	40.98	17.84	01.66	02.88

Table 2: Mean Heavy metal concentration in soils around North-bank auto- mechanic refuse dumpsites in Makurdi metropolis

Heavy metals concentration in mg/kg					
Dumpsites	Cd	Cr	Cu	Pb	Ni
I	02.14	56.42	32.76	64.60	39.20
II	04.40	51.56	41.82	104.72	32.08
III	04.12	57.28	37.60	172.76	74.58
Control	00.90	49.66	31.76	04.76	22.54

The mean Cr content at the Apir and North bank refuse dumpsite soils are indicated in Tables 3 and 4 respectively. This finding is in accordance with that of Abida et al (2009) who carried out a similar study in India and reported higher values of Cr concentration in refuse dumpsites soil. Yahaya et al (2009) also reported similar concentration of Cr content in a similar study in Nigeria. Higher concentration of Cr in the refuse dumpsites soil may be attributed to the Cr content of oil waste on the sites that leaches into the underlying soil layer.

Mean Cu concentration in the refuse dumpsites soil at Apir and north bank auto-mechanic shops are shown in Tables 3 and 4 respectively. This result agrees with that of Yahaya et al (2009). Results recorded in this study have shown that the mean Cu concentration at Apir was higher than that obtained at North bank shops location. This may be attributed to the differences in the disposal habitats and the volume of Cu content wastes in the two locations.

The results obtained for Ni concentration at Apir and North bank refuse dumpsite soil are presented in Tables 3 and 4 respectively. These results conform to that of Yahaya et al (2009) who carried out a similar study in Nigeria.

Table 3: Heavy Metal content of soils in Apir auto-mechanic shops refuse dumpsites expressed in mean and standard deviation (mg/kg).

Heavy metal	Mean ± SD
Cd	0.60 ± 00.14
Cr	48.28 ± 04.18
Cu	51.04 ± 40.16
Pb	37.64 ± 31.62
Ni	04.20 ± 00.96

Table 4: Heavy metal content of soils in North-bank auto-mechanic shops refuse dumpsites expressed in mean and standard deviation (mg/kg)

Heavy metal	Mean ± SD
Cd	03.56 ± 01.22
Cr	53.76 ± 02.46

Cu	37.38 ± 04.52
Pb	114.02 ± 54.66
Ni	48.62 ± 22.76

Tables 3 and 4 present the mean Pb content at Apir and North bank auto-mechanic shops refuse dumpsites soil respectively. Higher levels of Pb obtained in this study is in accordance with the findings of Yahaya et al (2009), but disagrees with that of Uba et al (2008) who reported lower levels of Pb concentration in a similar study. Pb content obtained in this study is in agreement with the result of a similar study in a landfill soil in Ibadan in south west Nigeria by Ogunyemi et al (2003). Although, results recorded in this study has shown that the refuse dumpsites contribute significant levels of toxic metals to the environment. Sorting and recycling of wastes should be intensified to reduce the quantity of these toxic metals in the dumpsites.

Conclusion: The results revealed the presence of significant concentrations of Cd, Cr, Cu, Pb and Ni in dumpsites soils in both Apir and North-bank mechanic sites within Makurdi metropolis. There were variations in the content of the heavy metals from the two different sampling locations. Education and legislations on management of wastes in the workshops should be intensified to forestall the effects of waste related problems on the environment. Modern waste disposal facilities should be acquired by relevant authorities and appropriate waste disposal sites be chosen to avoid the injurious effects of indiscriminate disposal of wastes.

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REFERENCES

Abida, B., Ramaih, M, Harikrishma, I K and Veena, K (2009). Analysis of heavy metals concentrations in soils and litchens from various localities of Hosur road, Bangalore, India. E-Journal of Chemistry, 6(1): 13-22.

Alloway, B.J. (1996): Heavy metals in soils. Halsted press, John Wiley and Sons Inc London, UK

Amusan, A.A., Ige, D.V. and Olawale, R.J. (2005) Human Ecology. Environmental Science Journal 17, 167 – 171.

Ash, C.P.J. and Lee, D.I. (1980). Lead, Cadmium and Iron from roadside sites. Environmental Pollution Journal 22: 56 – 67.

Benson, N.V. and Ebona, G.A. (2005). Heavy metals accumulation in soils and plant parts. Journal of sustainable tropical agricultural research 16: 77 – 88.

Bishop, P.L. (2000). Pollution prevention; fundamentals and practice. McGraw-Hill companies Inc USA pp 61 – 89.

Cairney, T. (1993). Contaminated land: problems and solutions. 1st ed. Blackie academic and professional Glasgow, Scotland 180pp.

Cobb, G.P., Sands, K., Waters, M., Wixson, B.G. and Dorward-King, E. (2000). Toxic effects of heavy metals. Environmental Toxicology and chemistry Journal, 19: 600 – 607.

Ebong, G.A., Akpan, M.M. and Mkpene, V.N (2008). Heavy metal content of municipal and rural dumpsite soils and rate of accumulation by Carica papaya and Talinum triangulare in Uyo Nigeria. E-Journal of Chemistry, 5(2) : 281-290.

Harrison, R.M. and Chirgawi, M.B. (1989). Sources of metals in the soil. Science of total environment journal 83, 13 – 34.

Jarup, L. (2003). Toxicity of heavy metals and sources in the environment. British Medical Bulletin 68: 167 – 182.

Myung, C.J.(2008). Heavy metal concentrations in soils and factors affecting metal uptake by plants in the vicinity of a Korean, CU-W Mine. Sensors 8, 2413-2423.

Odukoya, O.O., Bamgbose, O. and Arowolo, T.A. (2007). Heavy metals pollution from leachates in aquatic and terrestrial environment. Journal of pure and applied science. 467 – 472.

Ogunyemi, S., Awodoyin, R.O. and Opadeji, T. (2003). Heavy metal contamination of Amaranthus cruentis L grown on domestic refuse landfill soil in Ibadan Nigeria. Journal of Agricultural Science 15(2): 87 – 94.

Olajire, H.A. and Ayodele, E.T. (1996). Levels of heavy metals in soil and water. Environmental international journal 23: 91 – 101.

Oni, O.O. (1987). Water Quality Surveillance and Treatment: National water quality bulletin 2, 15.

Uba, S., Uzairu, A., Harrison, G.F.S., Balarabe, M.L. and Okunola, O.J.(2008). Assessment of heavy

metals bioavailability in dumpsites of Zaria metropolis, Nigeria. African Journal of Biotechnology, 7(2) : 122-130.

Udosen, E.D., Benson, N.U., Essien, J.P. and Ebong, G.A. (2006) Concentration of heavy metals in waste dumpsites. International Journal of soil science 23, 91-101.

Yahaya, M.I., Mohammed, S. and Abdullahi, B.K.(2009). Seasonal variation of heavy metals concentration in Abattoir dumping site soil in Nigeria. J. Appl. Sci. Environ. Manage. 13(4): 9-13.

Yakowitz, H.(1988). Identifying, Classifying and Describing Hazardous Wastes: In Jacqueline, A.L.(Editor) Hazardous Wastes Management(industry and environment). Vol II United Nation Environmental Programme