JASEM ISSN 1119-8362

Full-text Available Online at www.ajol.info and www.bioline.org.br/ja

J. Appl. Sci. Environ. Manage. *Dec.,* 2012
Vol. 16 (4) 317-321

Effect of Automechanic Works on Lead and Iron Content in Two Mechanic Villages in Port Harcourt, Rivers State Nigeria

***EDORI, O. S. AND EDORI, E. S;**

Department of Chemistry, Ignatius Ajuru University of Education, PMB 5047 Rumuolumeni, Port Harcourt, Nigeria
Government Comprehensive Secondary School Mbiama, Ahoada West, Rivers State, Nigeria

Keywords: Lead, iron, conductivity, pH, mechanic workshop

ABSTRACT Forty soil samples were collected from two mechanic workshops (villages), Mile 2, Anyama and Mile 3, zone C and a control, UST to examine the pH, conductivity and the concentrations of lead (Pb) and iron (Fe). The pH at the top soil samples (0-15cm) were formed to be higher than those of the lower soil samples (15-30cm). pH values ranged from 7.3- 8.4. The values observed for conductivity also followed the same pattern as the pH with the top soil samples(0-15cm) having higher conductivity values than those of the lower soil samples (15-30cm) and were within the range of 7.70×10 - 6.60×10^2 µS/cm. The values of the pH and conductivity were higher in the mechanic workshops than the control. The concentration of Pb were very low at UST(control), which were 4.09mg/kg for the top soil and 3.44mg/kg when compared to those observed at the mechanic workshops which were within the range of 205.50mg/kg 1551.25mg/kg. The value of Pb was highest at Mile 3 zone C 1 (155.25mg/kg) and lowest at Mile 3 zone C 2 (205.50mg/kg). Iron (Fe) concentration was lowest at UST (control), being 1412.50mg/kg (top soil) and 2325.00mg/kg (lower soil) and was highest at the Mile 2, Anyama 1 workshop which was 13162.50mg/kg (top soil) and 13050.10mg/kg (lower soil). The work showed that the contribution of heavy metals into the soil through anthropogenic activities at the workshops is alarming.

Industrial and anthropogenic activities results in heavy metal pollution of the soil, water and the atmosphere. This constitutes a growing environmental problem (Alirzaveya *et al*., 2006). The concentration of heavy metals in the soil is an important concern to the environment because of their implications to man and the environment. The mobilization of heavy metals into the biosphere by human activity is a very a very important process in geochemical cycling of these metals (Chen *et al*., 2005) which is acutely evident in urban areas where various stationary and mobile s sources releases large quantities of heavy metals into the atmosphere and soil above natural emission rates (Bilos *et al*., 2001). Soils in non agricultural settings such as parks and residential areas may also have direct influence on public health since they can easily be transferred into the human body (Madrid *et al*., 2002). The ingestion of dust and soil particles (especially among children) is one of the key ways of exposure to metals and metalloids from paints, vehicles, local industries and leaded gasoline (Meyer *et al*., 1999).

It is a common practice in Nigeria that in cities and towns, large tracts of land are allocated to auto mechanic activities and are designated as mechanic villages where workshops and repair services are offered to the public (Adelakan and Abegunde 2011) and there are environmental threats associated with this practice. The activities performed in mechanic villages (workshops) includes the spilling of oil, greases, petrol, diesel, battery electrolytes, paints and others which contains heavy metals into the bare soil (Adelakan and Abegunde 2011). The interactions between metals and the solid phase of soil, soil

**Corresponding Author:* onisogen.edori@yahoo.com +2348038984391

water and air within and above soil depends on a number of chemical factors which also help in determining the fate and transport of these metals (Curtis and Smith, 2002).

Food chain contamination by heavy metals has become a potential threat and burning issue over the years due to the fact that they get accumulated in biosystems through contamination of the soil, water and air. According to Begum *et al.*, (2009), large quantities of pollutants are continuously discharged into the ecosystem due to urbanization and industrial processes. Metals are persistent pollutants that are magnified in the food chain thereby becoming more dangerous to humans and wild life.

This study was carried out to examine the levels of iron(Fe), lead(Pb) and two physico-chemical properties (pH and conductivity) of mechanic village sites at Mile 3 zone C and Ayama in Mile 2, all in Diobu area of Port Harcourt metropolis in Rivers State, Nigeria.

MATERIALS AND METHODS

Forty soil samples were collected from three sites with soil auger within depths of 0-15 and 15-30cm. The samples were immediately put into polyethene bags and tightly sealed. The samples were then transferred to the Laboratory Department of the Institute of Pollution Studies of the Rivers State University of Science and Technology, Port Harcourt. The samples were air dried in the laboratory to constant weight and then ground to fine particles in a ceramic mortar. The ground samples were sieved with 2mm mesh to remove stones. 2g of the fine samples were digested with 1: 10 ratio of HNO_3 : HCl. 25ml distilled water was added to the mixture and then heated for 20minutes in water bath to obtain a milky colour. The samples were removed from the heat and allowed to cool and were transferred into 50ml ($50cm^3$) sample bottles and were made up to the 25ml mark with distilled water. The concentration of the metals (Fe and Pb) were determined with atomic absorption spectrophotometer (AAS) model AA-670 attached to a graphic printer PR-4 after the calibration of the equipment.

The pH and conductivity were determined by adding 10g of soil to 25ml of distilled water and stirred. Results of pH and conductivity were determined with a pH/ conductivity meter.

RESULTS AND DISCUSSION

Table 1: pH and conductivity of soil samples at different depths from the sample stations

Sample station	Depth of sampling(cm)	pH	Conductivity µS/cm
	0-15	7.5	1.81×10^2
UST	15-30	7.3	7.70×10
Mile 2 Anyama 1	0-15	8.4	1.82×10^2
Mile 2 Anyama 2	15-30	8.2	2.2×10^2
	0-15	8.0	5.8×10^2
Mile 3 Zone	15-30	8.3	5.5×10^2
C 1	0-15	8.2	6.6×10^2
Mile 3 Zone	15-30	8.15	4.4×10^2
C 2	0-15	8.2	8.82×10^2
	15-30	7.8	1.85×10^2

Table 2: Lead(Pb) and iron(Fe) concentration of soil samples at different depths from the sample stations

Sample station	Depth of sampling(cm)	Pb(mg/kg)	Fe(mg/kg)
UST	0-15	4.09	1412.50
Mile 2 Anyama	15-30	3.44	2325.00
Mile 2 Anyama 2Mile 3	0-15	287.20	13062.50
Zone C 1	15-30	231.56	10350.10
Mile 3 Zone C 2	0-15	618.13	2843.75
	15-30	403.13	7400.00
	0-15	1551.25	7887.50
	15-30	957.50	6287.50
	0-15	256.88	2050.00
	15-30	205.50	3775.00

Table 3: Average concentration of Lead(Pb) and iron(Fe) in soil samples from the sample stations

Sample station	Pb(mg/kg)	Fe(mg/kg)
UST	3.7	1868.75
Mile 2 Anyama 1	259.38	11706.30
Mile 2 Anyama 2	510.63	5121.88
Mile 3 Zone C 1	125.38	7087.50
Mile 3 Zone C 2	231.19	2912.50

The pH of the soil samples ranged from 7.3-8.4. the top soil samples in all cases had higher pH values when compared to the corresponding samples at lower depths. Conductivity values ranged from 1.81×10^2 - 6.60×10^2µS/cm. It also followed the same pattern as the pH. Lead (Pb) content in the soil samples were lowest at the UST area from the various depths collected, which were 4.09 and 3.44mg/kg for 0-15 and 15-30 cm respectively. However, the value of 1551.25mg and 959.50mg/kg were observed at the mile 3 zone C 1 as the highest value at 0-15 and 15-30 cm depth respectively. Iron (Fe) content were lowest at UST site which were 1412.50 and 2325.00mg/kg at 0-15 and 15-30 cm depth respectively from the Mile 2 Anyama samples.

pH influences the mobility of ions in a solution and also is involved in the rate of absorption and desorption of metal ions in complexation of these ions. The value of pH observed were slightly alkaline and this might help to build the capacity to support the retention of these ions in the soil. Conductivity takes place in electrolytic solution between electrons and ions. In all the sites, the conductivity observed at the top soil was found to be more (higher) than that at the lower depth. This shows that there was a corresponding relationship between the pH and the conductivity observed in the samples. The higher pH in each case corresponds to hiher conductivity. These factors (pH and conductivity) are part of the soil chemistry which influences the general mobility of metal ions in soil (Adelekan and Abegunde, 2011). The conductivity values observed in this study were in consonants with the values observed by Ayeni (2010) in automobile workshops in selected locations in Osogbo.

The level of heavy metals in automechanic workshops depends on the age of the workshop (Ayeni, 2010; Abidemi, 2011; Osu and Okereke, 2010; Adelekan and Abegunde, 2011). The metals (Pb and Fe) were distributed more at the top soil than the lower soil than the lower soil and were by far higher higher than that of the control. the increase in these metal ions in the workshops may be due to accumulation of automobile waste from mechanic activities on such soils (Osu and Okereke, 2010).

The increase in value of Pb could have resulted from Pb containing compounds such as batteries, vanishes, and paints used at the workshop (Abidemi, 2011; Adelekan and Abegunde, 2011). Lead (Pb) is a significant factor in soil pollution(Martin, 2001) due to the fact that its deposition in particular is greatly influenced by vehicle emissions and the introduction of Pb in gasoline (Blake and Goulding, 2002). Although in Nigeria, Pb in petrol is banned, but with the recent importation of petroleum products into the country, the source may not be fully verified can also constitute a source of Pb introduction into the environment. Studies have shown that increased Pb deposition is connected with ongoing Pb deposition in soils withon mechanic workshops (villages) and vehicle battery manufacturing sites (Olusoga and Osibanjo, 2007; Osibanjo, 2009). USEPA, (2008) considered Pb to be hazardous when it exceeds 400mg/kg on bare soils, thus implying that the content of Pb at Anyama 2 and Zone C 1 were far above the minimum limit of Pb content on bare soil and thereby putting people at risk of Pb adsorption. Lead (Pb) constitute health risk at high concentrations in blood and tissues of animals. High blood levels of Pb inhibits haem synthesis, cause irritation, mental retardation, brain damage, produce tumour and also a general disease problem known as plumbism.

The increase in iron (Fe) content in the workshops may be due to dumping of iron(Fe) scrap, unused body parts of vehicles, tin can, solvents, hydraulic fluid, spent lubricants, etc at these worksops((Ayeni, 2010; Abidemi, 2011). In most mechanic workshops , left over corroding vehicles are a common site and this may be the major cause of Fe increase in these mechanic workshops. Also, Fe is a major component of steel alloy which the material used in manufacturing of the body of vehicles.

Conclusion: The investigation in this study showed that the soils in automechanic workshops are adversely contaminated or polluted with Pb and Fe and far exceeds their recommended values in soils. Therefore adequate steps should be taken to remedy the situation.

REFERENCES

Abidemi, O. O. (2011). Levels of Pb, Fe, Cd and Co in soils of automobile workshoping Osun State, Nigeria. *Journal of Applied Environmental Management*, 15(2): 279-282.

Adelekan, B. A. and Abegunde, K. D. (2011). Heavy metals contamination of soil and groundwater at automobile mechanic villages in Ibadan, Nigeria. *International Journal of Physical Sciences*, 6(5): 1045-1058.

Alirzayeva, E. G., Shirvani, T. S., Yazici, M. A., Alverdiyeva, S. M., Shukurov, E. S., Ozturk, L., Ali-Zade, V. M. and Cakmak, I. (2006). Heavy metal accumulation in Artemisia and faliaceous litchen species from the Azerbaijan flora. *Forest snow and landscape research*, 80(3): 339-348.

Ayeni, K. E. (2010). Heavy metals pollution in selected industrial locations. *Continental Journal of Renewable Energy*, 1: 9-14

Begum, A., Ramaiah, M., Harikrishna, E., Khan, I. and Veena, K. (2009). Analysis of heavy metals concentration in soil and litchens from various localities of Hosur Road, Bangalore, India. *Electronic Journal of Chemistry*, 6(1): 13-22.

Bilos, C., Colombo, J. C., Skorupka, C. N. and Presa, M. P. J. (2001). Sources, distribution and variability of airborne trace metals in La Plata City area, Argentina. *Environmental Pollution*, 111: 147-158.

Blake, L. and Goulding, K. W. T. (2002). Effects of atmospheric deposition, soil pH and acidification of heavy metal concentrations in soils and vegetation of semi-natural ecosystems at Rothamsted experimental station, UK. *Plant and Soil*, 240: 235-251.

Cheng, T. B., Zheng, M. Y., Lei, M., Huang, C. Z., Wu, T. H., Cheng, H., Fan, K. K., Yu, K., Wu, X. and Tian, Z. Q. (2005). Assessment of heavy metal pollution in surface soils of urban parks in Beijing, China. *Chemosphere,* 60: 542-551.

Curtis, L. R. and Smith, B. W. (2002). Heavy metals in fertilizers: Considerations for setting regulations in Oregon, Department of Environmental and Molecular Toxicology, Oregon State University, Oregon, USA.

Madrid, L, Diaz-Barrientos, E. and Madrid, F. (2002). Distribution of heavy metal contents of urban soils in parks of Seville. *Chemosphere*, 49: 1301-1308.

Martin, L. (2001). Urban land use influences on heavy metal fluxes and surface sediment concentrations of small lakes. *Water, Air and Soil Pollution*, 126: 363-383.

Meyer, I., Heinrich, J. and Lippold, U. (1999). Factors affecting lead, cadmium and arsenic levels in housedust in a smelter town in Eastern German. *Environmental Research*, 81: 32-44

Olusoga, T. O. and Osibanjo, O. O. (2007). Contamination of soil with battery wastes: Prospects for phytoremediation. *European Journal of Science Research*, 17(1): 6-10.

United States Environmental Protection Agency, USEPA (2008). Allowable limits for lead in soil.