SOME METAL STATUS OF AUTOMOBILE CONTAMINATED SOIL FROM A SPARE PARTS MARKET AT EFFURUN, WARRI, DELTA STATE, NIGERIA

Agbogidi O.M, Erhenhi H.A*, Egboduku W.O. and Amuamuzia J.A.
Department of Botany, Faculty of Science, Delta State University, Abraka, Nigeria.
*Corresponding author. E-mail: omagbogidi@yahoo.com. Tel: 07038679939.

ABSTRACT
This study was conducted in 2013 on some metal status of automobile contaminated soil from different sites of a spare parts market at Effurun, Warri, Delta State, Nigeria. Soil samples were collected from the different sites of the spare parts market and 1km away from it, which was the control. The results of soil analysis using the Atomic Absorption Spectrophotometer showed that the soil of the spare parts sites is accumulated with heavy metals like Fe, Zn, Cd, Cr, Pb and Cu when compared with values obtained from the control subplots. Although the values observed were not significantly higher than the tolerable limits given by standard bodies including WHO and FAO, the high concentration of the metals reflects a general and diffuse contamination of soil of the automobile spare parts market by heavy metals. The paper recommends that there is an urgent need for the monitoring of spare parts markets across the country because of the inherent health risks of metals abundant in the affected area.

Key words: Metal status, automobile pollution, spare parts market, Delta State, Nigeria.

INTRODUCTION

Heavy metals are referred to as metallic elements with high atomic weight which can damage living cells at low concentrations and also tend to accumulate in food chains (USEPA, 1999). They find their way into the soil and environment in many ways and get associated; they form several complexes which alter mobility, reactions and are available for plant use (Agbogidi, 2013). Sources of heavy metals include automobile sources, and different operations of the mechanic such as fluid leakage, component wear, engine oil and corrosion of metal contribute immensely to soil contamination. Other sources are coal, zinc including burning of plastics, fossil fuels, automobile wastes, electric batteries, seed dressing herbicides and other industrial processes, diesel oil, residual oil, smoke and non-ferrous alloys, power stations, corrosive products, lead fall out, paints, burning of coal, petroleum, breakthrough of lubricating oils, vehicle tyres, galvanized metals, chemicals and catalysts as well as steel (Baathm, 1989; Dolan et al., 2006; Akbar et al., 2006; Agbogidi and Enujeke, 2012). Examples of metals are mercury, cadmium, chromium, nickel, copper, lead, iron, zinc, etc. Soil pollution resulting from heavy metal has been well researched. The ability of a soil to act as a sink depends on its carrying capacity and this varies with climatic and factors. The effects of soil contamination from metals have been reported to include loss of soil nutrients, infertility, production of food interference with the biochemistry of diverse group of microbes as many heavy metals are components of enzymes, structural balance of the (Kosolakpor et al., 2004). When metals are retained in the soil by repeated and uncontrolled addition, they interfere with key metabolic and biochemical processes. They alter ecological balance including efficient nutrient cycling, nutrient mobilization, impair enzyme synthesis and activity which affect plant growth and productivity (Agbogidi, 2013; Agbogidi and Erhenhi, 2013; Agbogidi et al., 2014).

Many agricultural soils in many parts of the world are slightly and in most cases, moderately or greatly contaminated by heavy metals including cadmium (Cd), copper (Cu), zinc (Zn), nickel (Ni), cobalt (Co), chromium (Cr), arsenic (As) and lead (Pb). Heavy metal pollution causes lipid peroxide which results in biomembrane deterioration. Cd has been reported to cause acute and chronic toxic effects of plants. Plants exposed to high Cd levels have been known to

cause reduction in photosynthesis, water uptake and nutrient uptake (Itumoh et al., 2012). Other effects of heavy metals on plants include chlorosis, wilting, growth retardation, browning of root tips, reduced metabolic functions, senescence and finally, death (Agbogidi and Eruotor, 2012; Mohammad et al., 2012). In animals, metals constitute a very heterogeneous group of elements widely varied in their chemical properties and biological functions. They accumulate in food chain through uptake at primary producer level and man through consumption at consumer level, inhalation or injection. The problem of lead poisoning in animals is a well-known phenomenon. It is a cumulative tissue poison and gets stored in different parts of the body especially in bones, liver, kidney and brain (Olatunji et al., 2009). This study reported the heavy metal status of automobile contaminated soils from a spare parts market in Warri, Delta State, Nigeria.

MATERIALS AND METHODS

Study area

The metropolitan City of Warri in the Niger Delta area of Southern Nigeria is a medium size town typified by extensive petroleum exploration, production and petrochemical activities. Warri lies roughly between longitude $5^{o}31'$N and latitude $5^{o}45'$E. It has a mean annual temperature of 32.8^{oC} and annual rain fall of 2673.8mm. There are high temperatures of $32\text{-}36^{o}$ C. It has a natural vegetation of rainfall with swamp forest in some areas. The forest is rich in timber, palm trees and fruit trees. It has a population of over 311,970 people according to the National Population Commission figures of 2006.

Soil samples source

Soil samples were randomly collected from an automobile 6 major sites of a spare parts market (0-30cm) in Effurun, Warri, Delta State with the aid of auger; they were mixed together to get a representative sample. In the same vein, samples of soil were randomly collected from a virgin soil which is about 1km away from the spare parts market and this acted as the control subplot.

Sample preparation and soil analyses

The soil samples were air-dried in ambient temperature, passed through 2mm mesh sieve and stored in labeled polythene. The experiments were replicated three times. In the laboratory, both the contaminated and uncontaminated soil samples were analyzed for heavy metal contents. Concentration of heavy metals including Fe, Zn, Cd, Cr, Pd, and Cu was determined after digestion of soil samples with a mixture of hydrofluoric, perchloric and sulphuric acids. The concentrations of the elements were analyzed using Atomic Absorption Spectrophotometer procedure (Association of Official Analytical Chemists (AOAC) (2005). Data collected were subjected to analysis of variance and the significant means were compared with the Duncan's Multiple Range Tests using SAS (2005).

RESULTS AND DISCUSSION

Soil sample analyses showed significantly ($P \leq 0.05$) higher concentrations of metals in the two sampled sites (Table 1).

The results showed a buildup of heavy

Table 1. Heavy metal status of contaminated and uncontaminated soil samples (mgkg) in Warri, Delta State.

	Concentration (mg/kg^{1})		
Heavy metal	**Contaminated soil sample**	**Uncontaminated soil sample**	**WHO; FAO Levels (ppm)**
Fe	1,874.00^{a}	56.44^{b}	Not fixed; Not fixed
Zn	297.16^{a}	108.93^{b}	200; 300-600
Cd	10.57^{a}	3.68^{b}	10; 3-6
Cr	11.63^{a}	3.79^{b}	Not fixed; Not fixed
Pd	281.17^{a}	114.31^{b}	70; 250-500
Cu	254.10^{a}	30.88^{b}	40; 46

Means with different letters within the same row are significantly ($P \leq 0.05$) different using the Duncan's Multiple Range Tests.

including Fe, Zn, Cd, Cr, Pb and Cu in area of oil impact when compared with area of no oil impact (Table 1). This finding agrees with prior reports of Agbogidi and Egbuchua (2010) who worked on heavy metal concentrations in soil contaminated with spent engine in Asaba, Delta State, Nigeria. The presence of some heavy metals in the un-contaminated soil samples (Table 1.) indicates that heavy metals are natural components of the ecosystem. This observation is in harmony with the reports of Chee et al. (2006) and Gbanuku and Friday (2007), that under normal condition, heavy metals are useful to organisms because they are vital components of the environment. Agbogidi (2010) had earlier reported that metals abound in soils impacted with petroleum products. The amounts observed in the area of oil impact of the Effurun spare part market were above the recommended limits by Standard bodies FAO (2002) and WHO (2002)). Some steps need to be followed to avoid the spread of this to other areas adjudging from the fact that these elements are not biodegradable and a lot of health risks are envisaged. The need for metal monitory by the government cannot be over emphasized. The high concentrations of heavy metals observed also reflect a general and diffuse contamination of soil of the automobile spare parts market.

Conclusion

Conclusively, this study reports some metal status of automobile contaminated soil from a spare parts market in Warri, Delta State, Nigeria. Heavy metals accumulation was observed including Fe, Zn, Cd, Cr, Pb and Cu in area of oil impact when compared with area of no oil impact in the observed spare parts market. Although the values obtained when compared with FAO (2002) and WHO (2002) levels are not significantly higher, it is recommended that there is an urgent need for the monitoring of spare parts markets across the country because of the inherent health risks of metal abundant in the area.

REFERENCES

Agbogidi, O. M. (2013). Trace metal components of *Gambaya albida* (Linn) grown in soils contaminated with spent lubricating oil. *In*: Adam, A. (ed.). Proceedings of the Remediation organized by the World Academy of Science, Engineering and Technology held at the Holding Inn, Sandston, Johannesburg, South Africa. pp. 1006-1014.

Agbogidi, O.M and Egbuchua, C.O (2010). Heavy metal concentrations of soil contaminated with spent engine oil in Asaba, Delta State. *Acta Agron. Niger.* **10(1)**: 65-69.

Agbogidi, O.M. and Enujeke, E.C. (2012). Effects of spent motor oil on soil physico-chemical properties and growth of *Arachis hypogae* L. *Glob. J. Biosci. Biotechnol.* **1(1)**: 71-74.

Agbogidi, O.M. and Eruotor, P.G. (2012). Morphological Changes due to spent engine oil contamination and its heavy metal components of *Jatropha curcas* Linn. *In:* Baby, S. and Sandhu, P.S. (eds.), Proceedings of the International Conference on Bioscience, Biotechnology and Health Sciences (ICBBHs' 2012), Singapore. pp. 88-93.

Agbogidi, O. M. and Erhenhi, H.A. (2013). Metal concentrations of four leafy vegetables sold in markets of Abraka, Delta State, Nigeria. *J. Biol. Chem. Res.* **30(2):**813-822.

Agbogidi, O.M., Obi-Iyeke, G.E. and Arinze, A.N. (2014). Effects of kerosene contaminate soil on the growth of soya bean (*Glycine max* (L.) Merr.) *J. Biol. Chem. Res.* **31(1)**: 425-434.

Akbar, K.F., Hale, W.H.G., Headley, A.D. and Athar, M. (2006). Heavy metals contamination of roadside soils of Northern England. *Soil Water Resour.* 1(4): 158-163.

Association of official Analytical Chemist (AOAC) (2005). Official Methods of Analysis 12th (ed).

Baathm, E. (1989). Effects of heavy metals in soil on microbial processes and populations. *Wate, Air Soil Pollut.* **47(3-4)**: 335-379.

Chee, P. S., Tahir, N. M., Zuchi, H. M., Musa, M. I., Hork, N.K. and Noor, A.M. (2006). Heavy metal content in soil of major towns in the east coast of peninsular Malaysia. *Chin. J. Geochem.* **25(1)**: 56 -59.

Dolan, L.M.J., Van Bohemen, H., Whelan, P., Albar, K.F.O., Malley, V.O., Leiry, G. and Keizer, P.J. (2006). Towards the sustainable development of modern Road ecosystem. *In*: European Commission, European Commission, Office for Official Publication of the European Communities. Lucemberg, Council Directives 66/278/EEc on the protection of the environment in particular of soil, when sewage sludge is used in agriculture.

FAO (2002). World Agriculture: towards 2015/2030. Summary report, Rome.

Gbanuku, B.C. and Friday, O.U. (2007). Bioaccumulation of heavy metals in soil in some fauna and flora. *Int. J. Environ. Sci. Technol.* **4(2)**: 197-202.

Itumoh, E.J., Uraku, A.J., Omaka, O.N. and Nwabue, F.I. (2012). Trace metal toxicity in our environment: case studies of influx of metals in soils, water and air in Ebonyi State. *Glob. J. Biosci. Biotechnol.* **1(2)**: 320-324.

Kosolakpor, D.B., Kushk, P., Vainshtein, M.S., Vatsourina, A.V., Wiebner, A., Kasterner, M. and Miller, R.A. (2004). Microbial processes of heavy metal removal from carbon deficient effluents in constructed wetlands. *Eng. Life Sci.* **4(5)**: 403-411.

Mohammad, R., Reza, F. and Mojib, S. (2012). Effects of heavy metals on medicinal plants. *Int. J. Agron. Plant Prot* **3(4):** 154-1587.

Olatunji, B.O., Deacon, B.J. and Abranmowitz, J.S. (2009). The cruelest cure ethical issues in the implementation of exposure-based treatments. Cog. Behaviour. *J. Sci.* **2**:172-180.

Statistical software (SAS) (2005). Hargen and enhanced SAS Inst. Inc. USA.

USEPA, (1999). National primary drinking water regulation United States Environmental Protection Agency.

World Health Organization (2002). Environmental lead exposure: a public health problem of global dimension. WHO bulletin, Tong, S., Yasmin, E., Von, S. and Prepamontol, T. (eds.). Geneva, Switzerland.