Trace metals concentrations, distribution and bioavailability in urban soils of Abeokuta and its environs, South-western Nigeria

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Concentration, distribution and bioavailability of metals in soils are important for monitoring environmental pollution in urban areas. Potentially harmful elements (PHE) are of great concern due to their non-biodegradable nature and consequent negative effect on human and plant health. This study therefore, will establish the spatial distribution, and assess the level of contamination and bioavailability of PHE in the urban soils of Abeokuta, south-western, Nigeria.

Soil samples were collected systematically at depth between 0 – 15cm, air dried, digested with aqua regia and the metallic composition and concentrations determined using the Inductively Coupled Plasma Atomic Emission Spectroscopy. The sequential extraction of metals in the soil includes; exchangeable cations adsorbed by clay and elements co-precipitated with carbonates; elements adsorbed by organic material, amorphous and crystalline Fe and Mn oxides , sulphide species and clay minerals, and the silicate remnants.

Geochemical maps and statistical analysis (cluster and factor analyses) revealed the wide spatial distribution of PHE over the underlying rock types of the study area. Five main metal associations were deduced from these analyses. The first association include Cr, V, Fe, and Ni while the second association comprise Mn, Co and Y. These associations are mainly distributed over the underlying migmatite, schists and gneisses. The third association include Pb, Zn and Sr, which are distributed over areas strongly influenced by human activities, typified by commercial activities, heavy traffic and dense population where both solid and liquid waste are often generated. The fourth association consists of Al, Ni, and Zr which showed distribution over Ise Sandstone of the eastern Dahomey Basin. The only significant metal in the fifth association, Cu is relatively well distributed over various rock types.

Sequential analysis showed that 55.20 percent of the PHE are associated with the Fe-Mn oxide phase. 16.38 percent of the PHE, being associated with residual fraction, are essentially unavailable. 10.05 percent of the PHE being bounded to sulphide spe-

cies and clay minerals can, also, only be poorly mobilized, while 9.25 percent of the PHE were bounded to organic matter and can readily be mobilized. However, the PHE in the mobile exchangeable phase (9.13 percent) constitute quite a considerable proportion of PHE in the soils. Further analysis showed that Ni, Cr, Fe, V, and Cu were found mostly in the sulphide phase, Mn, Pb, Zn and Co in the Fe-Mn oxide phase, while Al, Sr, Y, and Zr were found mostly in the residual phase. The Contamination degree indicates that the soils was moderately contaminated. The present level of metal contamination and the considerably large amount of PHE potentially available for mobility calls for monitoring in order to prevent unwanted build up of metal contaminants in the urban soils of Abeokuta.

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