Geochemical fingerprint on sediments of the rivers draining Ibadan Metropolis, Southwestern

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The drainage systems in Ibadan Metropolis are depocenter for both industrial and domestic wastes/effluents. These acts of man are often major contributors of potentially harmful elements (PHE) not only into the stream sediments but also the environment. These elements have their attendant health implications on man and the entire ecosystem as a whole. This study therefore examines the trace metal contents in the sediments and evaluates their pollution status and origins of these trace metals.

The entire drainage basin was divided into four zones according to the type of human activities in and around the river channels. The four zones are: Zone 1-Agricultural zone; Zone 2–Industrial; Zone 3–densely populated area (Old city) and Zone 4-new city area. A total number of two hundred and thirty (233) samples were collected systematically in a gridded pattern along the river channels. Physical parameters such as pH, temperature and electrical conductivity were carried out in-situ on the sediment samples. These sediments were air dried, disaggregated and sieved to <75µm grain size before being digested with aqua regia and analysed with both inductively Coupled Plasma-Mass Spectrometry (ICP-MS). Mineralogical analysis using XRD was conducted on the silt-clay fraction of the sediments. Sequential leaches was also carried out to determine metals occurring in the sediments as absorbed ions on clay, organic compounds, amorphous Mn and Fe, sulphide and residue.

XRD data revealed the dominant minerals as kaolinite, illite, montmorillonite and quartz. Trace metals concentrations in the sediments ranges from Mn (102.00-2120.00), Zn (80.90-2450.00), Pb (40.30-5140.00), Cu (18.30-513.00), Cr (23.10-154.00), Ni (7.20-114.00), Co (3.80-37.60), As (0.20-7.10), Cd (0.08-24.40), and Se (0.40-4.50ppm). Cu-Pb-Zn-Sn-Cd-Sb revealed their highest concentrations in the densely populated and industrial areas of the city, Ag and Cr occur mostly in the new city area while the dominant contaminants for the agricultural areas are As and Co. Geochemical maps also revealed the various hotspots for these contaminants. Pollution Load Index (PLI) values for the zones are 127,

471, 582, 512 for zones 1 to 4, respectively. Statistical and contamination indices confirm that the sources of these metals could be linked to industrial and sewage wastewater discharges, agricultural practices and domestic wastes, fossil fuel combustion and atmospheric deposition. An appreciable percentage of Pb, Zn Cd, was observed in the exchangeable fraction while Cu and Ag are attached to the reducible fraction.

Comparison made with Mean World River Sediments and sediment quality guidelines show a polluted drainage system with Cu, Pb, Zn, Cd and Ni dominantly pronounced in the densely populated areas of the metropolis (old and new city areas). Metals concentration and the degree of contamination is therefore linked to high population density, urbanization and increased human activities which generate metals within the river channels.

Keywords: Pollution, Zones, Potentially Harmful Elements, Drainage Basin, Sequential leaches

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