

Unraveling the fate and sources of Pb in urban environmental media using Pb isotopes: A Study from cities in Southwestern Nigeria

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One hundred and twenty composite soils samples, 55 sediments, 31 road dust and 21 representative rock samples were collected. The soil, sediment and dusts samples were digested using Aqua Regia and subsequently analysed for elemental components using ICP-MS. The rock samples also analysed using both ICP-MS and XRF. The chemical fractionation of Pb in the soil, sediment and dust samples were determined by sequential analysis. The lead isotopic compositions of the samples were determined using ICP-MS while the mineralogy was determined with XRD.

The results revealed that the concentrations of Pb ranged from 2-487ppm (Akure); 13-3288ppm (Ibadan) and 21-1963ppm (Lagos). For the rock samples, Pb concentrations range as follows: 6-40ppm (Akure); 2.9 - 20.3ppm (Ibadan) and 2.8-7.2ppm (Lagos). The sequential analysis results revealed that Pb were fractionated into organic and sulphide phase (23.06-922.35) ppm, Reducible (2.33-291.73) ppm, carbonate (2.51-939.52) ppm and exchangeable (0.03-2.26) ppm. The results for the Pb-isotopes showed that ²⁰⁴Pb ranged from (1.43- 47.41) ppm; ²⁰⁶Pb (30.69-779.68) ppm; ²⁰⁷Pb (21.96-664.46) ppm and ²⁰⁸Pb (52.61-1642.27) ppm. The XRD revealed quartz, K-feldspar plagioclase, kaolinite, calcite, Illite, muscovite, goethite and biotite as some of the minerals in bedrocks, soils and sediments of the areas. The study areas were characterized by low ²⁰⁸Pb/²⁰⁷Pb and ²⁰⁶Pb/²⁰⁷Pb; low ²⁰⁸Pb/²⁰⁷Pb and moderately high ²⁰⁶Pb/²⁰⁷Pb and moderately high ²⁰⁸Pb/²⁰⁷Pb and ²⁰⁶Pb/²⁰⁷Pb. The migration patterns of Pb in the study areas were largely controlled by organic and sulphide phase. Area with dense population, intense commercial and industrial activities were significantly enriched in Pb and that over 80% of Pb in the environmental media were derived from anthropogenic sources as established from the (²⁰⁶Pb/²⁰⁸Pb) / (²⁰⁸Pb/²⁰⁷Pb) and the very low concentrations of Pb in the various bedrocks. The Pb levels in these cities have attained very intolerable levels when compared with all prescribed guideline values