Assessment of Heavy Metal and PAH pollution of Onitsha, southeastern Nigeria

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Onitsha metropolis is the most industrialised city in southeastern Nigeria with legacy of environmental pollution that has not been well documented.

One hundred and fourteen soils, 42 sediments and 6 rock units (geologic control) samples were collected for the study. Samples were digested and analysed for total elemental composition using Inductively Coupled Plasma-Mass Spectrometry (ICP-MS). Twenty samples with the most elevated HMs were further subjected to sequential extraction and analysed with ICP-MS. The soils and sediments were analysed for lead isotopes, (Pb^{204}, Pb^{206}, Pb^{207} and Pb^{208}) using ICP-MS. The concentrations of the PAHs were determined using Gas Chromatography/Mass Spectrometry (GC/MS). Data were analysed using descriptive statistics. Mineralogy of the samples were determined using X-ray Diffractogram (XRD) technique.

The selected HMs concentrations (mg/kg) in soils, sediments and rock units revealed that Pb ranged from 7.2-2026.0, 19.7-540.1 and 7.2-28.1; Zn, 3.0-8395.0, 101.1-502.5 and 3.0-35.3; As, 0.5-19.8, 80.6-16.9 and 0.5-27.3; Mn, 7.1-1920; 180-1410 and 10.0-221.0; Cd, 0.1-1.03, 0.21-1.6 and below detections, respectively. Soils and sediments showed higher concentrations for Pb, Zn, Cd and Mn compared to the rock units except for As. The sequential extraction showed that Zn and Cd were more in the carbonate bound fraction, while As was higher in the Organic bound fraction with Mn and Pb being more in the hydroxide and residual fractions, respectively. The estimated mobility of HMs was Cd>Zn>As>Mn>Pb. The plots of $^{206}Pb/^{204}Pb$ vs $^{207}Pb/^{204}$ and $^{207}Pb/^{204}Pb$ vs $^{206}Pb/^{204}Pb$ suggestted similar anthropogenic origin of Pb in the environmental media. The PAHs mean concentrations (µg/g) were: Fluoranthene, 187.2 ± 146.4, Pyrene, 187.5 ± 133.7, Benzo[a]anthracene, 93.8 ± 72.0, 150.4 ±94.8 and Benzo[a]pyrene, 178.9 ± 112.2, respectively. The plots of the ratios of the Anthracene: (Anthracene + Phenanthrene) and Fluranthene: (Fluranthene + Pyrene), indicated that the PAHs were from Pyrogenic(combustion) activities. Quartz, kaolinites and hematite were the dominant minerals present in the soils.

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