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Examining toxic metals contamination, speciation and geochemistry of soil impacted by open disposal of waste cathode ray tubes in Nigeria

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Abstract. In this study, soil contamination by toxic metals released from cathode ray tubes (CRTs) openly discarded within the vicinities of artisans' workshops in Nigeria was assessed in order to ascertain the metal leaching potential of CRTs, mobility and bioavailability of the leached metals in soil. Furthermore, the ecological geochemistry of the impacted soils was carried out. Seventy soil samples were randomly collected from thirty five locations at depths 0 – 15 cm (top-soil) and 15 – 30 cm (sub-soil), respectively from two selected states each within five geographical regions of Nigeria. Environmentally available lead (Pb), cadmium (Cd), chromium (Cr), nickel (Ni) and copper (Cu) were extracted from dried and sieved soil samples using aqua regia solution and were analyzed using flame atomic absorption spectrometry (AAS). Additionally, the metals were also sequentially extracted into five fractions and their concentrations determined using AAS. Concentration of Pb ranged from 0.4 – 6510 mg/kg with all top-soils exceeding the Nigerian NESREA regulatory limit of 164 mg/kg while Cd, Cr, Ni and Cu levels were within their respective regulatory limits. Geoaccumulation index values indicated that approximately 83% of all top-soils represented strong to extreme contamination by Pb while sequential extraction showed that majority of the extracted Pb was in the Fe-Mn oxide, residual and exchangeable forms. The results generally suggest that CRT disposal areas are highly polluted with Pb with significant amounts in bioavailable phases. Thus, waste CRTs are required to be managed in an environmentally sound manner to forestall any probable harm to ecological functioning of such areas.

Keywords: cathode ray tube, leaching, toxic metals, geoaccumulation index, sequential extraction.

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