

Assessment of Contamination, Health Risk and Bio-accessibility of Potentially Toxic Elements (PTEs) in the soil of Artisanal Gold mine sites in North Central Nigeria.

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The research investigated the contamination, health risk and bioaccessibility of ten Harmful Elements (HEs) within the soil of small-scale gold mining and processing sites in Minna, North-Central Nigeria. Geochemical analysis of thirty-three soil samples was conducted using Inductively Coupled Plasma Mass Spectrometry (ICPMS) method. Harmful elements (HEs) in the soil which include; Cu, Pb, Zn, Ni, Fe, As, Mn, U, Cr and Cd varied in ppm from 12.24 – 1387.66, 9.21-22595, 20.78-1068.05, 3.49-76.40, 13797.20 – 106242.50, 1.0 – 3659.04, 257.21-1850.36, 0.93 – 10.01, 8.65 – 121.57 and 0.03-11.83 respectively. The concentration of HEs was above upper crustal continental value (UCC) and China standards recommended for agricultural soil in most of the samples. The contamination degree and potential ecological risk ranged between 5.1 to 2224.8 and 34.44 to 35110.34 which indicated low to very high degree of contamination and low to very high potential risk posed by HEs in soil respectively. The health risk index (HI) calculated for non-carcinogenic varied between 3.44 – 327.4 and 0.59 – 68.99 for child and adult respectively with most values greater than safe level of 1. Pb, Cd, Cr and As also posed a low to moderate carcinogenic risk in the soil. Pb and As contributed >70% to the health risk and highest exposure routes was from ingestion. The results of bioaccessible fraction (BAF), as the proportion of HEs which are bioaccessible in the stomach or gastrointestinal tract from the sample matrix showed that Mn, Cu, Zn, Pb and Cd were within very high bioaccessibility factor, Arsenic showed high bioaccessibility factor, Cr, Ni, and U showed intermediate bioaccessibility factor while Fe showed low bioaccessibility factor. Bioaccessibility hazard quotient (BHQ) for most HEs was also above safe value of 1. This showed that all the HEs investigated are bioaccessible and could cause both carcinogenic and non-carcinogenic health risks to residents with a higher risk in child than in adult.

Keywords: Bioaccessibility, Cancer, Gold, Health Risk, Mining