

Analysis of Heavy Metals in Soil and Medicinal Plants (*Bryophyllum Pinnatum*[BPI] and *Vernonia Amygdalina* [VA]) using Risk Assessment Indices

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Abstract

The study of heavy metal contamination in soil and plants is crucial in environmental science because it has significant implications for ecosystem health and human well-being. Heavy metals have become environmental pollutants due to human activities such as industrialization, agricultural intensification, and urbanization. The aim of this research is to analyse heavy metals in soil and medicinal plant of *Bryophyllum Pinnatum* (BPI) and *Vernonia Amygdalina* (VA) using environmental and health risk indices.

The soil and medicinal plant (leaves, stem, root) for heavy metals (Mn, Fe, Cu, Zn, Cr and Pb) were analysed using Atomic Absorption Spectrophotometer (AAS). The soil and medicinal plant (leaves, stem, root) calculated environmental and health risk assessment. Data were evaluated using descriptive statistics and Pearson correlation. The heavy metal concentrations in soil for BPI and VA ranged from 15.82-217.33 and 366.38-513.60 mg/kg for Mn; 8541.78-9632.78 and 6500.23-16045.03 mg/kg for Fe; 16.30-18.93 and 5.95-23.58 mg/kg for Cu; 161.18-202.35 and 18.88-255.28 mg/kg for Zn; 12.93-18.63 and 6.00-15.58 mg/kg for Cr while Pb is 24.60-30.20 and 0.00-23.65 mg/kg. Heavy metal concentrations in medicinal plants (leaves, stem and root) of BPI and VA ranged from 3.08-72.60 and 8.53-109.13 mg/L for Mn; 36.05-2546.34 and 159.23-382.63 mg/kg for Fe; 5.55-13.68 and 4.13-14.05 mg/kg for Cu; 6.55-104.85 and 9.78-58.78 mg/kg for Zn; 0.0020.75 and 0.00-6.15 mg/kg for Cr while Pb was 0.00-18.08 and 0.00-0.00 mg/kg. Mn, Cu, Zn, Cr and Pb were below the WHO allowable level while Fe especially in the soil was above the WHO permissible limit. The heavy metals was positively correlated in medicinal plants and soil of BPI and VA which are: Mn (1.00 and 1.00); Fe (0.99 and 0.93); Cu (0.93 and 0.77); Zn (0.96 and 0.68); Cr (0.70 and 0.87); Pb (0.95 and 0.67). Ecological risk assessment shows that the soil of the medicinal plants indicates severe pollution. Health risk assessment observes $HI < 1$, and do not pose non-carcinogenic risk in both plants and soil for adults and children. Also, the two medicinal plants did not pose carcinogenic risk because their Pb and Cr value are 0.00 which is less than 1×10^{-4} . Non-carcinogenic and Carcinogenic risks assessed on the soil and leaf of plants indicates that the two samples (BPI and VA) can be used for the cure of some illnesses such as cancer and malaria already specified in literature because they have been proven to be below the threshold value.

Keywords: Heavy metals, Non-carcinogenic risk, Soil, Medicinal plants, Ecological risk

