World Academy of Science, Engineering and Technology
International Journal of Environmental and Ecological Engineering
Vol:18, No:04, 2024

Toxic Metal and Radiological Risk Assessment of Soil, Water and Vegetables around a Gold Mine Turned Residential Area in Mokuro Area of Ile-Ife, Osun State Nigeria: An Implications for Human Health

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Abstract : The Mokuro area of Ile-Ife, South West Nigeria, was well known for gold mining in the past (about twenty years ago). However, the place has since been reclaimed and converted to residential area without any environmental risk assessment of the impact of the mining tailings on the environment. Soil, water, and plant samples were collected from 4 different locations around the mine-turned-residential area. Soil samples were pulverized and sieved into finer particles, while the plant samples were dried and pulverized. All the samples were digested and analyzed for As, Pb, Cd, and Zn using atomic absorption spectroscopy (AAS). From the analysis results, the hazard index (HI) was then calculated for the metals. The soil and plant samples were air dried and pulverized, then weighed, after which the samples were packed into special and properly sealed containers to prevent radon gas leakage. After the sealing, the samples were kept for 28 days to attain secular equilibrium. The concentrations of 40K, 238U, and 232Th in the samples were measured using a cesium iodide (CsI) spectrometer and URSA software. The AAS analysis showed that As, Pb, Cd (Toxic metals), and Zn (essential trace metals) are in concentrations lower than permissible limits in plants and soil samples, while the water samples had concentrations higher than permissible limits. The calculated health indices (HI) show that HI for water is >1 and that of plants and soil is <1. Gamma spectrometry result shows high levels of activity concentrations above the recommended limits for all the soil and plant samples collected from the area. Only the water samples have activity concentrations below the recommended limit. Consequently, the absorbed dose, annual effective dose, and excess lifetime cancer risk are all above the recommended safe limit for all the samples except for water samples. In conclusion, all the samples collected from the area are either contaminated with toxic metals or they pose radiological hazards to the consumers. Further detailed study is therefore recommended in order to be able to advise the residents appropriately.

Keywords : toxic metals, gamma spectrometry, Ile-Ife, radiological hazards, gold mining
Conference Title : ICEPR 2024 : International Conference on Environmental Pollution and Remediation
Conference Location : New York, United States
Conference Dates : April 22-23, 2024