

Geochemical and Spatial Distribution of Minerals in the Tailings of Ife/Ijesa Gold Mine Zone, Nigeria

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Abstract

The main objective of this research is to identify the geochemical and mineralogical characteristics potential of unexplored tailings around gold deposit region using spatial statistics and map modeling. Some physicochemical parameters such as pH, redox potential, electrical conductivity, cation exchange capacity, total organic carbon, total organic matter, residual humidity, Cation exchange capacity and particle size were determine from both the mine drains and tailing samples using standard methods. The physico-chemical parameters of tailings ranges obtained were pH (6.0 – 7.3), Eh (-16 - 95 MeV), EC (49 - 156 μ S/cm), RH (0.20-2.60%), CEC (3.64-6.45 cmol/kg), TOC (3.57-18.62%), TOM (6.15-22.93%). The geochemical oxide composition were identified using Proton Induced X-ray emission and the results indicated that $\text{SiO}_2 > \text{Al}_2\text{O}_3 > \text{Fe}_2\text{O}_3 > \text{TiO}_2 > \text{K}_2\text{O} > \text{MgO} > \text{CaO} > \text{Na}_2\text{O} > \text{P}_2\text{O}_5 > \text{MnO} > \text{Cr}_2\text{O}_3 > \text{SrO} > \text{K}_2\text{O} > \text{P}_2\text{O}_5$. The major mineralogical components in the tailing samples were determined by a quantitative x-ray diffraction techniques using Rietveld method. Geostatistical relationships among the known points were determined using ArcGIS 10.2 software to interpolate minerals concentration with respect to the study area. The Rietveld method gave generally Quartz value as 73.73-92.76%, Ilmenite as 0.38-4.77%, Kaolinite group as 3.19-20.83%, Muscovite as 0.77-11.70% with trace of other minerals. The high percentage of quartz is an indication of a sandy environment with loose binding site.

Keywords: Tailings; minerals; spatial statistics; diffraction techniques