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Interaction of gold mine tailings leachates with soil and geochemical partitioning of toxic metal species.

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Abstract

The un-rehabilitated gold mine tailings dams are major environmental concerns due to potential release of toxic chemical species into underlying soil and groundwater systems. The unrehabilitated tailings can be blown by the wind or eroded by the rain-water to contaminate the soil, surface and ground water in the vicinity of the mine. The chemical interactions of gold mine tailings with ingressed CO₂ and O₂ from the atmosphere and percolation of rain-water generate leachates that can negatively alter the physico-chemical properties of soil and water at the study area. The aim of this study was to determine the interaction of gold mine tailings leachates with soil and geochemical partitioning of toxic metal species. The geochemical partitioning of toxic metal species was determined by sequential extraction methods and the effect of interaction of soil and gold mine tailings leachates on the leachate quality and soil physico-chemical properties was determined by batch experiments. Concentration of toxic metals in the aqueous samples was determined by ICP-AES and ICP-MS. The study showed that the soil have a low capability of adsorbing toxic metals from gold mine tailings leachates which is influenced by low clay and organic matter content. Geochemical partitioning experiments showed that toxic metals are mainly associated with the residual phase fraction when interacting the soil with mine tailings leachate. Hence, the mobility and bio-availability of toxic metals from the mine tailings leachates in the soil resulted to be low and this shows a less risk of contamination of the surface water and groundwater because residual phase is non-mobile.

Key words: *Gold mine tailings leachates, Soil physico-chemical properties, Batch experiments, Toxic metals, Geochemical partitioning.*