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Environmental stability of the processing waste from sulfide mining districts of Namibia

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Kinetic batch leaching of the flotation wastes from Berg Aukas and Kombat mining districts (northern Namibia) in 500 µM solutions of citric, oxalic and acetic acids was performed to simulate the release of trace metals and As in the rhizosphere-like environment. The obtained data demonstrate that citric acid may significantly contribute to mineral waste alteration accompanied by contaminant mobilization; the maximum dissolution rates corresponded to 7% (Cu), 3% (As), 2% (Cd), 0.8% (Pb) and 0.3% (Zn) of their total amounts [1]. In contrast, the role of oxalic and acetic acids in the complex process of contaminant leaching was usually negligible and/or comparable with water. The precipitation of newly formed Fe (hydr)oxides followed by the adsorption of Pb, Cd and eventually Zn from the model solutions seems to be the key mechanism which led to the metals' stabilization, as predicted by speciation modelling. Considering the neutral and slightly alkaline (and lowly organic) character of soils around the investigated flotation waste dams, Cu and As, present as neutral or anionic species, are suggested to be contaminants with the highest potential for rhizospheric mobilization and subsequent vertical mobility in local soils and/or transfer to plants [1].

It should be highlighted that the present data simulate “short-term” mobility and mobilization mechanisms of metals and As associated with the specific mine wastes when interacting with LMWOAs. However, the role of LMWOAs in the rhizosphere systems, where root activity and acid production are continuous during the vegetation season, will presumably be more pronounced in the long-term.

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References:

[1] Vaněk A et al. (2014) J Geochem Explor 144: 421-426