Wind mobilization of particulate material in the surface of tailings deposited in arid and semi-arid climatic conditions

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The erosion of tailings from mine industry is an important source of heavy metal particles that can enter the atmospheric flow and its subsequent deposition could become a public health issue. The climate plays an important role in the formation of surface crusts of newly formed minerals, changing the erodibility parameters and dispersion of metals.

In order to evaluate the potential harmfulness of tailing materials, we aimed to characterize the physico-chemical properties of those erodable material by comparing shallow layer (of 2 cm) in two tailing deposits with and without mineral crusts, associated to semiarid and arid climates, respectively. For this, different samples were studied by means of XRD, XRF, BET, laser granulometry and SEM-EDS.

The results show significant differences, evidencing a finer granulometry in those tailings where crust is generated. This can be explained by the secondary mineralization and cementation of uppermost layer. Nevertheless, BET analyses show that particles from crusted materials have a smaller specific surface area, which can affect the erosive process and its subsequent interaction with the environment after transport and deposition. Both SEM and XRD confirm the presence of secondary minerals in the crusted surfaces, pointing to the weathering and/or replacement of primary phases, differentiating it from the surfaces without crust. On the other hand, FRX and EDS results evidence of a higher concentration of heavy metals in minerals from crusts.

The evaluation of particle characteristics in both materials (with and without crust) let us supposing that although the crust mitigates the erodibility of semiconsolidated material, particles that can be eroded from it have greater probability of dispersion due to their smaller sizes. Also they provide the greater ecological incidence, since they contain more toxic metals in soluble form than the tailings without mineral crust.