

Contributions of isotopic techniques to the development of metallurgical tailings bioweathering

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Abstract

Metallurgical tailings or slags are the vitreous by-products or wastes resulting from the metal smelting industries. In addition to being produced in large quantities and stored in open air, the composition of the metallurgical slags varies widely depending on the initial ore content and different processing methods applied. Slags are often enriched in potentially toxic elements (Cu, Pb, Zn) which can be leached out through weathering or alteration processes and pose the treat to the environment. This research focuses on the study of Pb and Zn in slags resulting from the pyrometallurgical activities of Lead Blast Furnace and Imperial Smelting Furnace (LBF and ISF, resp., Noyelle-Godault, N. of France). Isotopic techniques will be used in this study to identify the slags bioweathering mechanisms in natural environment, due to the microbial activity of a heterotrophic microorganism (*Pseudomonas aeruginosa*). The main issue will be to decipher between the biological and chemical processes (dissolution, precipitation, complexation and adsorption) affecting the elements behavior. Furthermore, the potential application of heterotrophic organisms on the bio-recovery of Pb and Zn from alkaline slags will be studied and investigated as well. The morphology of slags before and after weathering, along with the isotopic fractionation of Pb and Zn due to the weathering are of primary concerns in this research. Hence, the analytical techniques to be applied are HR-ICP-MS (Neptune and Element II), ICP-OES, XRF, XRD, and SEM/EDS. In parallel to the chemical batch experiment, the metal speciation in the leachates will be determined using the Visual Minteq software.