

HYdrometallurgy and Phytomanagement Approaches for Steel Slag management (HYPASS)

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Abstract

Metallurgical slags are major by-products generated by the steel and iron industry. Although they represent potentially important economic resources, as they still often contain significant amounts of "Strategic Metals" (SMs), slags are also considered as industrial waste that may pose public health and environmental concerns. The goal of the HYPASS project [funded by the "Agence Nationale de la Recherche" (ANR)] is to propose technological innovations for both a cost-effective recovery of strategic metals and an eco-friendly management of metallurgical dumps. In this respect, HYPASS will consider the process as a whole, from by-products production to slag valorization and finally rehabilitation of contaminated landfills, with the ultimate goal of developing economically feasible and environmentally acceptable "zero-waste" processes.

The core of the project is the development, assessment and evaluation of two complementary valorization routes using: 1/ hydrometallurgical-based approaches (under alkaline conditions) to recover high SMs amounts, and 2/ phytostabilization approaches [and the beneficial role of "Arbuscular Mycorrhizal Fungi" (AMF)] to promote ecological restoration of slagheaps. Additionally, HYPASS proposes to list and to map existing dumpsites, to perform "Life Cycle Assessments" (LCA) for various processing methods and to develop a "Decision-Support Tool" (DST) to help identifying the best treatment options, both from an economical and from an environmental point of view. HYPASS technologies will be implemented at a large slagheap situated at Châteauneuf (Loire, France), which is registered in the SAFIR¹ network. The project involves one industrial (Industeel France ArcelorMittal²) and two academic partners (ARMINES/SPIN³ and BRGM⁴) and is organized into eight complementary "Working Packages" (WPs).

Strong and numerous impacts are expected from the project. Technologically, the development of new approaches to recover SMs is in itself very innovative and promising, as this could allow to process large amounts of slags that are currently weakly re-used. This is very important in relation to the ambitious targets set by the "European Union" (EU) for recycling metallurgical by-products and decreasing landfilling practices. Environmentally, using phytostabilization as a capping strategy for slagheap rehabilitation will not only improve visual aspect of degraded lands, but this will also trigger the restoration of a local biodiversity and the construction of a technosoil. Restoring biodiversity and stimulating soil formation could give a new value to derelict slagheap, as this is directly linked to ecosystem services that a land may deliver. Additionally, HYPASS will have significant economical and societal impacts, as it could reduce the dependence of European countries to SMs importation. Finally, HYPASS could help to create new jobs in the emerging area of high added-value waste treatment and valorization.

¹ SAFIR ("Sites Ateliers Français pour l'Innovation et la Recherche pour la gestion des sols") [<http://www.safir-network.com/>].

² Industeel France ArcelorMittal (<http://industeel.arcelormittal.com/industeel/where-we-are/>).

³ ARMINES ("Association pour la Recherche et le Développement des méthodes et processus industriels") [<http://www.armines.net/>] / SPIN ("Sciences des Processus Industriels et Naturels") [<http://www.mines-stetienne.fr/recherche/5-centres-de-formation-et-derecherche/sciences-des-processus-industriels-et-naturels/>].

⁴ BRGM ("Bureau de Recherches Géologiques et Minières") [<http://www.brgm.fr>].