

Oral presentation

Theme 3. Strategies for managing contaminated properties

IS VEGETALIZATION A SUSTAINABLE SOLUTION TO MANAGE A FORMER SETTLING POND OF IRON INDUSTRY?

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The iron industry generated numerous by-products that are now found in brownfields, *e.g.* sludge resulting from wet cleaning of blast furnace fumes, which were often dumped into settling ponds. After their cessation, some ponds have been colonized by vegetation despite the potentially polluting compounds, *e.g.* heavy metals or cyanides, they contain [1]. This development of vegetation may suggest a rather low bioavailability and mobility of metals in the soil. However the question of the potential mobilization of metals under the influence of the vegetal cover arises. In fact, plants can modify the soil structure and water flows as well as the chemical ambience (pH and redox potential) in the rhizosphere, soil influenced by root activity. Moreover, exudation of organic ligands by roots and associated microorganisms may increase the availability of elements [2]. With the aim of finding adapted solutions to manage such sites, a former settling pond of the iron industry was investigated to characterize the dynamic of metals in the soil and the influence of roots on it.

The studied pond (Frouard, North-Eastern France) received mainly blast furnace sludge until the mid-20th century and is nowadays covered by a diversified forest. To monitor the flows of metals through the soil, two lysimeters (2 m deep – 1 m² in area) were sampled in the pond and installed in the GISFI experimental station (<http://www.gisfi.fr>, Homécourt, North-Eastern France) under real climatic conditions. The percolates were quantified and analysed. Twelve samples were collected in different layers along the profile resulting from the extraction of one lysimeter. Chemical and mineralogical characterizations were carried out to determine speciation of metals. Physical and hydraulic parameters, *e.g.* specific surface area, porosity and water retention were measured to characterize phenomena of transport in the soil. In order to study the potential influence of roots on metal mobilization, samples were collected in the surface layer and separated into rhizospheric and bulk soils. Chemical and mineralogical characterizations were carried out on these both fractions.

Elemental composition was dominated by Fe, Mn, Ca and Si with very high contents of heavy metals, up to several percents for Pb and Zn. The soil was slightly alkaline with a quite high cation exchange capacity. Mineralogy was characterized by poorly crystalline and reactive phases, mainly aluminosilicates, Fe and Mn (hydr)oxides and carbonates (5-30 %). The main physical and hydraulic properties were a low bulk density, a high microporosity, a strong water retention capacity and a high specific surface area. All these properties were favourable to a low mobility of metals, which was rather confirmed by the monitoring of percolates of

lysimeters. However, the characterization of the surface layer revealed a higher extractability of metals in the rhizospheric soil than in bulk soil even if the extractible fraction of metals remained low. This may arise the problem of the sustainability of vegetalization as solution of management for such sites.

[1] Mansfeldt, T. and Dohrmann, R., 2004. *Environ. Sci. Technol.*, 38, 5977-5984.

[2] Hinsinger, P. *et al.*, 2009. *Plant Soil*, 321, 117-152