Stability and transformation of Pb smelter fly ash in soils

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Soils represent an important sink for metals released into the environment by anthropogenic activities. Emissions from non-ferrous metal smelters are responsible for extremely high concentrations of metals in adjacent soils related to the deposition of the fly ash particles during periods of the filtering inefficiency in the smelter flue-gas cleaning system [1, 2, 3].

To understand the dynamics and fate of smelter-derived contamination, we studied the reactivity of secondary Pb smelter fly ash in acidic soils. The polyamide bags (mesh 1 μm, 2 x 4 cm) were loaded with 0.5 g of fly ash and sealed by welding. Testing bags were placed in contrasting soils in two experiments: (i) a short-term (21-day) laboratory pot experiment with soil pore-water monitoring (Rhizon suction cups) and (ii) a long-term (1-year) *in situ* experiment in soils developed under different vegetation cover (spruce, beech, meadow). After each experiment, the bags were weighted to determine the mass loss and the weathered fly ash was studied by XRD and TEM/EDS. The total concentrations of metals, their chemical fractionation and Pb isotopic composition were determined in soils by the combination of ICP techniques.

More than 60% of fly ash was dissolved during the experiment, especially in organic soil horizons and secondary anglesite ($PbSO_4$) formed as a stable alteration product [1, 2]. A significant increase in the metal concentrations in the soils was observed during the experiment, especially in the litter and organic horizons: Cd (248 x), Pb (15 x), Zn (1.8 x). Cadmium was the most mobile element in the pots and soil profiles, being strongly released into the soil water and bound mostly in the labile soil fractions. A significant shift in the Pb isotopic values towards the fly ash signature ($^{206}Pb/^{207}Pb$ =1.16) confirmed the effect of smelter-induced contamination on metal dispersion, binding and mobility in soils.

[1] Ettler et al. (2005) *Chemosphere* **58**, 1449-1459. [2] Ettler *et al*. (2008) *ES&T* **42**, 7878-7884. [3] Ettler *et al*. (2009) *J. Hazard. Mater*. **170**, 1264-1268.

Treatment of rural effluents by infiltration percolation process using sand-clay fortified by pebbles

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Low-cost and high-performance decentralized wastewater treatments system for rural application in developing nations necessitated this study. The grain size and mineralogy of the sand filter constituting the infiltration bed, is of course one of the key elements and is the main subject of this article. In the other hand, clay samples collected from north eastern Tunisia were characterized by studying the mineralogical and geochemical composition and prove her great potential to fix pollutants. Performance efficiency studies were conducted to determine the best combination ratio of sand-clay/pebbles. Sand-clay (mixture contain 90% sand 10% of clay in weight) fortified with pebbles in the ratio 3:1 gave the optimum water purification and appropriate permeability for the infiltration percolation system. The effects of continued usage on the performance efficiency of the fortified column were studied and the results showed a decrease of Nitrogen, BOD, COD and Bacteria.