Trace metal(oid) stabilization by raw and thermally modified geo-materials as soil amendments

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Seven different mineral-based amendments in raw or thermally modified form have been tested for inducing immobilization of inorganic contaminants in soil. The used geo-materials include different types of palygorskite-rich and saponite-rich clay as well as finely grained red diasporic bauxite. Thermal modification has been achieved by heating the geo-materials at different temperatures ranging from 105 to 450 ^{o}C. All materials have been characterized in terms of mineralogical and chemical composition. A pot experiment was set up, where the amendments were mixed at different proportions with contaminated soil from the sulfide ore mining village of Stratoni, north Greece. Total concentrations in untreated soil have averages of 1000 mg/kg Pb, 712 mg/kg Zn, 6 mg/kg Cd, 2900 mg/kg Mn and 296 mg/kg As.

The effectiveness of soil amendments was evaluated by comparing water leachable contaminant concentrations of treated and untreated soil after a four week period of repeated cycles of wetting and mixing. A 95% reduction has been observed for water leachable Pb by using a mixed palygorskite-saponite clay. However, the maximum efficiency was observed by using treated bauxite at the temperature of 450 °C with negligible water leachable concentrations of Pb, Zn, Cd and As after treatment [1]. Specific surface area (SSA) of the clay materials is the crucial parameter affecting surface charge and thus the capability of the studied elements to form inner or outer sphere complexes. Mineralogical changes in bauxite during heat treatment within the range of 350-450 ^{o}C, associated to dehydroxilation of both Fe and Al-rich phases, lead to structural changes of the minerals resulting in higher SSA and greater efficiency for contaminant retention.

[1] Argraki, A. *et al.* (2017) Towards sustainable remediation of contaminated soil by using diasporic bauxite: Laboratory experiments on soil from the sulfide mining village of Stratoni, Greece. *Journal of Geochemical Exploration* (in press)
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