Stabilization of As and Cr Polluted Soil with Ochreous Sludge from Waterworks

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Abstract:
Stabilization is a technology where contaminated soils are mixed with a substance that decreases the leaching and chemical availability of the contaminants. By stabilization of contaminated soils spreading of pollutants is avoided and the risk of exposure is minimized. Iron oxides are well known sorbents of anions like chromate and arsenate[1] . Iron oxide forming compounds have been used at several occasions at former wood impregnation sites polluted with copper, chromium and arsenic. Zero valent iron or iron sulfate are the usual amendments, but have the disadvantage of lowering the soil pH when forming iron oxides[2]. Ochreous sludge is a waste product from the treatment of groundwater to drinking water. It consists mainly of ferrihydrite, a low order iron oxide. The pH effect of mixing ochre and soil is very limited and causes only a slight increase in pH.

A small scale field experiment has shown a large reduction in the leaching of arsenic and chromium in a polluted soil, wich has been added 3% ochreous sludge. The soil pore water concentration of arsenic was reduced from 5-70 mg/L to 20-100 µg/L in the experiment. However ferrihydrite is an unstable meta-product and will eventually form more stable iron oxides as goethite or hematite. They have a lower sorption capacity and the transformation will decrease the effect of the stabilization. At the moment field experiment is carried out in order to investigate the structural changes in the ochreous sludge, in order to predict the long time performance of the method. Another concern is the potential of water clogged soil and resulting iron reducing conditions, which could lead to a complete remobilization of arsenic in the stabilized soil. Results from the field experiment indicates however, that even under iron reducing conditions the leaching of arsenic is an order of magnitude smaller from the treated soil.

As ochre is a waste product the cost of the method is limited to the mixing of soil and ochre, which can easily be done by ploughing. Using ochre as an amendment is a passive technology with no energy consumption and low running costs. The method is hereby recommended as an option in brownfield management to avoid arsenic and chromium leaching.

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[1] *Cornell, R. and U. Schwertmann: The iron oxides - Structure, properties, reactions, occurrences and uses. Wiley-WCH 2003*
[2] *Kumpiene, J. A. Lagerkvist and C. Maurice: Stabilization of As, Cr, Cu, pb and Zn in soil using amendments – A Review Waste Management 28 215-225*