

Abstract

This work deals with As behaviour in topsoil in the vicinity of the municipality Mokrsko. Influence of phosphate or farmyard manure application to soil on As mobility was studied on the basis of equilibrium, kinetic and column leaching experiments. The equilibrium and the kinetic experiments were carried out using two types of leaching solution: demineralised water (DW) and $28 \mu\text{mol/l PO}_4^{3-}$ (P solution). Pulses of 100-ml volume of leaching solution were applied to four types of soil columns: a column for application of DW; a column for the application of P solution; a column with the addition of manure for the application of DW; a column with the addition of manure for the application of P solution. Hydrodynamic tests of water flow and solute transport in the soil columns were performed. Leachates were analysed for pH, Eh, alkalinity and major and trace elements (Na, K, Mg, Ca, PO_4^{3-} , SO_4^{2-} , Cl⁻, F⁻, Fe^{3+} , Al, Mn, Pb, Cr, Cu, Ni, Co, Zn, Cd, Ba, As). Differences in composition of individual types of leachates were evaluated on the basis of statistical analysis and geochemical equilibrium models and related to P solution or manure application.

The soil sample contained 125.9 mg/kg As a 891 $\mu\text{g/kg}$ As extractible with DW. All As was bound onto soil sorption complex. Extractible As (DW and P solution) was determined using solid/liquid ratio (S/L) 0.01. Higher ratio leads to underestimation of extractable As. Concentration of As in experimental leachates varied in the range of about 8-30 $\mu\text{g/l}$. Concentration of As grew by about 50% after application of P solution only in kinetic and equilibrium experiments. During kinetic experiment, As concentration reached max. 15.34 $\mu\text{g/l}$ (DW) and 23.33 $\mu\text{g/l}$ (P solution). Concentration of As in soil column leachates varied from 8.8 to 15.5 $\mu\text{g/l}$ and was not affected by leaching solution composition or manure addition to soil. Farmyard manure addition caused higher concentrations of major inorganic components, DOC, Al and Cr, and lower Eh and Mn concentration. Application of P solution resulted in lower NO_3^- a SO_4^{2-} concentration (enhanced biological fixation). Approximately 19.5 ml of 100 ml of leaching solution applied to soil column mixed with 24.5 ml of previously applied solution and stayed for 48 h until following application of leaching solution. Description of hydrodynamic conditions of transport in soil columns enabled comparison of experimental system with natural conditions in soil.

Application of P solution caused significant increase of As concentration in leachate, however it did not exceed range of relatively low values. Influence of manure application on As mobility was not proved.