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Mineral-organische Wechselwirkungen: Bildung, Eigenschaften und Auswirkungen auf Stoffkreisläufe

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Titel
Adsorption of Pb on iron oxide colloids as a function of DOM concentration

Abstract
Soil contamination with lead (Pb) is of particular concern for human health, especially with respect to potential transport to the groundwater. Pb can be co-transported with both organic and inorganic colloidal particles in soils. The aim of this study is to determine the interactions between Pb and typical soil colloids such as dissolved organic matter (DOM), goethite colloids, and organic matter coated goethite (OMCG) colloids as well as to investigate the influence of these colloidal particles on the mobility of Pb in soils.
For that, experiments were conducted with DOM derived from Fagus sylvatica litter and goethite colloids with mean particle size of 500 nm. The effects of DOM concentration on goethite colloid zeta potentials and aggregation behavior were investigated to determine potential mobility in soil materials. Furthermore, the adsorption of Pb^{2+} onto iron oxides and DOM was determined at pH 6 in three variants: (i) goethite colloids + Pb^{2+}, (ii) DOM + Pb^{2+}, and (iii) OMCG colloids + Pb^{2+}.
In the absence of DOM, the zeta potential of goethite colloids was positive. With rising DOC concentration, the zeta potential turned increasingly negative. The zeta potential affected goethite colloid aggregation behavior. While colloids repel each other both in the absence of DOM and at DOC concentrations above 1.0 mg/l, the more neutral zeta potential at 0.1 mg/l DOC caused aggregation of OMCG colloids. Furthermore, the adsorption of Pb^{2+} onto goethite colloids at different DOC concentrations is likewise related to zeta potentials. Only small amounts of Pb^{2+} were adsorbed on pure goethite surfaces in the absence of DOM. In contrast, Pb^{2+} was readily adsorbed onto OMCG colloids at 1.0 mg/l DOC. Notably, the largest amount of Pb^{2+} adsorption was found for pure DOM in the absence of goethite colloids. This can be explained by the fact that pure DOM has more potential sorption sites left for Pb^{2+} than DOM coatings on goethite colloids have.
We conclude that DOM-induced changes in goethite colloid zeta potentials affected both the colloid aggregation behavior and the sorption capacity for Pb^{2+}.These results serve as the base for transport experiments, in which the mobility of (i) Pb^{2+}, (ii) Pb