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TEM-EDS study of metals' partition at particle level after their sorption in soil

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Association of soil mineral particles could significantly modify the sorption capacity of the individual soil components. We studied this phenomena using single element and competitive batch Cd, Cu, Pb and Zn sorption experiments on six soil samples with contrasting characteristics. Their sorption properties were characterized by XRD and FTIRS analyses, as well as sorption curve evaluation. TEM-EDS analyses were used to characterize the soil mineral particle associations and their metal sorption capacities.
Submicron sized smectite particles were found to be associated to tiny ferryhidrite and goethite patches in the acidic forest soil samples, whereas the alkaline meadow soils could be characterized by goethite and smectite particles attached to large carbonate grains. Point chemical analyses carried out on such associations showed that significant metal separation may occur at particle level within the mineral associations observed. This is primarily obvious for Cu and Pb, which are preferentially sorbed by iron oxides over clay mineral particles. This phenomenon is more pronounced in competitive situation. Highest affinity to clay minerals was found for Zn and it may be also characteristic for Cd in acid conditions. However, decrease in available sorption sites and increase in pH may result in enhanced precipitation for the studied metals.
Our results suggest that estimation of the role of soil components in metals' sorption can not be adequate enough when the sorption properties of a set of bulk soils are studied exclusively. Direct observation of metals' partition at particle level may result in a deeper insight into soil-metal interaction.
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