Direct observation of sorption capacity of individual soil mineral particles and their association

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Association of soil mineral particles could significantly change the sorption capacity of their individual components. We studied this phenomena using batch Cd, Cu, Pb and Zn sorption experiments on two soils with contrasting characteristics. Their sorption properties were characterized by XRD and FTIRS analyses, as well as sorption curve evaluation. Using TEM-EDS, submicron sized smectite particles were found to be associated to tiny ferryhidrite and goethite patches in the acidic forest soil, whereas the alkaline meadow soil could be characterized by goethite and smectite particles attached to large carbonate grains.

Point analyses and elemental maps carried out on such associations showed that significant metal separation may occur at particle level. This is primarily obvious for Cu and Pb, which are preferentially sorbed by iron oxides over clay mineral particles. This 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, while decrease in available sorption sites and increase in pH may result in enhanced precipitation for these latter metals.

These results suggest that estimation of the role of soil components can not be carried out when only the bulk soil is studied.

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