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Organoclay Sorbents versus Soil Organic Matter: Sorbent Hydration Effect on Interactions with Organic Compounds

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The assemblages of soil organic matter (SOM) and mineral components present in soils are considerably more heterogeneous than are organoclays and hence the latter cannot directly serve as models for the complex systems that are soils. Yet, comparison between the behavior of soils and of organoclays vis a vis organic sorbates may shed light on the nature of the interaction of organic sorbates with SOM and the architecture of this key environmental sorbent.

This presentation provides a comparative examination of recently published data on the effect of sorbent hydration on sorption interactions of selected probe organic compounds with a model organoclay (Na-montmorillonite exchanged with n-hexadecyltrimethylammonium) and model SOM. Effect of the sorbent hydration has been established by comparing the sorption isotherms of a probe organic compound measured on a (dried) sorbent from water and from inert, non-aqueous medium (n-hexadecane). To eliminate differences in compound-bulk solvent interactions, a comparison of sorption isotherms was carried out using the compound activities instead of compound concentrations in a solution phase.

A different effect of sorbent hydration on the interactions of organic compounds with organoclays and with SOM is observed. While sorbent hydration may significantly enhance the sorbate's interactions with SOM, in the case of the organoclays it strengthened interactions to a much lesser extent or even weakened them. This difference may be associated with a large number of functional groups present in SOM and the non-covalent, intra- as well as inter-molecular links they form. Such links block sorbate access but are broken in the presence of water. This effect is not present in organoclays which lack functional groups in the quasi-organic layer. This contrast supports the previously proposed idea that the presence and disruption of non-covalent linkages formed between functional groups in the SOM structure as well as a direct involvement of the SOM-sorbed water in the sorption process have an important role in the interactions between organic compounds and SOM.