CLAYS WITH INTERESTING ENVIRONMENTAL PROPERTIES: EFFECT OF STRUCTURE ON CARBON SEQUESTRATION

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Allophanic soils are interesting in terms of environmental properties especially because of their potentialities as sinks for "greenhouse gases": Allophanic soils exhibit higher organic carbon content (usually by a factor 4) than the one measured in other clay soils. Allophanes are amorphous clays, issued from the transformation of volcanic materials (glasses and ashes) which present completely different structures and physical properties compared to usual clays.

We study the fractal structure of the allophane aggregates, at the nano scale and we propose that this peculiar structure and the associated low permeability could explain the high nitrogen and carbon content of the allophanic soils. We introduce a numerical model to simulate the structure of allophane aggregates. The algorithm is based on Diffusion-Limited Cluster-Cluster Aggregation and the textural properties (pore volume, specific surface area, and hydraulic diameter) of the different simulated structure are calculated. Numerical results are in good agreement with allophanic soils experimental data and we can derive the permeability of the allophane aggregates. We show that, at the scale of the allophanic aggregates, the calculated permeability is low and could be an important parameter to explain the larger C and N content of allophanic soils.

Because of the low allophanic aggregate permeability, the fluid exchanges and chemical reactions are slow, leading to an accumulation of C and N not chemically transformed. The peculiar structure of the allophane aggregates plays the role of a labyrinth which traps C and N.