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Characterisation of green waste compost and interaction of SOM (Soluble Organic Matter) with copper and clay

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Among compostable products, green wastes constitute an interesting object of research. Generally maturated compost elaborated from green wastes present properties which make it a good organic soil amendment. However a part of SOM coming from compost can present risks for bio-physicochemical equilibrium of soil. These risks can be related to an intrinsic polluting nature of SOM, but also to the influence of SOM in metal immobilisation and transfer in soil. The main objective of this work is the study of the multiple interactions between organic matter - clay - metallic cations, which can influence metal behaviour in soil, i.e. transport with the liquid phase or reversible or not immobilisation on solids..

A green waste compost was selected (12 months of maturation) and was characterised by determination of pH, TOC, NTK, C/N ratio, humic substance content, humic acid versus fulvic acid ratio (according to IHSS method). SOM was obtained by filtration at 0.45 μm after batch water extraction (ratio 1/5 g of compost versus g of water). In order to get information on size repartition, SOM was ultra filtrated (threshold of cut 1 kDa and 10 kDa). XAD-4 and XAD-8 resins were used to determine the hydrophilic and hydrophobic properties of ultrafiltrated SOM fractions. Each fraction obtained was characterised by its organic carbon content and UV-visible spectrum analysis. Based on the obtained results, the only 10-1 kDa SOM fraction was selected for the SOM-clay-Cu2+ multiple interactions study. The clay was characterised by

X-ray analysis, and its cation exchange capacity, specific surface area, and composition were determined. The following experiments were performed: - complexation of copper by SOM, - single-sorbate sorption on clay were performed for copper or SOM, and the experimental isotherm data were analysed using Langmuir isotherm model, - the multiple interactions: copper partition i.e. adsorbed on solid phase or either bound to SOM or free in solution, was studied in two cases: pre-contact (contact between clay and organic matter during 24h before adding copper) and co-contact (simultaneous contact between clay, organic matter and copper). Concentrations of copper were determined in different phases by ICP-OES.

Results confirm that SOM is issued from a stable compost rich in humic-like substances. SOM is constituted for 60Experimental data on single-sorbate sorption on clay were found to follow the Langmuir isotherm model making it possible to determine: - the highest Cu2+ or 1-10 kDa SOM sorption capacity of clay, respectively 88 mg of Cu2+ per g of clay and 5.6 mg organic carbon per g of clay, - the Langmuir constants which could be related to the affinity between the sorbent and the sorbate. Whatever the mod of contact, presence of SOM enhance maximum Cu2+ sorption capacity of solids, from 88 mg/g to 130 mg/g. However, it influences partition between free copper and copper bound to organic matter in solution, more Cu2+ being bound to remaining SOM in the case of pre-contact. This could be due to a discrimination of soluble organic compounds sorbed on clay according to their hydrophobic characteristics.

The results make it evident that SOM brought by compost to soil, by its capacity of copper complexation in solution but also by its interaction with mineral phase, can modify transport of trace elements in soil. They also show that only single-sorbate experiments are insufficient to approach mechanisms of these transports, and that multiple interactions have to be taken into account.

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