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The sorption characteristics of mercury as affected by organic matter content and/or soil properties

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The determination and description of the mercury sorption extend on soil is significant for potential environmental toxic effects. The aim of this study was to assess the effectiveness of mercury sorption at different soil samples and vermicomposts. Mercury interactions with soil organic matter were studied using three soils with different physical-chemical properties - fluvisol, cambisol, and chernozem. Moreover, three different vermicomposts based on various bio-waste materials with high organic matter content were prepared in special fermentors. First was a digestate, second was represented by a mixture of bio-waste from housing estate and woodchips, and third was a garden bio-waste.
In the case of vermicompost, the fractionation of organic matter was executed primarily using the resin SuperliteTM DAX-8. Therefore, the representation of individual fractions (humic acid, fulvic acid, hydrophilic compounds, and hydrophobic neutral organic matter) was known. The kinetics of mercury sorption onto materials of interest was studied by static sorption experiments. Samples were exposed to the solution with known Hg concentration of 12 mg kg-1 for the time from 10 minutes to 24 hours. Mercury content in the solutions was measured by the inductively coupled plasma mass spectrometry (ICP-MS). Based on this data, the optimum conditions for following sorption experiments were chosen. Subsequently, the batch sorption tests for all soil types and vermicomposts were performed in solution containing variable mercury concentrations between 1 and 12 mg kg-1. Equilibrium concentration values measured in the solution after sorption and calculated mercury content per kilogram of the soil or the vermi-compost were plotted. Two basic models of sorption isotherm - Langmuir and Freundlich, were used for the evaluation of the mercury sorption properties.
The results showed that the best sorption properties from studied soil were identified in chernozem with highest cation exchange capacity. The highest amount of mercury was adsorbed by the vermicompost from garden bio-waste. This vermicompost contained the most humic acids and the least amount of other fractions of organic matter.

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