



The influence of organic-mineral complexes on micro-elements dynamic in ecological systems of vegetables cultivation

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In ecological systems of vegetable cultivation (hortic antrosols; soils from greenhouses), exists an ensemble of equilibriums between organic-mineral combinations, very sensitive even to relatively small variations of physical-chemical conditions in soils. As such, these can manifest a strong influence on organic matter, clay minerals and microelements from soil, which in turn impacts on the productivity of these soils and the quality of obtained products (vegetables, fruit). Although many studies consider these organic-mineral combinations are meta-stable combinations, our work has shown that the stability of organic-mineral combinations in hortic antrosols (especially for clay-humic, clay-ironhumic combinations and chelates) is higher. We believe that this is due to the higher flexibility of these combinations' structures with the variation of chemical-mineralogical composition and physical-chemical conditions in soil.

This paper highlights the results of our research on the differentiation possibility of organic-mineral complexes, depending on their structure and composition (using Raman and FT-IR spectrometry) and the influences manifested by the organic-mineral complexes on the micro-elements dynamic from ecological systems of fresh vegetable cultivation. The non-destructive separation of organic-mineral compounds from soil samples was carried out through iso-dynamic magnetic separation and extraction in aqueous two-phase systems (PEG-based). The Raman and FT-IR spectrometry analyses on raw soil samples, extracts obtained from soil samples and separated mineral fractions have been supplemented by the results obtained through chemical, microscopic and thermal analyses and by UV-VIS absorption spectrometry.

Ours experimental studies have been done on representative samples of hortic antrosol from Copou glasshouse (Iasi, Romania), and was studied five micro-elements: Zn, Ni, Cu, Mn, Cr and P. The total contents of the five microelements and their fractions differential bonded on mineral and organic components of hortic antrosols, have been determined by atomic absorption spectrometry after combined sequential extraction in solid phase extraction – aqueous biphasic (PEG based) systems. The specific mechanisms of the microelements interaction with organic components have been estimated on the basis of studies realized on fractions obtained after each extraction step by Raman and FTIR spectrometry. These data have been correlated with those obtained by chemical analysis and UV-VIS spectrometry. In conditions of hortic antrosol, from total contents of Zn, Ni, Cu, Mn and Cr, more than 65 % are binding on organic components. A specific phenomenon of hortic antrosols is the microelements complexation exclusively with the functional groups of organic macromolecules. This phenomenon has two important consequences: (i) the strong fixation of microelements (these can be extracted only in very extremely conditions, which implied the organic part destroying) and (ii) their presence determined major modifications in the structure, conformation and stability of organic macromolecules. Under these conditions, the type and structure of organic-mineral compounds represent determinant factors for the dynamic of micro-elements and organic compounds in ecological systems of vegetables cultivation.

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