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Application of Emission Excitation Matrix spectroscopy and fluorescent indices for characterization of soil organic matter

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The soil organic matter (SOM) has important functions in the ecosystems of the soils. It is a key element in the carbon storage, the adsorption of pollutants, and in the soil fertility. Although the organic molecules of soils have no definable structure several analyses are able to characterize the structural property of these substances. Different indices, such as HIX, FI and E4/E6 can help to determine the complexity, size and aromaticity of the soil organic molecules. The qualitative evaluation of the water soluble fraction (DOM) of the soil organic matter is commonly used technique. However, ex situ examinations of the stabilized organic matter on minerals are often difficult because more robust extraction procedures could cause structural changes or aggregation.

Present study focuses on the applicability of various indices for organic material characterization, such as Humic and Fulvic acid. 72 arable soil samples were extracted using a slightly modified procedure recommended by the International Humic Substances Society. Two fractions were separated from each sample using this procedure: 1./ organic matter fraction that precipitated in acidic medium (Humic acid), and 2./ organic matter fraction that remained dissolved in both acidic and alkali medium (Fulvic acid).

UV-Vis (E2/E3, E4/E6, SUVA254), fluorescent (HIX, BIX, FI) indices and the Coble peaks were determined from the absorption, and EEM spectra of the samples. The molecular size of the organic matter fractions were measured by photon correlation spectroscopy (DLS), while the organic carbon content was determined by TOC analyser.The UV-Vis indices of the samples were consistent with the most of the published results, however, in same cases, the fluorescent indices provided contradictory results. The more detailed examinations of the EEM spectra along with the examination of the calculation methodology made it possible to understand the difference between these values, and the previous ones. The EEMs have clearly shown that the red shift of fluorescent radiation was so high, that the measured values were outside the calculation range of indices. Our results suggest, that fluorescence indices without the application of the EEMs are not applicable for the characterization of soil organic matter. Furthermore, the presence of high molecular weight organic compounds in the organic fraction cannot be determined by fluorescent indices, because of the greater red shift.

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