

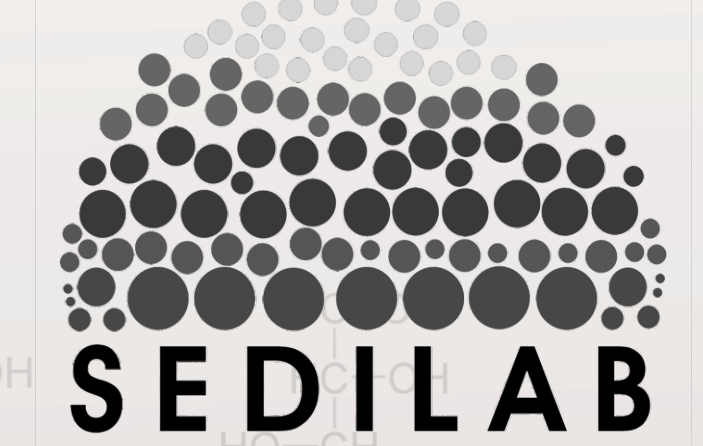
APPLICATION OF EMISSION EXCITATION MATRIX SPECTROSCOPY AND FLUORESCENT INDICES FOR CHARACTERIZATION OF SOIL ORGANIC MATTER

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This research was supported by the National Research, Development and Innovation Office (NKFIH) from the National Research, Development and Innovation Fund (NKFI); Grant Agreement: NVKP_16-1-2016-0003

1.

Soil organic matter (SOM) has many important functions in the ecosystems of the soils.

- key element in carbon storage
- potential adsorption of pollutants
- improves soil fertility
- protects soils against erosion

Studying chemical and structural parameters of SOM molecules help us understand these functions in more details. Although the organic molecules of soils have no definable structure several analysis are able to characterize the structural and chemical properties of these substances.

To study water soluble organic molecules they often use:

- FI indices
- HIX indices
- BIX indices
- Coble peaks

To study alkaline extractable organic molecules they often use:

- E4/E6 indices
- E2/E3 indices
- SUVA254 indices
- C/N rates

Present study focuses on the applicability of fluorescent indices for alkaline extractable organic matter characterization, such as Humic and Fulvic acid.

2.

SOM was extracted from 72 arable soil samples (Szentgyörgyvár, Hungary) using a combined procedure of the following studies

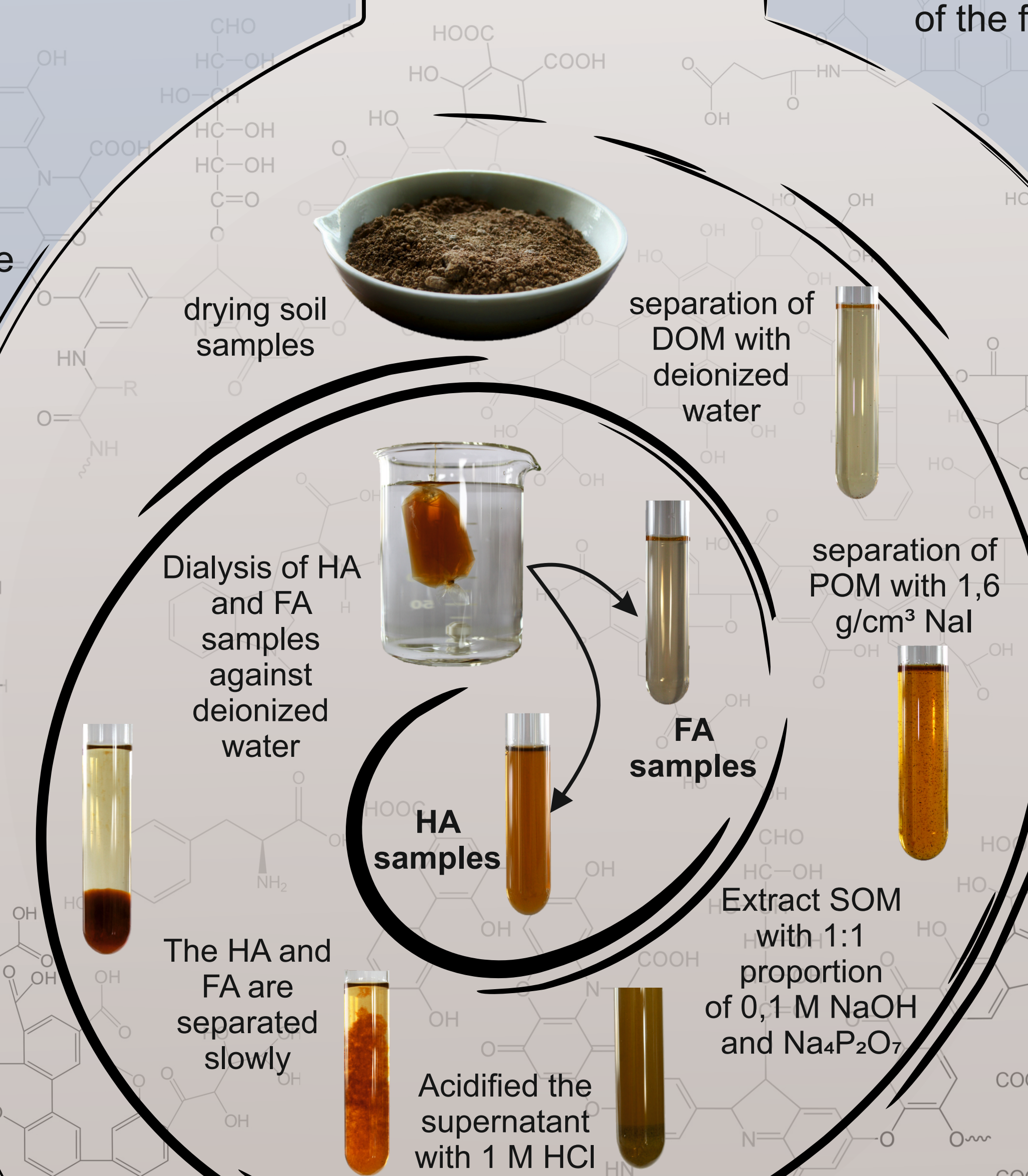
- Christensen 1992 - The separation of **POM** fraction with NaI
- Zsolnay, 1996 - The separation of **DOM** fraction
- Kononova, 1966 - The **chemical parameters** of the alcali extraction
- Swift 1996 - The **separation of HA and FA**

Two fractions were separated from each sample:

- **Humic acid** fraction that precipitated in acidic medium (**HA**)
- **Fulvic acid** fraction that remained dissolved in both acidic and alkali medium (**FA**)

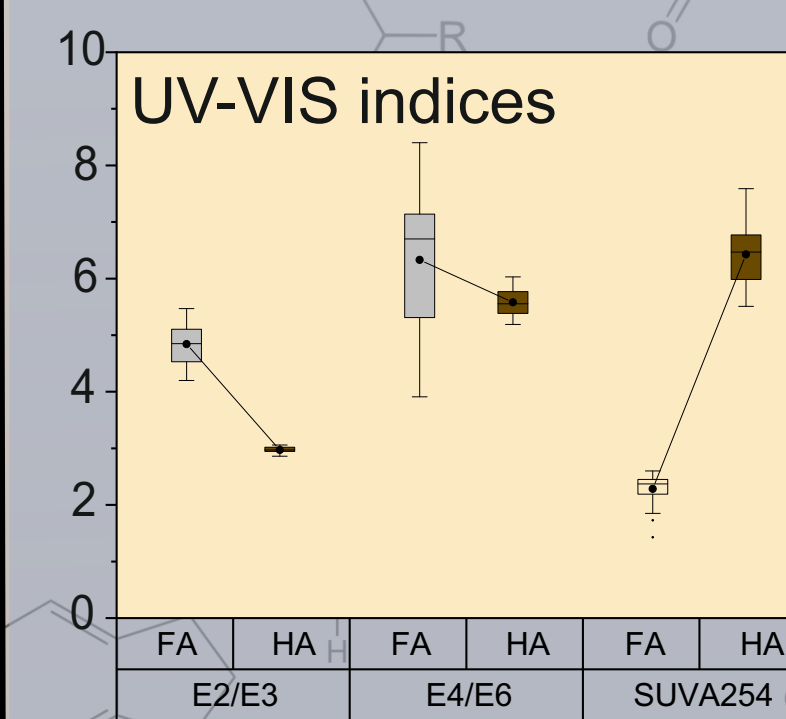
UV-Vis (E2/E3, E4/E6, SUVA254), fluorescent (HIX, BIX, FI) indices and the Coble peaks were determined from the absorption, and EEM spectra of the samples. The molecular size of the organic matter fractions was measured by photon correlation spectroscopy (DLS), the organic carbon content was determined by TOC analyser.

Most of the results were consistent with the majority of the published results, however, the HIX indices provided contradictory results.

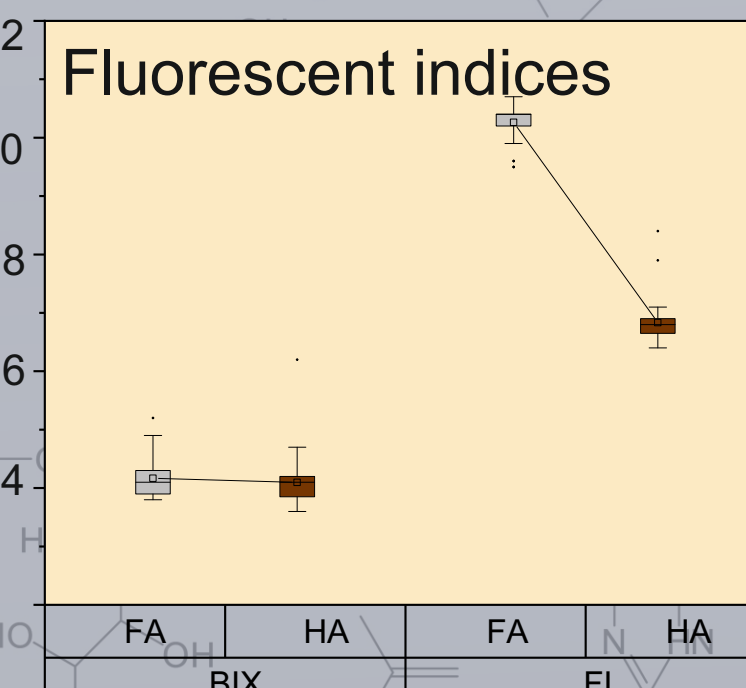


3.

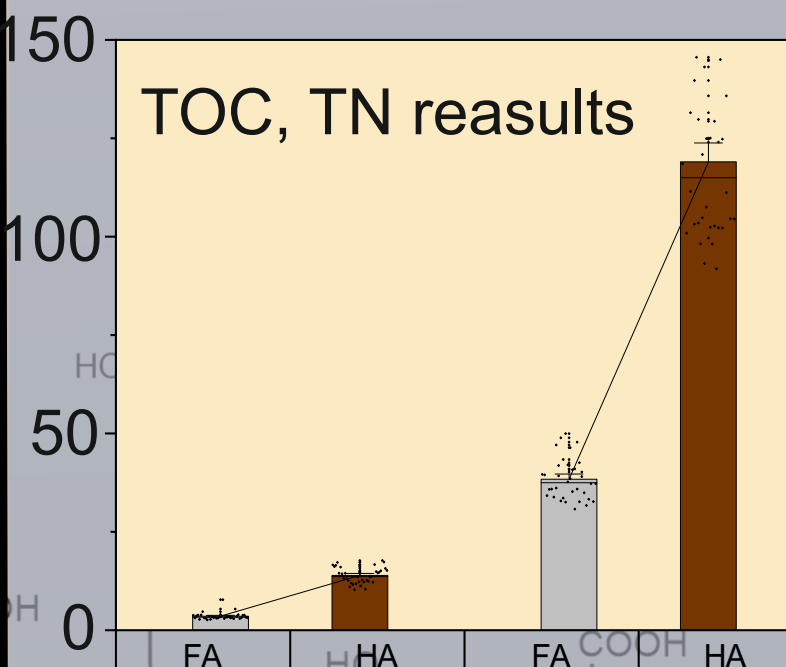
Expected results:



UV-VIS results show, that the HA molecules are more aromatic and more complex than the FA molecules.

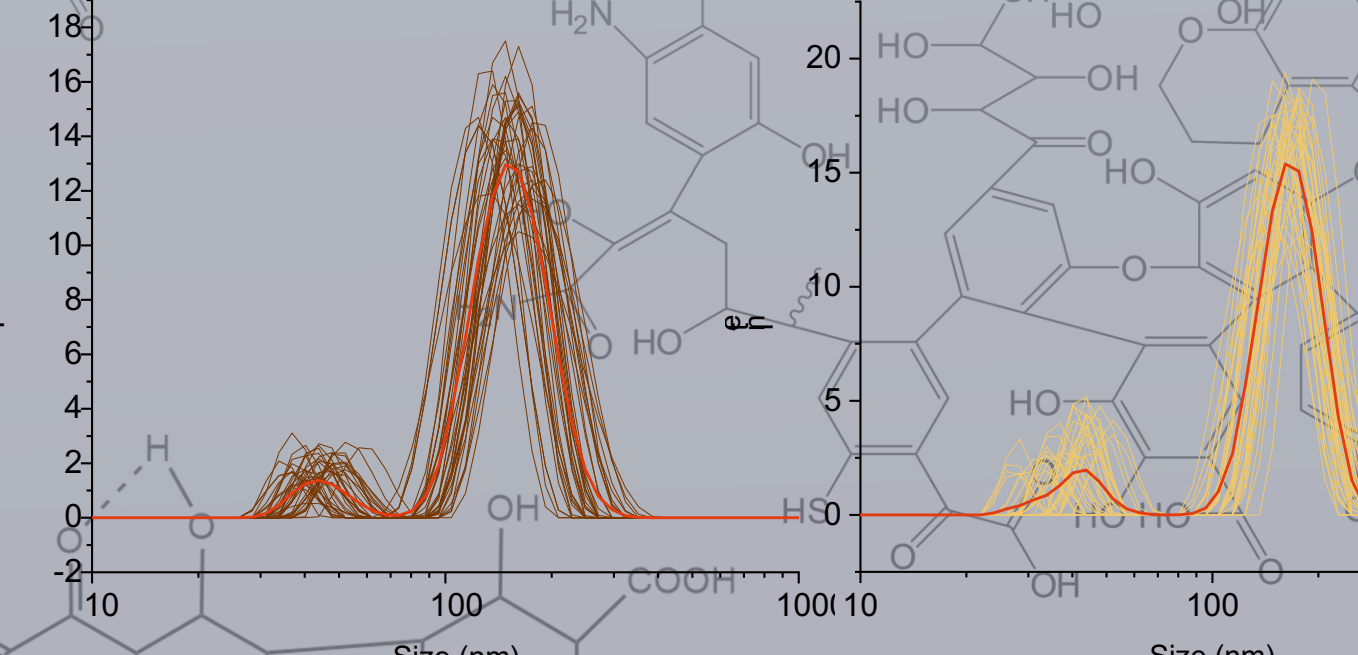


FI and BIX indices show that both fractions are terrestrially sourced, but the HA fractions are more aromatic.



TOC results and C:N ratios show, that the FA molecules contain less Nitrogen, therefore these are more degraded, and oxidized molecules.

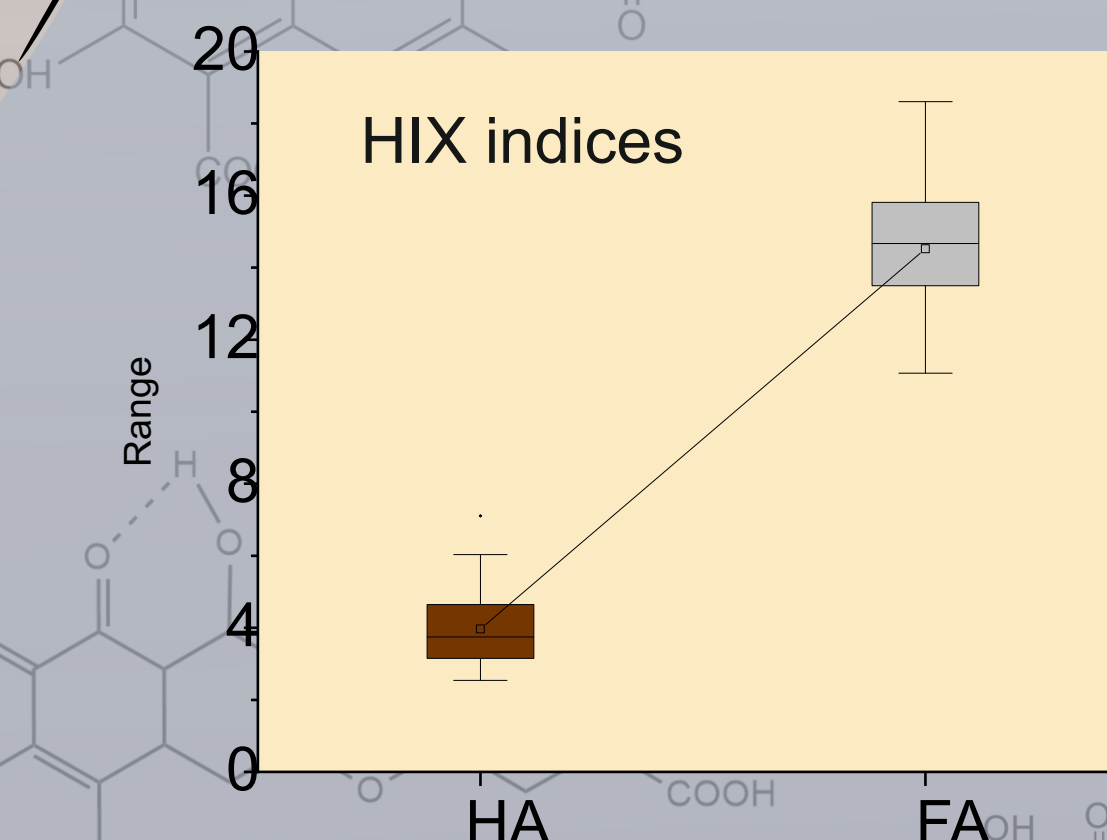
Size distribution of HA (first) and FA (second)



Based on the size distributions there is no significant difference between the size of HA and FA molecules in slightly acidic medium.

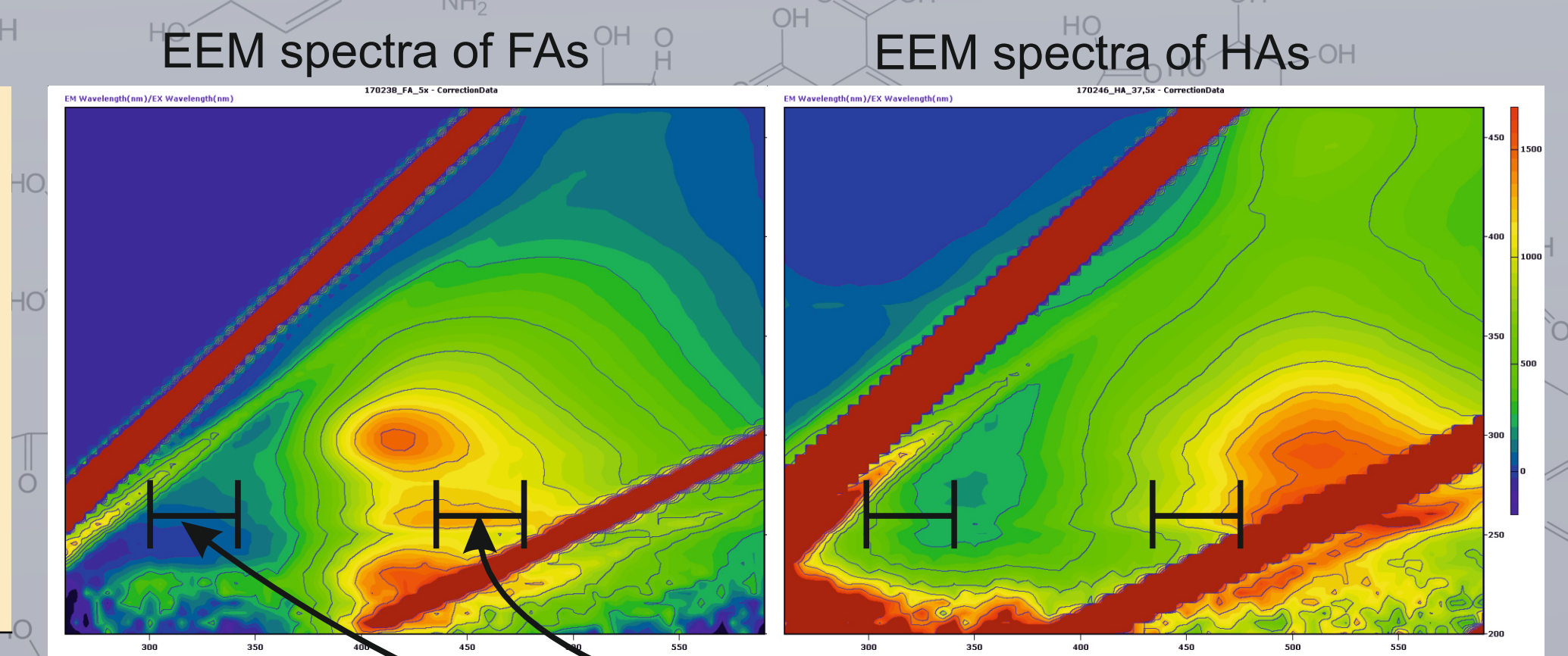
4.

Contradictory Results:



HIX indices show, that the the FA molecules are more complex and aromatic, than the HA molecules. This result **contradict to all the other results.**

HIX index calculation is based on the theory of redshift. More aromatic molecules (contain more π-bonding) cause greater redshift in the spectrum. As the EEM spectra shows in the case of **FA** samples, the detected **peak overlaps** the HIX index **calculation area**. However in the case of **HA** samples, the **peak occurs** at a **higher wavelength**, (because of the greater redshift) probably due to the HA molecules more aromatic structure. Therefore the **peak is outside** of the HIX index **calculation area**.



$$HIX = \frac{I_{480} - I_{345}}{I_{300}} (\lambda_{exc} 254)$$

• As the consequence of the previous findings the calculated HIX values of HA samples lead to false interpretations.

• We suggest, the HIX index is not suitable for research of alkaline extractable SOM. The analysis of EEM spectras is essential.