

Spectral characteristics of water-soluble and alkaline-soluble humic substances of fallow soils

Giniyatullin K., Smirnova E., Okunev R.

Kazan (Volga region) Federal University, Russian Federation, giniyatullin@mail.ru

doi: 10.36291/HIT.2019.giniyatullin.028

Solutions of colored natural compounds isolated from soils, bottom sediments, brown coals, "crude oils" and asphaltenes are characterized by a continuous uniform increase in the absorption intensity with a decrease of wavelength in UV and visible spectral regions. The similar nature of the spectra can be explained in different ways: high molecular weight, wide polydispersity, random molecular structure, wide variety of chromophores, the effect of the "total spectrum" of the ensemble of molecules, as well as the combined effect of all the above reasons. Characterization of UV and visible spectra of uncertain composition compounds can be successfully used to quickly assess the direction of changes in natural organic matters (OM) in dynamic natural systems. The criteria $SUVA_{254}$ and Sr are usually used to characterize the spectra. It is believed that the $SUVA_{254}$ criterion has a close correlation with the aromaticity of OM, and Sr with their molecular masses [1, 2].

The content of organic matter and its individual fractions in layered samples isolated from the old arable horizon were studied in different age (7 and 75-80 years) fallow soils. It was shown that with age of deposits there is a significant increase in the content of OM in the upper layers of the old arable horizon and the content of water-soluble and alkaline-soluble fractions. The qualitative composition of the labile OM fractions was evaluated according to the $SUVA_{254}$ and Sr criteria, which were calculated from the absorption spectra in the UV range. It was shown that in the upper part of the old arable horizon (0-5 and 5-10 cm) there is accumulation of water-soluble and alkali-soluble humic substances (HS) with a lower degree of aromaticity and higher molecular weight than the HS in the total thickness of this horizon, apparently due to the predominant accumulation of younger more aliphatic compounds under the fallow vegetation. With the age of the deposit, the aromaticity of water-soluble OM significantly increases, which may indicate a preferential selection of more water-soluble molecules that are more resistant to destruction. In the case of alkaline-soluble OM, this tendency is practically does not appear. It can be concluded that the factor of selective conservation of stable compounds for this fraction is not so relevant, and the stability of alkaline-soluble HS in soils is most likely due to their spatial inaccessibility to heterotrophic microorganisms due to the formation of supramolecular aggregates, as well as interactions with minerals and metal ions.

Acknowledgements. This work was supported in part by the Russian Foundation for Basic Research, research project № 17-04-00846.

References

1. Weishaar J.L. et al. // *Environ. Sci. Technol.* 2003. 37: 4702–4708.
2. Helms J.R. et al. // *Limnol. Oceanogr.* 2008. 53(3):955–969.