MONITORING OF HUMIC ACID FRACTIONS FROM SOIL AFTER ORGANIC FERTILIZING FOR REGULATING ORGANIC MATTER QUALITY

N.N. Kriklya (Kamneva),[a,b] M.A. Popirny,[b]

[a] Kharkiv V. N. Karazin National University, 61022, Kharkiv, Ukraine; E-mail: kamneva@chemist.com

[b] National Scientific Center «O. N. Sokolovsky Institute for Soil Science and Agrochemistry Research», 4 Chaikovska St., 61024, Kharkiv, Ukraine

The main characteristics of humic acids

Humic fraction are more chemically active than non-humified materials of soil and play major role in the function of soil formation, bio-transformation of organic matter, accumulation and sequestration of soil organic carbon and control soil aggregate structure, these all aspects crucial to soil fertility.

The size of humic acids (HSs) particles dictate the mobility and reactivity of soil organic matter to soil minerals and in the complex processes of soil podsolization.

Applying various fertilizer systems has a great and diverse influence on soil organic matter quality and carbon content at all levels of soil structural organization.

The aim of the research

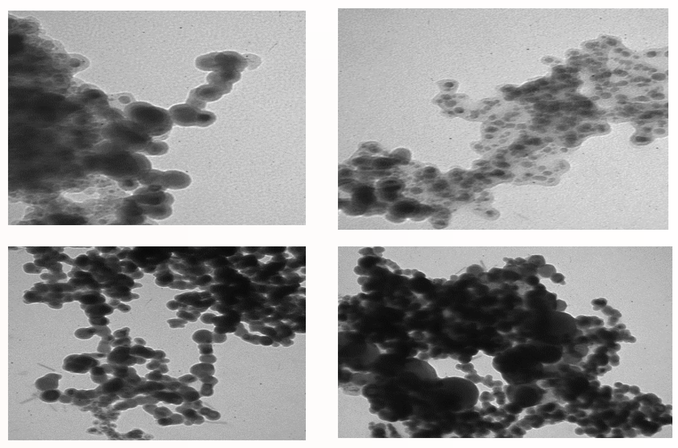
The aim is to monitor effect of fertilizers on carbon content (carbon of HA and fulvic acid) and particles size distribution of humic fraction as most reactive soil organic matter component by using of DLS, UV-visible spectroscopy and TEM.

View of humic fraction

UF-4 – Humic substances fraction after 0.1. NaOH extraction from decalsificate soil by acid

UF-5 – Humic acid fraction (humic fraction) obtained after acidification UF-4

The visualization of HA nano-particles by TEM at 50 000x.



The nano-particles colloid visual represent by set of size from 10-20 nm to 50-60 nm. The agglomerates of humic particles have size from 200 to 700 nm.

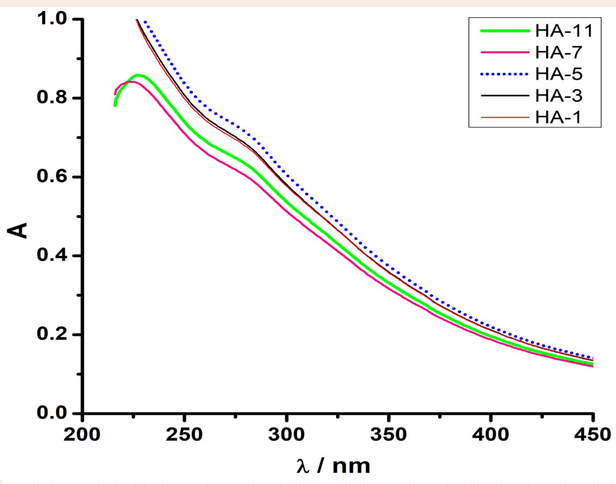
DLS measurements with Malvern Zetasizer Nano ZS

HA fractions	C, % (HA\FA)	Z-average, d. nm	PDI	PSD by volume (Peak 1), *d* / nm	PSD by volume (Peak 2), *d* / nm
HA from control soil	0.09\0.15	200	0.373	150	-
HA soil with manure and NPK complex	0.07\0.19	444	0.720	114	23
HA from soil with manure and green manure	0.06\0.20	218	0.401	161	40
HA soil with manure	0.06\0.19	211	0.537	163	65

Under long-term (60 years) fertilizers of soddy -podzolic soil increased carbon content of fulvic acid (FA) and some decreasing of HA. The activation of soil biotransformation process by organic fertilizers promote neo -formation of young humic molecules, which in podzole soil is a fulvic as precursor of HA.

By DLS study of soil HA fractionswe determined that system is polydispersity and dynamic mostly consist from small sized colloid particles. Established that in HA fractions from soil with fertilizers appear second peak 2 of nano-sized particles (from 20-60 nm). Observed increasing of Z-average size (444 nm) in HA fraction of soil with manure and NPK complex that can explained of large number of small nano-sized particles of peak 2.

Spectra of HA



UV-visible specter of HA fractions

(HA-1 from control soil;

HA-3 from soil with manure and NPK complex;

HA-5 from soil with manure;

HA-7 from soil with manure and green manure;

HA-11 from soil with green manure)

Table. Coefficient of condensation of HA (E4\6 = C%*(Abs400\600 nm) in humic fraction

Humic fraction	665	445	4\6	C%. HA	E4\6
HA-1	0.027	0.144	5.33	0.09	0.48
HA-3	0.025	0.144	5.76	0.07	0.40
HA-5	0.025	0.145	5.8	0.06	0.34
HA-7	0.019	0.114	6	0.06	0.36
HA-11	0.022	0.131	6	0.08	0.48

E4\6 coefficient know as level of condensation of HA in solutions. The fertilizer lead to decrees coefficient that means increasing content of benzene structures with C=C bond in HA aromatic system that promote stability of soil organic matter.

Conclusions

- Revealed that most dispersed system (PDI 0,720) of HA fraction with smallest nano-sized particles (23 nm) and highest intensity (85 %) form in soil with manure and NPK complex that can increase dynamicity, mobility and weak stabilization of humic substances in profile of soody-podzol soil and lead to decrease soil structuration and carbon accumulation that decrease soil fertility and agricultural valuable.
- The manure and manure with green manure lead to increasing size of particles and decrease PDI in HA fractions that promote stabilization of neo-form humic substance and accumulation of soil organic carbon and in soil fertile up-layer.
- Well know that decreasing soil organic matter quality and quantity occurred by weak stabilization of neo-form humic substances in soil that can lead to soil degradation and erosion.
- Evaluation of PSD of soil humic fraction can be valuable in monitoring and prediction of soil process under agricultural management to effective using of fertilizers, control carbon sequestration and regulating of soil organic matter quality.