STRUCTURE AND PROPERTIES OF COMMERCIAL HUMATES FROM COALIFIED MATERIALS, PEAT AND SAPROPEL

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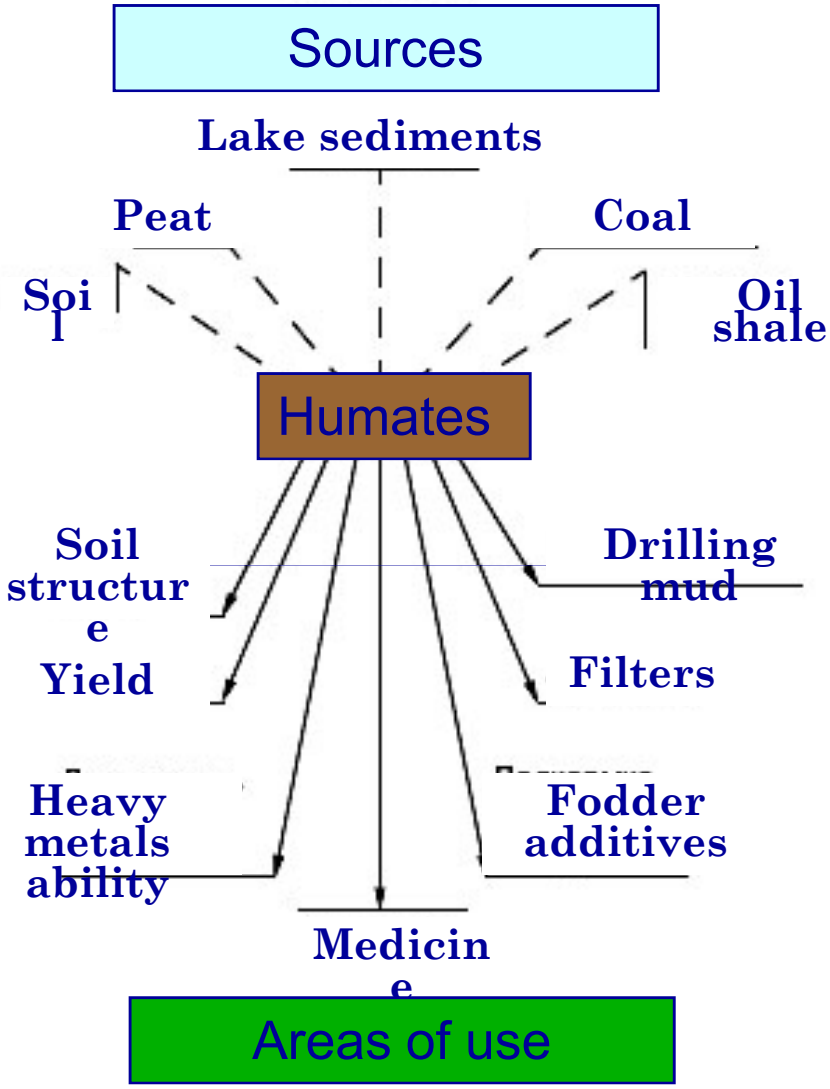
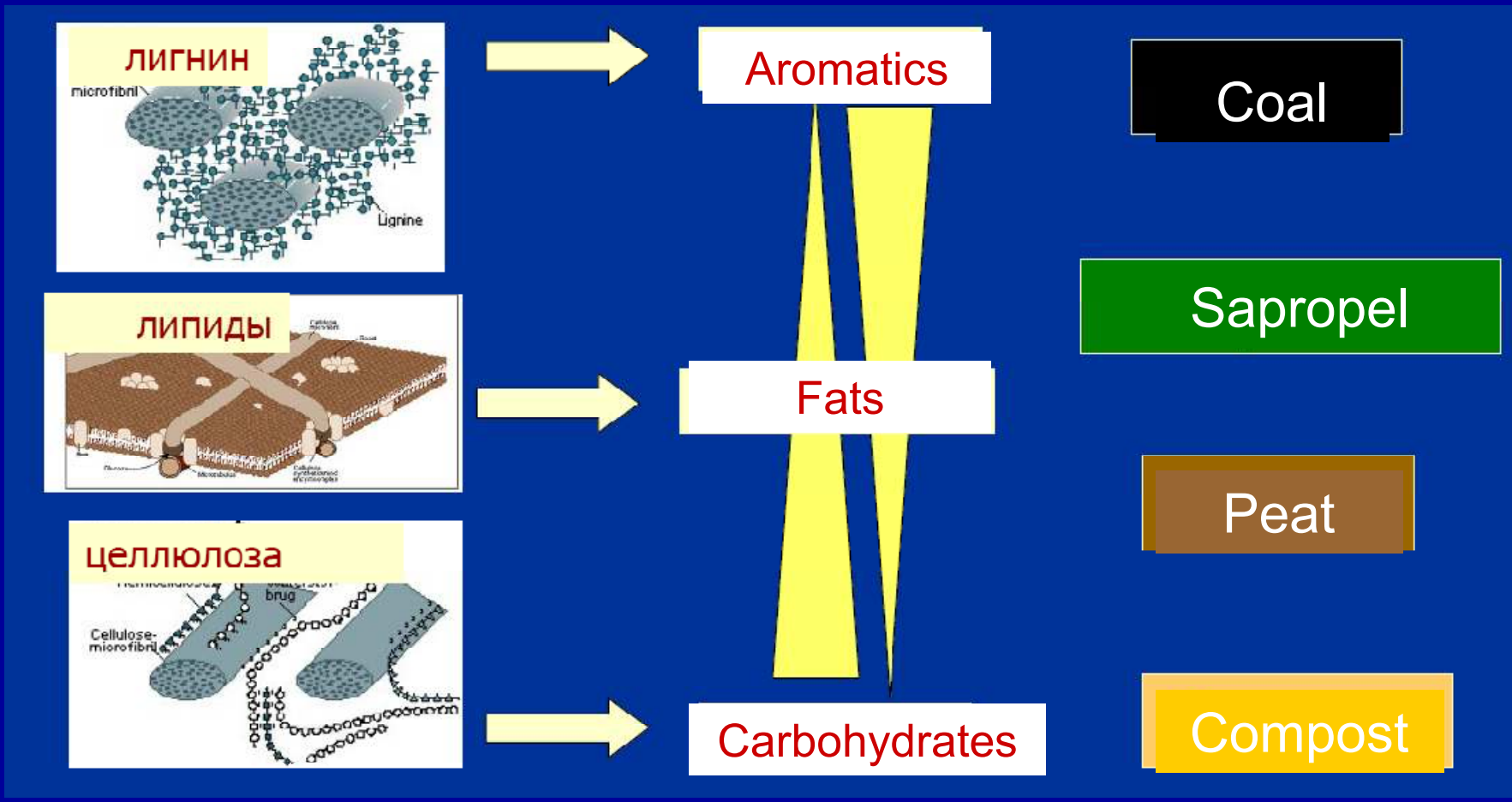
Humates: areas of use

- Plant growth stimulators
- Landscape architecture, gardening, golf courses, stadiums, parks, gardens, and lawns
- Humic-coating of mineral fertilizers
- Anti-stress additives for plants treated with chemical plant protection products
- Biotechnologies
- Remediation of polluted territories
- Fodder additives for livestock, fish, and poultry
- Dietary supplement for human
- Additive for medical and cosmetic industry



Specifics of humic resources

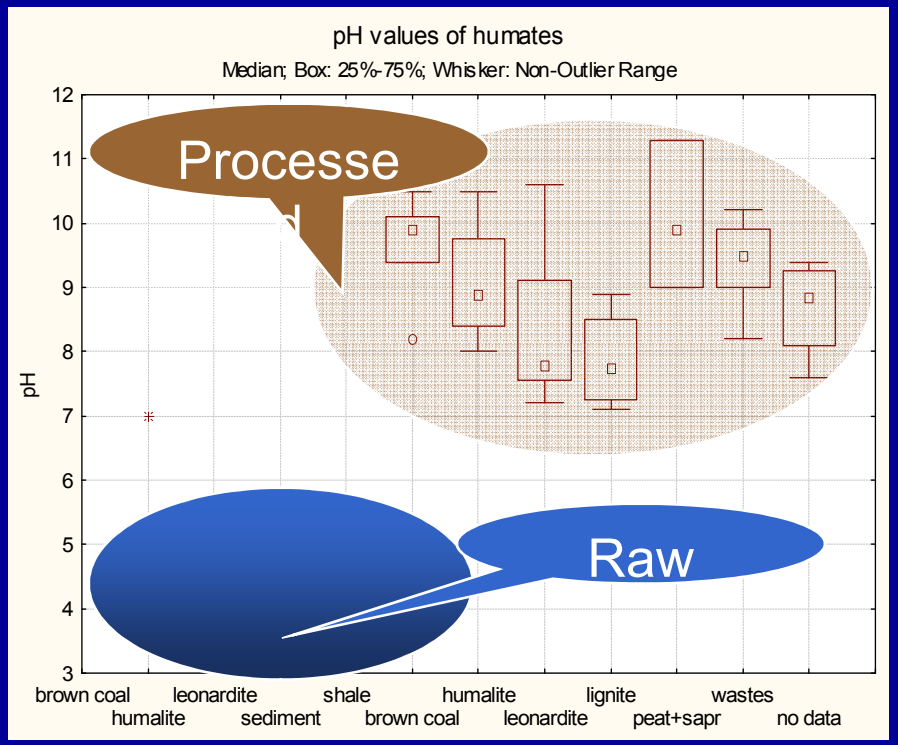


Perminova, 2006

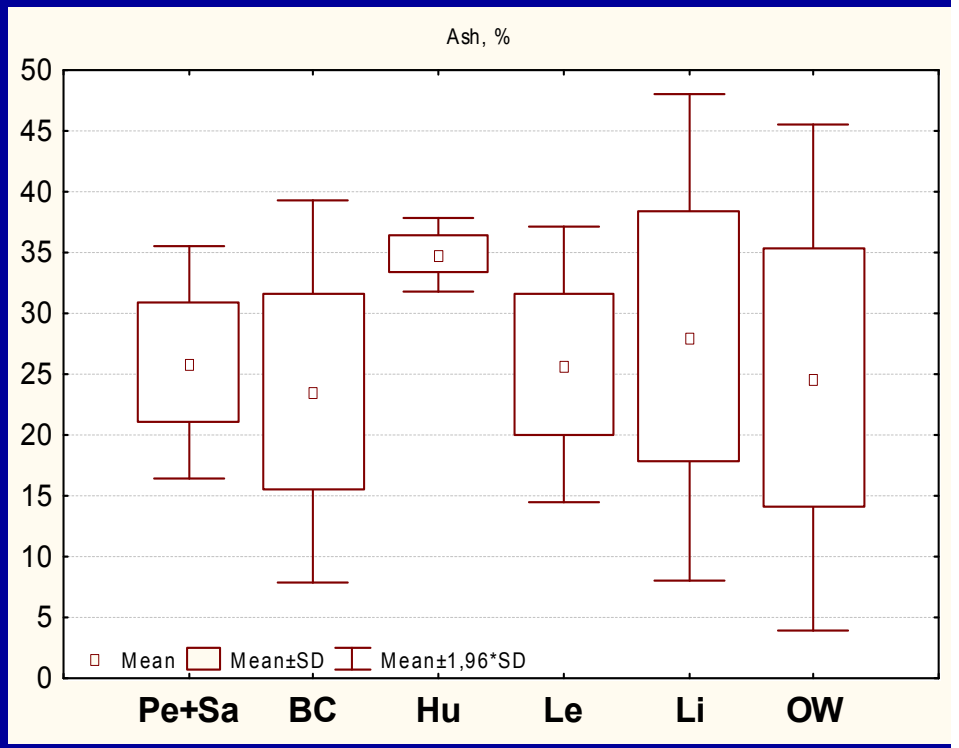
Source materials of studied HUM products

Source of HUM	Abbreviation of HUM-product	Amount of samples
Brown coal	BC	3
Leonardite	Le	4
Lignite	Li	3
Humalite	Hu	3
Peat	Pe	3
Sapropel	Sa	2
Organic Waste	Ow	2

Main properties of humates



pH

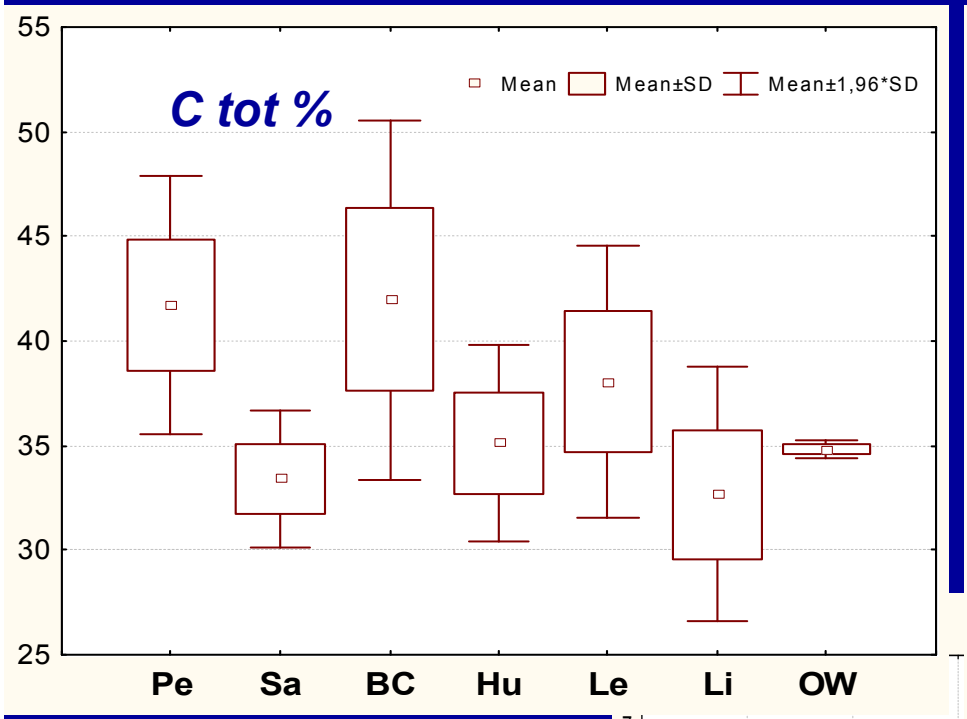


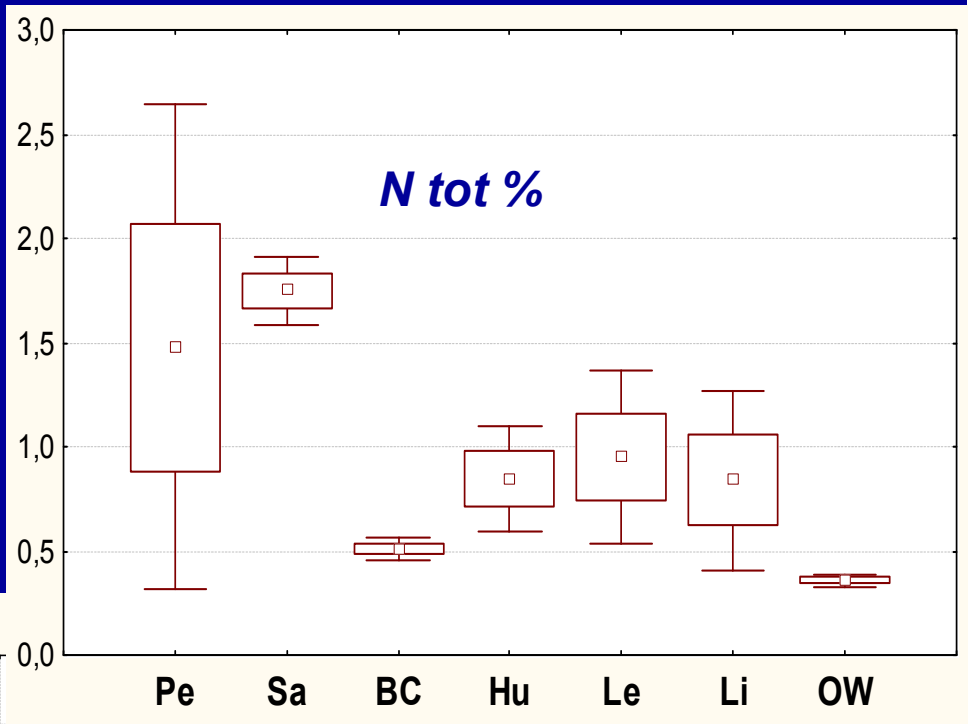
Ash, %

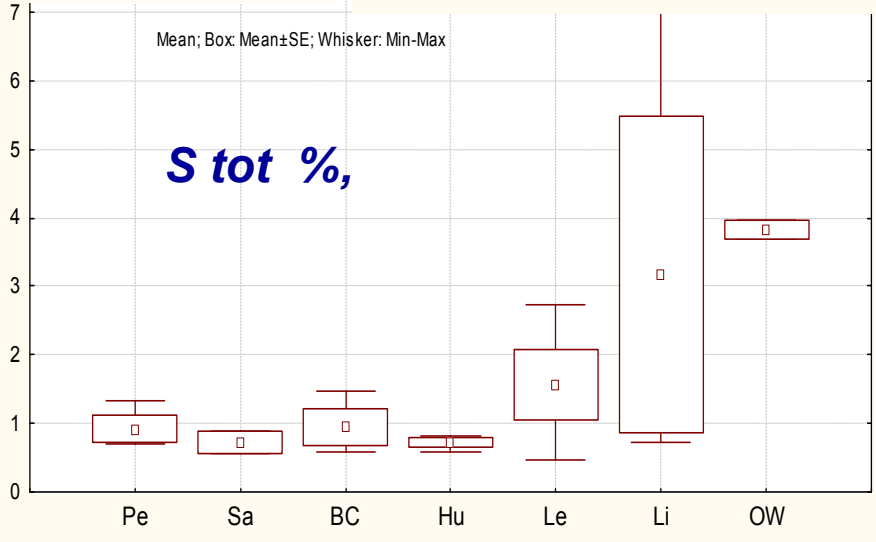
Content of elements in HUM' ash, mg/g

Source	Na	K	Fe	Mn	Cu	Zn
Pe	130	6	39,5	0	0,12	0,06
	11	73	9,3	0,04	0,44	0,05
	31	151	11,5	0,04	0,69	0,06
Sa	31	27	7,6	0,07	0,04	0,02
	62	62	4,9	0,09	0,05	0,03
BC	15	2	0,5	0,01	0,02	0,02
	22	86	9,6	0,04	0,09	0,09
	33	2	2,2	0,09	0,04	0,04
Hu	33	12	0,6	0,01	0,03	0,02
	24	55	1,1	0,05	0,02	0,02
	30	15	0,6	0,01	0,02	0,02
Le	16	120	1,1	0,04	0,02	0,03
	13	50	4,6	0,04	0,02	0,02
	21	4	1,0	0,04	0,03	0,04
	7	26	2,0	0,01	0,02	0,02
Li	9	4	0,4	0,01	0,01	0,01
	23	70	0,5	0,03	0,03	0,01
	10	35	0,6	0,01	0,03	0,01
Ow	35	16	0,3	0,03	0,00	0,05
	29	17	0,1	0,03	0,03	0,05

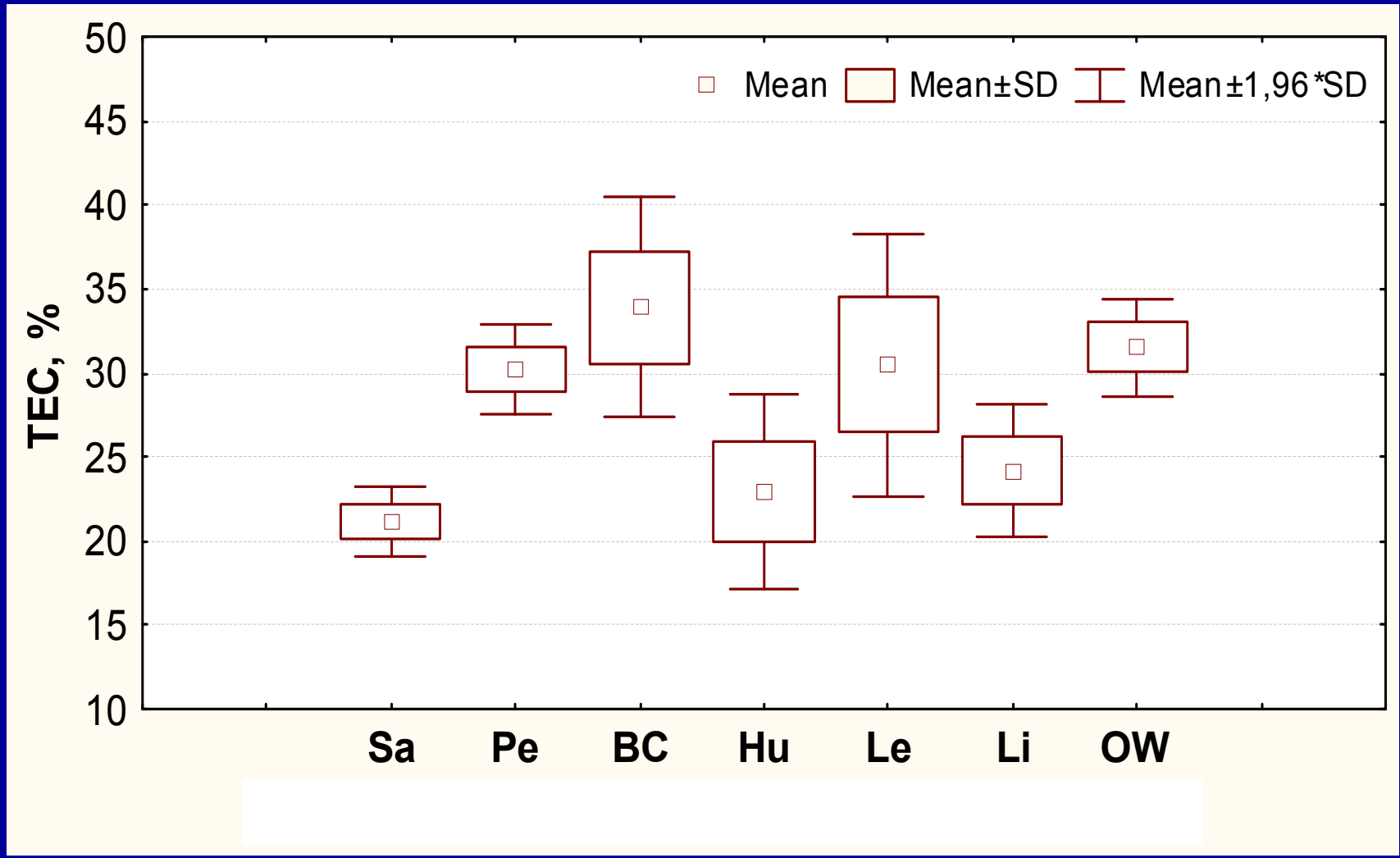
Total C, N and S content



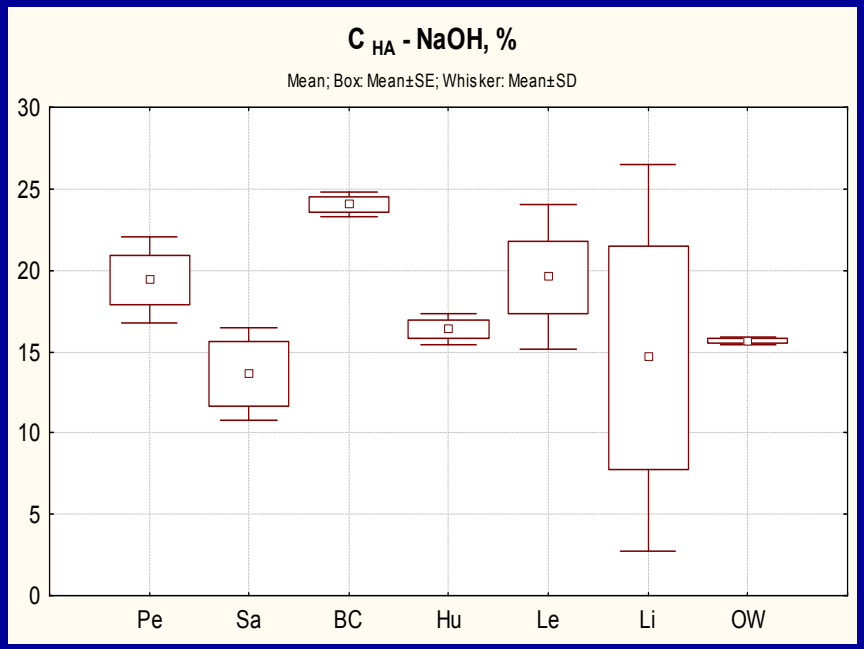


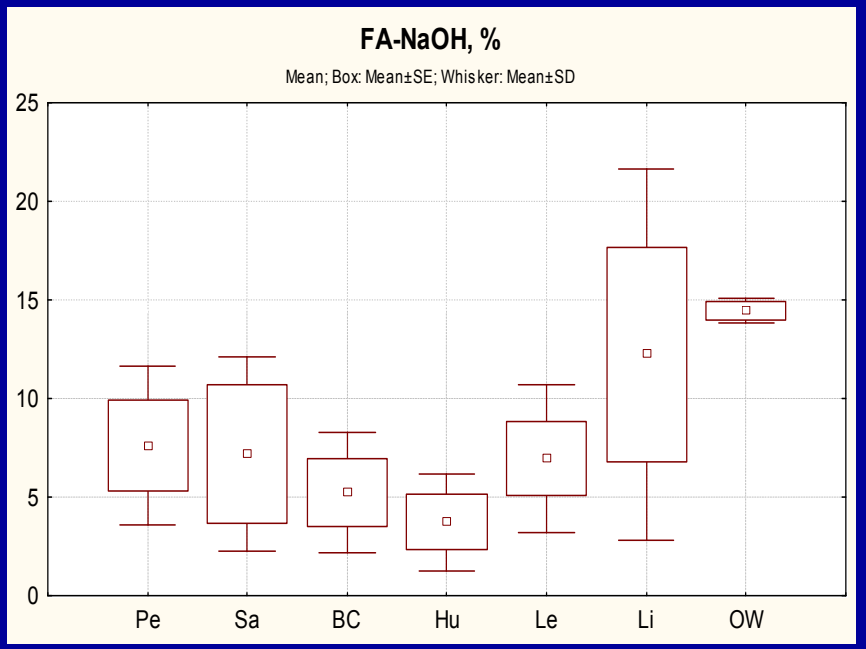


Box plot of TEC in HUM, %

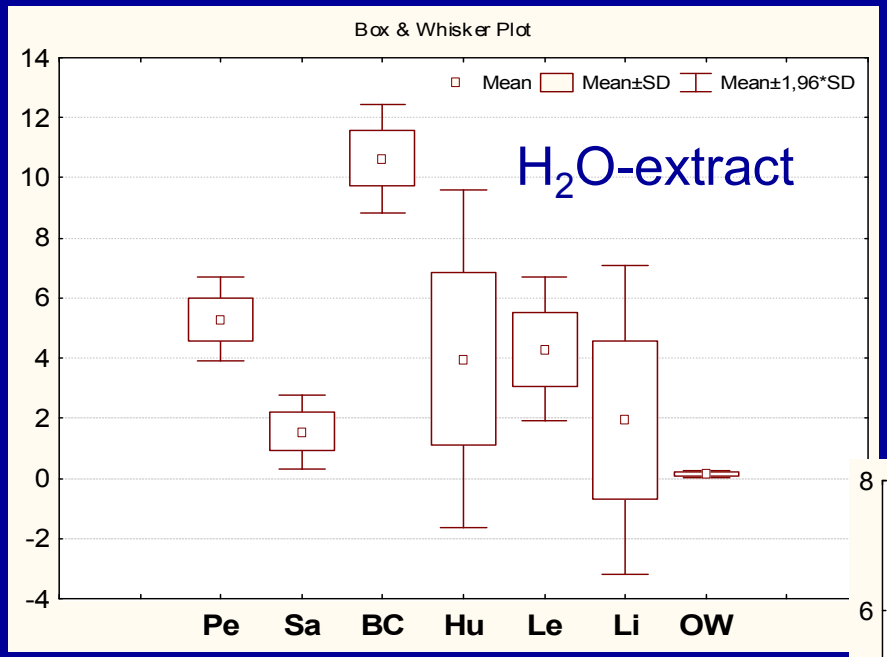


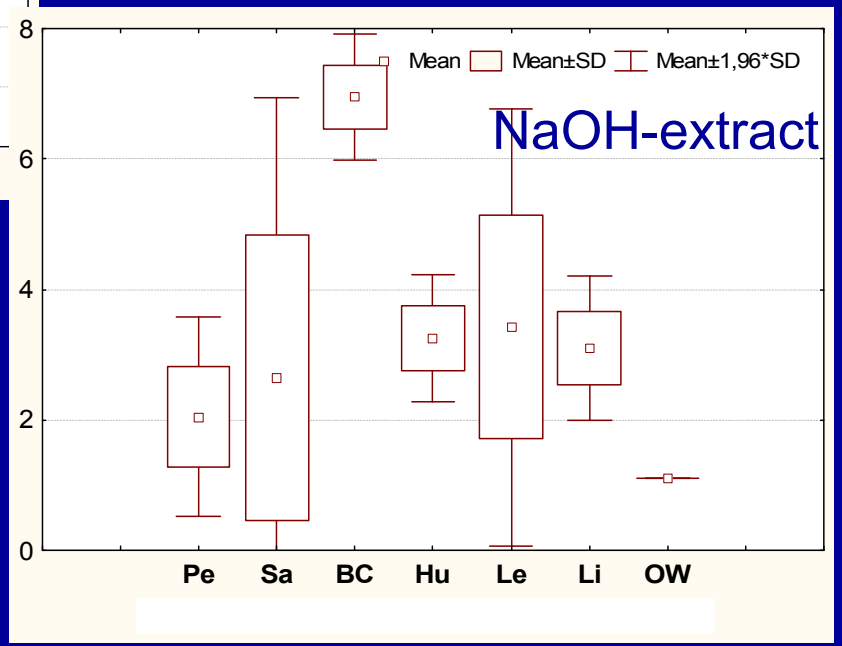
Box plots of C_{HA} and C_{FA} contents





Box plots of $C_{HA} : C_{FA}$ ratios





Elemental content of HA from HUM

HUM	Ash,%	Wt %, ash-free				
		C,%	N,%	H,%	S,%	O,%
BC	3,4	61,2	2,2	4,1	1,6	31,0
Le	10,6	59,3	2,1	4,7	1,6	32,3
Pe	3,6	48,7	2,7	5,2	1,6	41,9
Sa	4,0	55,6	3,4	5,4	2,1	33,4
OW	4,2	57,9	0,9	5,5	7,6	28,0

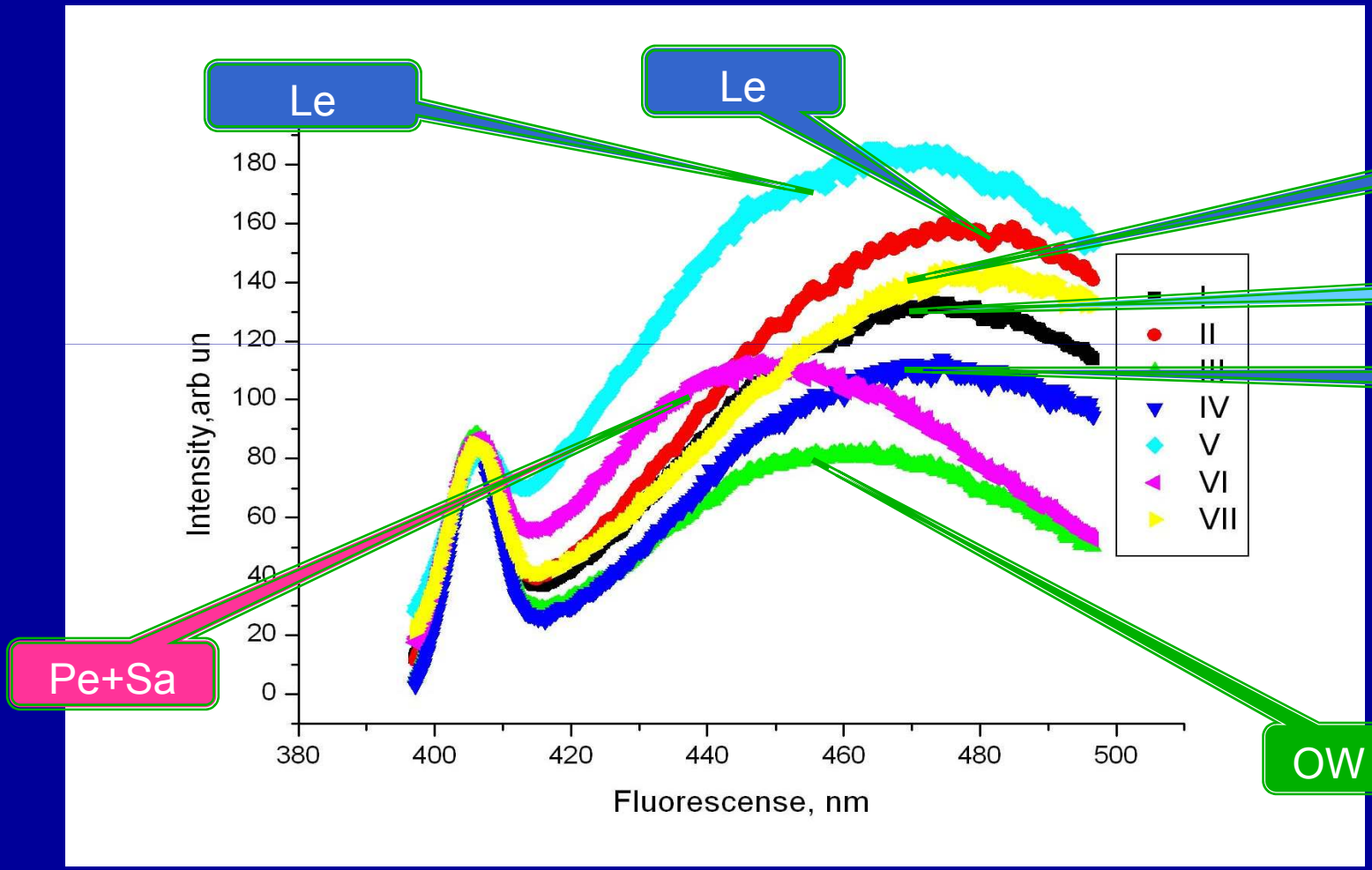
Functional groups in HA from HUM

HUM	Total acid, mM (+)/100g	(COOH), mM (+)/100g	(OH_{Ph}), mM (+)/100g
BC	444	264	180
Le	465	252	213
Pe	459	258	201
Sa	1035	274	761
OW	359	105	254

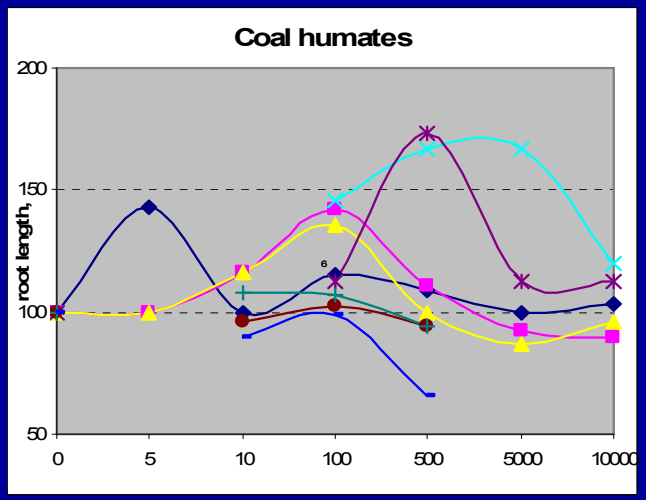
IR-spectra

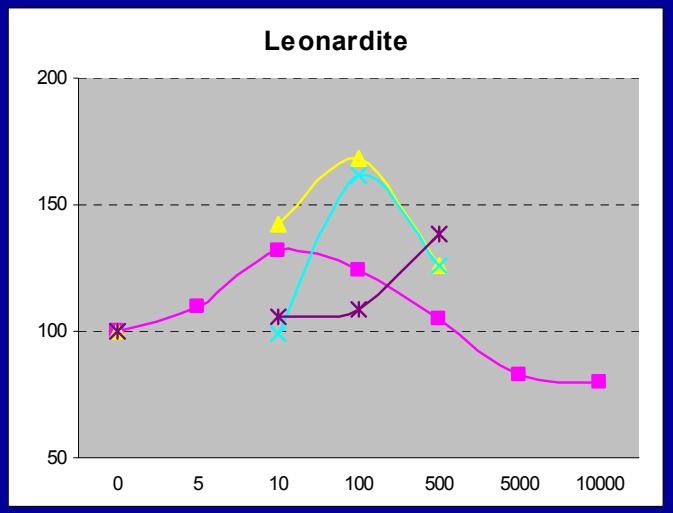

4000
3500
3000
2500
2000
1500
1000
500
cm-1
BC
3335
2909
1705
1601
1219
1030
Le
3344
2914
1705
1605
1231
1030
OW
3400
2926
2837
1705
1595
1420
1456
1142
1034
Pe
1508
1259
1207
1207
Sa
3383
2918
2849
1711
1624
1418
1030
1715
1630
1213

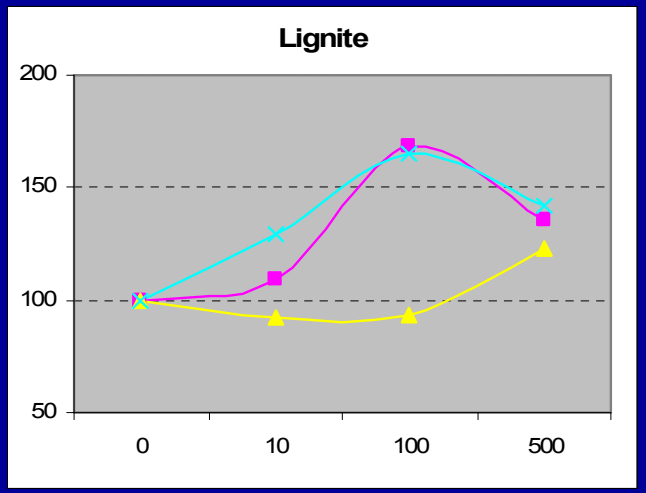
Laser fluorescence spectra of HUM solutions

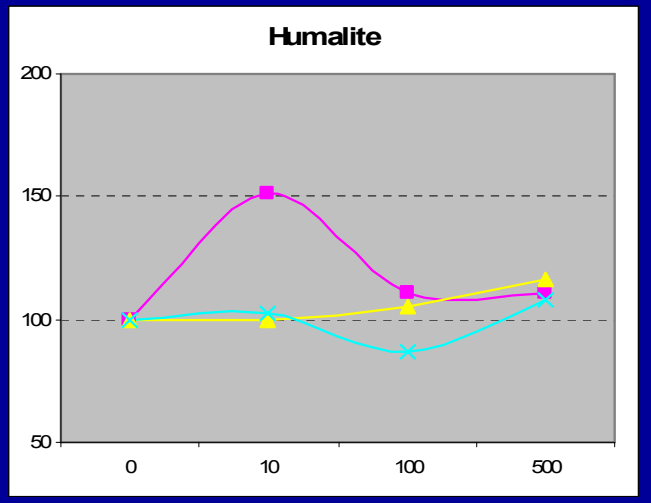


Auxin-like effect of HUM of different origin









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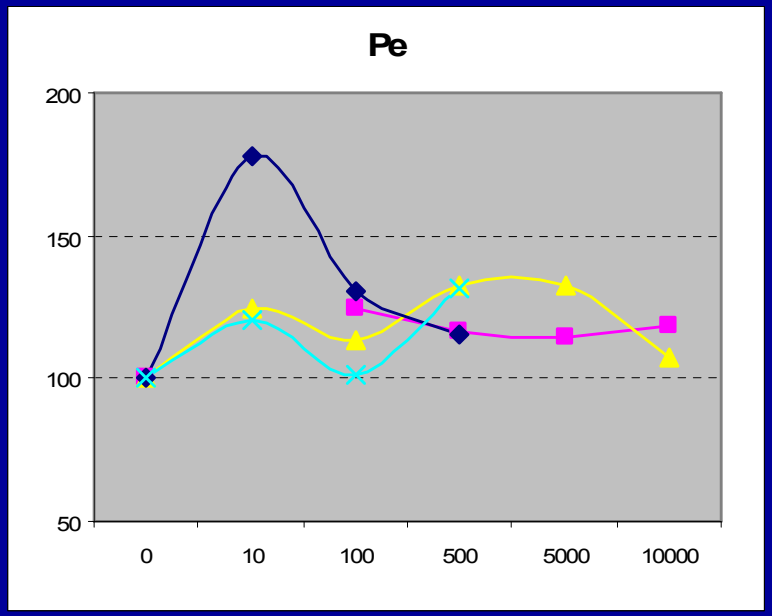
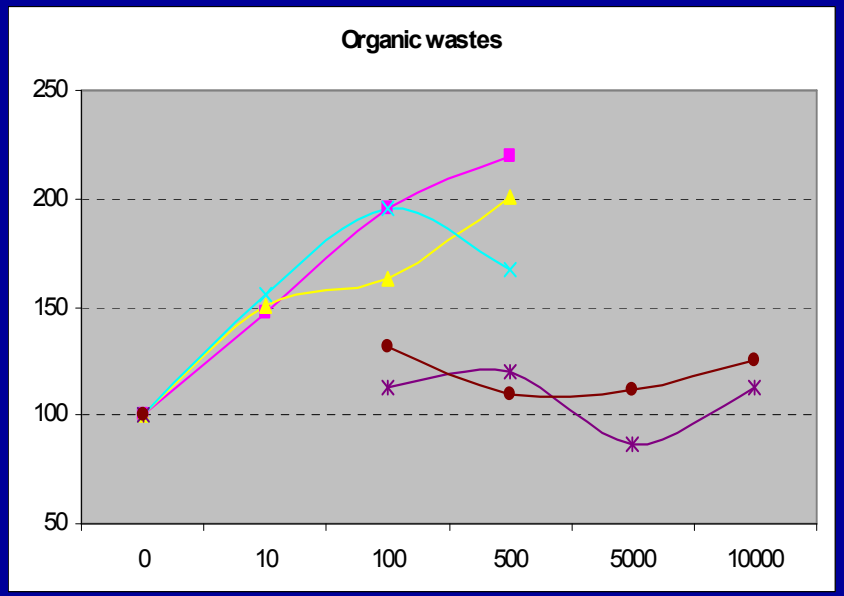
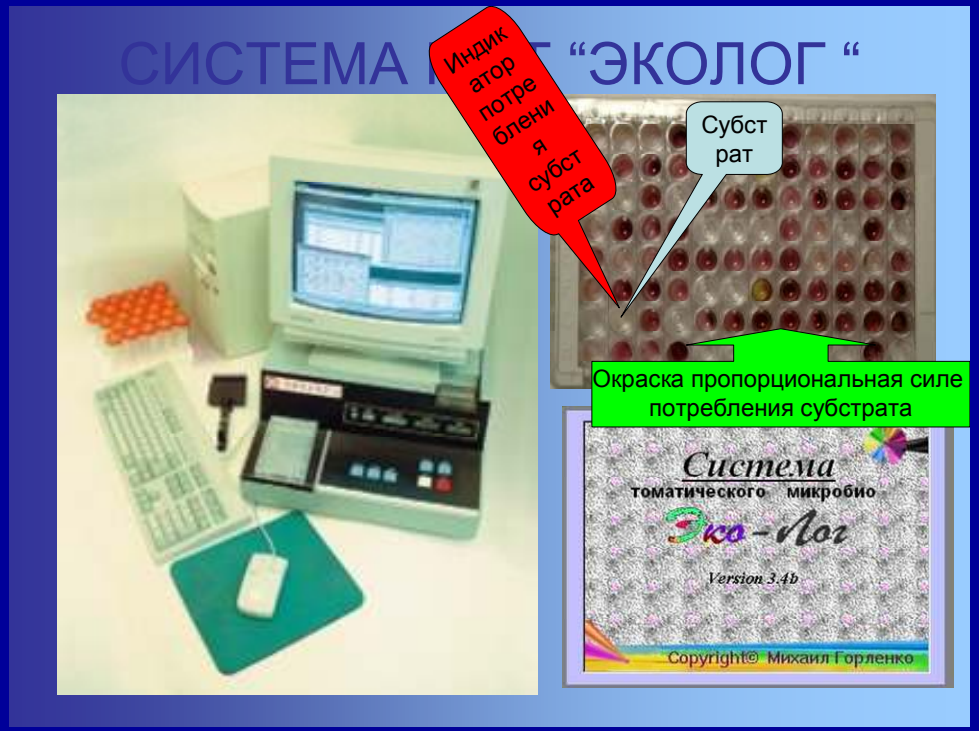




Influence on soil microbial community

“Community level physiological profiling” (“Eco-log” system, Gorlenko, 2005)



Functional biodiversity coefficients

- **Vitality index G**

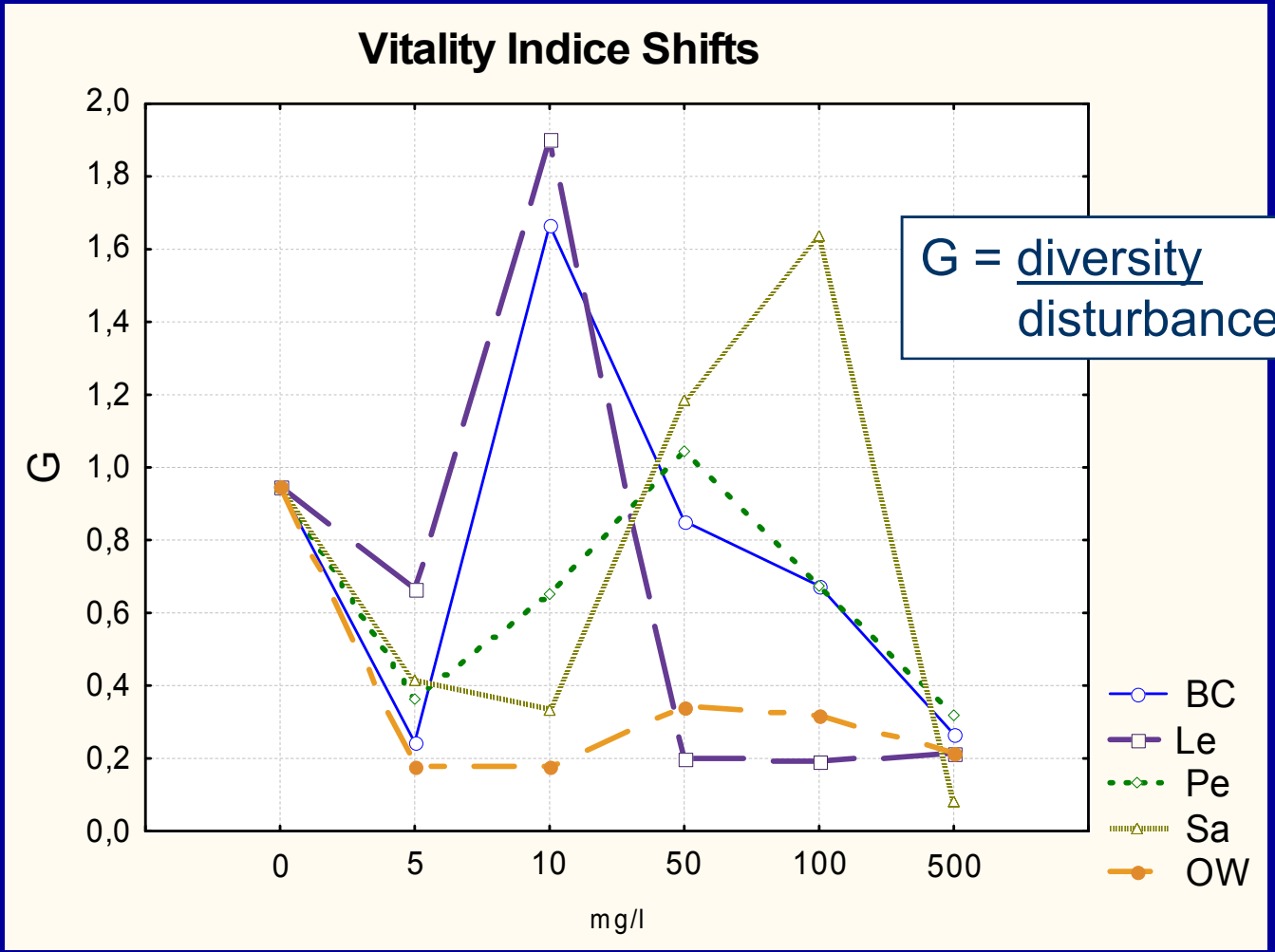
$$G = (N / N_{max})/d,$$

*Nmax is total n*umber of test-substrates, 47

*N is n*umber of substrates consumed *(index of diversity)*

d –rank distribution coefficient, measure of microbial system disturbance

Influence on soil microbial community



G = diversity
disturbance

Conclusions

- Among chemical parameters C and N contents may be useful to distinguish HUM products by OM origin. The pattern is also fits for HA-HUM.

  C: Pe~BC~Le (35-45%) Sa~Hu~Li (30-35%)

  N: Pe~Sa (0.5-5%) BC, Le, Hu, Li ~OW (0.3-1.3%)

- By humification parameters HA/FA HUM can be segregated by source:

  BC – Pe - OW

- Fluorescence spectra is a useful tool to monitor the HUM structure.
- Physiological activity of HUM is unequal and depends more on the technology of their production then on organic matter origin.
- HUM demonstrate certain influence on soil microbial community. Positive effect was revealed at concentrations 10-100 mg\l, whereas at low and high concentrations a disturbance of microbial system was observed.

Acknowledgments

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Thank you for your attention!
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Raw Humate
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Tha.
The Bio-Ag Corp.
USA
15
The Bio-Ag Corp.
Black
17
Soluble product - IL
HUMIC-F-P-K
Soluble product-IL
HUMIC-G-K
HPA
WDG70
India
90%
Soluble
Humisdue - CZ
Solution
80%
New Mexico
Raw MV 55
HPA
WP80
Chinese
Potassium
Humate
70% Chip
MV