54. DETOXICATION OF ACETOCHLORE BY PREPARATIONS OF HUMIC ACID FROM DIFFERENT SOURCES

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INTRODUCTION

Acetochlore is used on a large scale in USA and European countries as a weed-control agent. Like as a persistence herbicide, acetochlor can be accumulated in soil. The result of its use is pollution and damage of the environment. Soil organic matter plays an important role in decrease of the toxic activity of acetochlore in soil. Humic substances as the major components of natural organic matter may play an important role in this detoxication.

That is why the use of preparations of humic acids (HA) for detoxication of acetochlore is very prospect. HA can be obtained from different natural sources like soil, peat, coal etc.

In this investigation the detoxication activity of HA from soil, peat and coal on acetochlore was compared.

MATERIALS AND METHODS

HA were obtained from different soils (Podsoloic soil (Umbric Podzols), Grey forest soils (Grey-Luvic Phaeozems), Chernozems (Chernic Chernozems)), peats (high-moor peat and lowland peat) and brown coals. HA were obtained accordingly the recommendations of Orlov et al[1]. Detoxication ability of HA was measured by biotesting method on germination energy of barley seeds. For studying a degree of toxic impact of different acetochlore concentrations the barley seeds were soaked in distilled water solutions of appropriate concentrations of 10, 20, 40, 60, 80,100, 120 mg/l of acetochlore. There were 50 seeds selected with fourfold repeats and 24-hour exposition time. The solutions then had been poured off; the seeds being put into the Petri dishes between wet layers of filter paper, and subjected to germination at the temperature of 20^0 C. The seeds germination energy was determined on the third day and was estimated as the percent of germinated seeds. At the same time the growth-stimulating activity of HA on the germination energy of barley seeds in the absence of toxicants was investigated in a series of researches with concentrations 5, 10 ,30 , 50, 100 and 150 mg/l. The exposition time was 24 hours. To investigate the influence of HA on acetochlore toxic degree the seeds had been soaked within 24 hours in solutions containing 100 mg/l of acetochlore and of concentrations 5, 10, 30, 50, 100, 150 mg/l of the tested HA preparations, and also in water. Detoxification coefficients (D) were calculated as result of experiments as describe Perminova et al[2].

D were calculated as follows:

$$D = \left| 1 - \frac{R_d - R_{d+t}}{R_d} \Big/ \frac{R_0 - R_t}{R_0} \right| \times 100\%$$

where, R_0 - seeds germination energy of control; R_d - seeds germination energy in presence of HA; R_t - seeds germination energy in presence of acetochlore; R_{d+t} - seeds germination energy in presence of acetochlore and HA

RESULTS AND DISCUSSION

The typical dependence of D on concentration of HA is shown in figure 1. On basis of D values the toxicological constants of bounding of acetochlor by organic carbon (Koc^{tox}) were calculated as described by Perminova et al[2]. The values of Koc^{tox} were calculated by approximation of following expression:

$$D = \frac{K_{OC}{}^{tox} \times C_{HA}}{1 + K_{OC}{}^{tox} \times C_{HA}}$$

where, C_{HA} is concentration of HA. Values of Koc^{tox} are shown in table 1.

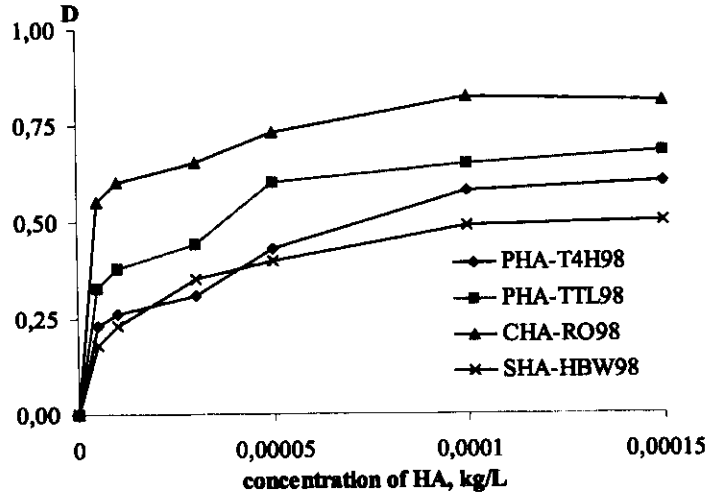

Figure1 *Typical curve dependence of D on concentration of HA*

Table1 Values of Koc^{tox} for HA from different sources

Soil HA		
Soil type and agricultural status	index of HA	Koc^{tox}, L/kgOC
Podsoloic soil (forest)	SHA-Pw98	11631
Podsoloic soil (forest)	SHA-PwN	14194
Podsoloic soil (field)	SHA-Pg96	14866
Grey forest soils (forest)	SHA-Gw98	13838
Grey forest soils (field)	SHA-GpS00	14966
Chernic Chernozem (field)	SHA-CtL00	25950
Chernic Chernozem (deposit)	SHA-CtV98	29675
Peat HA		
Peat	index of HA	Koc^{tox}, L/kgOC
High-moor peat	PHA-T4H98	15072
High-moor peat	PHA-T5H98	17459
High-moor peat	PHA-T6H98	20668
High-moor peat	PHA-T7H98	18938
High-moor peat	PHA-T10H98	16743
Lowland peat	PHA-TTL98	30254
Coal HA		
Coal	index of HA	Koc^{tox}, L/kgOC
Brown coal	CHA-ALD	30144
Brown coal	CHA-AGK	32831
Brown coal	CHA-K2	53085
Brown coal	CHA-K3	46394
Brown coal	CHA-K4	71038
Brown coal	CHA-RO	

The minimum detoxication activity was observed on HA obtained from soils. For soil Koc^{tox} values ranged as follows: Podsoloic soil < Grey forest soils < Chernozems. Values of Koc^{tox} for high-moor peats were close to Koc^{tox} for soils. Values of Koc^{tox} for lowland peat were close to Koc^{tox} of brown coals. The values of Koc^{tox} for brown coals were maximum.

According to literature data, the coal and lowland peat HAs usually have more aromatic compounds than high-moor peats and soils. So the higher detoxication activity of coal HAs and lowland peat HA in comparison with the high-moor peat HA and soil HA can be explained by the higher content of aromatic compounds in these preparations. Indirectly, this is verified by the fact that the detoxication ability of HA from chernozem soils, which are the most rich in aromatic compounds, is higher than of HA

from other soils. Consequently, HA from lowland peat and brown coal are the most prospect for using as a detoxicants of acetochlore.

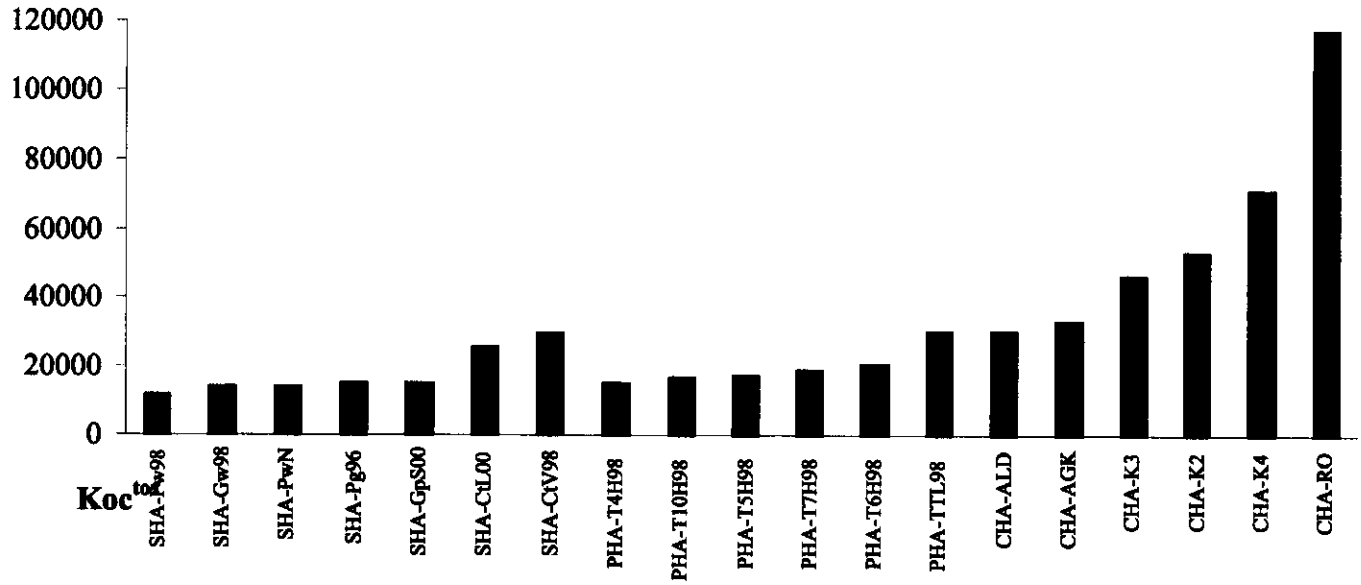

Figure 2 *The range of values of Koc^{tox} from different sources shows*

References

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2. I.V. Perminova, N.U. Grechischeva, D.V. Kovalevski'et al. *Envir. Sci. Technol.*, 2001, 35, 38-41.