HUMIC SUBSTANCES IN ECOSYSTEMS 8

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CONTENT

THE INFLUENCE OF ORGANIC MANURING ON THE PHYSICAL SOIL PROPERTIES AND THE CONTENT OF SOIL ORGANIC MATTER IN LONG - TERM MONOCULTURE

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ABSTRACT

With regard to the threats brought about by continuous cropping the Research Institute of Plant Production Piešťany were carried out a field investigation in 1974 – 2009 concerning the questions: What are the possibilities of the decreasing the negative impacts of the continuous cropping of cereals? Stationary trial was established in 1974 in the experimental station Borovce, on a medium heavy textured soil (Luvi-Haplic Chernozem on loess). Three variants of fertilization were used. In the years 2007 – 2008 the effect of mineral and organic fertilization on the physical and chemical properties of winter wheat and spring barley in continuous cropping was investigated. It can be supposed that the supplied organic matter in the form of ploughed in cereal straw or in the form of ploughed in cereal straw and organic manure Veget contributed to a higher total porosity, increasing of maximum water capillary capacity and increasing of content of humus. It is not possible to exclude that the differences can bring about the heterogeneity of soil, too. The combination of straw ploughed in with the organic manure Veget had a positive impact on the soil moisture maintenance, on the air content, seems much more suitable.By the continuous cropping of spring barley at the variant with ploughed in straw the lowest content of organic carbon, the lowest content of potassium and phosphorus and the lowest total porosity was found in this variant. The present results are showing that the continuous growing of spring barley contributed to a stronger decline of soil physical and chemical properties than the continuous cropping of winter wheat. These findings can be explains by the different root systems of winter wheat and spring barley.

***KEY WORDS**: winter wheat, spring barley, long-term monoculture, organic manuring, physical and chemical soil properties, soil organic matter*

PROPOSAL OF EVALUATION OF SOIL ORGANIC MATTER SORPTION CAPACITY

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ABSTRACT

It is well known that sorption capacity of humic substances (HS) is much higher in comparison to clay minerals. The two most important functional groups in this respect are the carboxyl and phenolic-OH groups. Since fulvic acids (FA) exhibit higher total acidity values than humic acids (HA), results of study on chelation and complexation analyses indicate that metal chelatation by humic acids (HA) appears more effective than by FA. The larger molecules and the more complex structures of HA are accepted to be the reason for more binding sites and higher binding capacity in contrast to FA, which are smaller and less complex. Humic acids are also higher in aromatic structures than fulvic acids. For this reason proposal of evaluation of SOM sorption capacity use basic quantitative and qualitative humus parameters – content of soil organic carbon (SOC), ratio of carbon of humic and fulvic acids (C_{HA}/C_{FA}) and optical parameter (Q^4_6) but also such selected parameters of HA chemical structure, which the most effect its sorption capacity – content of carboxylic groups and aromatization degree (α), which take into account humification degree of HA. High sorption humus capacity is characterized by SOC content >2, $C_{HA}/C_{FA} > 1$, $Q^4_6 < 4.5$, COOH>4 and $\alpha > 50$.

***KEY WORDS**: soil organic matter, sorption capacity, humic acids*

INFLUENCE OF LONG-TERM FERTILIZATION AND CROP ROTATION ON THE QUANTITY AND QUALITY PROPERTIES OF SOIL HUMUS SUBSTANCES

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ABSTRACT

In researches examined and compared composition of soil organic matter fraction and spectrofotometric properties of humic acids (HA) from soil samples in dependence on agricultural treatments. The research was performed on the basis of long-term fertilization trial carried out by SGGW since 1923 in Skierniewice Research Station. The soil samples were taken from the stands under the monoculture and crop rotation of rye and potato, considering selected fertilization combinations. It was found that humus in the stand after rye in monoculture was characterized by higher contribution of carbon of humic acids, higher value of HAs carbon to FAs carbon proportion (C_{HA}: C_{FA}) and by lower participation of humins. In the 5-fields rotation system comparable results as in monoculture were found in humus under potato. The highest values of C_{HA}: C_{FA} were obtained in both cultivation systems with complete mineral-organic fertilization, lower values were noted in soil fertilized only by NPK. Taking into consideration two fractions of HAs – labile (FI) and strongly bound with mineral part of soil (FIII), higher values of absorbance ratios ($A_{2/4}$, $A_{2/6}$, $A_{4/6}$) were recorded for HAs of FI fraction extracted from soil fertilized with participation of manure under rye in monoculture and rotation. Regardless to cultivated plant species absorbance ratios of HA from labile fraction were higher in soil in rotation system than in monoculture.

***KEY WORDS**: humus, fraction composition, UV-VIS, monoculture, crop rotation*

CARBON AND NITROGEN IN THE BOTTOM SEDIMENTS OF THE „ŻURSKIE" LOWLAND BARRAGE LAKE.

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ABSTRACT

Paper presents results of analyses of carbon and nitrogen content as well as roasting losses from bottom sediments of barrage lake "Jezioro Żurskie". The samples of sediments with consideration of 3 cm layers were taken from the core of sediments extracted by Instorf probe from central part of the lake. Obtained results indicate two layers of sediments. In the layer of thickness 62-41 cm (the oldest sediments) there was no significant vertical differentiation of analyzed parameters. Starting from the layer 38 cm characterized by the lowest values of examined parameters to the layer of present sediments there is noted systematical increase of carbon and nitrogen content as well as roasting losses. Carbon content in dry mass of sediments reached values from 10.86 to 15.95% and nitrogen 0.59 to 1.46%.

***KEY WORDS**: barrage lake, bottom sediment, carbon, nitrogen.*

PROPERTIES OF HUMIC ACIDS OF SOIL UNDER DIFFERENT MANAGEMENT REGIMES

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ABSTRACT

The aim of the present paper was to determine the elemental composition, hydrophilic and hydrophobic properties and polydispersity of humic acids of soils which differ in the farming method and the management regimes applied. The research involved forest and agricultural soil samples. Humic acids isolated with a commonly-applied Schnitzer method were exposed to the following analyses: elemental composition, division into hydrophilic and hydrophobic as well as low- and high-molecular fractions with chromatographic methods. The present results, confirmed by the cluster analysis, showed that the basic factor conditioning the properties of humic acids is the soil type, but also one can disregard neither the soil management method nor the agricultural practices applied.

KEY WORDS: *agricultural and forest soils, humic acids, elemental composition, HPLC, HPSEC*

ROLE OF POST-HARVEST RESIDUE IN DEVELOPING THERMAL PROPERTIES OF HUMIC ACIDS IN THE SOILS OF DIFFERENT TYPES

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ABSTRACT

The aim of the present paper was to determine parameters of thermal decomposition of humic acids of the soils of different types with no additives and when mixed with post-harvest residue before and after 360 days of incubation. The research was based on a model incubation experiment carried out at the Dept. of Pedology and Geology of the Slovak Agricultural University in Nitra. Plant residue (mixtures of aerial parts and roots) of corn (K), oilseed rape (Rz), sunflower (Sl), potato (Zm) and rye (Z) were mixed in the ratio 10:1 with the following soil samples: Haplic Luvisol (Lo), Chernozem (Hh), Haplic Arenosol (Re) and Haplic Gleysol (Ge) and the mixtures were incubated at 25°C and 60% of field water capacity. The plant-soil mixtures were analyzed prior the experiment and after 360 days of incubation. Humic acids were separated from the control soil (without plant residue), and plant-soil mixtures before and after incubation with the standard Schnitzer method. Thermal properties were determined with the use of the Derivatograph C (MOM, Hungary). Samples of 40 mg humic acids were mixed with Al_2O_3 (1:9) and heated in the air at the rate of 3.3 °C min^{-1}. The results of thermal analysis showed that parameters of thermal decomposition of humic acids were determined both by the soil type and by the properties of post-harvest residue introduced into soil. The process of decomposition of post-harvest residue was connected with, e.g. a decreased value of the parameter corresponding to the burning heat of humic acids. Low values of parameter 'Z' were due to the presence of non-decomposed lignin and cellulose structures in the molecules of humic acids

KEY WORDS*: post-harvest residue, humic acids, TG, DTG, DTA*

SPECTROSCOPIC CHARACTERISTICS OF HUMATES ISOLATED FROM DIFFERENT SOIL TYPES

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ABSTRACT

In this project have been used the optical methods (UV-VIS and SFS). Five Czech soil humates samples (Leptic Cambisol, Haplic Cambisol, Eutric Cambisol 1-arable soil, Eutric Cambisol 2-grassland, Haplic Chernozem) were compared. Absorbance in spectral range 300-700 nm was measured using optical fiber on spectrometer Varian Cary 50 Probe. Fluorescence spectra (SFS) in the range 255-655 nm were measured by spectrofluorimeter Aminco Bowman. From UV-VIS spectra color indexes (Q4/6) were determined. Fluorescence indexes (F) were calculated from SFS spectra at Δλ=55 nm as ratio RFI468/RFI522. The same main fluorophore at wavelengths λex./λem.= 467/522 nm was observed in all soil humates. Samples were also compared by humus quality, carbon content and fluorescence or colour indexes.

***KEYWORDS**: soil humic substances, Synchronous fluorescence spectroscopy, humus quality*

THE CARBON AND THE FRACTIONS OF SULPHUR IN NATURE RESERVE ŽITAVSKÝ LUH IN SELECTED SOILS

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ABSTRACT

The aim of our work was to determine soil organic carbon (C_{ox}) and selected fractions of sulphur in soils of Nature Reserve Žitavský luh. This area is located on the borders of the Žitava River, on foothill of hilly country of Hronska pahorkatina. The wetlands are interesting in not only from industrial point of view but they also play very important role in type of vegetation and composition of forest and plant communities by their position, climatic and soil conditions. We compared examined indicators in samples from different soil types, which were taken from the soil profiles in Natural Reserve Žitavský luh, in years 2004 - 2006. From soil types there are Mollic Fluvisol Eutric Fluvisol and Histi-Umbric Gleysol in the reserve. The environment protection and ecological measures oriented to decrease of discharged sulphur compounds caused the fall of the supply of sulphur. One of the limiting factors for vegetal production is the deficit of sulphur. Sulphur is one of the essential, irrecoverable nutrients in cultivating agricultural plants; it is a mobile element and in environment it is reliable to very important changes because of the variety of its chemical forms.

***KEY WORDS**: Nature Reserve, Žitavský luh, environment, soil type, fractions of sulphur, sulphur dynamics*

PROPERTIES OF HUMUS IN SOILS OF DIFFERENT MANAGEMENT REGIMES

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ABSTRACT

The objective of the study was to evaluate differences occurring in the soil environment between agricultural, meadow and forest soil management. Soil samples were collected from spruce and oak monocultures as well as meadow of the Mlyňany arboretum (Slovakia) and near arable sites and analyzed for the total organic carbon (TOC), total nitrogen (Nt) and phosphorus (P) content and fractional composition of organic matter. Extracted humic acids were analyzed for the elemental composition, UV-VIS, FT-IR spectra and thermal analysis. It was shown that different use of soils affects the content of carbon and nitrogen as well as fractional composition of organic matter. Forest soils had higher concentrations of TOC and Nt as compared with meadow and arable soils. Humic acids of forest and meadow soils were characterized by higher values of the O/H and O/C ratios as well as higher values of absorbance coefficients in the UV-VIS region than humic acids of arable soil.

***KEY WORDS**: agricultural, meadow and forest soils, humus, humic acids*

THE USE OF HPLC IN THE ASSESSMENT OF THE INFLUENCE OF ANTHROPOGENIC POLLUTION ON THE PROPRIETIES OF HUMIC ACIDS OF LIGHT SOIL MANURED WITH ORGANIC FERTILIZERS.

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ABSTRACT

Humic substances are naturally developed mixtures of organic compounds, representing various steps of transformation of plant residues. Complex structure of humic substances and their changeability suggest research on new research methods, which would result in the greatest possible amount of information on their structure and transformation. Using of HPLC in HAs analysis allow to separate hydrophobic (HOB) from hydrophillic (HIL) fractions. The ratio HIL/HOB can be use as an indicator of degree of transformation of organic matter in soils. The conducted research aimed at assessment of the influence of anthropogenic acidification, salinification and alkalisation on the chosen parameters of humic acids, which to a large extent are responsible for the state of soils. Regardless of the experiment's variant, the short-term action of the polluting factors did not influence significantly the properties and transformations of humic substances described with the use of standard parameters. The use of an analytic method, new in the field of humic substances research, namely high-performance liquid chromatography (HPLC) proved significant diversity of the examined humic acids considering their fractional composition.

KEY WORDS: *humic acids, anthropogenic pollution, HPLC*

UTILIZATION OF IMMOBILIZED ALUMINIUM (III) METAL ION AFFINITY CHROMATOGRAPHY FOR ANALYSIS OF HUMIC ACID

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ABSTRACT

Immobilized metal ion affinity chromatography (IMAC) method is based on the ability of certain macromolecules to form coordination complexes with metal ions, which were chelated to a multidentate ligand immobilized onto a support material. In the present work, IMAC was developed for the fractionation of humic acid (HA). Iontosorb Salicyl has been used as the chelating resin containing salicylic acid bound via azo group in side chains of modified bead-form cellulose. Sorption characteristics of Al(III) ions at this chelating sorbent were determined at different pH values. Simple photometric detection at 590 nm was used for monitoring aluminium as SPADNS-Al(III) chelate in eluent during breakthrough experiments. Resulting sorption capacity is the highest at pH 5.5 giving value 36 µmol of aluminium per 1 g of sorbent.

Furher study was focused on the fractionation of the group of aromatic acids or HA by Al-loaded Salicyl IMAC technique. The effect of various pH values (3.9, 6.7 and 8.9, resp.) on the retention of model sample of acids was investigated. The IMAC eluted fractions of acids were separated and determined by reverse-phase high performance liquid chromatography (RP-HPLC) with UV-VIS detection. Finally, IMAC technique was developed for the fractionation HA applying a buffer-based pH gradient (between pH 8.9 and 2.0) for their gradual elution. The HA fractions retained by the Al(III)-IMAC were eluted with mobile phase of decreasing pH value, and the fractions collected were characterized by UV–VIS detection. Based on the obtained results, IMAC appears to be a promising tool for chemical separation of HA. The results will help in the understanding of the nature of HA, and their metal binding characterization, and in modeling natural environments.

KEY WORDS*: Immobilized aluminum (III) affinity liquid chromatography, soil acids, humic substances*

THE INFLUENCE OF FARMING SYSTEMS ON AREA HETEROGENEITY OF TOTAL ORGANIC CARBON CONTENTS

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ABSTRACT

The aim of paper was study the influence of different farming systems on area heterogeneity of total soil organic carbon contents. Soil samples were taken in spring 1997 and 2009 from top layer 0-0.2 m from long time field trial. The integrated and ecological farming systems were established at the Slovak Agricultural University Research Station Dolná Malanta on Haplic Luvisol clay-loamy soil in the fall of 1990. We measured total soil organic carbon contents (SOC) in the fertilized and unfertilized variants of integrated and ecological farming systems. In spring 2009 was on ecological farming system in the fertilized variant (with farmyard manure) average of total organic carbon content 1.46% and in the unfertilized variant 1.28%. We note in comparing with the year 1997 higher content of total organic carbon by 0.28% in the fertilized variant and lower content by 0.12% in the unfertilized variant. In spring 2009 was on integrated farming system in the fertilized variant (with farmyard manure and NPK) average total organic carbon content 1.08% and in the unfertilized variant 0.92%. Compared with the year 1997 the total organic carbon content declined by 0.37% in the fertilized variant and in the unfertilized variant declined upon 0.72%. We can state, from results obtained in our study, that ecological farming systems is from long-term duration (12 years) more sustainable and stabile for total organic carbon content as integrated farming systems.

***KEYWORDS**: Soil organic carbon, arable systems, area heterogeneity*

STUDY OF OFF-LINE COMBINATIONS OF HPLC AND CZE METHODS FOR ANALYSIS OF LOW MOLECULAR WEIGHT SUBSTANCES POTENTIALLY RELATED TO HUMIC SUBSTANCES DEGRADATION PRODUCTS

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ABSTRACT

Design and development of novel systems for characterization of humic substances and/or their degradation products in solutions is still challenging. Two-dimensional system devised in this work was created by off-line combination of gradient elution reversed-phase high performance liquid chromatography and capillary zone electrophoresis in an open system. Electrophoretic system was used as a selective detector for collected liquid chromatographic fractions. We tested orthogonality of liquid chromatography and zone electrophoresis for group of cationogenic and anionogenic compounds under conditions of high compatibility of both separation systems. The choice of the model substances was based on criteria of their potential presence in solutions of degradation products of humic substances (photolysis, hydrolysis, oxidation, oxidative photolysis, biodegradation etc.). Migration and retention characteristics of analytes were evaluated both by Spearman rank correlation coefficients and Pearsons correlation coefficients. We measured migration times in electrophoresis and retention times in chromatography, respectively, of basic compounds by use of phosphate buffers of varying pH values. Similar experiments were done also with the set of acidic compounds. Combination of reversed - phase, or aqueous normal phase liquid chromatography, respectively, and capillary electrophoresis gives us results, that are interpreted as non-existence of proof of data sets correlations in studied combinations of CZE and HPLC systems. That practically means formulation of separation systems orthogonality. Similar combinations of orthogonal separation systems will be used also for the characterization of treated solutions of humic substances.

***KEY WORDS**: CZE and HPLC methods, humic substances*

ON-LINE FLOW-THROUGH EXTRACTION–PRECONCENTRATION-LARGE VOLUME INJECTION REVERSED-PHASE LIQUID CHROMATOGRAPHY METHOD FOR TRACE DETERMINATION OF SELECTED PYRETHROIDS IN SLOVAK SOIL MICRO-SAMPLES

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ABSTRACT

A rapid micro-analytical multiresidue method has been developed for the analysis of selected pyrethroids (cypermethrin and permethrin) in a micro-sample of soil (mass around 200 mg). The method is based on the on-line flow-through extraction of soil micro-samples (packed into a short glass column) with a methanol-aqueous citric acid buffer mixture, successive on-line solid-phase extraction preconcentration (SPE) of analytes from the extract and on-line RP-HPLC analysis with UV photometric detection. The separation of pyrethroids was performed on a Purospher RP-18e column with methanol-water binary mobile phase. Effects of sorbent placed at bottom of short column holding the soil sample and different kinds of on-line SPE columns were tested. Beside the influence of volume of the effluent on the pyrethroids recovery was also studied. Calibration curves were linear over the range assayed from 0.01 to 0.2 $\mu g.mL^{-1}$ with correlation coefficients of linear regression in the range 0.998-0.999. Recovery studies were carried out at 0.25-1.00 $\mu g.g^{-1}$ dry soil fortification level and obtained recoveries were for cypermethrin 56-59% and for permethrin 58-63%. Achieved detection limits of studied synthetic pyrethroids were 3.7 $ng.g^{-1}$ of cypermethrin and 3.6 $ng.g^{-1}$ of permethrin, respectively.

***KEY WORDS**: pyrethroids, soil micro-samples, RP-HPLC analysis*

LEAF LITTER FALL DECOMPOSITION IN AGE-DIFFERENTIATED STANDS OF BLACK POPLAR, CLONE HYBRID 275

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ABSTRACT

The aim of this study is to compare the decomposition of leaves, the main component of the plant litter fall, among plantations of Black Poplar (Populus nigra L.) clones Hybrid 275 of different ages. The study was conducted in 2000-2002 at three plantations of Hybrid 275 Black Poplar of different ages. The process of decomposition occurred at a different rate at each plantation. It was fastest in the 54-year-old stand (54Y), slightly slower in the 28-year-old stand (28Y) and slowest in the 17-year-old stand (17Y). After 12 months in the 54Y stand almost 80% of the initial mass was decomposed, in the youngest stand it was slightly more than 40%. The coefficients of decomposition, based on Olson's model, were 1.49 for 54-year-old plantation, 0.97 for 28-year-old plantation and 0.61 for 17-year-old plantation. During decomposition at all the locations the ratio C/N narrowed to values of about 25:1, which was linked to the immobilisation of the nitrogen. Potassium was leached out quickly during decomposition. The concentration of phosphorus and magnesium remained relatively constant during decomposition, which differed at each plantation. The concentration of calcium tended to rise at all the plantations, but its supply decreased gradually. The study showed a high intensity of leaves decomposition at plantations of poplar clone Hybrid 275 in comparison with other species of broadleaved trees. A high correlation coefficient between the age of poplars and the rate of decomposition was found. Leaves of old trees decomposed quicker than those of younger trees. Distinct differences were noted between the plantations in the content of phosphorus, potassium and magnesium. Only for lignin were high negative correlations obtained between their concentration and the age of the poplars from which the leaves originated, and the index of decomposition. Only small differences were observed in the nitrogen content and the C/N ratio, which excludes these as differentiating factors.

***KEY WORDS**: poplar, Hybrid 275, leaf litter fall, decomposition, nutrient turnover*

THE INFLUENCE OF BROWN COAL ON PHYSICO-CHEMICAL PROPERTIES OF SANDY SOILS

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ABSTRACT

A steady decline of organic matter in soils in Poland is observed, therefore the pending problem and new challenge for soil and environmental scientists is to increase its level, particularly in sandy soils. A growing interest was observed in last decades in different sources of organic matter, for example from brown coal, its derivatives and composts that are considered as an important source of enriching the soil with organic matter. The Rekulter – a brown coal preparation was introduced 20 cm deep into the soil in autumn 1987 at 2 doses of 80 and 160 $t \cdot ha^{-1}$.

Applying the Rekulter resulted in changes of physicochemical properties of the soil. One year after application, the highest increase in soil reaction pH (pH_{H2O}=7.5; pH_{KCl}=7.4) was found in the case of higher dose of Rekulter, and the same behavior (pH_{H2O}=7.2; pH_{KCl}=6.4) was observed 20 years after its application. In objects with higher dose of the Rekulter, the TOC decreased from about 20 $g \cdot kg^{-1}$ after 1 year to 15 $g \cdot kg^{-1}$ after 20 years of its application. The highest growth of the Nt content of 1.1 $g \cdot kg^{-1}$ (1988) and 0.9 $g \cdot kg^{-1}$ (2008) occurred at higher dose of the Rekulter. The highest value of TOC to Nt ratio of 20 obtained for soil sample with higher dose of the Rekulter was due to the highest carbon content in this object.

***KEYWORD**: organic matter, physico-chemical properties, soil, brown coal, Rekulter*

INFLUENCE OF CROP ROTATION AND DIFFERENT FERTILIZATION SYSTEMS ON CHROMATOGRAPHIC PROPERTIES OF HUMIC ACIDS IN SOIL

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ABSTRACT

Humification is a complex process of decomposition, transformation and synthesis of different organic compounds which leads to the formation of new humus substances referred to as humus. The characteristics of humus substances are provided based on the examination of the properties of soil extracts obtained with selective solvents. An important analytical method which facilitates getting to know more about these compounds is High Performance Liquid Chromatography (HPLC). The aim of the present paper was to investigate the effect of agrotechnical practises, including crop rotation and fertilisation, on the hydrophilic and hydrophobic properties and the degree of polydispersity of humic acids. The present results of the chromatographic analysis show that the structure of humic acids is mostly determined by the soil type. However, there was noted an effect of the crop rotation on the share of hydrophilic and hydrophobic fractions and low- and high-molecular fractions in the humic acids analysed. Enriching soil with humus by an adequate selection of the crops results in an obvious increase in the content of hums substance at the initial stage of decomposition, which is confirmed by the occurrence of the so-called 'young' humic acids of a lower molecular weight and a lower degree of aromatic structure condensation.

***KEY WORDS**: humic acids, fertilization, crop rotation, HPLC*

THE STRUCTURE AND PROPERTIES OF HUMIC SUBSTANCES FROM BROWN COAL 11 YEARS AFTER ADDITION INTO SOIL

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ABSTRACT

Soils in many areas of Poland are characterized by low contents of organic matter, which greatly contributes to their limited fertility and productivity, and higher vulnerability to contamination and degradation. Recently, the use of organic amendments other than traditional manure showed to be efficient for the improvement and/or restoration of soil organic matter. Brown coal added to soil may be transformed into humic substances (HS) in (micro)biological and abiotic ways. An application of organic matter from brown coal resulted after 11 years in changed structure of humic acids (HAs) extracted from soil as indicated by an increase of the carbon contents in elemental composition, and consequently decreased values of the H:C ratio. HAs extracted from amended soil showed higher absorbance values in the UV-VIS region, higher contents of oxygen functional groups, and were more resistant to thermal decomposition. HAs molecules were also richer in aromatic structures and resistant to decomposition with a high potential of sorption properties. Organic matter from brown coal introduced to soil relatively slowly undergoes transformation and thus causes permanent soil enrichment with HS.

***KEY WORD**: structure, properties, soil, humic substances, brown coal*

EFFECTS OF AGROTECHNICAL TREATMENTS ON SPECTROPHOTOMETRIC PROPERTIES OF HUMIC ACIDS IN ALBIC LUVISOLS

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ABSTRACT

The objective of the investigations was to evaluate effects of agrotechnical treatments on physicochemical properties of humic acids of brown podzolic soils. Crop rotation appeared to be the basic factor affecting the optical density properties of humic acids. Rotation of crops enriching the soil with organic matter caused higher absorbance values of HAs solutions than in the one depleting the soil. Higher values of $A_{2/4}$ and Δlog K parameters in crop rotation B indicated that HAs isolated from the soil supplemented with organic matter had a higher content of humus at the start of decomposition than HAs of the variant depleting the soil. The kind of crop rotation modified spectroscopic parameters of HAs. Humic acids of the soil under rotation of crops introducing less organic matter had a higher percentage of lignin structures than those of the other crop rotation. As compared with mineral fertilization, FYM fertilisation triggered a development of HAs of a smaller molecular weight. A clear presence of absorption bands in the range 1460-1000 cm^{-1} in the IR spectra of humic acids separated from the combination enriching the soil with organic matter showed their 'chemical youth'.

***KEY WORDS**: humic acids, fertilization, crop rotation, IR, UV-VIS*

INFLUENCE OF TIME AND STORAGE CONDITIONS OF HUMIC ACIDS (HA) SOLUTIONS ON THEIR OPTICAL PROPERTIES

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ABSTRACT

The research refers to influence of time and storage conditions of humic acids (HA) solutions on optical properties. HA coming from lake sediment was subjected to examinations. The 0.1 M NaOH solution was used to the HA extraction. The UV-VIS absorption analysis and the measurement of intensity of the long-term photo-induced luminescence were carried out for obtained HA extracts. The analyses were done after different time of preservation of the HA solutions at the room temperature of 24°C with access to daylight as well as at the temperature of 4°C in the darkness (in a refrigerate). They found that conditions in which HA extracts intended for analyses were being deposited had significant influence of HA particles on structural changes.

***KEY WORDS** : humic acids, long-term delayed luminescence, UV-VIS absorption*

RELATIONS OF ENZYME ACTIVITIES WITH DIFFERENT FRACTIONS OF SOIL ORGANIC MATTER

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ABSTRACT

Stabilization and maintenance of extracellular enzymes activity in soil is important ecological function of humic substances. Enzymes catalyze all biochemical reactions and are an integral part of nutrient cycling in the soil. Stable humus pool and humus–enzyme complexes are of great importance in soil fertility. Humus–enzyme complexes functioning in soil suggests the possibility to reveal enzymatic indicators of soil quality. Specific hydrolytic enzymes (cellulase and invertase) and oxidases (peroxidase and polyphenoloxidase) were tested because they are linked to carbon cycle. The aid of investigation was the assessment of relationships between enzymes activities and the contents of different fraction of SOM in Albeluvisol loamy sand soil. 'Humus' parameter (Tyurin method) was used for characterization of stable SOM. Decomposable part of SOM was determined by measurement of Chwe content in soil. However the decomposable part of SOM is important in the evaluation of the farming systems sustainability it is less appropriate for soil quality diagnostic. Stable organic matter may be more appropriate to indicate the quality of a soil ecosystem. For the development of reliable biochemical parameters for soil quality diagnostic the enzyme interrelationships with different fractions of soil organic matter were studied. It was concluded that the activity of enzymes, which is closely correlated with humus and weakly related to decomposable SOM, are more appropriate for specific biochemical tests in the definition of soil quality. Ligninolytic enzymes peroxidase and polyphenoloxidase are adequate for this purpose in a greater degree unlike hydrolytic enzymes cellulose and invertase. Hydrolytic enzymes activities were related closely with humus and Chwe contents as well. Simplicity of the assay is one of advantages of proposed biochemical indicators as well.

KEY WORDS*: stable and active fractions SOM, peroxidase, polyphenoloxidase, cellulase,*

CHARACTERIZATION OF SOIL ORGANIC CARBON AND ITS FRACTION LABILE CARBON IN ECOSYSTEMS

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ABSTRACT

Total carbon content, labile carbon content and biological properties in selected Cambisols were determined. Our work represents a part of long-term field experiments that have been carried out in the Czech Moravian Upland since 1999. Among the basic soil parameters basal respiration activity and microbial biomass amount were determined. Results showed low humus content. Higher C and N contents were determined in grassland soils and C/N ratio was middle (8-11). Humic substances quality was low (HA/FA ratio was less than 1). Humification degree was middle. Absorbance in UV-VIS spectral range was low and calculated color indexes were high (more than 4). Grassland soils showed higher microbial biomass amount, but lower labile carbon content to compare with arable soils. Basal respiration was low and varied from 0.22 – 0.60 mg $CO_2.(100g)^{-1}.h^{-1}$. Bacterial biomass was higher in grassland 200 μg $C.g^{-1}$ dry weight to compare with arable soils (about 100 μg $C.g^{-1}$). To characterize connection between carbon and nitrogen content, and their microbial utilization the complex factor was calculated.

***KEY WORDS**: labile soil carbon, biological properties, humus quality*

THE ROLE OF SUSPENDED MATTERS AS SOLID SUPPORTERS OF HEAYY METALS IN WATER ENVIRONMENT

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ABSTRACT

The heavy metals, as a few of the inorganic compounds have strong adsorption properties. Suspended matter, which is an essential component of surface waters, plays an important role in the transport of metal pollutants. However, insoluble substances which occur as colloids suspended or adsorbed on the solid phase under the influence of variable physical and chemical conditions might dissolve and become a source of secondary pollution of the surface waters and a danger for the organisms. Therefore it is necessary to mark various metal forms present in each of the elements of the water ecosystem. A research concerning the role of suspended matters in transporting heavy metals has been carried out on the Bobrza River in 3 different measurement points. Those points differ in the management of the land: the source, Białogon - acidic environment, and Sitkówka - Nowiny - alkaline environment. The results received indicate the relationships between the area management and the degree of bounding the metals by suspended matters.

KEY WORDS: *heavy metals, suspended matter, suspension, river*

QUANTITY OF SOIL ORGANIC MATTER IN DIFFERENT ECOSYSTEMS

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ABSTRACT

This study deals about quantity of soil organic matter in natural ecosystems and arable land. Sampling places were located in Nitra, Komjatice, Močenok and Šaľa on soil types Eutric Fluvisols and Haplic Chernozems. There were four different ecosystems: agri-ecosystem (arable land), forest ecosystem, meadow ecosystem and anthropic soil included. The highest carbon content was in forest ecosystem, next less about 14 % it was anthropic soil, less about 20 % it was meadow ecosystem and with the lowest value (about 27 %) it was arable land. The highest total nitrogen content was in anthropic soil, next lower value about 2 % was in forest ecosystem, lower value about 31 % it was in meadow ecosystem and with the lowest nitrogen content about 32 % it was arable land. Soil organic matter balance in crop rotation is not influenced only by root crop share, for which farmyard manure is applied, but also maize share. Oil seed crops very importantly support higher content of total organic carbon, as well. Just variants with the highest share of oil crops and maize had the highest carbon content.

***KEY WORDS**: ecosystem, carbon, crop rotation, nitrogen, soil organic carbon*

QUALITY OF SOIL ORGANIC MATTER IN DIFFERENT ECOSYSTEMS

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ABSTRACT

This study deals about quality of soil organic matter in natural ecosystems and arable land. Sampling places were located in Nitra, Komjatice, Močenok and Šaľa on soil types Eutric Fluvisols and Haplic Chernozems. There were four different ecosystems: agri-ecosystem (arable land), forest ecosystem, meadow ecosystem and anthropic soil included. The highest quality of soil organic matter, evaluated according to extracted carbon of humic acids, was in agri-ecosystem 19 %, next it was in forest ecosystem 18 %, meadow ecosystem 16 % and with the lowest value 13 % it was in anthropic soil. The highest soil organic matter quality in agri-ecosystem on Haplic Chernozems was in variant CM-03, with share of cereals 72 % (maize 42 %), root crops 14 % and oil crops 14 %. Just in this variant the highest carbon and nitrogen contents were determined. In Eutric Fluvisols the highest soil organic matter quality was in variant FM-04, with share of cereals 72 % (maize 14 %), root crops 14 % and with the highest share of oil crops 14 % just in this crop rotation. In this variant also in one year spring cereal and maize for grain were growing. In other variants maize was growing for silage.

KEY WORDS: *ecosystem, crop rotation, humic acids, soil organic matter*

THE INFLUENCE OF CROP ROTATION, CULTIVATION AND FERTILIZATION ON SOIL ORGANIC MATTER IN LUVI-HAPLIC CHERNOZEM

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ABSTRACT

We investigated the influence of crop rotations, cultivation and fertilization on content and quality of soil organic matter. In 1990 started small field trial with two crop rotations (A1- biological with 1/3 of lucerne, 1/3 cereals and 1/3 FYM manured crops such of sugar beet and silage maize, A2 - cereal and leguminous and 1/3 FYM manured crops such of winter wheat and silage maize) at limited inputs of soil tillage (C1 - conventional tillage, C2 – protective soil tillage) and fertilization (B1 control – without NPK, FYM too times during of rotation, B2 – reduced NPK fertilization + crop residues of winter wheat and sugar beet, B3 – medium intensity of NPK, FYM too times during of rotation). Rotation was carried out on three fields in four replications on loamy Luvi-Haplic Chernozem, without additional irrigations. The influence on soil chemical characteristics changes, including soil organic matter quantity and quality was observed. During 6-yr field experiment we observed positive tendency and statistically significant increasing of soil organic carbon content, degree of humification, contents humic and fulvic acids, only in treatments with protection tillage comparing to conventional one.

***KEY WORDS**: crop rotations, soil tillage, fertilization, soil organic matter*