Conference Program

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CURRENT ENVIRONMENTAL ISSUES 2019

24 - 26 September 2019

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Dear Colleagues,

On behalf of organizing committee of the14th International interdisciplinary conference "Current Environmental Issues-2019" we would like to invite all who are involved in works on monitoring and protection of environment to participate in this event which will be held for the first time in University of Bialystok, Bialystok, Poland . The invitation is especially addressed to biologists, ecologist, economists, analytical chemists and employees of state governmental institution dealing with environmental protection.

The main goal of the conference is to present contemporary problems related to the broadly understood protection of natural resources and their exploitation in the context of protection and sustainable development. The presentations and communications presented at the conference will be a starting point for discussions on the state of the environment in border areas, with particular emphasis on the areas on the border of the European Union and non-EU countries, problems related to cross-border migration of pollutants (especially water and air) and opportunities to take joint initiatives aimed at protection of valuable cross-border areas.

The chairman of the Organizing Committee,
prof. dr hab. Joanna Karpińska

The conference was subsidized by Ministry of Science and Higher Education

The XIV International Interdisciplinary Conference Current Environmental Issues 2019 task financed under contract 545 P-DUN /2019 from the funds of the Ministry of Science and Higher Education for activities promoting science

Ministry of Science
and Higher Education
Republic of Poland

Detailed program of the Conference Current Environmental Issues – 2019 (Współczesne Problemy Ekologii- 2019), Department of Biology and Chemistry, University of Bialystok, 24-16th September 2019

Poster session starts at 9.00 a.m. and finished at 5.20 p.m. in Institute of Chemistry at the second floor (passages between buildings of Chemistry, Biology and Physics). Chairmen of poster session: Elżbieta Wołyniec and Barbara Leśniewska

24.09. 2019 (Tuesday)		
8.00-9.00 Registration of participants, Institute of Chemistry, first floor		
9.00-9.30	**Opening ceremony**	
9.30-9.50	Bożena Łozowicka	Are plant protection products a threat to food and the environment?
9.50-10.10	Oleg Sozinow	Method for evaluating the biological diversity current state of “Bialowiezskaya”
10.10-10.30	Andrzej Górniak	Water ecosystems of north-eastern Poland in the 21st century - problems and challenges
10.30-11.00	**Coffee break**	
11.00-11.20	Beata Kalska-Szostko	Nanomaterials and its influence on the environment
11.20-11.40	Harengiri Gosai	Development of bioremediation techniques for polycyclic aromatic hydrocarbons (PAHs) along Gujarat coastline
11.40-12.00	Galina Yukhnevich	Solid-liquid separation in the activated sludge process and filamentous bacteria
12.00-12.20	Presentation of sponsors (Linegal, Shimpol)	
12.20-13.40	**Lunch**	
13.40-14.00	Tatsiana Marchyk	Biochemical parameters in the system. Monitoring of soil
14.00-14.20	Anastasija Rashenko	Informing people of climate changes: a task for the environmental concerned organizations and initiatives
14.20-14.40	Anastasija Les	Sustainable consumption is the way to reduce the amount of solid waste
14.40-15.10	**Coffee break**	

Session IV, room No 2044 Institute of Chemistry Chairman: Adam Tylicki, Niafiodau Leonid		
15.10-15.30	Marek Nieoczym	The distribution of anuran larvae and invertebrate predators between open water zone and complex habitat under predation pressure of fish
15.30-15.50	Irina Zhabrak	Mycotrophicity of plants f. Ericaceae in marshy pine forests (landscape reserve «Ozyory»)
15.50-16.10	Wojciech Pol	Vertical and horizontal changes of bacterial abudance and activity in Hańcza lake (Poland)
16.10-16.30	Tauseef Anwar	Bio-herbicidal potential of fatty acid methyl esters
16.30-17.20	**Poster session**	
19.00	**Social event**	
Session V, room 2001, Institute of Chemistry Chairman: Ada Wróblewska, Bourd Vassili		
13.40-14.00	Linas Balčiauskas	Foraging strategies of small mammals from commercial orchards as indicated by isotopic signatures
14.00-14.20	Linas Balčiauskas	Citizen-Scientist effort to monitor large carnivores in Lithuania
14.20-14.40	Marek Bartoszewicz	Genetic diversity and ecotypes of *Bacillus cereus sensu lato* from distinct climate zones
14.40-15.10	**Coffee Break**	
Session VI, room 2001, Institute of Chemistry Chairman: Piotr Zieliński, Aksana Paulava		
15.10-15.30	Magdalena Czajkowska	Does the chequered blue butterfly (*Scolitantides orion*) have a chance to remain in polish fauna? – genetic analysis of endangered populations
15.30-15.50	Magdalena Świsłocka	The distribution of low levels of differentiation within Auropean phylogenetic lineage of moose, *Alces alces* inferred from complete mitogenomes analysis
15.50-16.10	Urszula Czyżewska	Dr. Jekyll and mr. Hyde: dual nature of *Malassezia pachydermatis*
16.10-16.30	Huma Qureshi	Isolation of vitexin as natural bio-herbicide from *Lantana camara* leaves
16.30-17.20	**Poster session**	
19.00	**Social event**	

25.09.2019 (Wednesday)		
Session VII, room 2044 Institute of Chemistry Chairman: prof. Nina Kanunnikova, prof. Małgorzata Grabarczyk		
9.00-9.30	Monika Wawrzkiewicz	Anion exchangers contra hybrid adsorbents - comparison of sorption capacity for toxic azo dyes
9.30-10.00	Anna Wołowicz	Adsorptive removal of heavy metals from model solutions and real wastewaters using ion exchangers
10.00-10.20	Yanina Komarovskaya	Surface modification of polyamide fibres under the influence of bacteria - destructors
10.20-10.40	Presentation of sponsor	(Danlab-Renggli, Perlan)
10.40-11.00	**Coffee break**	
11.00-11.30	Tomasz Wojtal	Recovery of zinc and iron from metal-carrying sludge with the application of high-temperature reduction, where selected solid carbon reductors and hydrogen are used
11.30-11.50	Ewelina Polska-Adach	Influence of functional groups of polystyrene-divinylbenzene adsorbents on the effectiveness of acid dye removal
11.50-12.10	Natallia Bashun	Non-invasive nutritional assessment methods
12.10-12.30	Volha Yanchurevich	Sustainable water resources management and monitoring of the lake Beloe ecosystem in the republican landscape “Oziory” (Grodno Region, Belarus)
12.30-12.50	Huma Qureshi	Bio-herbicidal potential of *Lantana camara*
12.50-13.50	**lunch**	
13.50-16.00	visiting the University Nature Center	
16.00	**Social event**	
11.00-11.30	Paweł Staszek	Warm stratification of apple seeds leads to alteration in biotin containing proteins level
11.30-11.50	Nina Kanunnikova	Protective properties of dipeptyde glycylproline in experimental neurodegeneration
11.50-12.10	Aleksandra Maria Staszak	Lead ion as factor modulating seed viability of tress
12.10-12.30	Andrii Zabrodskyi	Of different agricultural machineries chassis influence on soil compaction and environmental pollution
12.30-12.50	Tauseef Anwar	Isolation and characterization of weedicidal compounds from *Lantana camara*
12.50-13.50	**Lunch**	
13.50-16.00	visiting the University Nature Center	
16.00	**Social event**	

26.09.2019 (Thursday)		
Session X, room 2044 Institute of Chemistry Chairman: Andrii Zabrodskyi, Joanna Karpińska		
9.00-9.20	Małgorzata Grabarczyk	Simple and fast method for determination of trace cadmium ions in environmental water samples containing humic substances
9.20-9.40	Barbara Leśniewska	Methods for determination of chromium forms in wastewater and soil
9.40-10.00	Dorota Kowalska	Assessment of the potential to bioaccumulation of ionic liquids using human plasma proteins
10.00-10.30	**Coffee break**	
Session XI, room 2044 Institute of Chemistry Chairman: Marek Bartoszewicz, Iryna Kalesnik		
10.30-10.50	Jakub Maculewicz	Bioconcentration assessment *in vitro*: membrane partitioning of ionic liquids cations
10.50- 11.10	Klaudia Świacka	Bioconcentration and metabolism of diclofenac by *mytilustrossulus*
11.10- 11.30	Cecylia Wardak	All solid state ion-selective electrode for lead monitoring in the environment
11.30-11.50	Mohammad Ishi Ali	Skin and hair pigment melanin degradation by catalytic oxidation of lignin peroxidases
11.50- 12.15	**Closing ceremony**	
12.15 -13.15 Farewell lunch		

CZY ŚRODKI OCHRONY ROŚLIN SĄ ZAGROŻENIEM DLA ŻYWNOŚCI I ŚRODOWISKA?

B. Łozowicka

Instytut Ochrony Roślin – Państwowy Instytut Badawczy, Terenowa Stacja Doświadczalna
Chełmońskiego 22, 15-195 Białystok
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Powierzchnia gruntów rolnych na świecie wynosi około 11% i wykazuje tendencję wzrostową, głównie ze względu na ciągły wzrost ludności na świecie. W związku z tym, wykorzystanie środków ochrony roślin (ś.o.r.) bardzo często jest sposobem na zwiększenie wydajności upraw rolnych oraz zmniejszenie ich strat poprzez wyeliminowanie chorób roślin czy ograniczenie populacji atakujących je szkodników. Jednakże mimo licznych zalet stosowania, ś.o.r. mogą wywierać negatywny wpływ na zdrowie człowieka, a ich pozostałości powszechnie występują w jego otoczeniu; można znaleźć je zarówno w otaczającym środowisku, jak i w żywności, którą spożywa.

Od wielu lat obrót i stosowanie ś.o.r. podlega ścisłemu nadzorowi, a świadczy o tym zmniejszenie liczby substancji czynnych (s.cz.) pestycydów dopuszczonych do stosowania. Jeszcze w 2000 roku w Unii Europejskiej zaakceptowanych do stosowania było około 900 s.cz, w 2008 roku liczba ta spadła do ok. 420, a w 2018 roku wynosi zaledwie 277. Jest to ściśle związane z dostosowaniem się do wymagań unijnych, w których za główny priorytet stawia się ochronę środowiska naturalnego.

Obecnie w Polsce, w której ponad 60% powierzchni użytkowej zajmują pola uprawne, zarejestrowanych i dopuszczonych do stosowania jest ponad 2,2 tys. preparatów. Zużycie ś.o.r. w Polsce waha się w przedziale 70 – 90 tyś. ton rocznie (w masie). W przeliczeniu na substancję aktywną zużycie sięga ok. 20 tyś. ton/rok.

Podstawową właściwością chemicznych ś.o.r. jest ich toksyczność, z czym wiąże się zagrożenie dla zdrowia ludzi i zwierząt oraz środowiska naturalnego. Nieracjonalne stosowanie ś.o.r. może spowodować negatywny wpływ na środowisko, człowieka oraz jest przyczyną wielu chorób i zatruć rolników, czy konsumentów produktów spożywczych.

Celem niemniejszego opracowania jest odpowiedź na pytania: Czy ś.o.r. stosowane w rolnictwie są zagrożeniem dla żywności i środowiska? Jakie wymagania stawiane są żywności, którą spożywamy, a także, jakie substancje mogą się w niej znajdować? Jakie substancje mogą się znajdować w środowisku i jaki jest ich okres półtrwania?

METHOD FOR EVALUATING THE BIOLOGICAL DIVERSITY CURRENT STATE OF «BIALOWIEZSKAIA PUSHCHA» NATIONAL PARK

O. Sozinov[1], D. Grummo[2], N. Zeliankevich[2], R. Tsvirko[2]

[1]Yanka Kupala State University of Grodno, Grodno, Ozheshko str., 22 (Belarus) [2]Institute of Experimental Botany of NAS of Belarus, Minsk, Akademicheskaya str., 27 (Belarus)

A biological diversity inventory of the «Belovezhskaya Pushcha» National Park (Belarus) was carried out, as a result of which a scientifically based approach to its functional zoning was developed. The basis of the work was the results of field studies (2013–2018) on the Belovezhskaya Pushcha territory in the form of 1851 complete geobotanical descriptions, including 743 descriptions of forest phytocoenoses, 452 bog phytocoenoses and 576 meadow, segetal and ruderal phytocoenoses. The work consisted of 2 stages. First: compilation of large-scale (M 1: 100 000) analytical maps which the current state and functions of the biological diversity elements of the «Belovezhskaya Pushcha» National Park reflected. 1. *Vegetation map* with the legend according to Brown Blanca classification. 2. *Biotopes map* based on the classification of the EUNIS system, 3. *«Rare and typical biotopes» map* was created according to national criteria. 4. *«Rare and protected species of plants and animals» map* – the location of rare species of biota, 5. *«Species diversity» map* – average number of species (higher vascular plants, bryophytes) per 100 m^2, 6. *«Variety of habitats» map* – number of habitats of the EUNIS system per 1×1 km network, 7. *«Current state of vegetation» map* reflected the degree of vegetation cover disturbance, 8 «Environment-protective functions of biotopes» map. The second stage involved the integration of all thematic maps elements into the final integrated map «Key territories for the biological diversity conservation of the «Belovezhskaya Pushcha» National Park". For each 1 km^2, the weighted average (taking into account the habitat area) value of the biodiversity integrated indicator was calculated. As a result, the Belovezhskaya Pushcha territory by the level of significance for the biological diversity conservation was ranked. It is complementary to modern forest management and will be used for the forestry and environmental measures design and implementation.

ANION EXCHANGERS CONTRA HYBRID ADSORBENTS - COMPARISON OF SORPTION CAPACITY FOR TOXIC AZO DYES

M. Wawrzkiewicz

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Water resource, as the most precious resource for human survival, is facing unprecedented challenges. Water pollution has become one of the most serious global issues. Dyeing wastewaters flowing into the reservoirs are toxic and carcinogenic to both aquatic life and human beings.

Adsorption technology, as a facile and effective method, has been extensively used for removing dyes from aqueous solutions for decades. Numerous researchers have attempted to seek or design alternative materials for dye adsorption.

The aim of the study was to compare the sorption capacities of the strongly basic polystyrene and polyacrylic anion exchange resins with a macroporous and gel structure with hybrid sorbents against the azo dye (type: direct dye). Sorption tests were carried out using the static method. The sorption reaction rate constants in the dye-adsorbents system were calculated using the pseudo-first order kinetic equations, pseudo-second order kinetic equation and intraparticle diffusion model. Adsorption equilibrium data were modelled using the Langmuir, Freundlich and Dubinin-Radushkevich isotherm models. The next stage of the research was the assessment of the influence of additional substances (salts and surfactants) on the process of dye uptake. The possibility of dye desorption was also investigated.

Anion exchange resins, especially polyacrylic ones, were characterized by a much bigger sorption capacities than hybrid sorbents compared to direct dye, and therefore can find a potential application in industrial sewage treatment plants in the textile industry.

ADSORPTIVE REMOVAL OF HEAVY METALS FROM MODEL SOLUTIONS AND REAL WASTEWATERS USING ION EXCHANGERS

A. Wołowicz

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Environmental pollution by heavy metal ions has become one of the most serious environmental problems nowadays. Due to heavy metals properties such as recalcitrance and persistence in the environment, they tend to accumulate in living organisms. As they are characterised by toxic or carcinogenic properties their treatment is of special concern. In recent years various methods for heavy metal removal from wastewater have been extensively studied. Such innovative processes for heavy metal ions treatment of industrial wastewaters often involve technologies for their toxicity reduction in order to satisfy the technology-based treatment standards. Heavy metal ions removal from wastewaters can be achieved by conventional treatment processes such as ion exchange, chemical precipitation, electrochemical removal etc. These processes possess significant disadvantages e.g. high-energy requirements, non-quantitative removal, toxic sludge production etc.. Comparison of technology costs (capital and operating) provided by Eccles shows that the capital cost of adsorption using granulated activated carbon is much higher (500 US$/m^3) than the ion exchange (100 US$/m^3) or precipitation and microfiltration (150 US$/m^3) methods therefore low cost adsorbents are produced e.g. from solid agricultural wastes and by-products. Adsorption using ion exchangers is effective, selective and characterised by simplicity and reliability.

Studies of selected heavy metal ions removal using different types of ion exchangers as well as the static and column methods were carried out. There it was found that the removal efficiency from the real and model solutions depends on the type and functional groups presence of ion exchangers as well as the type and form of heavy metals. Additionally, kinetic studies show that the sorption process of selected heavy metal ions is fast. High selectivity of weakly basic ion exchanger with the chelating functional groups toward copper was found. Moreover, quantitative removal of palladium (II) ions from the chloride solutions was obtained and it was found that sorption processes depend on the phases contact time, initial concentration, composition of solutions, agitation speed and temperature.

Oral presentations

Cross-border problems of natural environment protection

GENETIC DIVERSITY AND ECOTYPES OF *BACILLUS CEREUS SENSU LATO* FROM DISTINCT CLIMATE ZONES

M. Bartoszewicz[1], U. Czyżewska[2], M. Siemieniuk[2]

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Bacillus cereus sensu lato is a group of several species with diversity and taxonomy investigated only in a part. Their frequent presence in the environment and huge impact on human activities and health is linked to their toxicity, spore forming ability and psychrotolerance.

In order to assess any potential influence of climate on the genetic diversity and phenotypic properties of *B. cereus sensu lato*, 450 strains representing *B. cereus, B. thuringiensis, B. mycoides, B. pseudomycoides, B. cytotoxicus* and *B. weihenstephanensis* from soil were investigated in the areas of their toxicity, cold-adaptation and genetic diversity (MLST and 16S rRNA nucleotide sequencing).

On the basis of the obtained results, we found out that there is a significant correlation between average temperature and concentration of *B. cereus sensu lato* in soil samples. Moreover, the frequency of particular species in distinct samples from different climates were varied. The highest concentration of *B. mycoides* and *B. weihenstephanensis* as well as cold-adapted *B. cereus* was found in samples from temperate oceanic climate zone. On the other hand, the lowest frequency of psychrotolerant bacilli was noted in samples from samples representing hot summer continental climates. In general, samples obtained from warm oceanic climates contained more diverse isolates and the average number of species identified was higher there. In turn, clonality was more typical for bacteria from cold and dry climates. Samples obtained there were containing lower average number of species per sample. We conclude that the climate is important factor moderating the natural diversity and population structure of *B. cereus sensu lato.*

NANOMATERIALS AND ITS INFLUENCE ON THE ENVIRONMENT

B. Kalska-Szostko*, U. Klekotka[1], E. Zambrzycka-Szelewa[1], D. Satuła[2]

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Nowadays we have to deal with many environmental hazards that can influence on humans and the environment as a result of air, drinking water, and soil pollution. The wast number of different applications of nanomaterials can resolve many humans problems among which can be found: controlled medical treatment, drug delivery, water purification, removal of harmful substances from exhausts, nanoadditives to fuels, bioprotection, etc. General and widespread fascination by nanomaterials cause the presence of many different kinds of nanoobjects in our closest vicinity. Many of them are not able to be controlled adequately due to their small size. Therefore from one site nanostructures are very promising but on the other hand, our environment soon will be overflowing by various kind of nanomaterials.

As is known, the properties of nanometric materials differ from those of micro- and macroscopic ones. This is mainly due to increased surface area and reactivity, which can lead in turn to associated toxicity. This property strongly depends on the type of nanoparticles (chemical composition), morphology (crystallinity) and associated surface termination. The nanoparticles surface characteristic also determine their durability and mobility in colloidal systems and suspensions, and affect the aggregation processes. Therefore its quantity, stability, and resistance to external factors should be also strongly considered as a subject of scientific studies.

In the presented work, a few types of nanomaterials were selected and exposed to chosen solutions to mimic some real conditions. Nanostructures before and after special treatment were characterized by physicochemical methods, like; X-ray diffraction, transmission and scanning electron microscopy, energy-dispersive X-ray spectroscopy and atomic absorption spectroscopy, etc.

Ecological biochemistry, physiology and medicine

SKIN AND HAIR PIGMENT MELANIN DEGRADATION BY CATALYTIC OXIDATION OF LIGNIN PEROXIDASES

M.I. Ali

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Skin darkening, results in accumulation of skin pigment melanin. Skin lightening agents are used to curtail melanin synthesis. These agents have detrimental side effects and can increase the risk of skin cancer. Decolourization of melanin could be an alternative way of skin lightening. Melanin shares structural similarity with lignin, which is efficiently degraded by fungus, Phanerocheate chrysosporium, with the help of enzyme lignin peroxidase suggesting that melanin, could be decolorized by the fungus using the same enzyme. To examine the ability of Lignin peroxidase; from the fungus *Phanerocheate chrysosporium* for decolorization of synthetic melanin. Melanin decolourization ability of *Phanerocheate chrysosporium* was examined on solid and submerged media containing melanin, by visualizing the change in color of media. Veratryl aldehyde enzyme assay of submerged media performed to confirm the presence of lignin peroxidase. Placket-Burman design used for enhanced production of Lignin peroxidase. Purification of lignin peroxidase was done by Ammonium precipitation and gel chromatography methods. A decolourization experiment of melanin at different environmental conditions carried out by purified enzyme. FTIR and SEM analysis of decolorized melanin carried out to confirm any structural changes. *Phanerocheate chrysosporium* decolorizes melanin with the help of Lignin peroxidase enzyme. Purified enzyme decolorized melanin effectively but the decolorization effect was more prominent in the presence of a veratryl aldehyde. The highest decolorization of 96% observed at an enzyme concentration of 15 IU/mL in the presence of a veratryl aldehyde. The decolourization efficiency increases in the presence of Veratryl aldehyde.

ISOLATION AND CHARACTERIZATION OF WEEDICIDAL COMPOUNDS FROM *LANTANA CAMARA*

T. Anwar[1] and H. Qureshi[1,2,3]

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Allelochemicals are non-nutritive secondary metabolites. Allelochemicals can potentially be used as growth regulators, herbicides, insecticides, and antimicrobial crop protection products. The study was aimed to evaluate allelopathic potential of *Lantana camara* flowers against selected weeds of *Triticum aestivum* viz. *Avena fatua*, *Euphorbia helioscopia*, *Chenopodium album*, *Phalaris minor* and *Rumex dentatus*. The bioassay analysis of three methanolic flower, Combi*Flash* fractions was carried out at 100%, 75% and 50% concentration compared to control using parameters of germination percentage, radicle and plumule length (cm) inhibition. The Combi*Flash* fraction 2 significantly inhibited all weeds while showing non-significant effect on *T. aestivum* compared to fraction 1 and 3. The Combi*Flash* fraction 2 showed minimum germination percentage for *P. minor* (31%), radicle length for *A. fatua*(32%) and plumule length for *R. dentatus* (31%). The assessment of physiological effects by the fraction indicated significant suppression in chlorophyll, antioxidant enzymes (peroxidase, superoxide dismutase) and protein contents of all weeds. Gas chromatography-mass spectroscopy (GC-MS) and nuclear magnetic resonance (NMR) of the fraction, identified four allelopathic fatty acid methyl esters (FAMEs) viz. Methyl oleate, Methyl palmitate, Methyl stearate and Methyl linoleate. The allelopathic potential of these four compounds is reported for the first time.

Ecological biochemistry, physiology and medicine

BIO-HERBICIDAL POTENTIAL OF FATTY ACID METHYL ESTERS

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Allelochemicals are non-nutritive secondary metabolites. Allelochemicals can potentially be used as growth regulators, herbicides, insecticides, and antimicrobial crop protection products. The study was aimed to evaluate allelopathic potential of *Lantana camara* (Sage-plant) flowers against selected weeds of wheat (*Triticum aestivum*) viz. *Avena fatua* (Wild oat), *Euphorbia helioscopia* (Sun-spurge), *Chenopodium album* (Goosefoot), *Phalaris minor* (Canary-grass), and *Rumex dentatus* (Knotweed). Four compounds viz. methyl oleate, methyl palmitate, methyl stearate and methyl linoleate, were isolated from the flowers of *Lantana camara* using Combi*Flash* chromatography. Their chemical structures were identified by gas chromatography mass spectrometry as well as ^{1}H and ^{13}C nuclear magnetic resonance spectroscopic analyses. Bioassays showed that the four compounds had significant allelopathic effects on the germination and seedling growth of selected weeds. The four compounds inhibited germination, shoot and root growth of test weed species, methyl palmitate being the most potent allelochemical, which inhibited growth parameters by approximately 80% at a concentration of 50µM. Methyl palmitate inhibited total chlorophyll and protein components of test species by 50-60 %. The results of activity testing indicated that the methyl palmitate isolated from flowers of *Lantana* plant had strong allelopathic potential and could cause different degrees of influence on growth of weeds. Moreover, this compound could be key allelochemical in weeds-infested wheat fields. Furthermore, studies on the level and extent of the phytotoxicity of isolated compounds at different growth stages in agronomic and environmental conditions are recommended.

Ecological biochemistry, physiology and medicine

FORAGING STRATEGIES OF SMALL MAMMALS FROM COMMERCIAL ORCHARDS AS INDICATED BY ISOTOPIC SIGNATURES

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Investigations of isotopic niche are widely used for determining foraging strategies and community structure or tracking movements in various animal species. Small mammals represent an important ecological group in terrestrial ecosystems, which channel nutrients and energy up to higher trophic levels as they mostly utilize green plant material (*Microtus* spp.), seeds and fruits and/or foods of animal origin (*Apodemus* and *Micromys* spp.) or feed on both low and high energetic plant resources and animal food (e.g. *Myodes glareolus*). For the first time in the Baltic countries, we investigated $\delta^{13}C$ and $\delta^{15}N$ stable isotope signatures in the hair of small mammals trapped in commercial orchards, berry plantations and neighboring control habitats, mainly meadows. Out of 10 species registered at 15 sites, the dominants were *Apodemus agrarius* (31.1 %) and *Microtus arvalis* (26.0 %). Averages of $\delta^{15}N$ values ranged from 4.5 ‰ in *M. agrestis* to 7.5 ‰ in *Micromys minutus* in accordance with the food preferences of the species. $\delta^{13}C$ values ranged from -27.3 ‰ in *M. agrestis* to -19.3 ‰ in *Mus musculus*. No sex-based differences in $\delta^{15}N$ and $\delta^{13}C$ values were found. Juveniles of *A. agrarius* had significantly lower $\delta^{15}N$ than adults, while juveniles of *A. flavicollis* and *M. glareolus* had lower $\delta^{13}C$ values. *A. agrarius* was characterized by the widest trophic niche ($\delta^{13}C$ = -29.5–-13.3 ‰, $\delta^{15}N$ = 2.5–11.1 ‰). $\delta^{13}C$ values were most similar between *Microtus* voles. Concluding, carbon and nitrogen stable isotope values in the hair of small mammals from the commercial orchards were in line with other natural habitats (flooded meadows and forest). With a few exceptions, significant differences between stable isotope values in small mammals from orchards and control habitats were not found in any species, implying (i) similar diets in the orchards and marginal meadows, and (ii) the possibility of migration of animals between orchards and surrounding natural habitats. Grant MoA Lithuania, No MT-18-3. No MT-18-3.MT-18-3.

Ecological biochemistry, physiology and medicine

NON-INVASIVE NUTRITIONAL ASSESSMENT METHODS

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Increasingly, specialists are using non-invasive methods of analysis. Invasive and non-invasive methods are distinguished. The invasive methods are associated with penetration through the body's natural external barriers (skin, mucous membranes). The invasive methods of obtaining information are expensive and can only be carried out in an accredited laboratory. The study of the component composition of a human body has the great interest for medical workers and researchers. Body composition analysis is used to describe the percentages of fat mass, fat-free mass, bone and muscle mass, total body water and visceral fat area in human body. Components of body composition are important indicators of aging, chronic diseases, and increased morbidity and mortality. The non-invasive methods do not involve penetration through external barriers; they are simple to implement and not expensive. The most common non-invasive methods are anthropometry, bioimpedance analysis, X-ray fluorescence analysis of hair, method for studying the excretion of micronutrients and their metabolites. Anthropometry refers to a set of methodological techniques for measuring (somatometry) and descriptions (anthroposcopy) of the human body as a whole or its individual parts, as well as for characterizing their variability. The main interest for the characteristics of body composition are those indices in the construction of which the body mass is involved. Currently, the most widespread is Ketle index or body mass index (BMI). However, BMI can only estimate approximately the condition of your body. Today, one of the most advanced diagnostic methods in sports, clinical and health medicine is bioimpedance analysis of body composition, as it is an efficient, safe, non-invasive, highly informative diagnostic method. The X-ray fluorescence analysis of hair allow to determine the content of Ca, Zn, I, Fe, Cu, Se, Cr. Methods for studying the excretion of micronutrients and their metabolites allow to determine the content of vitamin C, B_2, B_3, B_6, I, Se, Ca and P in the human body. A study conducted among 236 students showed that, regardless of the level of physical activity, students lack of Ca, Zn, I, P and Se, as well as vitamin B_3. In this way, non-invasive methods for studying the nutritional status of person can include a study of the component body composition (bio-impedance analysis), the content of bio-elements in the hair (X-ray fluorescence analysis) and the excretion of basic micronutrients (spectrophotometric and spectrofluorometric analysis methods).

Ecological biochemistry, physiology and medicine

DR. JEKYLL AND MR. HYDE: DUAL NATURE OF *MALASSEZIA PACHYDERMATIS*

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Malassezia pachydermatis is a part of the physiological biota of the skin and mucous membranes of most mammals and birds. This opportunistic species causes mainly surface skin infections. However, in extreme cases it can also cause fungemia in neonates and patients hospitalized in the intensive care units. Since *M. pachydermatis* is isolated almost equally from diseased animals and those without clinical symptoms of the disease, accurate diagnosis of infections caused by this yeast is a problem of great importance in veterinary and medicine. Therefore, the isolation of these fungi from patients is not an equivalent to the identification of the etiologic agent of infection. According to the current state of our knowledge, the problem of diseases associated with *M. pachydermatis* is correlated with the metabolic, hormonal and immunological state of the host.

However, in the light of the literature review, a significant question arises, whether the pathogenicity of *M. pachydermatis* is solely conditioned by host-dependent factors, or maybe the pathogenic strains have independent virulence mechanisms and the other factors only trigger their expression.

In order to search for the answer, we determined and compared the overall genetic diversity and phylogenetic relationships of obtained isolates and, in the following step, we assessed the activities of intracellular and extracellular enzymes. Moreover, lipid and protein profiles of *M. pachyderm*atis strains from healthy and infected dogs were compared in searching for any differentiating properties.

By the application of two different techniques, RAPD-PCR fingerprinting and nucleotide sequencing of ITS-1 fragments, we have demonstrated the high level of genetic diversity and an origin-dependent grouping scheme of the strains. These results suggest that *M. pachydermatis* is diverse and highly polymorphic species despite adaptations to the occupied ecological niche. Apart from the lack of any speciation signals between strains representing both groups and in spite of their high polymorphism, the existence of features differentiating both group of strains still cannot be excluded.

We have shown that the lipid and protein profiles of individual strains correlate to their origin. Particularly, it is noteworthy that some important features (lower content of ergosterol esters and total fatty acids as well as presence of nerve acid) were found only in the case of strains isolated from *otitis externa* irrespective of the culture conditions. In these strains, I also found the presence of specific proteins: the NADP-dependent mannitol dehydrogenase (EC 1.1.1.138) and ketol-acid reductoisomerase (EC 1.1.1.86) which can play an important role in the pathogenesis process. These strains also exhibited significantly higher phospholipase C activity in comparison to strains isolated from dogs without clinical symptoms of infection.

The undeniable confirmation of the presence of typically commensal and potentially pathogenic strains of *M. pachydermatis* would require further studies including other *Malassezia* species and additional clinical modeling. Distinctive attributes of the different strains can be used in order to precise diagnose the early steps of infection, prophylactic procedures application or even identification of the risk groups prior to onset of clinical symptoms. The identified characteristics (phospholipase activity, presence of characteristic proteins and lipid profile) may become a good marker of strains pathogenicity, what is particularly important due to increasing number of opportunistic infections in animals and humans.

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PROTECTIVE PROPERTIES OF DIPEPTIDE GLYCYLPROLINE IN EXPERIMENTAL NEURODEGENERATION

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The increase in the lifespan of people, the intense rhythm of work, the influence of various chemical factors in the environment are accompanied by an ever wider spread of neurodegenerative diseases. The treatment of such diseases is carried out for a long time, so the development of new medicines that are close to the natural metabolites and have no toxic effect is of particular relevance. In recent years, neuropeptides are increasingly being used for the treatment of encephalopathy, ischemic damages of the brain, effects of poisoning, so as to increase stress resistance, and work efficiency, as they are effective when used in small doses, have low toxicity. We studied the neuroprotective effect of the glycylproline dipeptide (gly-pro) in models of experimental neurodegeneration in rats. In order to facilitate the penetration of the substance into the brain across the blood-brain barrier, we used the intranasal method of its administration. It has been shown that the administration of gly-pro following experimental cerebral ischemia in rats leads to a decrease in the percentage of animal mortality, activation of the Krebs cycle enzymes against the background of a decrease in the activity of GABA-bypass enzymes as an alternative pathway for the formation of succinate. The ratio of the content of excitatory amino acids to inhibitory is reduced due to the predominance of the latter. The neuroprotective activity of gly-pro in the experimental model of parkinsonism in rats was quite high, which is confirmed by histomorphological studies, decrease of animal mortality, and changes in such biochemical parameters as the activity of GABA metabolism enzymes, enzymes of energy metabolism, parameters of oxidative stress, activity of glutathione system in the brain. These data indicate the promise of studying peptides as substances for correcting disorders in neurodegenerative pathology.

SURFACE MODIFICATION OF POLYAMIDE FIBRES UNDER THE INFLUENCE OF BACTERIA – DESTRUCTORS

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Polyamide materials are raw materials for production of the big list of products. Annually 500 tons of materials from polyamide are manufactured in Belarus, that involves a serious problem in its further processing and utilization.

In the safest and low-cost way of change of an original structure of fiber, biochemical degradation of polyamide fibers under the influence of enzymes of microorganisms is.

In this work the microorganisms destructors allocated from treatment facilities of JSC «Grodno Azot» and city treatment facilities and also the polyamide fibers of tex 93 made in Branch «Khimvolokno Plant» JSC «Grodno Azot» were used. Fibers were cultivated in anaerobic conditions, in the grown poor liquid medium during 7,14 and 21 days.

The Atomic-powered research of a surface of polyamide fibers, showed existence of structural changes. After biomodifying on a surface of exemplars of fibers defects of various form (spherical, ellipsoidal, piramidoidalny etc) and the size are observed (from several nanometers to 1.5 microns). The quantitative indices of a microtopography of a surface of fibers in the course of bioprocessing significantly change. In particular average square roughness (Rq) it is model after biomodifying, depending on the chosen mode, increases to 2.2 times that demonstrates increase in a difference between values of height of a surface (z). The surface area of the bioprocessed fibers (S) increases to 4.5 times (in comparison with the area of a control specimen). The mean squared deviation of values z at initial fibers is 50% lower, than at the modified.

The destructive changes of a surface of the bioprocessed polyamide fibers can testify not only to a possibility of their destruction microorganisms, but also possibilities of use of the bioprocessed fibers with more developed surface as a part of composites.

Ecological biochemistry, physiology and medicine

ISOLATION OF VITEXIN AS NATURAL BIO-HERBICIDE FROM *LANTANA CAMARA* LEAVES

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'Yield maximization' is the last word of modern agriculture for food security of population of the world. Maximizing world's agricultural efficiency depends largely on controlling a variety of pests and diseases. Among pests, **weeds** have largest negative impact on crop productivity. Among main strategies used to control weeds (i.e., physical, mechanical, chemical and biological) the chemical method is most popular for decreasing negative effects of weeds in crops. But, herbicide-resistant weeds have been emerging due to extensive use of synthetic chemical herbicides, and public concerns over impact of synthetic herbicidal chemicals on environment and human health are increasing. Natural compounds, known as "**bio-herbicides**" pose a big area for environmentally safe herbicides, based on compounds produced by living organisms. In current study, crude methanol extract of invasive toxic plant ***Lantana camara*** leaves was prepared by cold maceration technique and was subjected to fractionation. Fractionation resulted in three organic (ethyl acetate, chloroform and n-hexane) and one aqueous fraction for the crude extract. Bioassays were performed at 10,000ppm, 1,000 ppm and 500ppm concentration against selected weed test species (monocot: *Avena fatua* and *Phalaris minor*; Dicot: *Rumex dentatus* and *Chenopodium album*). Chloroform fraction was selected on the basis for its highest herbicidal activity. Silica gel was used for column chromatography. Sample was loaded after adsorption on silica gel by making a uniform and even layer. Mobile phase of Hexane: Ethyl acetate (60:40) was used based on TLC profiling. A total of 31 elusions were collected in small column vials. They were left overnight to make them concentrated and were again subjected to Thin Layer Chromatography (TLC). Vanillin TLC stains was used for visualization purpose. Fractions with similar TLC pattern were combined and bio-assayed against radish seeds at 1mg/mL. Sub-fraction (iii) of fraction 23 showed highest growth inhibition therefore selected for further analysis. GC-MS (Shimadzu GC-MS-QP2010 ultra) with Helium gas as carrier was used to find out purity of compound and possible compound identification. GCMS analysis showed the compound as **Vitexin** ($C_{21}H_{20}O_{10}$) (flavone glucoside). To the best of our knowledge *Lantana camara* leaves have not been previously reported to possess flavonoid compound 'vitexin' and tested against weeds of wheat crop.

Ecological biochemistry, physiology and medicine

BIO-HERBICIDAL POTENTIAL OF *LANTANA CAMARA*

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Herbicide-resistant weeds have been emerging due to extensive use of synthetic chemical herbicides, and public concerns over impact of synthetic herbicidal chemicals on environment and human health are increasing. Natural compounds, known as "bio-herbicides" pose a big area for environmental safe herbicides. In current study, crude methanol extract of invasive plant *Lantana camara* was prepared by cold maceration and subjected to fractionation. Fractionation gave three organic (ethyl acetate, chloroform and n-hexane) and one aqueous fraction. Bioassays were performed at 10,000ppm, 1,000 ppm and 500ppm concentration against selected weed test species (monocot: *Avena fatua* and *Phalaris minor*; Dicot: *Rumex dentatus* and *Chenopodium album*). Chloroform fraction was selected based on its highest herbicidal activity. Sample was loaded after adsorption on silica gel by making a uniform and even layer to perform column chromatography. Mobile phase of Hexane: Ethyl acetate (60:40) was used based on TLC profiling using vanillin visualization stain. Fractions were combined and bio-assayed against radish seeds at 1mg/mL. Sub-fraction (iii) of fraction 23 showed highest growth inhibition. GC-MS (Shimadzu GC-MS-QP2010 ultra) with Helium gas as carrier showed the compound as Vitexin ($C_{21}H_{20}O_{10}$) (flavone glucoside) in the fraction. It is suggested to further analyze the action mechanism of isolated compound.

Ecological biochemistry, physiology and medicine

LEAD ION AS FACTOR MODULATING SEED VIABILITY OF TRESS

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Seed germination capacity is one of the most important traits necessary for plant development. In polluted area heavy metals like: lead, copper or cadmium may affect seed germination, mostly by reducing viability or complete blockage of germination. In consequences natural renewal of different plant, e.g., trees like *Pinus sylvestris* would be reduced, what is dangerous for proper functioning of ecosystems. We are still far from understood a germination processes and the role of heavy metals that could played in it. Goal of this study was to determinate the role of lead chloride and lead nitrate in germination of *P. sylvestris* seeds. We examine how different lead compounds (in various concentrations) affect germination capacity. Length of root, localization of reactive oxygen species, catalase activity and leakage of electrolytes were measured. Differences in germination dynamics, in accordance to concentration of lead compounds, selected through germination test, were observed. Lead compounds modulate the level of reactive oxygen species - superoxide anion monoxide and hydrogen peroxide. Analyses of root growth parameters showed that seed germination, as affected by different concentrations of lead compounds, is not correlated with formation a properly developed pine seedling.

Ecological biochemistry, physiology and medicine

WARM STRATIFICATION OF APPLE SEEDS LEADS TO ALTERATIONS IN BIOTIN CONTAINING PROTEINS LEVEL

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Apple (*Malus domestica* Borkh.) seeds germination is very slow due to the deep embryonic dormancy. Cold stratification of apple seeds breaks dormancy and stimulates germination. Contrary, warm stratification does not remove embryo dormancy. Furthermore, seedlings developed from such treated seeds are characterised by the presence of the morphological anomalies. Prolonged warm stratification stimulates apple embryos ageing. During ageing vigour and viability of seeds are reduced as degenerative changes (seed deterioration) occur. The marker of seed viability is the content of seed biotin containing proteins (SBP). During germination SBPs are degraded and serve as an important source of biotin. Protein degradation is regulated (among others) by ubiquitin-dependent pathway. Abnormal functioning of the ubiquitin-proteasome pathway leads to pathophysiological changes.

The aim of our work was to use warm stratification as a controlled deterioration treatment to examine the level of biotin containing proteins and ubiquitin marked proteins levels to evaluate the seed vigour loss during ageing. The estimation of biotin containing proteins and ubiquitin linked proteins levels were done using dot blot technique. Alterations in the level of biotin containing proteins as well as ubiquitin marked proteins in apple embryonic axes were dependent on the time of warm stratification.

This work was financed by grant Opus 12 2016/23/B/NZ9/03462 given by National Science Centre, Poland.

PLANT POLYPHENOLS REGULATE FUNCTIONS OF ISOLATED RAT LIVER MITOCHONDRIA AND PREVENT MITOCHONDRIA IMPAIRMENTS *IN VIVO* AND *IN VITRO*

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There is a strong interest to compounds of plant origin as potential medicinal agents due to their effectivity, safety and a wide range of biological activities. The aim of the present work was to evaluate the mitochondrial effects of plant polyphenols and terpenoids using isolated rat liver mitochondria *in vitro* and toxic liver damage in rats *in vivo*. Terpenoid ferutinn isolated from the plant *Ferula tenuisecta* considerably increased the permeability of artificial and cellular membranes to Ca^{2+}-ions. Ferutinin in a dose-dependent manner (5-27 μM) decreased the rate of ADP-stimulated oxygen consumption and resulted in uncoupling of respiration of isolated rat liver mitochondria. These effects depended on the presence of Ca^{2+}-ions in the medium. In the presence of Ca^{2+}-ions, ferutinin induced considerable depolarization of the mitochondrial membrane and permeability transition pore formation, the latter effect being inhibited by cyclosporin A. We confirmed that the mitochondrial effects of ferutinin were induced by stimulation of mitochondrial membrane Ca^{2+}-permeability as well as by transfer of other ions. The treatment of rats with cranberry flavonoids (7 mg/kg, 30 days) during chronic carbon tetrachloride-induced intoxication prevented mitochondrial damage, including fragmentation, rupture and local loss of the outer mitochondrial membrane. The treatment of rats chronically receiving ethanol (4 g /kg bw, 8 weeks) with cranberry polyphenols (daily, 4 mg /kg bw) partially prevented alcoholic liver damage, ameliorating steatosis and inflammatory signs in the liver, decreasing serum and liver triglyceride contents, and ALT and AST activities. The polyphenols restored mitochondrial functional activity in these animals, inhibited Ca^{2+} - induced mitochondrial permeability transition in the liver, free radical generation, and membrane lipid peroxidation. *In vitro*, cranberry polyphenols effectively scavenged different types of free radicals and prevented lipid peroxidation and glutathione oxidation and considerably prevented mitochondrial ultrastructure oxidative impairments. In conclusion, the hepatoprotective potential of polyphenols could be due to specific prevention of rat liver mitochondrial damage.

Ecological education for sustainable development

SUSTAINABLE CONSUMPTION IS THE WAY TO REDUCE THE AMOUNT OF SOLID WASTE

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Solid waste is a common problem for all countries in the world. It is a great environmental threat, which causes climate changes as well. We should admit that solid waste has an affect on water and air pollution. Everybody knows about the Great Pacific Garbage Patch, which is the largest accumulation of plastic in the ocean. In Ukraine, one person produces approximately 300 kg of solid waste in a year. The worst is that 98% of it is not recycled and is simply accumulate on the piles of garbage. Besides, in most rural areas of our country we do not have any garbage collection systems. We conducted a sociological research in Zhytomyr (Ukraine) that showed that only 3.5% of inhabitants understand the reason why garbage should be recycled. The rest of the respondents do not realize the necessity and throw all wastes in one dump. It has been proved, that the spread of sustainable consumption is a way to preserve the environment and improve the quality of life. Sustainable consumption is the use of goods and services that satisfy basic needs and improve quality of life with minimal use of natural resources and with the least damage to the environment. The main purpose is to draw attention to the problems of health and environment. We strongly believe that the main reason of the problem listed above is the lack of information. People do not realize the danger from the garbage that they produce every day. We can live without thousands of things that we buy (plastic packaging, bottles, disposable tableware etc.). Last year we started a “Climate Change Agents” campaign for 6-8 grade students, where we teach them the basics of sustainable consumption. They understand that the way of life can influence the future generations level of life. It was a great experience which we want to share. It is obvious that human kind must realize the responsibility for the impact of their activities on the environment. Promotion of sustainable consumption ideas among the population will achieve the goal.

Ecological education for sustainable development

VERTICAL AND HORIZONTAL CHANGES OF BACTERIAL ABUNDANCE AND ACTIVITY IN HAŃCZA LAKE (POLAND)

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The research was conducted in the late summer (beginning of September 2018) on the deepest, glacial reservoir in the central part of European Lowland Depression - Lake Hańcza. The aim of the study was to determine the level of diversity in bacterial occurrence, activity and the live to dead ratio (92 samples were collected from the thirteen stratified sampling points). The bacterial abundance ranged from 0.57 to 3.97 × 10^6 cells ml^{-1} and there was no uniformed pattern of spatial and vertical changes in the number of bacterioplankton. The highest abundance of bacteria has been noticed at two bay sampling points, both located in the south part of the lake, near the agroturism farm. However, some differences in the number of bacteria were recorded in the horizontal gradient ($F=1.865$; $p=0.170$). There were also no significant differences of bacterial activity and live to dead ratio between the stations and horizontal gradient. Our results indicate that the activity of bacteria can be affected by pH (0.510; $p<0.0001$), temperature (0.438; $p<0.0001$), SWWT (0.389; $p<0.0001$), SRFe (0.312; p=0,003), IC (-0.487; $p<0.0001$), TN (-0.486; $p<0.0001$).

Ecological education for sustainable development

INFORMING PEOPLE OF CLIMATE CHANGE: A TASK FOR THE ENVIRONMENTAL CONCERNED ORGANIZATIONS AND INITIATIVES

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A context of growing concern about climate change increased the number of different climate and environmental organizations and initiatives in Ukraine. The case of Zhytomyr shows that those initiatives are mainly represented by NGOs, individuals and research institutions. The purpose of the present study was to identify the main points that climate change related organizations and initiatives can develop to increase people's knowledge about the topic. Accordingly, we designed a questionnaire and got 385 valid responses. The findings can be used as simple pieces of advice for the organization and initiatives related to climate change. Information and education programs on climate change should be conducted to increase the level of ecological culture and awareness of the global problem. Such information support campaigns should include materials in the media, awareness-raising measures, educational materials and printed instructive material. Several areas of activity have been identified: savings and restrictions on the use of fossil fuels; informing about renewable energy sources; adoption and implementation of programs and projects in the area of energy efficiency and transition to RES. Thus, the activity of public organizations and ordinary citizens in the area of prevention and adaptation to climate change is increasing every year. Obviously, it is necessary to develop and implement an integrated approach to addressing the problem of providing information and education actions on a regular basis and involving all stakeholders in their implementation.

REVIEW OF DIFFERENT AGRICULTURAL MACHINERIES CHASSIS INFLUENCE ON SOIL COMPACTION AND ENVIRONMENTAL POLLUTION

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Soil compaction due to uncontrolled field traffic and using heavy machinery is most common degradation type for Europe. Nowadays, world organizations such as the UN are paying more and more attention to it. And it's very helpful. Also, compacted soils have negative effect to environment, for example it can lead to erosion, landscape degradation, additional air and water pollution. Reviewing and analyzing the information sources on the effects of various wheels and tracks on soil compaction and environmental pollution is basic method of this study. Chassis type and others parameters of agriculture machinery has a significant impact to soil and it degradation processes, for example compaction. Soil compaction after using different tracks and wheels is not the equal, it can be concluded after comparing various research result. Soil stress modeling or direct measurements are used to evaluate compaction. Modeling shows well the tendency to spread stress, but usually only vertical stress is evaluated. According to different studies soil stress for close soil moisture, close soil structure, at various depths. For 0.15 m single wheels has vertical stress 150 kPa, dual − 80 kPa, rubber tracks − 60 kPa. The trend persists with increasing depth, confirmed by other experiments measuring or simulated.

SIMPLE AND FAST METHOD FOR DETERMINATION OF TRACE CADMIUM IONS IN ENVIRONMENTAL WATER SAMPLES CONTAINING HUMIC SUBSTANCES

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The increasing concentration of heavy metals in natural waters is one of the most important elements of environmental contamination and may have a negative effect on living organisms and plants if they are present in concentrations above norm. One of such metals is cadmium, which as a result of human activities has become the main chemical pollution of the environment, because it is used in various branches of industry and in agriculture. Therefore, there is a constant need for simple, cheap and fast methods to determine the lowest concentrations of cadmium in environmental waters. One of the techniques that meets all these requirements is stripping voltammetry. This method, however, has a disadvantage related to interferences caused by the presence of humic substances (HS) in the environmental waters. Therefore, the aim of this work will be to present a fast and simple method of determining the trace of cadmium ions in waters containing HS. In order to reduce the interference associated with the presence of HS, it was proposed to introduce Amberlite XAD resin into the measuring cell. In this case, HS present in the analysed sample do not block the working electrode on which cadmium determination takes place because they are adsorbing on the resin. Optimization of the proposed procedure was aimed at choosing a number of parameters for obtaining the most efficient removal of HS by means of a resin and at the same time quantitatively leaving cadmium ions in solution. The following parameters were selected: supporting electrolyte composition, the ratio of the resin mas to the volume of the sample, the time of mixing the resin with the sample. The proposed procedures was tested for Cd(II) determination in river water samples collected from eastern areas of Poland which were additionally enriched in HS. The successful practical application of the proposed procedure appears to be promising for their adoption to environmental waters monitoring.

ASSESSMENT OF THE POTENTIAL TO BIOACCUMULATION OF IONIC LIQUIDS USING HUMAN PLASMA PROTEINS

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Ionic Liquids (ILs) is a large group of chemical compounds consisting only of ions. ILs have a unique properties such as negligible vapor pressure, excellent thermal stability and low melting point. These special properties caused that ILs have a big application potential and they can therefore easily get into the water or soil environment as post-production waste or as a result of uncontrolled spills. Therefore, it is extremely important to determine their impact on individual components of the environment. Although there is evidence of their toxicity, there is still little data on their potential for bioaccumulation in living organisms. Therefore, the aim of this work is to evaluate the affinity of selected cations and anions of ionic liquids to blood proteins. Human Serum Albumin (HSA) and Alpha-1-acid Glycoprotein (AGP) were selected as model proteins. In order to assess the potential to bioaccumulation of selected compounds, two techniques were used : ultrafiltration and commercially available TRANSIL test kits. Unbound fraction was analyzed by using the HPLC-DAD. On the basis of the results obtained, the amount of ionic liquid that was attached to the protein was determined. The obtained results indicate that some cations and anions of ionic liquids show high affinity to the protein, what may indicate that when they enter the body they can be distributed along with the blood to various tissues and organs, which may translate into their potential for bioaccumulation. Nevertheless, it is necessary to conduct further research aimed at a thorough explanation of what is happening with ionic liquids after they enter the environment, because they undoubtedly have effect on living organisms.

The research is financed by the National Science Center as part of the scientific grant no NCN/2016/23/6/ST5/04245.

Good practice in monitoring of environment pollution

METHODS FOR DETERMINATION OF CHROMIUM FORMS IN WASTEWATER AND SOIL

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Chromium occurs in the environment mainly in the form of compounds on the +III and +VI oxidation states, which differentiate in terms of chemical properties, biological and toxicological effects on living organisms. Cr(III) is considered to be essential for the proper functioning of living organisms, while Cr(VI) possess carcinogenic and mutagenic properties. In order to protect the human health and the environment, the maximal concentration of total chromium and its toxic form (Cr(VI)) in drinking and surface water, wastewater and soil, is regulated by legal acts. To meet the obligation to control chromium levels in the environment, it is necessary to use sensitive analytical methods. In this work new methods based on solid phase extraction (SPE) and flame atomic absorption spectrometry (FAAS) were developed for the determination of chromium in wastewater samples. For the separation and enrichment of Cr(III) form, ion imprinted polymers (IIP) were designed and synthesized on the basis of the modern concept of ionic recognition. The parameters that affect the retention and elution efficiency of Cr(III) were optimized in dynamic mode. For determination of chromium forms in soil, alkaline extraction procedure using Na_2CO_3 solution was optimized. To identify chromium forms in soil extracts, a liquid chromatography (HPLC) coupled on-line to inductively coupled plasma mass spectrometry (ICP-MS) was used. All developed methods were validated with the use of certified reference materials of wastewater RES 10.2, RES 25.2 and soil CRM041, and were successfully applied for analysis of environmental samples. The concentration of chromium in treated municipal wastewater from Białystok plant was below detection limit of developed methods. The presence of a small amount of the toxic form of Cr(IV) in relation to the total chromium content was found in soil collected from a contaminated area of an old tannery.

Good practice in monitoring of environment pollution

BIOCONCENTRATION ASSESSMENT *IN VITRO* : MEMBRANE PARTITIONING OF IONIC LIQUID CATIONS

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Accumulation of anthropogenic chemical substances in aquatic organisms is a major issue from the point of view of environmental protection. However, existing estimation methods such as the octanol-water partition coefficient are questionable. Current studies suggest that ionic compounds may accumulate on a much larger scale than previously predicted. It is therefore necessary to use more advanced methods in the risk assessment. In vitro testing with artificial biological membranes may be a good solution. One of the tools used for this purpose is solid supported lipid membrane (SSLMs). Among the ionic compounds, the production of which is rapidly increasing, ionic liquids should be distinguished. So far, however, little is known about their potential accumulation in the environment. Therefore, the aim of this study was to assess the potential for bioconcentration of selected cations of ionic liquids using SSLMs. The experiments were conducted using SSLMs commercially available under the trademark Transil. Stock solutions of selected ionic liquids were added to the tubes containing SSLMS and PBS buffer to a final concentration of tested compound of 10-50 μM. After 30 minutes of incubation, the samples were centrifuged and then the concentration of the compounds in the supernatant was determined via HPLC. The obtained results were used to calculate the liposome-water partition coefficient. In the present study it has been observed that organic cations of ionic liquids may show significant affinity to biological membranes, and the main factor influencing the potential for bioconcentration is their hydrophobicity. Nevertheless urther testing with artificial biological membranes and confirmation of the results with *in vivo* measurements are necessary and will allow for a better estimation of the potential for bioconcentration of ionic compounds.

The authors would like to acknowledge the financial support of the National Science Centre (Poland) under decision NCN2016/23/G/ST5/04245.

Good practice in monitoring of environment pollution

BIOCHEMICAL PARAMETERS IN THE SYSTEM MONITORING OF SOIL

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Enzymatic activity of soils is used in the evaluation of fertility, humus content, pollution degree, serves as an indicator of microbiological activity and one of the criteria of biological state of soils.

Studies of enzymatic activity (catalase, dehydrogenase, polyphenoloxidase, peroxidase, invertase, phosphatase, protease) were carried out on sod-calcareous and sod-podzolic soils with different anthropogenic load (meadow, forest, arable field, urban ecosystem) (Grodno region, Belarus).

Indicators of enzymatic activity to varying degrees are suitable for use for soil monitoring. The diagnostic efficiency of the following enzymes for the evaluation of sod-carbonate soils parameters was revealed: invertase activity – humus content (for all subtypes, R^2=0.60–0.97), polyphenol oxidase activity – humus content (for all subtypes, R^2=0.63–0.94), on the basis of which the indication scales were developed. For the least transformed sod-carbonate soils additionally: phosphatase – provision of mobile forms of phosphorus (R^2=0.99), protease – provision of easily hydrolyzed nitrogen (R^2=0.94).

To assess the conditions of humus accumulation, a conditional coefficient based on the indicators of enzymatic activity (the ratio of polyphenoloxidase activity to peroxide activity) and a five-step author's scale were used. It was found that this figure is reduced there is an increase in promoting human influence different types (plowing, gas and dust emissions of the cement plant, the number of transport stream).

A summary of indicators for integrated assessment of soil condition is used an integral index of soil biological activity, for calculation of which is taken seven soil katalytic activity of humus horizons. The modified scale for determination of their ecological state is offered.

INFLUENCE OF FUNCTIONAL GROUPS OF POLYSTYRENE-DIVINYLBENZENE ADSORBENTS ON THE EFFECTIVENESS OF ACID DYE REMOVAL

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Unfavourable changes in physical and chemical properties caused by the presence of toxic organic and inorganic compounds have contributed to the tightening of water pollution regulations. As a consequence, this contributed to the search for effective methods of their removal from wastewaters. Dyes containing sewages occur in many branches of industry, and most of them come from the textile industry (about 22%). A small amount of dyes present in water causes its clouding and at the same time giving it an invisible look and disrupting all biological processes. Adsorption is one of the most frequently used methods of removing pollutants from the environment. This is due to the wide availability of sorption materials, the possibility of their modification and regeneration and which is important, the relatively low price.

The aim of the paper was to examine the possibility of removing cochineal red A from aqueous solutions using the polymer sorbents with a polystyrene-divinylbenzene matrix (Fig.1). The adsorbent lacking functional groups as well as with the tertiary amino groups were selected for the research. Determination of kinetic adsorption parameters was a particularly important stage of the research. The most frequently used empirical expressions describing the kinetics of dyes adsorption on sorbents include the following equations: pseudo-first order equation (PFO), pseudo-second order equation (PSO) and intra-particle diffusion (intragranular).

a) b)

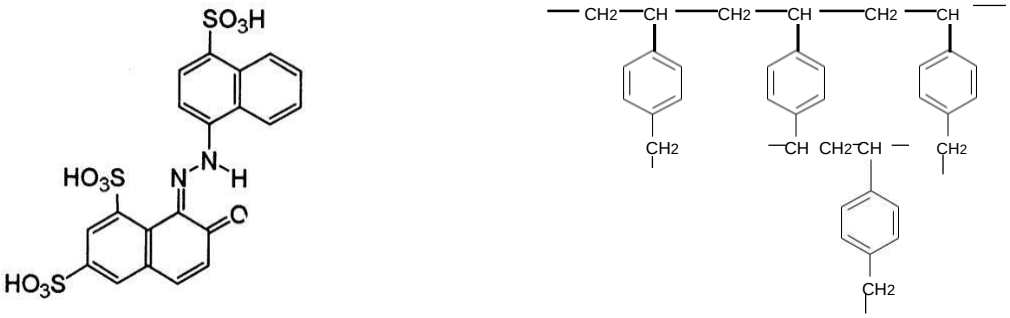

Figure 1. Structural formulae of dye (a) and polystyrene-divinylbenzene matrix (b) sorbents.

Good practice in monitoring of environment pollution

BIOCONCENTRATION AND MTABOLISM OF DICLOFENAC BY MYTILUS TROSSULUS

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Interest in the presence of pharmaceuticals in the aquatic environment has been growing for more than 20 years, but there is still not enough studies on the kinetics of these compounds in the marine organisms. One of the most frequently detected groups of pharmaceuticals in aquatic ecosystems worldwide, are NSAIDs (Non-Steroidal Anti-Inflammatory Drugs). NSAIDs are the most frequently sold over the counter and consumed pharmaceuticals. Of this group, diclofenac is the most frequently detected drug in the aquatic environment. This compound is characterized by high persistence and toxicity to terrestrial and aquatic organisms, therefore it was included in the European monitoring list of surface waters according to the Water Framework Directive. The aim of our work was to determine the bioconcentration and metabolism of diclofenac by *M. trossulus* from the Baltic Sea. The experiment was conducted for 10 days. The mussels were exposed to diclofenac at a concentration of 133.33 μg/L for five days, following a five-day depuration phase. The aim of this experiment was to evaluate the bioconcentration and metabolism of diclofenac, as well as the impact of diclofenac on the condition of the model species. Our research has shown that *M. trossulus* mussels have the ability to absorb diclofenac directly from the water, as indicated by the presence of pharmaceutical in mussel tissues. It was also observed that exposure time affects the bioconcentration of diclofenac in *Mytilus trossulus* tissues. Diclofenac also affected the condition of mussels during the purification phase. Moreover, this study has revealed that mussels metabolize diclofenac to 4-OH and 5-OH diclofenac. So far, there are only few studies on the metabolism of diclofenac and other pharmaceuticals in marine organisms. This work has provided a more in-depth look at this aspect, which is extremely important for the protection of the marine environment.

ALL SOLID STATE ION-SELECTIVE ELECTRODE FOR LEAD MONITORING IN THE ENVIRONMENT

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Lead is a very strong poison that is one of the environmental pollutants and tends to accumulate in organisms and ecosystems. Exposure to this element even at a low level causes adverse effects on human health. Lead is an inhibitor of hemoglobin synthesis and shortens the life of erythrocytes, resulting in anemia. It has a detrimental effect on the functioning of the central nervous system, it can lead to brain edema, degeneration of nerve cells and the death of nerve cell cells. Due to the harmful effects of lead, it is very important to monitor its content in the natural environment. It is present in air, soils and natural waters. In the environment, lead occurs primarily as inorganic Pb (II) which can be readily detected and quantified potentiometrically with ion-sensitive electrodes sensitive to lead ions. In this paper new all solid state lead ion-selective electrode (ISE) is presented. This type of ISEs has numerous advantages including simple construction, small size, low cost of production and mechanical resistant. Moreover ISEs with solid contact are desirable from practical point of view because they can have any shapes, they can work in any position and in high pressure environments. Proposed Pb-ISE was prepared by the simple drop casting of membrane cocktail on the surface of inner glassy carbon electrode. Electrode membrane apart from conventional components such as polyvinyl chloride, plasticizer and ionophore contained additionally multiwalled carbon nanotubes(MWCNTs) and ionic liquid (IL). Such membrane modification has a positive effect on the sensors performance. The electrode with a modified membrane was characterized by lower detection limit and better selectivity in relation to sodium, potassium and calcium ions than the electrode having membrane with classic composition. It also exhibited good potential stability and reproducibility.

SUSTAINABLE WATER RESOURCES MANAGEMENT AND MONITORING OF THE LAKE BELOE ECOSYSTEM IN THE REPUBLICAN LANDSCAPE "OZIORY" (GRODNO REGION, BELARUS)

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Under the conditions of intensive technogenous load, the problem of monitoring and adequate assessment of the aquatic environment quality, without which it is impossible to effectively manage water resources, acquires particular urgency. Recently, there is a strong anthropogenic impact on water bodies surface. Lake Beloe is the largest natural reservoir in the Grodno region and the largest lake in the Republican landscape reserve «Ozery»lake system. On the shore of the lake is the Oziory agro-town with a population of more than 3,000 inhabitants. This territory is visited annually by a large number of tourists. In addition, the P-145 motorway with heavy traffic passes near the lake. Water entering the lake from the motoway is polluted with oil products, engine oils, heavy metals, salts, etc. The aim of the work was a comprehensive monitoring of the Lake Beloye ecosystems of the Republican landscape reserve "Oziory" to conduct and places where pollutants enter the water body to identify. For the monitoring and ecological status of Lake Beloe study, 4 sampling plots (SP) were chosen. Sampling for monitoring the hydrochemical parameters of the Beloye Lake surface waters was carried out three times at four monitoring points in April 2018. 17 indicators were evaluated: pH, BOD, dry residue, ammonia, COD, petroleum products, synthetic surfactants, polyphosphates, nitrites, nitrates and a number of heavy metals. Hydrochemical indicators complex monitoring at sampling plots made it possible to pre-assess the aquatic environment quality. Thus, in particular, the value of the BOD_5 indicator, which is considered as the main indicator of the reservoir contamination overall degree, exceeds the norm at SP1 (4.73 mg / dm3) – the reservoir is dirty. The water at the sampling plots SP2, SP3, SP4 is polluted (BOD_5 values are 3.83; 3.87; 3.77; the norm for BOD_5 is 4). At SP1 an increased content of manganese and a number of other indicators also noted. Also here there is a significant amount of coastal plants such as cattail and reed. This creates a specific buffer zone for collecting pollutants and petroleum products. They are collected on the coast and accumulate in the soil, which was confirmed by the soils chemical analysis data on sampling plots (exceeding the UC for oil products). Biological monitoring included 3 hydrobionts sampling at each sampling plot with a water net. To assess the aquatic environment quality, the Mayer index was calculated. Indicators of water purity are mayfly larvae, megaloptera larvae, caddisflies larvae and bivalve mollusks. In our collections there are representatives of different indicator groups. The presence of organic pollution in varying degrees on all sampling plots was revealed. But taking into account the catchment pollutants area, the most vulnerable to anthropogenic pollution are biotopes at SP1. Thus, studies have shown that in order to maintain the stability of Lake Beloe aquatic and riparian ecosystems, the installation of a sand-oil separator system at SP1, where the pollutants are directly washed off the road, is necessary. As a result of monitoring, in 2019, it was decided to develop and install a combined sand-gas-oil separator at SP1, which is designed to trap petroleum products and fine mechanical impurities of mineral origin. This installation was specially designed to accommodate its placement in a specially protected natural area («reserve» status). Thus, the concentration at the entrance: petroleum products, mg / l – 40, suspended solids, mg / l –600; whereas the concentration at the exit:

petroleum products – no more than 0.05, suspended solids – no more than 10. This installation the ingress of pollutants into the pond prevents.

The studies were carried out with the financial support of the Coca-Cola Foundation and the Global Water Problem under the New World Program.

Rational use of land resources and reclamation of polluted lands

DEVELOPMENT OF BIOREMEDIATION TECHNIQUES FOR POLYCYCLIC AROMATIC HYDROCARBONS (PAHS) ALONG GUJARAT COASTLINE

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This study is certainly the first report for the development of bioremediation strategies at polycyclic aromatic hydrocarbons (PAHS) contaminated sites along Gujarat coast line. The study reveals astounding concentrations of chemical pollutants in the marine sediments of different ports along Gujarat coastline. These observations are of high concern to address biological risk to marine biota. PAHs concentrations in surface sediments of were recorded to be relatively high in comparison to other coastal areas worldwide. Human health and ecological risk assessment clearly indicated sites to be at a higher risk which can have adverse effects on human health and marine biota. Multiple PAHs degrading bacteria were isolated from contaminated site *viz*. *Stenotrophomonas maltophilia,* mixed culture of *Stenotrophomonas maltophilia, Achromobacter mucicolens* and *Bacillus campisalis* and developed enriched native microflora which could be emerging players for bioremediation of PAHs contaminated sites. The fabricated CCD-RSM model for optimization of medium components successfully rendered enhanced biodegradation of multiple PAHs by *S. maltophilia*, mixed culture and enriched native microflora. The comparative predictive potential of ANN over RSM as a bioprocess modelling tool would surely encourage the scientific community to extensively explore the salient features of ANN over traditional RSM analyses. Microcosm and mesocosm studies revealed multiple PAHs degradation potential with pure single strain, mixed culture and enriched native microflora, making sediment remediation a feasible approach for enhanced biodegradation. Changes in bacterial community structure during bioremediation provide insights of the major participating bacterial communities in the bioremediation which can be important for restoration of PAHs contaminated sites.

Rational use of land resources and reclamation of polluted lands

RARE EARTH ELEMENTS RECOVERY FROM DIFFERENT WASTE SOURCES

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Rare earths elements (REEs) include 15 elements from the periodic table known as lanthanides as well as yttrium and scandium. They are usually divided into three groups except Pm and Sc: a) light rare earth elements (LREEs) - La, Ce, Pr and Nd, b) medium rare earth elements (MREEs) - Sm, Eu and Gd as well as c) heavy rare earth elements (HREEs) – from Dy or Ho to Lu and Y. Due to their unique magnetic, optical and electrical properties they are critical materials in high technologies. Therefore nowadays the recovery of rare earth metals from secondary sources, such as waste electronic and electrical equipment (WEEEs) as well as mine coal combustion products (CCPs) and acid mine drainages (AMDs) is of great interest. It should be emphasized that large contents of REEs as well as recovery of REEs from coal combustion products can reveal advantages over traditional rare earth mining. The aim of the paper was to study possibilities of recovery of metal ions contained in WEEEs e.g. Ni-MH cells liquors through their adsorption on the low cost adsorbents and ion exchangers. Among them special attention was paid to La, Ce, Nd, Pr as well as Fe, Ni, Co. Kinetic studies and equilibrium adsorption experiments were taken into consideration to acquire kinetic parameters, saturated adsorption capacity and Gibbs free energy change by the static method. The spent Ni-MH batteries were from POLBlume (Poland). The contents of La, Ce, Nd, Pr ions in the liquor samples after acidic leaching were determined using inductively coupled plasma optical emission spectroscopy (ICP-OES) (Varian Model 720, Australia). The contents of Fe, Ni and Co as well as Cu and Zn ions in the aqueous solution were determined using the fast sequential atomic absorption spectroscopy (Varian SpectrAA 240FS, Australia) operating with an air-acetylene flame. The laboratory shaker Elpin+ type 357 (Poland) was used in the experiments. A PHM 82 laboratory pH-meter (Radiometer, Copenhagen) was used for measuring the pH values. The use of REE alloys in the nickel-metal hydride (Ni-MH) batteries is based, among others, on their hydrogen storage properties. As they are expensive, lanthanum is partly replaced by Mischmetal (mixture of rare earth elements such as Ce, La, Nd, Pr and in smaller quantities of Sm, Tb and Y). Nickel is usually substituted by Al, Mn, Cr, Fe, Co, Cu or Si. Recycling processes of spent batteries in Batenus (Pira GmbH,

Gremany), Recupyl and POLBlume (Poland), Recyctec (Jönköping, Sweden) and Revatech (Belgium) after the pre-treatment and separation steps is followed mainly by the hydrometallurgical processes by dissolving the electrode powders in mineral acids, such as H_2SO_4, HCl, and HNO_3. Next metals are separated from one another at appropriate pH of the solution, adding reaction agents to precipitate metallic salts or by solvent extraction (SE) and/or ion exchange (IX). In our studies the multi-component solutions were treated in three steps: 1) to remove Fe and Ni - using 10 wt% NH_3 OH solution at room temperature and oxalate precipitation, 2) to remove residues of Fe and Ni using SE using D2EHPA and 3) to separate Ln ions using ion exchange process. Therefore the optimum parameters for the leaching step are directly utilized in the preparation of solutions for the separation process of individual lanthanides. To this aim zeolites and ion exchangers were applied.

The financial support from the National Centre of Research and Development (Poland) within Project No. POIR.04.01.01-00-0040/17-00 is acknowledged.

Rational use of land resources and reclamation of polluted lands

RECOVERY OF ZINC AND IRON FROM METAL-CARRYING SLUDGE WITH THE APPLICATION OF HIGH-TEMPERATURE REDUCTION, WHERE SELECTED SOLID CARBON REDUKTORS AND HYDROGEN ARE USED

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Rising prices of natural resources, with their excessive use, limited surface areas on which metallurgical waste can be stored (increase in disposal prices), and the negative impact of heavy metals on the natural environment causes the problem of their recycling is an area of interest for the steel industry around the world. Post-production pollutants, including metal-carrying sludges, are a by-product of pyrometallurgical processes. Considering their elemental composition, including the content of valuable metals, metallurgical sludge could become their alternative source. In the case of processing metal-carrying sludge, all technologies based on processes where high-temperature smelting furnaces are used. In these furnaces, oxide forms of metals such as Zn, Pb and Cd are reduced. Under the influence of high temperature thes metals are evaporated and then re-oxidized above the batch layer. This results in separation of some metals from the rest of them included in the waste being processed. The study investigated the possibility of using solid-carbon reducers (coke oven dust and charcoal) as well as a gas reducer

- hydrogen in Zn and Fe recovery processes from zinc-bearing waste sludges. It has been checked how their presence affects the level of extraction of these metals from the tested material. The reduction process was carried

out at two temperatures of 900^{O}C and 1200^{O}C. The time of keeping the sample in the furnace heated to the set temperature was always 30 minutes. The contrecation of Zn and Fe in the material before and after the reduction process was checked by using flame atomic absorption spectrometry (FAAS). The amount of solid reducer added

to the sample ranged from 0÷0.5g, while for gas reduction, gas mixtures of 80% H_2 and 20% Ar were used. The tests carried out show that the use of a hydrogen gas reducer significantly improves the separation of Zn from Fe at a lower temperature. With constant reducers it is necessary to use a high temperature regardless of the amount of reducer added.

Rational use of water resources and wastewater treatment

SOLID-LIQUID SEPARATION IN THE ACTIVATED SLUDGE PROCESS AND FILAMENTOUS BACTERIA

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In the wastewater industry, the successful operation of the activated sludge process relies on the physical characteristics of the activated sludge flocs, many of which relate to the growth of filamentous bacteria. The size and morphology of floc particles determine the settleability of the flocs in the secondary clarifier. The compressibility of the floc material also affects the subsequent dewaterability. Filamentous bacteria influence these properties, together with the extracellular polymeric substances and floc-forming bacteria (zooglea); these three factors therefore impact on the efficiency of the waste water treatment process. Excessive filamentous growth interferes with the solid-liquid separation process by producing a sludge that settles slowly and compacts poorly, commonly referred to as filamentous bulking. Excessive growth of filamentous bacteria can result from operational changes or changes to influent composition. One of the most frequent causes of filamentous bulking is low dissolved oxygen concentration in the aeration tank. The aim of this study was therefore to investigate the role of filamentous bacteria on the settling and compacting properties of activated sludge at different technological modes of aeration at urban sewage treatment facilities. The total filament length and sludge flake area at microscopic image have been applied to investigate the relationship between filament bundance and settling characteristics at aerobic and anoxic conditions. We established a low probability of filamentous bulking in the aeration tanks with the release of a central anoxide zone. However, they form fine dispersed flakes with low sedimentation properties, and as a result, the sludge index increases. The instability of the enzymatic activity of the sludge was detected in aerotanks with tubular aerators located on the bottom with the aerator arm in the center.

Sustainable use and protection of flora and fauna

CITIZEN-SCIENTIST EFFORT TO MONITOR LARGE CARNIVORES IN LITHUANIA

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Wolf management policy in Lithuania has generated disagreement among wolf conservationists, stakeholders, officials and scientists. In the first wolf conservation plan of 2012, a figure of 250 individuals was set as a favorable population status. In 2018, this was modified to 31–62 breeding families (250–500 individuals) ranging over 60% of the country. The modified plan did not include input from hunters and farmers. We summarize results of a citizen-science project to monitor large carnivores in 2015–2018, a period when conventional snow-based survey methods were not conducted. We collated records of carnivores based on carcasses, photographs/videos of animals, tracks, scats, kills (livestock and wild prey) and vocalizations. Of 1025 reports on wolves (2020 individuals), most were of tracks (532 cases), while wolves were seen in 283 cases, scats in 78 cases, livestock kills in 103 cases and wild prey kills in 25 cases. The mean number of wolves per observation increased steadily from 1.59 in 2015 to 2.30 in 2018. From the collected data, the approximated population size in 2016–2018 was in the range of 400– 500 individuals, this substantially larger than official survey data. Hunters and farmers (n = 80 and 60 respectively) expressed disagreement with the management plan both in terms of population size and range. According to hunters, a favorable population status should be less than 180 individuals ranging over 40 % of the country, while farmers consider a favorable population status to be < 100 individuals (or 10 family groups) over 20 % of the territory. Nearly 60% of respondents of both groups indicated that their opinions were ignored and only 3% thought their opinions were considered by the Ministry of Environment. In conclusion, we found that citizen science information suggested that the population of wolves in Lithuania was substantially greater than official estimates. In such case, current wolf hunting quotas could result in increased wolf numbers.

Sustainable use and protection of flora and fauna

DOES THE CHEQUERED BLUE BUTTERFLY (*SCOLITANTIDES ORION*) HAVE A CHANCE TO REMAIN IN POLISH FAUNA? – GENETIC ANALYSIS OF ENDANGERED POPULATIONS

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Nowadays, the disappearance of many butterfly species is observed in Europe and the main reason of that situation is the loss of natural habitats and their fragmentation, resulting from the processes of natural succession and human activities. A good example is a situation of the chequered blue butterfly (*Scolitantides orion*) in Poland. This xerothermophilous insect is considered as critically endangered in Poland and has survived only in a few localities. Therefore, the knowledge of its genetic population structure is extremely important. We sampled two largest populations of the chequered blue butterfly, inhabiting the Vistula valley near Kazimierz Dolny, but on the opposite banks of the river. Genetic analyzes were carried out on small wing pieces of 65 individuals. A variety of genetic markers (fragments of mitochondrial *COI* and *NADH* genes and nuclear gene sequences of *Wgl* and *EF1a*, and seven highly variable microsatellite DNA loci) were used to determine the level of genetic variation of the studied populations, the degree of genetic diversity between them, and to detect immigrant individuals. Analyzes revealed that genetic variation is low in both of the studied populations but higher in the sample came from the eastern bank of the river. Similarly, the genetic differentiation between two localities was low. It could suggest the existing gene flow, despite the Vistula river as a geographic barrier. According to the dominant wind direction in this region we hypothesize that occasional migration of individuals occurs more frequently from the west to the east. It may also contribute to a better genetic condition of the population located to the east bank of the river. This study may help to create an appropriate and effective plan for the species protection in the future.

THE DISTRIBUTION OF ANURAN LARVAE AND INVERTEBRATE PREDATORS BETWEEN OPEN WATER ZONE AND COMPLEX HABITAT UNDER PREDATION PRESSURE OF FISH

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Fish is known for its strong top-down impact on freshwater communities. Both tadpoles and predatory invertebrates are endangered by fish. Tadpoles, additionally, are the prey of many predatory aquatic invertebrates. We studied the spatial distribution of Anura tadpoles and their invertebrate predators (Anisoptera larvae, Dytiscidae larvae and imagines) between open water zone as a simple habitat and emergent aquatic vegetation (helophytes) as a complex habitat in the presence and absence of fish (Cyprinidae) in ponds. Amphibian species trapped in the ponds were fish-intolerant anurans: Pelobates fuscus, Hyla orientalis, Rana spp., Pelophylax spp., Bombina bombina, Pseudepidalea viridis and fish-tolerant Bufo bufo. The most widespread anurans were B. bufo, recorded from 25 (71%) ponds, P. fuscus - 23 (66%) ponds, H. orientalis - 16 (46%) ponds, and Rana frogs - 15 (43%) ponds. The total densities of fish-intolerant anurans were significantly lower while those of fish-tolerant B. bufo higher in ponds with fish compared to fishless ponds. The total densities of invertebrate predators were not affected by fish presence/absence in the ponds. The densities of all three investigated groups showed a positive interaction between fish presence and the use of complex habitat. We found a strong influence of fish on the distribution of invertebrate predators and tadpoles between pond habitats. So, tadpoles shifted to littoral vegetation in the presence of fish which may put tadpoles at greater risk of being killed by invertebrate predators, also confined by fish to the complex habitat. On the other hand, fish can indirectly mitigate invertebrate predation on tadpoles by intraguild predation, as well as disturbances or reduced invertebrate activity in the presence of fish. Nevertheless, maintenance of vegetated habitat may be a crucial management action of waterbodies to support amphibian abundance and diversity.

Sustainable use and protection of flora and fauna

LOW LEVELS OF DIFFERENTIATION WITHIN EUROPEAN PHYLOGENETIC LINEAGE OF MOOSE, *ALCES ALCES* INFERRED FROM COMPLETE MITOGENOMES ANALYSIS

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Mitochondrial DNA is a phylogenetic marker for inferring the evolutionary and demographic past of both populations and species. The mammalian mitochondrial genome consists of a circular, double-stranded DNA molecule that is typically ~16 kbp in length. Although, mitogenome sequences are often the ideal tool in studies of species where there is little or no previous mtDNA data available, the phylogenetic studies based on them are still rare. In our study we used genetic material from seven moose (*Alces alces*), belonging to all evolutionary lineages of this species occurring in Poland: clade Ural, Biebrza and Fennoscandia branches representing the clade Central Europe. Using 25 different pairs of primers we sequenced complete mitochondrial genomes of moose. We conducted the first full sequencing, to our knowledge, of mitogenomes from moose representing the European evolutionary lineage of this species. Among the seven studied mitogenomes (16 416 bp) we found only 89 segregating polymorphisms, including 85 transition and 4 transversion. Analysis of distribution of nucleotide diversity revealed a very high proportion of invariable sites in moose mitogenomes. Our results based on complete mitogenomes confirmed previous reports, which analyzed only smaller mtDNA regions such the D-loop, about limited diversity, recent divergence of lineages and in general not long evolutionary history of *Alces alces*. McDonald-Kreitman test showed no significant effect of natural selection in shaping the variability in moose mitogenomes. We conclude that the most important factor that shaped the current genetic structure of moose in Poland was post-glacial recolonization from different glacial refugia.

Sustainable use and protection of flora and fauna

MYCOTROPHICITY OF PLANTS F. ERICACEAE IN MARSHY PINE FORESTS (LANDSCAPE RESERVE «OZYORY»)

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Ericoid mycorrhiza expands the adaptive abilities of plants of the family Ericaceae, that allows them to grow on relatively poor soils and dominate in marsh cenosis. We studied the mycotrophicity of three species of plants of f. Ericaceae in a marsh pine forest on five test areas. The frequency of occurrence of ericoid fungi on the roots of Vaccinium uliginosum L. varied from 5,1 to 8,9%, Ledum palustre L. – 4,3-6,0%, Oxycoccus palustris Pers. – 5.3-8.1%. The intensity of mycorrhization of Vaccinium uliginosum was 2,8-4,4%, Ledum palustre – 2.5-3.9%, Oxycoccus palustris – 3.3-4.1%. We identified ecological regimes (phytoindication according to D.N. Tsyganov (1983)), hydrochemical parameters of water (salinity, pH, hardness, chromaticity), the number of bacteria and microscopic fungi, diversity microscopic fungi (Shannon index) in peat, peat catalase activity on the sample areas. We found that environmental factors (soil richness in nitrogen (NT), soil fertility (TR), continental climate (KN)) and water chromaticity in the swamp result in the increase in the degree of mycorrhization of Oxycoccus palustris. The formation of mycorrhizal symbiosis in Vaccinium uliginosum was positively influenced by hydrochemical parameters of water (salinity, hardness, chromaticity), ecofactors (thermoclimatic factor (TM), moisture variability (FH)), a variety of microscopic fungi in peat, negative – catalytic peat activity and quantitative content microscopic fungi. Ledum palustre's microtrophycity was positively influenced by tree stand density, peat catalytic activity, thermoclimatic factor (TM), climate continentality (KN), soil moistening (HD), soil fertility (TR), light intensity / shading (LC), soil richness in nitrogen (NT). Thus, on the mycotrophycity of plants f. Ericaceae to varying degrees influence the environmental, hydrochemical and microbiological indicators of their places of growth.

Poster presentation

P 01

Ecological biochemistry, physiology and medicine

COMPARSION OF GROWTH AND CAULOGENESIS OF TWO VARIETIES OF FLAX (*LINUM USIATATISSIMUM* L.) CULTURED *IN VITRO*

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Flax plants have been the subject of many applied and basic research in a plant cell and biotechnology studies in recent years. *In vitro* regeneration response in terms of the number of produced shoots is an important factor determining the success of plant micropropagation. The caulogenic ability of hypocotyl explants of oil and fibre flax in different media, supplemented with plant growth regulators, was investigated in this study. Hypocotyl explants of 7-day-old seedlings of oil flax (*Linum usitatissimum* L., cv Szafir) and fibre flax (cv Selena) were cultured on Murashige and Skoog (MS), Gamborg (B5) and MS+B5 (macronutrients + micronutrients and vitamins) medium. The caulogenic effect of various plant growth regulators (PGRs): benzyloaminopurine (BA), kinetin, tidiazuron and 2,4-dichlorophenoxyacetic acid (2,4-D) was also tested. Cultures were incubated for 28 days in a growth chamber under controlled conditions. CO_2 exchange was measured with the use of an infrared CO_2/H_2O analyzer (LI-6262, USA). Chlorophylls and carotenoids content was determined in hypocotyl explants, 5-, 14- and 28- day-old cultures and in 7-day-old seedlings. The measured intensities of net photosynthesis and dark respiration, as well as chlorophylls and carotenoids content were different, depending on a cultivar of flax and the stage of growth. The regeneration of shoots from explants of flax cv Szafir was effective on all tested media, whereas from cv Selena - only on B5, MS+B5 medium. Both varieties of flax required similar types of cytokinins, as well as the same concentrations of PGRs in the medium. Under optimum conditions of growth, more effective organogenesis were distinguished on cultures of cv Szafir, compared to the Selena cultures.

P 02

Ecological biochemistry, physiology and medicine

WILL THERMOSENSITIVE DRUG DELIVERY SYSTEMS INFLUENCE THE QUANTITY OF PHARMACEUTICALS IN THE ENVIRONMENT

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In the past few decades, the environmental problem of the increasing amount of pharmaceutical products in the natural environment has deepened. In 2016 Beek, Weber, Bergmann, Grüttner and Carius presented the databse containing 178,708 entries. They have detected 771 different pharmaceutical substances worldwide in concentrations above their detection limits of the respective analytical methods employed. The regulatory framework for Environmental Risk Assessment (ERA) of pharmaceutical products was developed in the cooperation of scientists, regulatory agencies and the European Commission. Smart Drug Delivery Systems (SDDS) are chemical compounds with a specific structure, which are used to transport active substances. The use of polymeric carriers can contribute to reducing the doses of drugs and improve their biodistribution. An example of a thermosensitive polymer with potential use in such systems is poly(*N*-isopropylacrylamide) (PNIPAAm), which exceeds the Lower Critical Solution Temperature (LCST) between 32-34 ° C. The use of therapies based on controlled delivery of pharmaceuticals may prevent excessive ingress of bioactive substances into the environment.

P 03

Ecological biochemistry, physiology and medicine

FREE AMINO ACIDS AND THEIR DERIVATIVES IN THE PATHOGENESIS OF ATHEROSCLEROSIS

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The purpose of this study is to determine the patterns of formation of the amino acid pool in rat blood plasma and liver against the background of atherosclerosis in the pathogenesis of this disease. An experimental model of atherosclerosis (long-term maintenance of rats on an atherogenic diet) was implemented on 20 white rats, males weighing 220–300 g and keeping animals for two months on a diet, which, along with all the necessary components, included 10% cholesterol, 30% beef tallow and 0.005% mercazolil. Determination of physiological concentrations of amino acids and their derivatives in biological samples (blood plasma or liver) deproteinized with perchloric acid carried out reversed-phase HPLC with post-column derivatization with o-phthalic aldehyde. A pronounced amino acid imbalance is formed in rat blood plasma and liver against the background of simulated atherosclerosis, characterized by a significant depletion of the pool of free amino acids and their derivatives, a decrease in the Fischer's antitoxic index, the levels of reduced glutathione and the most important glycogenic (alanine, serine, glycine) amino acids. Additional administration (intraperitoneally, 100 mg/kg b.w. for 10 days) induces against atherosclerosis of the tested antiatherogenic amino acid minicomposition (arginine, histidine, taurine and lysine substances in a ratio of 5: 2.5: 2.5: 12.5) a pronounced tendency to normalization of the levels of the studied compounds in the overwhelming majority of certain indicators. Thus, the use of the tested minicomposition of amino acids confirms the pathogenetic significance of the processes of formation of the amino acid pool in the development of atherosclerosis and is a potentially effective way of its prevention and treatment.

P 04

Ecological biochemistry, physiology and medicine

MOLECULAR MECHANISMS OF 1,2-DI-O-GALLOYL-4,6-VALONEOYL-β-D-GLUCOSE ANTIHEMOLYTIC ACTIVITY AGAINST STAPHYLOCOCCAL α-HEMOLYSIN

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Increase of bacterial resistance to antibiotics is a worldwide problem, especially in the field of medicine. This resistance results in a large number of diseases that are very hard to treat. Under these circumstances, searching for new antibacterial substances, both synthetic and natural, becomes urgent necessity. Tannins belong to secondary plant metabolites and exhibit strong antioxidant, anti-inflammatory, immunomodulating and antibacterial activity that make them a promising molecular tool in treatment of bacterial-derived diseases. In our studies we analyzed the molecular mechanisms of antihemolytic activity of 1,2-di-O-galloyl-4,6-valoneoyl-β-D-glucose – T1 (tannin isolated from *Euphorbia turkestanica*) against *Staphylococcus aureus* α-hemolysin. In experiments using erythrocytes from sheep, we demonstrated that T1 strongly inhibits hemolysis caused by α-hemolysin. To explain the mechanisms of T1 anti-hemolytic activity Zeta Potential (ZP), fluorescence spectroscopy and black lipid membrane (BLM) techniques were applied. Zeta potential measurements revealed that T1 decreased the ZP of sheep erythrocytes as the result of interaction with the cell membrane. Using fluorescence labels Laurdan and DPH it was shown that T1 causes the decrease of erythrocytes' outer layer membrane fluidity without effecting the inner lipid layer. Such membrane rigidification may hinder the binding of the α-hemolysin monomer to the lipids or its oligomerization. BLM electrophysiological technique was used to assess the influence of tannin on electrical conductance of the single channel formed by α-hemolysin. Analysis showed that the presence of tannin causes concentration-dependent closing of the pores formed by α-hemolysin. Based on our studies it can be concluded that 1,2-di-O-galloyl-4,6-valoneoyl-β-D-glucose possesses strong antihemolytic activity against staphylococcal α-hemolysin. The mechanisms of T1 antihemolytic activity are related to stabilizing effects on erythrocytes membrane and to the inhibitions of pores formed by α-hemolysin.

P 05

Ecological biochemistry, physiology and medicine

GROWTH AND METABOLISM OF *CHLORELLA VULGARIS* UNDER THE INFLUENCE OF MANGANESE AND IRON(III) IONS

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The aim of this study was to investigate the effect of manganese(II) and iron(III) on the growth and basic metabolic processes of the unicellular alga *Chlorella vulgaris*. To this end, alga cultures were treated with ions of iron(III) and manganese(II) at concentrations 0.1, 0.5, 2, 5, 10, 20 and 50 mg L^{-1} and then analyzed in terms of changes in the number of cells, content of monosaccharides, proteins, chlorophyll and the activity of antioxidant enzymes: superoxide dismutase and glutathione reductase. The development of *C. vulgaris* was influenced more by manganese(II) than iron(III). The largest increase in the number of cells and concentrations of the studied biochemical parameters and antioxidant enzyme activity was induced by 20 mg L^{-1} manganese(II). The experiment also showed that an appropriate amount of iron(III) helped control the level of manganese(II) thanks to the co-precipitation of metals, and so could help in tackling the worldwide problem of eutrophication. In the case of introduction of 50 mg L^{-1} of both iron(III) and manganese(II), the number of *C. vulgaris* cells decreased, and thus the concentration of the biochemical parameters in water. The results of this experimental studies well collaborate with the conducted earlier study of surface water, which showed the existence of strong correlation between the concentration of manganese in the water and algal biomass, which determinant is chlorophyll *a*.

P 06

Ecological biochemistry, physiology and medicine

TO BE INVISIBLE? *LATIBULUS ARGIOLUS*, PARASITOID IN THE NEST OF SOCIAL WASPS

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Social insects form colonies which are attractive shelters or food stores for many intruders such as parasitoid and predators. Thence nestmate recognition is a key for defend the colonies. Insect social life is governed by chemical communication and hydrocarbons present on the cuticle (CHC) are the most important nestmate recognition cues. CHC profiles in social insect are mixtures of up to 100 different hydrocarbons. Presumably, the detection of the difference in the relative proportions of hydrodrocarbons in this species-specific mixture, allows to discriminate between nestmates and alien individuals. However social insect often accept/do not attack individuals that have lower concentrations of cuticular hydrocarbons. In our study we investigated the cuticular patterns of hydrocarbons of ectoparasitoid, *Latibulus argiolus* (Hymenoptera: Ichneumonidae) developing in the nest of the social *Polistes* wasps (Hymenoptera: Vespidae). We identified above one hundred hydrocarbons with chain length between C14 and C36 were identified in the heptan fractions by gas chromatography-mass spectrometry (GC-MS). Methyl-branched alkanes with one to four methyl groups were major components, along with traces of n-alkanes and monoalkenes. Cluster and PCoA analysis showed huge similarity of CHC profiles of females parasitoid to profiles of their host. However chemical profiles of males of *L. argiolus* differ significantly both from females of this parasitoid and from paper wasps from which nests were reared.

P 07

Ecological biochemistry, physiology and medicine

FUND OF NEUROACTIVE AMINO ACIDS IN THE REGIONS OF THE BRAIN ON THE BACKGROUND OF HEPATITIS

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The purpose of this study is determine changes in the fund of neuroactive amino acids of brain regions with different functional-metabolic orientation (striatum, hypothalamus, midbrain) against the background of toxic liver damage caused by administration of thioacetamide (500 mg / i.g, 10 days) or ethanol (25% solution, 3, 5 g / kg., 14 days). Determination of physiological concentrations of amino acids and their derivatives in deproteinized with perchloric acid brain areas carried out reversed-phase HPLC with post-column derivatization with o-phthalic aldehyde. Toxic hepatitis caused by the introduction of thioacetamide is accompanied by a decrease in the content in the striatum and hypothalamus of rats of the contents of both excitatory and, in a greater degree, inhibitory (γ-aminobutyric acid) amino acids, which indicates the predominance of inhibition processes. With alcoholic hepatitis in the striatum against the background of an increased level of the inhibitory neurotransmitter glutamine, the level of the excitatory neurotransmitter glutamate decreases, which indicates a violation of the interconversion of these amino acids in the glial and neuronal compartments. In addition, the content of tryptophan is significantly increased in the striatum, which may indicate an inhibitory effect of ethanol on the serotonergic system. Alcoholic hepatitis increased tyrosine levels in all studied brain regions, which suggests inhibition of the dopamine system. The additional introduction of an artificial amino acid mixture “Polyamine” (10 ml., i.g, 10 days) on the background of alcoholic hepatitis induced an increase in the pool of both excitatory (aspartate, glutamate) and inhibitory amino acids (glycine, taurine, γ-aminobutyric acid), leading to to a significant normalization of their ratios, which suggests the effectiveness of the use of “Polyamine” as a drug to eliminate metabolic imbalances in hepatic encephalopathy.

P 08

Ecological biochemistry, physiology and medicine

EFFICACY OF AMINO ACIDS AND THEIR DERIVATIVES IN THE CORRECTION OF METABOLIC DISBALANCE

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The purpose of this study is to determine the physiological concentrations of free amino acids and related compounds in plasma of practically healthy people and patients in the initial stages of the formation of liver pathology (cholecystitis) and their changes when administered intravenously as a means of metabolic correction of artificial amino acid mixtures ("Polyamine"). Determination of physiological concentrations of amino acids and their derivatives in deproteinized with perchloric acid brain areas carried out reversed-phase HPLC with post-column derivatization with o-phthalic aldehyde. The results obtained in the study of the amino acid fund in the blood plasma of patients indicate a combined violation of the processes of synthesis and degradation of amino acids against the background of chronic cholecystitis. The enrichment of the pool of replaceable amino acids revealed in this case is most likely a consequence of the suppression of gluconeogenesis characteristic of cholecystitis, and the indispensable ones - activation of proteolysis, damage to the transport systems and the utilization of amino acids by tissues. Parenteral administration of "Polyamine" (800 ml / day, 10 days) induced a positive effect on the formation of the amino acid pool of blood plasma in cholecystitis and a significant decrease in the levels of amino acid markers of damage to hepatocellular membranes. In addition, the appointment of "Polyamine" to patients with cholecystitis contributed to a pronounced decrease in the total pool of free amino acids in the blood plasma due to the activation of tissue utilization processes and the elimination of amino acid imbalances due to exogenous intake, interorganization of redistribution and activation of amino acid utilization by the liver against the background of its antitoxic function.

P 09

Ecological biochemistry, physiology and medicine

ACTIVITY OF LYOPHILISATES OF DRONE BROOD HOMOGENATE ON VIVABILITY OF HUMAN SKIN MELANOMA C-32

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Melanoma (*melanoma malignum*) is a cancer of the skin and mucous membranes with very high malignancy. The most common cause of this type of cancer is a genetic factor and an excessive exposure to the ultraviolet radiation. The types of melanoma differ with the time of development, the dynamics of growth and prognosis for the patient. The amelanotic melanoma has the high malignancy and gives the bad prognosis. Research is being carried out regarding the use of natural products as potential measures to prevent the development of this type of cancer. The effect of lyophilisate of drones brood homogenate (LDBH) on the survival of human amelanotic melanoma cells C-32 skin was investigated. Drone larvae (bee larvae from which drones will develop) is characterized by a complex chemical composition in which, in addition to protein (57.7g/100g), carbohydrates (17.8g/100g) and lipids (21.9g/100g), also marked group B vitamins (B2, B3, B5, B6, B12), folic acid, biotin, choline, inositol, as well as high content of macroelements (potassium, magnesium, sodium, phosphorus) and micronutrients (manganese, copper, iron, selenium). Besides the mentioned nutrients, LDBH contains steroid hormones: testosterone (0.31±0.015nmol/g), progesterone (51.32±8.69 nmol/g), estradiol (677.6±170.3 nmol/g) and prolactin (410.0±65.4 nmol/g). According to the review of the available scientific literature, no reports on the effect of lyophilisates of drone brood homogenate on normal and cancer cells were found. Determination of cytotoxicity of variety concentrations of LDBH by Carmichael's method (MTT) against C-32 melanoma cells was carried out. Survival rate of amelanotic cells affected by LDBH ranged from 72.2% to 130.2%.

This work was supported by grant no. 2015/17/N/NZ9/03646 (National Science Centre of Poland) and grant no. N/ST/MN/17/001/2227 (MUB).

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Ecological biochemistry, physiology and medicine

DIFFERENTIATION OF MALASSEIZA PACHYDERMATIS FIELD STRAINS SUSCEPTIBILITY TO POLYENES

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Increasing drug resistance of microorganisms also applies yeast from genus *Malassezia*. The aim of this study was to evaluate the susceptibility of *Malassezia pachydermatis* field strains isolated from healthy dogs and dogs with *otitis externa* to nystatin and natamycin − the most commonly used polyenes agents. For all tests, a group of 42 strains isolated from dogs with *otitis externa* and 15 strains from healthy dogs were used. The antifungal susceptibility of *M. pachydermatis* strains to nystatin (2,6 μg/ml - 1311 μg/ml) and natamycin (1,28 μg/ml - 164 μg/ml) was assessed using broth microdilution method based on modified CLSI M27-A3 protocol. The mean MIC

and MFC values for natamycynin were 16 μg/ml and 19 μg/ml respectively, while for nystatin 120 μg/ml and 136 μg/ml respectively. It was found that 19 strains were resistant to nystatin and 1 to natamycin. All of them were isolated from healthy dogs. Both groups of strains differed to nystatin and natamycin susceptibility (for strains isolated from healthy dogs − MIC_m of nystatin = 343 μg/ml, MIC_m of natamycin = 24 μg/ml and strains isolated from dogs with *otitis externa* − MIC_m of nystatin = 48 μg/ml, MIC_m of natamycin = 13 μg/ml). In conclusion natamycin occurs antifungal activity in lower concentration in comparison to nystatin. The presence of resistant strains to nystatin and natamycin confirmed the phenomenon of drug resistance to polyenes in yeast. There is connection between the origin of the *M. pachydermatisa* strains and their susceptibility to tested polyenes. Strains isolated from healthy dogs show higher tolerance to nystatin and natamycin compared to strains from dogs with *otitis externa*. Our data indicated that commensal strains from healthy animals might be a source of drug resistance.

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Ecological biochemistry, physiology and medicine

PLANT GROWTH PROMOTION CHARACTERISTICS OF WHITE CLOVER(*TRIFOLIUM REPENS*) MICROSYMBIONTS GROWING ON Zn-Pb BOLESŁAW WASTE HEAP IN POLAND

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Plant growth-promoting rhizobacteria (PGPR), which include rhizobia, may be able to increase the growth and development of plants which inhabit unfavourable conditions, e.g. through the synthesis of phytohormones (*i.e.* auxins, ethylene), increased nutrient assimilability due to i.e. synthesis of siderophores, organic acids production, increased phosphate solubility, and inhibition of pathogens (acetoin synthesis). The purpose of present study was to examine the characteristics of PGP microsymbionts of *T. repens*, growing on approximately 100-year-old waste heap zinc-lead (Zn-Pb) Bolesław (S. Poland), and compare it to bacteria traits obtained from *T. repens* nodules growing on control area. Isolated strains from Zn-Pb Bolesław heap and control area as well have been examined by chosen microbiological tests. Studies has shown that strains received from studied areas are potentially able to promote plant growth. Bacteria from the Bolesław waste heap are equipped in more PGP characteristics than bacteria from a control site.

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Ecological biochemistry, physiology and medicine

THE EFFECT OF LEAD AND *ACYRTHOSIPHON PISUM* INFESTATION ON THE ALLOCATION OF CARBON IN PEA SEEDLINGS

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The main goal of this study is to investigate the effect of lead, as an abiotic factor, at various concentrations and cross-talk between lead and pea aphid [*Acyrthosiphon pisum* (Harris)], as a biotic factor, on the allocation of carbon in pea seedlings (*Pisum sativum* L. cv. Cysterski). The first goal was to verify whether lead in a concentration range of 0.025 – 0.5 mM $Pb(NO_3)_2$ and cross-talk between lead and *A. pisum* affect the growth of pea seedlings. The second goal was to determine an effect of lead and cross-talk between lead and *A. pisum* on total carbohydrate content and invertase activities, enzymes involved in hydrolysis of sucrose into glucose and fructose. Analysis of growth parameters of pea seedlings demonstrated that lead at a low concentrations causes a hormesis effect, i.e. stimulation of seedlings growth, whereas lead at higher concentrations inhibit seedling growth, which manifest itself in the decrease in length and fresh biomass of epicotyls and roots of these seedlings. Both length and fresh biomass of epicotyls and roots of pea seedlings growing on the medium with high lead concentration and in the case of high lead doses and aphid infestation were significantly lower than in other experimental variants. Moreover, the increase in total carbohydrate content and acid and alkaline invertase activity in pea seedlings growing on lead-supplemented medium and next during combinatory effect of the two stressors Pb and *A. pisum* was observed. In turn, the decrease in total carbohydrate content was observed only at certain time points of experiment, especially in roots and leaves of *P. sativum* seedlings containing a low dose of lead. Received results showed, that response of *P. sativum* seedlings depends on applicated dose of lead and direct contact of stress factor with organ.

This work was supported by the National Science Centre, Poland, grant number 2017/25/N/NZ9/00704.

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Ecological biochemistry, physiology and medicine

PHOTOCATALYTIC PROPERTIES IN THE HYDROGEN GENERATION PROCESS OF $SrSnO_3$ SEMICONDUCTOR MODIFIED WITH RARE EARTH METALS

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Hydrogen is ideal clean energy carrier for our future sustainable energy economy as well for zero-emission mobility.

As of today, research works on obtaining such a semiconductor which will be characterized by low production cost, low toxicity, ease of preparation and above all absorption of irradiation in the visible range. For the semiconductors it belongs of $SrSnO_3$ however in the literature there is little information about the use for hydrogen generation due to the considerable width of band gap (3.4 eV), so it is necessary to modify it. One of the possible methods of modification is the use of rare earth metals. Rare earth metals, due to their unique properties, have the ability to absorb irradiation in the visible range, which is why their application brings an interesting proposition to the proposed research. Strontium stannate modified with metals Er and Yb was successfully obtained by hydrothermal method (amount of Er and Yb precursor - 0.5; 1; 3 % by weight admixture). Characteristics of the obtained powders included: morphology analysis using scanning electron microscope (SEM), X-ray diffraction (XRD) and measurement of optical properties using a UV-Vis spectrophotometer. Measurements of photocatalytic activity were examined in the model water splitting reaction under the influence of UV-Vis and Vis irradiation. In the typical procedure methyl alcohol applied as the sacrificial reagent for holes (h^+). XRD analysis confirmed the crystalline structure of $SrSnO_3$ semiconductor. The images taken with the use of scanning electorn microscopy showed obtainig a rod-like morphology with a square base of around 1 μm and a height of approximately 10-30 μm. Among all obtained photocatalysts, the highest photocatalytic activity in the hydrogen generation process was observed $SrSnO_3$_1% Er/Yb sample (8.91 μmol/min after 4 h irradiation), while the lowest photoefficiency was noticed for $SrSnO_3$_0.5% Er/Yb (6.33 μmol/min also after 4 h irradiation).

The research work was financially supported by the project of Research of Young Scientists at the University of Gdansk (grant No. 538-8620-B337-18).

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Ecological education for sustainable development

EVALUATION OF THE INVOLVEMENT OF STUDENTS OF YANKA KUPALA STATE UNIVERSITY OF GRODNO IN ACTIVITIES TO ACHIEVE SUSTAINABLE DEVELOPMENT GOALS

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The aim of the work is to compare the degree of the involvement of first-year students of Yanka Kupala State University of Grodno of ecological and philological specializations in socially important activities to achieve SDG on the local level. Questionnaire was composed and survey of 40 students of the Faculties of biology and ecology and the philology was held. It was found out that students of the philology faculty are not informed about the 2030 Agenda for Sustainable Development, 60% of them have heard the term “Sustainable Development Goals” and only 30 % of them know that there are 17 Sustainable Development Goals. 100% of the students of the faculty of biology and ecology are informed about these questions. The majority of students of both specializations think that the solution of problems associated with the achievement of prosperity together with protecting of the planet in each country should be mainly done by republican authority (89% of philologists and 82% of ecologists), Committee of Natural Resources (44% and 57%), each person by himself (67% and 91% respectively). All students who took part in survey pointed that they took part in activities dedicated to the achievement of SDG. Student of philology specialization were more often involved in fundraising for sick people and care for the elderly people (78%), cleaning the area from the rubbish (67%), tree planting (44%), rarely in separate waste collecting (22%), help homeless animals (11%). Students of this specialization earlier haven’t taken part in ecological events. Answers of the students of the ecological specialization shows that all of them have already taken part in ecological events, cleaning the area, have helped sick and elderly people. 65% have taken part in tree planting, 52% collect waste separately, 48% help homeless animals. 94% of students who took part in survey said that they are ready to more widely participate in socially and ecologically important events. As a result it’s necessary to carry out active work on environmental education of students of the philology specialization and involve students of both specialization in practical activity more active.

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Ecological education for sustainable development

CURRENT STRATEGIES FOR THE PROTECTION OF ORGANIC CROPS IN VEGETABLES PRODUCTION

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Development of disease resistance to conventional pesticides and environmental contamination problems created pressure on farmers to adopt new strategies for disease control in the production of vegetables. In addition, consumers demand to minimize pesticide residues in food products is forcing the growers and the pesticide producing companies to formulate and develop alternatives to the contentious inputs currently marketed. Products obtained from biologically active compounds extracted from plants will play an increasingly important role in crop protection strategies.

Exploiting antimicrobial substances from plants that inhibit or halt the reproduction of pathogenic microbes, would become a more realistic and ecological method for the integrated management of plant diseases with the final goal of reducing or gradually phasing out contentious inputs without compromising the competitiveness of the organic sector. Obtaining, identifying, testing and physicochemical characterization of biologically active compounds with action to combat microbial diseases in vegetable crops shows both originality and complexity of activities proposed in the research work.

The present study provides an overview of the current state of external inputs use and proposes a solution to the stricter European standards, by a systemic approach of biotechnological sciences and agricultural sciences, with immediate applicability of the obtained results in farm practices.

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Ecological education for sustainable development

SUSTAINABLE TILLAGE TECHNOLOGICAL PROCESSES EFFECT FOR ENERGY CONSUMPTION AND CO_2 EMISSIONS

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Siustanable tillage technological processes different influence use of resources and impacts for environment. Diesel fuel, agricultural machinery using and fertilizers are the main contributors to environmental pollution in agriculture. Land cultivation in crop production accounts about 30% of total energy consumption. Research shows that use of sustainable technological systems in agriculture contributes GHG emissions reducing and energy efficiency increasing. Sustainable tillage techniques, such as strip tillage and seedless cultivation have better economic, energy-efficiency consumption. Research conducted by scientists has shown that sustainable tillage technologies require from 12 to 58% lower fuel consumption, which affects less CO_2 directly related to the greenhouse effect. Sustainable tillage technological systems can significantly reduce CO_2 emissions from agricultural activities.

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Food technologies for sustainable development

DETERMINATION OF OXYTETRACYCLINE IN DAIRY PRODUCTS USING LIQUID-LIQUID MICROEXTRACTION COUPLED WITH HPLC ANALYSIS

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Tetracycline antibiotics are widely used in veterinary medicine due to their high quality and broad spectrum of activity. The incorrect administration of these antimicrobial agents causes the occurrence of antibiotics in dairy products (e.g. milk, cheese, yoghurt). The presence of these compounds in animal-based food harmfully influences for human health. Therefore, the European Union has set the maximum residue limit of tetracyclines in milk (100 μg/kg). Monitoring of these compounds is necessary and analysts are focused to elaborate effective extraction and determination methods for antibiotics.

The performed studies describe developed a procedure for selective isolation of oxytetracycline (OTC) using liquid-liquid microextraction (LLME). The studied analyte is a good soluble in water compound with multiple ionizable functional groups (amine, phenolic hydroxyl). Oxytetracycline can undergo protonation and deprotonation reactions under different pH. After deproteinization of dairy products samples, the microextraction process of OTC was performed following by buthanol as extractant. The studied analyte in the extracts was determined by high performance liquid chromatography methods with ultraviolet detection system (HPLC-UV) and liquid chromatography methods connected with tandem mass spectrometry (LC-MS/MS). The obtained results indicate that the elaborate procedure of microextraction enables effective isolation of oxytetracycline. The chromatographic methods are characterized by a wide range of linearity and are given possibility for detection of OTC at the low level concentrations (below maximum residue limit). The developed procedure was applied for determination of oxytetracycline in milk and cottage cheese samples from regional producers.

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Food technologies for sustainable development

DETECTION OF HEAVY METALS IN FOOD-RELATED SAMPLES BY MODIFIED MAGNETIC NANOPARTICLES

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These days, heavy metal contamination in the environment is an urgent subject for scientists. Heavy metals are significantly toxic to plants, animals, and infants. Therefore, it is crucial to remove impurities from the diet or closest human environment, or at least have information about its contribution value. Presented results are related to the tests of heavy metal ions extraction from selected food samples. For the experiments; Pb2+, Cu2+, Cd2+ were added to water solutions of; apple, tomato, potato, beetroot, cabbage juices, or tea brew. The detection of metal ions was done by means of surface-functionalized magnetite nanoparticles doped with manganese or zinc, or covered with a silica shell. To increase the extraction efficiency of the heavy metals, nanoparticles surface was modified with different ligands (phthalic anhydride, succinic anhydride, 3-phosphonopropionic acid, and 16-phosphonohexadecanoic acid). The food samples after the extraction process were examined by Atomic Absorption Spectroscopy method. Nanoparticles before and after the experiment have been tested with Energy Dispersive X-ray. Ferrite nanoparticles were also characterized by physicochemical methods (Transmission Electron Microscopy, X-ray diffraction, IR spectroscopy, Mössbauer spectroscopy) to confirm their characteristic.

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Food technologies for sustainable development

CHEMICAL ASPECTS Of RECOVERED ALUMINUM FROM FOOD AND BLISTER PACKAGING WASTE

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The research aim was to investigate the chemical mechanism for aluminum recovering from food and blister packaging waste. Packaging for food-drink and packaging for pharmaceutical blisters represents the largest fraction of packaging waste and is mainly composed of multiple plastic films laminated with Al foil. The most produced multilayer film is based on the different polymers, such as polyester, polypropylene, and polyethylene as main components, and an aluminum layer. In general, mechanical and chemical recycling technologies are used to separate this type of packaging waste, which is quite a difficult process based on previous experiences. Three samples of multilayer packaging materials were selected from food and medicines packaging (candy wraps, chocolate/chips pack and blister packaging) for the laboratory experiment which was produced by local shops and pharmacy in Lithuania; Chemicals: Concentrated Nitric Acid(50%). Energy consumption, emission, and waste generation were maximally avoided during the experiment. The experiment was carried out in the following conditions: The volume of organic solvents 50-100 ml; Time 1–10 hours; The temperature – Room temperature; Mechanical stirring ≈300 rpm; Noticed: mechanical stirring was used in order to accelerate the process. After the separation Aluminum and polymer content in the packages was different for each samples: Pharmaceutical blister packaging ≈ 17.2% of Al, 82.2% of polymer; Chips and chocolate packaging≈ 51.5% of polymer (partly recovery); Coffee packaging ≈ 52.5% of Al, 47.5% of polymer; The study has shown that the multilayer packaging materials waste, such as food packaging and pharmaceutical blisters packaging can be processed in an environmentally safe and economically favorable way. During the experiment, there was a small loss of materials, and finally, the processing rate was increased, waste is treated almost 100%. After recycling, it is possible to regenerate solvents and can be used again.

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Food technologies for sustainable development

THE PROCESS OF PRODUCING CHITOSANE FROM MICELLAR MUSHROOMS OF ASPERGILLUS SPECIES

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Chitin has unique and complex properties: it's non-toxic, biocompatible, adsorptive and film-forming. It can be used in medical, cosmetic, food, agricultural and ecological industries. Economically, one of the most promising sources of chitin in the Republic of Belarus is the by-product of microbiologically synthesized citric acid - the biomass of *Aspergillus niger* micellar mushroom, which grows in the process of deep cultivation of beet molasses. The cell wall of *Aspergillus niger* micellar mushroom, which is the producer of citric acid and its by-product, may contain up to 20-25% of chitin. About 250-250 grams of chitin can be obtained from 1 kilogram of citric acid producer. In this regard, great importance is placed on developing different ways of obtaining chitine, chitin-glucan complexes and chitosan from the micellar biomass of *Aspergillus niger*, what in its turn would solve the problem of finding secondary use for biotechnological by-products (such as: used enzyme producents, antibiotics, organic acids). It would also satisfy the domestic market's demand for polyfunctional chitin-containing raw-materials, which can later serve as a basis for obtaining biologically active components, new generation foods and highly active sorbents for heavy metal ions. The chitin-glucan complex - chitosan - is extracted from the biomass of *Aspergillus niger* as a result of sequential three-step acid-base hydrolysis. At the first stage of research work was obtained a biosorbent-chitin-glucan complex from the waste of production of citric acid-biomass Aspergillus niger. It was proved its high sorption ability with respect to heavy metals in model solutions. The maximum absorption from solutions of individual metals took place with respect to the doubly charged cations of such highly toxic metals as manganese, cobalt, and nickel. The obtained sorbent accumulated from the solutions 98 - 99% ions of these metals for one hour, while their concentration in the solution decreased by 1-2 orders of magnitude. The concentration of manganese in solution was decreased by 58 times, cobalt by 165 times, nickel by 82 times after sorption. The obtained sorbent can be used for purification of natural, sewage and technological nutrient media from excess of mineral elements. The next stage of the work is the development and optimization of technological regimes of demineralization, deproteinization, depigmentation and deacetylation of chitin-containing raw materials, with the aim of obtaining chitosan and its derivatives, which can later be used in medicine, agriculture, ecology and food industry. In this way, we can obtain two target products with different functional orientation in the same technological chain: a biosorbent, a chitin-glucan complex which is used for wastewater treatment and technological nutrient media, and chitosan, which is used in medicine and food industry. The implementation of scientific research in this direction will fully ensure the secondary use of biotechnological waste products, and provide with chitin and chitosan, which will make it possible to stop importing it.

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Good practice in monitoring of environment pollution

APPLICATION OF *SINGLE PARTICLE* ICP MS FOR DETERMINATION OF SILVER AND TITANIUM DIOXIDE NANOPARTICLES AND THEIR IONIC COUNTERPARTS IN ENVIRONMENTAL MATRICES

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Remarkable attraction and utilization of metallic nanoparticles (MNPs) in modern technologies are observed. Silver and titanium dioxide nanoparticles (AgNPs, TiO_2NPs) are widely used in many industrial, scientific and biomedical applications. This fact results in increase of uncontrolled emission of MNPs into the environment. MNPs due to their small sizes can overcome biological barriers which can cause pathological changes of biological structures. *In vitro* studies showed cytotoxic and genotoxic effects of AgNPs, TiO_2NPs and Ag^+ on biological organisms, including humans. The concentration and physicochemical properties of MNPs, including particle size and shape, directly influence their bioavailability and toxicity. Recently, single particle inductively coupled plasma mass spectrometry (sp ICP MS) has been increasingly used for the characterization and quantification of MNPs. Sp ICP MS technique can distinguish dissolved and nanoparticulate forms of metals. In addition, this technique provides information on individual particles (size, number and mass concentration). In this work, the effect of environmental matrix (river water) on the determination of AgNPs, TiO_2NPs and their dissolved counterparts by sp ICP MS technique has been checked. The most significant problem of quantitative analysis was adsorption of analyte on the surfaces of micropipette tips, vials and sample introduction system. The influence of following substances which can eliminate adsorption effect was examined: Triton X-100, SDS, trisodium citrate, PVP and methanol. The best stability of AgNPs was obtained in the presence of 0.1% Triton X-100. The biosorption and biotransformation of Ag^+ and AgNPs by green algae (*Desmodesmus subspicatus*) were also investigated. The algae were exposed to 5 μg L^{-1} of Ag^+ or 40 nm PVP-AgNPs for 24h. The experiment was executed in three types of medium: Bold's Basal Medium, Milli-Q and fresh surface water.

This work was supported by the Polish Ministry of Science and Higher Education under subsidy granted to the Faculty of Biology and Chemistry, University of Bialystok for R&D and related tasks aimed at development of young scientists and PhD students (BMN 174).

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Good practice in monitoring of environment pollution

THERMOPLASTIC STARCH FOR Cd(II) IONS REMOVAL – EQUILIBRIUM AND KINETIC STUDIES

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Nowadays, removing the toxic heavy metal contaminants from waste streams is one of the greatest matters of interest. The main concern of environmentalists about heavy metals is that these elements are highly toxic and their detrimental impact on human health and surroundings is grave. Cadmium is one of the most toxic metals even in low concentrations. Cadmium toxicity causes disorders such as heart disease, cancer and diabetes. Cadmium poisoning may also result in lung cancer, anemia, skin, pulmonary edema, bone diseases, brain damage and trachea-bronchitis. Cadmium accumulates in bone, liver and kidney and is even more poisonous than mercury. Cadmium is mainly formed when waste streams are discharged from metallurgical alloying, ceramics, metal plating and sewage sludge.

Conventional methods including, reverse osmosis, electro-dialysis, ion-exchange, chemical precipitation, ultrafiltration and adsorption are used for removal of heavy metal ions from aqueous solutions. The adsorption method, among all above-mentioned processes, is the most preferable one because it is economically advantageous, highly efficient and applicable.

In this study, thermoplastic starch (TPS) was used as adsorbent for Cd(II) ions removal from aqueous media. Batch kinetic and isotherm experiments were conduct to determine the sorption behavior of the Cd(II) on TPS. Typical experimental conditions such as phases contact time, initial concentration and pH affecting efficiency of Cd(II) uptake were taken into consideration.

Percentage removal of Cd(II) using TPS depends on solution pH as well as sorption time, and the maximum values were found to be 75.4%, 34.5% and 28% for the solutions of the initial Cd(II) concentration 10, 50 and 100 mg/L, respectively.

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Good practice in monitoring of environment pollution

BODY SIZE OF *DAPHNIA CUCULLATA* AS AN INDICATOR OF LAKE TROPHIC STATUS

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The aim of the study was to determine the influence of environmental conditions and trophic status of lakes on the morphology of *Daphnia cucullata*. This species is common in lakes throughout Europe and is often the dominant component of zooplankton. It is the smallest representative of the genus *Daphnia* but shows a large variation in body size depending on environmental conditions. Therefore, the body size of *Daphnia cucullata* can be a good indicator in assessing the ecological and trophic status of lakes. The research was conducted in 57 lakes of north-eastern Poland, with a broad trophic spectrum and diverse morphometry. In each of the layers (epilimnion, metalimnion, hypolimnion), 30 individuals *D. cucullata* were analyzed. We measured the length and width of the body, as well as length of the head and the tail spike. The research of this study shows that *Daphnia cucullata* occurred in the majority of stratified lakes. Preliminary results indicate a significant effect of trophic status on the morphology of *D. cucullata*, and in particular on maximum and average body size. In addition, we have found that larger individuals of *D. cucullata* prefer deep water layer, while smaller individuals clearly prefer warm surface water.

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Good practice in monitoring of environment pollution

ANALYSIS OF GOLD NANOPARTICLES AND GOLD(III) IONS IN ENVIRONMENTAL SAMPLES BY SINGLE PARTICLE INDUCTIVELY COUPLED PLASMA MASS SPECTROMETRY

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Gold nanoparticles are widely used in many industrial and medical applications (e.g. electronics, sensory probes, catalysis, drug delivery, biological imaging). Food supplements and cosmetics labelled to contain nanogold (e.g. skin creams, lotions, and soaps) are commercially available. Therefore, it is certain that AuNPs will find their way into the environment. The development of reliable analytical methods for speciation of gold (nano and ionic forms) in complex matrices is crucial for the evaluation of its fate and transformation in the environment as well as its bioavailability and toxicity. In this study, single particle inductively coupled plasma mass spectrometry (sp ICP MS) was explored to characterize and determine gold nanoparticles and gold(III) in environmental samples. The strength of this technique lies in the possibility to obtain different types of analytical information: particle number concentration and mass concentration, particle size and size distribution, as well as the concentration of dissolved forms of metal. The effect of different stabilizing agents (sodium citrate, SDS, Triton X-100) on the recovery of gold species was studied. The limit of detection in number concentration for 60 nm AuNPs was $3.35 \cdot 10^5$ particle/L, whereas the limit of detection in size was found to be 11 nm. Repeatability was 1.8 – 3.3% (n=7) and reproducibility was 1.7 – 8.5% (n=4). Good recoveries were found for spiked experiments with AuNP standards (80.2 – 95.1%). The developed sp ICP MS method was successfully applied for the studies on the transformation of gold species in environmental samples.

This work was supported by the Polish National Science Centre (DEC-2014/15/B/ST4/04641).

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Good practice in monitoring of environment pollution

SANITARY-EPIDEMIOLOGICAL STATUS OF RIVER-LAKE SYSTEMS IN NORTH-EASTERN POLAND

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The determination of the sanitary-epidemiological status of waters used for tourism purposes is very important, hence the aim of this research was to determine the sanitary status of various types of surface water used for recreation. The research area included 18 stands on the Ostróda-Elbląg Canal and 25 on the Augustów Canal. Water samples were taken during summer period in 2017-2018. Microbiological analyzes were performed in accordance with PN-EN ISO standards and included determining the total abundance of bacteria, abundance of such bacteria as: *E. coli*, coliforms, fecal enterococci and *P. aeruginosa*. In addition, basic physicochemical analyzes of water were performed according to standard methods. The presence of indicator bacteria in the water indicates their fecal contamination and possible epidemiological threat. The general average abundance of bacteria for the waters of the Augustów Canal was 1628000±784000 CFU/mL, while for the Ostróda-Elbląg Canal 2242800±964300 CFU/mL. The abundance of *E. coli* bacteria in the waters ranged from 0 CFU/100mL to 6400 CFU/100mL, coliforms from 0 CFU/100mL to 7200 CFU/ 100mL, fecal enterococci from 0 to 5800 CFU/100mL. The maximum values of these indicators were recorded in lakes. The *P. aeruginosa* bacteria were isolated only from waters from artificial section of river-lake systems, and their abundance fluctuated in the 120-860 CFU/100mL range. Statistical analyzes have shown that the abundance of indicator bacteria depends on some physicochemical parameters of water, such as: EC, pH, temperature, carbon, nitrogen. Summing up, it can be concluded that the highest values of the abundance of indicator bacteria occurred in lakes. The river sections were characterized by higher values of abundance of coliforms and *E. coli* bacteria and the total abundance of bacteria compared to canal waters, which indicates a fresh inflow of pollutants to the tested systems. In turn, the canal sections were the only habitat of *P. aeruginosa*.

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Good practice in monitoring of environment pollution

ANALYSIS OF URBAN LAND COVER INFLUENCE TO SURFACE WATER QUALITY IN BIAłYSTOK

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The relationship of land and water in urban areas is a complex of physical, ecological and social interactions. Our research presents an object-oriented approach for analysing and characterising the urban landscape structure and its influence on the quality of surface waters and shallow groundwater. The phosphorous, nitrogen, and organic carbon concentrations were analysed in springs, streams and ponds from an urban area. Aquatic systems in Białystok are transformed by human activity. Most river valleys are modified, and the water flow is disturbed. However, there are still such areas with little urbanisation pressure. The land-cover classification was adopted with the conceptual framework of urban land cover (HERCULES model). The model of urban space integrates built and natural components. It facilitates understanding the fine-scale structure of urban watersheds. This study has demonstrated that water quality in the urban area is strongly related to land cover, and the degree of its transformation is not the same in all types of waters. The land cover of the direct catchment of ponds and streams is an important factor affecting water chemistry. Our results show that urban catchment has a significant impact on concentration of nutrients and organic carbon. The land with forests and shrubs doesn't have many extreme values in water chemical characteristics. Statistical analyses indicated that the main environmental factors influencing water chemistry are impermeable surfaces such as buildings. They are an essential element which deteriorates water quality. The patches with buildings and pavements were characterised by a wide gradient of nutrient concentration in rivers and ponds.

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Good practice in monitoring of environment pollution

ADSORPTION OF C.I. ACID GREEN 16 FROM AQUEOUS SOLUTIONS ON POLYSTYRENE ANION EXCHANGER - KINETIC TESTS

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The intensive development of many industries, often water-absorbing, contributes directly to the pollution of the water environment. The strong colour of wastewaters containing dyes deteriorates the penetration of light into the water, affecting the photosynthesis reactions, the production of oxygen in the water by underwater plants and thus the viability of aquatic animals and plants. Many dyes contain the azo groups in their structure which under anaerobic conditions and influence of microorganisms are degraded to toxic aromatic amines. One of the effective ways to treat wastewater after dyeing processes is to use ion exchange resins for the sorption of dyes from textile wastewater. Therefore the aim of the study was to estimate the effectiveness of C.I. Acid Green 16 removal from aqueous solutions using the commercially available macroporous anion exchanger Lewatit S 6368A. Tests of dye sorption from aqueous solutions were carried out using a static method. The sorption rate constants were determined on the basis of pseudo-first order (PFO) and pseudo-second order (PSO) kinetic models. The best fit the experimental data was obtained with the using the PSO model. It is evidenced not only by the high values of the determination coefficient r^2, but also by the values of the experimental sorption capacities, which are similar to those calculated from the PSO equation. The studies showed that Lewatit S 6368A can be potentially used in the process of C.I. Acid Green 16 removal from paint baths.

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Rational use of land resources and reclamation of polluted lands

MICROORGANISMS AS THE PLANTS' HEALTH STIMULATORS IN HEAVY METAL CONTAMINATED AREAS

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Environmental pollution with toxic heavy metals constantly increases. For this reason, effective, easy and inexpensive ways of cleaning up the environment are sought. One of them is the phytoremediation, which uses plants for this purpose. Because of the limitations of this technique, the usage of the microorganisms that can support the growth and development of plants can significantly increase the effectiveness the restoration of disturbed fields. The group of microorganisms able to promote the plant growth may substantially increase the growth and development of plants under these unfavourable conditions due to: the synthesis of phytohormones, improvement of nutrients availability, and inhibition of pathogens activity. The purpose of study is to present mechanisms of the microorganisms activity towards improving its hosts' fitness.

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Rational use of land resources and reclamation of polluted lands

RECOGNITION, IDENTIFICATION AND ANALYSIS OF MICROPLASTICS IN THE FINE FRACTION OF TORMA LANDFILL (ESTONIA)

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It has been 2 decades that microplastics (MP's) have become one of the major global environmental issues due to their ubiquity in different matrixes. Most of studies have covered the analysis of MP's in aquatic area and marine environment. In this study, the characterization of various types of polymers in term of microplastics in fine fraction from Torma landfill (Estonia) has been mentioned. The used method is based on separation by density, adsorption and desorption by using chemical salts; also, the identification using EDS and FTIR analysis was conducted. Although, the variety of physiochemical techniques have been implemented, not all polymers can be recognized due to their chemical behavior against spectroscopy. Sample preparation is classified by three major parts; namely, drying (in order to increase moisture content), sieving and digesting. These processes are followed by physical treatments, for instance, centrifugal separation and stress shaking separation (flat-bed shaker), to create the suspension layer. In the third stage, all flotation and suspension are extracted and pass through filter. EDS analysis finalized the process of identification.

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Rational use of water resources and wastewater treatment

QUALITY ASSESSMENT AND REHABILITATION OF SMALL WATER FACILITIES (FOR EXAMPLE, GRODNO)

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In a research evaluation test of small water objects in the territory of Grodno was carried out. Experimentally it was proved the excess of maximum permissible concentration in water r. Gorodnichanka on many physico-chemical parameters: colour, salinity, content of organic substances, nitrite-ions, sulfate-ions, synthetic surfactants, total iron. The calculation of the integral indicator of pollution in the aggregate in the water polluting substances and frequency of detection showed that the water in the river Gorodnichanka is classified as "very dirty". Limiting pollution indicators r. Gorodnichanka are iron and total nitrites. In the study of hydrochemical characteristics of six ponds on the territory of Grodno, it was revealed that the excessive concentrations observed in the contents of ammonium ions, synthetic surfactants, total iron. If the integrated assessment of the quality of water in reservoirs different as "dirty" and "very dirty". A limiting indicator of pollution of the water in the ponds is iron extend. We studied the possibility of using natural water treatment from nitrogen compounds Eyhornii (*Eichornia crassipes*) and Duckweed (*Lemna minor*). Has been proven ability eyhornii to reduce the concentration of nitrate ions in the water in 2-62%, nitrite-ions in 75-86% and ammonium ions on the 25-80%, depending on cultivation conditions (in the model or under natural conditions). The presence of Duckweed in the water reduces the concentration of nitrite ions by 50%, the nitrate ions by 68%, ammonium by 80%. To the use of water hyacinth in phytoremediation of natural water bodies should be treated with caution, given the relatively weak our understanding of the results of introduction of plants in aquatic ecosystems of Belarus. Lemna minor is a native and can effectively reduce the concentrations of nutrients in the water. Absorbing nitrogen compounds, duckweed synthesizes organic compounds, and after purification of natural bodies of water can be used for animal feed or as organic fertilizer.

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Rational use of water resources and wastewater treatment

OXIDATION OF SELECTED AQUEOUS MICROPOLLUTANTS USING ACETIC PERACID

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The increasing use of drugs and personal care products enhances the presence of organic micropollutants, including endocrine compounds, in wastewater. Conventional wastewater treatment methods are not effective enough to remove organic them. High efficiency in removing organic compounds is achieved by advanced oxidation processes (AOP's). These processes involve the generation of reactive radicals, usually hydroxyl, that react with impurities causing their oxidation to simple inorganic compounds. The generation of hydroxyl radicals uses ozone, UV radiation or hydrogen peroxide, often with the addition of catalysts such as MnO_2, Fe^{2+} or TiO_2. Recent studies indicates that the best results of oxidation are achieved in synergistic processes using systems consisting of two or three components, e.g. H_2O_2/UV or O_3/H_2O_2/UV. A relatively new solution is the use of peracids in the degradation of pollutants present in wastewater. The organic and inorganic peracids are strong oxidants. Their antimicrobial properties have found wide application in the food industry. The study investigated the possibility of using peracetic acid and peracetic acid in combination with UV-Vis radiation in the process of removing of endocrine

disrupting compounds, such as: benzophenone, 4-n-octylphenol, 4-n-nonylphenol, 3-(4-methylbenzylidene)camphor, α-endosulfan, β-endosulfan, oxybenzone, bisphenol A, diethylstilbestrol and estrone. For the isolation and analysis of these compounds, the ultrasound-assisted emulsification microextraction followed by the gas chromatography with mass spectrometry was used. Optimization of oxidation conditions was carried out and their kinetics was examined. The concentrations of all tested compounds treated with peracetic acid were reduced. The rate constant values of the processes carried out for individual compounds were from 0.01 to 0.06 1/min, and the half-lives from 12 to 121 minutes. The use of UV and Vis radiation to activate peracetic acid increases the efficiency of oxidation. The highest oxidation efficiency, reaching 99.9%, was obtained using UV radiation with a wavelength of 254 nm.

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Rational use of water resources and wastewater treatment

INFLUENCE OF THE SHAPE OF THE PHOTOCATALYST STRUCTURE CeO_2 ON THE ACTIVITY IN WATER SPLITTING REACTION

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Due to the continuous demand of the environment for effective methods in its purification and also hydrogen evolution as the fuel of future, our research group in focuses on the creation and characterization of different type of photocatalysts. One of the promising materials is cerium dioxide, that's why we were synthesized them in three shapes. Photocatalytic activity tests and optical properties of samples proved that the morphology of the nano/microparticles of the photocatalyst obtained has a key role in the efficiency of processes. The most commonly used semiconductor for photocatalytic purposes is TiO_2, however, due to the potential of its conduction band, TiO_2 shows negligible activity in the case of photocatalytic reaction of decomposition of water to molecular hydrogen. In turn, the CeO_2 conduction band has a slightly higher reduction potential, and also the width of band gap of this semiconductor reaches lower values than TiO_2. It proves that it is possible to use lower energy of irradiation to excite the CeO_2 photocatalyst. As part of the proposed research topic, three different three-dimensional shapes of nano/microparticles of CeO_2 were obtained by the solvothermal method, which then were surface-modified with platinum metal centers as cocatalyst produced in a hydrogen-reducing atmosphere. The SEM microscopic analysis of all the obtained photocatalysts was carried out and the absorption and emission spectra were also measured. In the last stage, photocatalytic experiments were carried out to determine the activity of the samples in the decomposition of water to molecular hydrogen.

The research was financially supported by the project of Research of Young Scientists at the University of Gdansk (No 538-8620-B289-18).

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Sustainable use and protection of flora and fauna

EXTREME IMPORTANCE OF SHELTERS FOR POPULATIONS OF VIOLET COPPER *LYCAENA HELLE*

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Violet Copper *Lycaena helle* is a butterfly species endangered in Europe and listed in Annexes of Habitats Directive. It shows boreo-mountainous type of distribution, and inhabits wet meadows where its larval food plants i.e. *Bistorta officinalis* (*=Polygonum bistorta*) and in the north also *B. vivipara* are abundant. Violet Copper is considered as an extremely sedentary species. Males are territorial and they show lekking behaviour. In eastern Poland the butterfly is still widespread and locally common occurring in two broods. We used transect counts for studies of local distribution of the butterfly on the site near Bialystok (NE Poland). We found out that density of imagines of both sexes was very uneven in the habitat i.e. area covered by *B. officinalis*. Vast majority of individuals were counted at transects fixed just along hedgerows and significantly less butterflies were observed at routes running just 10m away. Very few individuals were recorded in the middle of the meadow despite of abundance of the larval food plant. Presence of shelters showed to be extremely important for Violet Copper but we also found out that an appropriate management is also vital. Significant decrease in number of individuals during our studies was detected. Possible causes could be related to intensification of land use and overgrowing of some parts of the site as well as unfavourable weather conditions (especially droughts) in some seasons.

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Sustainable use and protection of flora and fauna

THE DIFFERENTATION OF MINT, ORIGANUM, LAVENDER, SALVIA USING SPECTROSCOPY METHODS COMBINED WITH CHEMOMETRY

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The information about components in herbal raw materials can be used to better control the quality of herbal medicines, asses geographical origin or detect adulterations in raw plant material.

The aim of presented work was a comparison of chemical composition of some herbal species cultivated in eastern Poland. The object of the presented study were dried leaves of plant species from family *Lamiaceae,* such as: *Mentha x piperita "*Variegata*", Mentha gracilis "*Ginger*", Mentha spicata* L. *"*Moroccan", *Origanum vulgare* L., *Origanum vulgare* L. "Hot & Spice", *Origanum majorana* L., *Lavandula stoechas* L., *Salvia Officinalis* L. "Aurea", *Salvia Fruticosa*, *Salvia Transsylvanica*.

IR (ATR-FTIR mode) and UV-Vis spectra of hexane extracts of dried plants samples were recorded. The obtained spectra were analyzed by chemometric methods: Principal Component Analysis (PCA) and Cluster Analysis (CA). The combination of chemometrics with spectral analysis allowed to distinguish of species and varieties of mint, origanum, lavender and salvia.

By using spectroscopic methods combined with chemometrics we can distinguish between each other of tested plant species and varieties. In order to confirm the obtained results, the hexane extracts were analyzed by gas chromatography with mass spectrometry detector (GC-MS). The main components were identified and the comparative analysis of the main chemical composition of herbal samples was made.

The chemical profile of a plant is usually obtained by using chromatographic methods, whereas spectroscopic methods can complement or be an independent tool for determining similarities in the analyzed samples. Our results proved the usefulness of IR and UV-Vis spectrometry for identification of plant material. The use of spectroscopic methods definitely reduce costs and the time of research and may be useful tool for the rapid quality control of herbal raw material.

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Sustainable use and protection of flora and fauna

THE POPULATION TRENDS OF BREEDING WATER BIRDS IN SOUTH-EASTERN POLAND DURING 30 YEARS

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Noticeable decreases in the number of many European bird species, including wetland birds as important bioindicators, is necessary to carry out continuing research of the occurrence of national avifauna. Therefore, it was decided to analyse time changes of the abundance of some species of water birds breeding in the area of south-eastern Poland. For this purpose, data from two periods comprising the years 1985-1999 and 2000-2014 were compared. Then an attempt was made to determine the trends in the abundance and distribution of 15 species of birds belonging to waterfowl (Anatidae - 10 species), grebes (4 species) and for Fulica atra under farm ponds conditions. In case of the majority of the studied bird species, decreasing trends were observed. The decline was statistically significant for Podiceps grisegena ($p<0.001$), Aythya ferina, Aythya fuligula and Podiceps nigricollis ($p=0.01$), F. atra ($p=0.003$). The highest declining trend concerned P. nigricollis (reduction of the number of breeding pairs by 91% and widespread from 50% to 13%) and P. grisegena (81% and from 94% to 44% respectively). The declining trends could also be observed in Spatula querquedula (reduction of the number of breeding pairs by 47%) and Anas crecca (44%). Four species showed increasing trends, however, these results were not statistically significant and they were Anser anser whose number has more than doubled, Mareca strepera (increase in the number of breeding pairs by 43%) and slight increase in the numbers of Cygnus olor and Tachybaptus ruficollis (<20%). The shown abundance trends of the majority of the described bird species in south-eastern Poland coincide with the observed avifauna changes in Europe. Consequently, it is recommended to continue the monitoring of waterbirds and to extend it to further waterbodies in Poland and undertaking transboundary research and protection initiatives in cooperation with ornithology societies and research institutions from neighbouring countries.