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ABSTRAKTŮ**



VYSOKÉ UČENÍ FAKULTA
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OBSAH

POSTEROVÁ STŘEDOŠKOLSKÁ SEKCE

- Validace komerčně dostupných T-DNA inzerčních mutantů
Arabidopsis thaliana14
Martina Brabcová
Ing. Hana Dufková
- Studium reakčních procesů v rámci sanační metody ISCO15
Tibor Malinský
Ing. Radek Škarohlíd, Mgr. Ing. Marek Martinec, Ph.D.
- Vývoj voltametrické metody stanovení léčiva atomoxetinu16
Martin Slavík, Renáta Šelešovská

SEKCE BAKALÁŘSKÝCH A MAGISTERSKÝCH STUDENTŮ

- Produkcia polyesterov pomocou extrémofilných baktérií18
Kristína Bednárová
Xenie Kouřilová, Stanislav Obruča
- Využití metabolomiky pro charakterizaci hlavních změn révy
vinné v rámci vegetačního cyklu, a při různých způsobech
kultivace 20
Bc. Adam Behner
Doc. Ing. Milena Stránská, Ph.D.
- Visible-light photoinitiators for cationic and free-radical
photopolymerization studied by indirect EPR techniques . . . 22
Kristína Czikhardtová, Dana Dvoranová
- Use of Poly(3-hydroxybutyrate) as Polymer Base for Drug Delivery
Systems 24
Nicole Černeková¹
Adriana Kovalčík²

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Analýza G-kvadruplexů v genomech lidských parazitických červů 26	
Michaela Dobrovolná ^{1,2} Alessio Cantara ² Jean-Louis Mergny ² Václav Brázda ^{1,2}	
Neural networks and their use in study of quantum-chemical systems	28
Peter Fraško, Peter Poliak	
Efekt povrchové modifikace škrobových plniv pomocí polydimethylsiloxanu na proces plnění tvrdých želatinových tobolek	30
Bc. Petra Havelková Ing. Pavlína Komínová, prof. Ing. Petr Zámotný, Ph.D.	
Manufacturing of personalised medicines by impregnation of mesoporous silica tablets	32
Zuzana Hlavačková Supervisor: prof. Ing. František Štěpánek Ph.D. Consultants: Ing. David Zůza	
Evolučné inžinierstvo PHA produkujúcich baktérií	34
Halomonas Halophila Bc. Terézia Ikrényiová doc. Ing. Stanislav Obruča, Ph.D.	
Sledovanie poškodenia miechy potkana pomocou magnetickej rezonancie metódou DTI.	36
Bc. Zuzana Kodadová	
Interakcia hormónov a liečiv s pôdnou organickou hmotou . . .	38
Bc. Soňa Krajňáková Prof. Ing. Martina Klučáková, Ph.D.	
Ošetření nápojů pomocí pulzního elektrického pole.	40
Bc. Gabriela Kuncová, Ing. Iveta Horsáková, Ph.D.	
Optimalizácia SPME v spojení s GC-MS/MS na stanovenie cypermetrínu v chemických postrekoach	41
Nikola Kuručová Agneša Szarka, Svetlana Hrouzková, Francisco Javier Arrebola-Liébanas	

Příprava a magnetické vlastnosti železnatých komplexov s pyridyl-benzimidazolovými ligandami.	43
Bc. Jana Vojčíková, Doc. Ing. Ivan Šalitroš, PhD.	

SEKCE DOKTORSKÝCH STUDENTŮ

Lipidomic Analysis as a Tool for a Comprehensive Description of Atherosclerotic Plaques	46
Kamila Bechynska Richard Voldrich, Hynek Macha, Vit Kosek, David Netuka, Vladimir Havlicek, Jana Hajslova	
Characterization of selected non-traditional cereals for development of enriched cereal products.	48
Agáta Bendová Michal Pecháček, Ivana Márová	
Development of an analytical method for the determination of phytocannabinoids and their bioavailability in rat blood plasma	50
Zuzana Bínová Marie Fenclová, František Beneš, Petra Peukertová, Jana Hajšlová	
Preparation of Mg-Al-Ti Bulk Materials Via Powder Metallurgy	52
Ing. Roman Brescher Ing. Matěj Březina, Ph.D.	
Fixation of the Lead in Alkali Activated Materials Based on Different Types of Ashes	54
Ing. Vladislav Cába Ing. Jan Koplík, PhD.	
Bioaccessibility of Metals in Urban Aerosol	55
Hana Cigánková	
Aminoclay as Drug Carrier.	57
Jakub Dušek	
Preparation and Characterization of Functionalized Wound Dressings	59
Lucia Dzurická Agáta Bendová, Julie Hoová, Petra Matoušková, Ivana Márová	

High Throughput Platform for Identification And Characterization Of Electrogenic Bacteria.	61	Surface Treatment of Cementitious Systems by Silicates.	79
Jiri Ehlich Lukasz Szydlowski Ph.D.		Valeriia Iliushchenko Lukáš Kalina, Petr Hrubý, František Šoukal, Tomáš Opravil	
Determination of micro-bioplastics in solid matrix.	62	Study of the influence of water coefficient on porosity and mechanical properties of high-performance concrete	81
Jakub Fojt ¹ Ivana Románková ¹ , Bára Komárková ^{3,4} Radek Přikryl ² , Jiří Kučerík ¹		Martin Janča, Pavel Šiler, Martin Alexa	
Study of Cholesterol's Effect on the Properties of Catanionic Vesicular Systems	64	Microwave-Assisted Preparation of Organo-Lead Halide Perovskite structures for electronics.	82
Martina Havlíková, Filip Mravec		Jan Jancik, Anna Jancik Prochazkova, Markus Clark Scharber, Alexander Kovalenko, Jiří Másilko, Niyazi Serdar Sariciftci, Martin Weiter, and Jozef Krajcovic	
Characterization of Hydrogels with Amphiphilic Structures	66	Relaxation Behaviour of Hydrogel Materials Using Classical Rheology Methods.	84
Richard Heger Miloslav Pekař		Martin Kadlec Jiří Smilek, Miloslav Pekař	
Study of simple electrolytes for magnesium batteries	68	Simple multi-analyte LC-MS method for the determination of food additives in soft drinks and alcoholic beverages	86
Jiří Honč		Ing. Aliaksandra Kharoshka Ing. Aleš Krmela, Ph.D., Dr. Ing. Věra Schulzová	
Humid Air Cooling by Shell and Tube Heat Exchangers.	69	Preparation of metakaolin with high whiteness	88
Petr Horvát Jaroslav Vlasák, Josef Kalivoda, Ondřej Křištof, Tomáš Svěrák		Jan Kotrla Jiří Bojanovský, Tomáš Opravil, Petr Hrubý	
Spectroscopic Study of Human Blood Plasma for Early Detection of Hepatocellular Carcinoma	71	Thermophilic Bacterium <i>Schlegelella thermodepolymerans</i> DSM 15344 as a Producer of Polyhydroxyalkanoates.	90
Kateřina Hrubešová Lucie Habartová, Petr Hříbek, Petr Urbánek, Vladimír Setnička		Xenie Kouřilová, Jana Musilová, Karel Sedlář, Kristína Bednárová Iva Pernicová, Stanislav Obruča	
The Influence of Alkaline Activator Type on the Carbonatation Process of the Alkali-activated Blast Furnace Slag	73	Development of a method for simultaneous determination of various esters of MCPD and glycidol in palm fat by supercritical fluid chromatography	92
Petr Hrubý Vlastimil Bílek, Lukáš Kalina, František Šoukal, Libor Topolář, Richard Dvořák		Tomáš Kouřimský Vojtěch Hrbek, Klára Navrátilová, Jana Hajšlová	
Characterization of Bacterial Strains Obtained in Evolutionary Engineering.	75	Tuning Solid State Polymorph Emission of Sterically Hindered Push-Pull Substituted Stilbenes.	94
Vendula Chatrná Stanislav Obruča, Ivana Nováčková		Matouš Kratochvíl Karel Pauk, Stanislav Luňák Jr., Aneta Marková, Aleš Imramovský, Martin Vala, Martin Weiter	
Assessment of potential heavy metal pollution of road dust in arid urban area	77		
Petr Chrást Jan Chalabala, Václav Pecina, Martin Brtnický, David Juříčka, Jindřich Kynický, Michaela Vašinová Galiová			

Monitoring of Pharmaceuticals in Scottish Rivers Using Passive Sampling Devices	96	Contamination of Urban Soils by Cd: An Example of a Coal Mining City (Shariin Gol, Mongolia)	114
Pavĺina Landova Ludmila Mravcova, Lydia Niemi, Stuart Gibb		Vaclav Pecina Renata Komendova David Juřicka Martin Brtnicky	
Numerical Simulation of Heterogenous Catalytic Reactions . . .	98	Fast Centrifugal Partitioning Chromatography (FCPC) – Innovative Method for Separation of Biologically Active Compounds from Cannabis	116
Martin Macak Petr Vyroubal, Jiřı Maxa		Petra Peukertova, Frantiřek Beneř, Marie Fenclova, Zuzana Bınova, Matej Maly, Jana Hajřlova	
Wet Pre-treatment Methods in Macroelements Recovery from Fly Ash Combined with Acid Leaching	100	The Influence of Non-canonical Structures on the P53 Isoforms Binding to DNA.	118
Michal Marko Tomas Opravil, Frantiřek řoukal, Jaromır Pořızka		Otılia Porubiakova ^{1, 2} , Natalia Bohalova ^{2, 3} , Vaclav Brazda ^{1, 2}	
OECT as a Device for Material Characterization: the Role of Parasitic Series Resistance	102	Novel method for isolation of PHB from bacterial biomass . . .	120
Aneta Markova, Stanislav Střıtesky, Martin Weiter, Martin Vala Visualization of a Ge Structure Using Fluorescent Nanoparticles Kateřina Markova Filip Mravec, Miloslav Pekař		Aneta Pospıřilova, Radek Přikryl, Ivana Novackova	
Plasticized poly(3-hydroxybutyrate)/poly(D,L-lactide) blends filled with tricalcium phosphate for FDM 3D printing and their biological properties	106	Effects of microplastics to aquatic environment	122
Veronika Melcova Kateřina Chaloupkova, Radek Přikryl, Lucy Vojtova and Michala Rampichova		Ing. Petra Prochazkova	
Monitoring of Gadolinium Anomaly in Soil, Grapevine and Wine Samples from the Czech Republic.	108	New possibilities in the analysis of modified trichothecenes type A in oats: immunoaffinity purification and enzymatic hydrolysis	124
Frederika Miřıkova Anna Krejcova, Jan Patocka		Nela Pruřova, Zbynek Dřuman, Jana Hajřlova, Milena Stranska-Zachariařova	
Olive Oil Authenticity: Detection of Soft-Deodorized Oils in Extra-Virgin Olive Oils Using Metabolomic Approach	110	Study of the Influence of Selected Compounds on Stability of Beer Foam	126
Klara Navratilova Vojtech Hrbek, Kamila Hurkova, Jana Hajřlova Assessment of air pollution in the Czech Republic by emerging chlorinated contaminants Ondřej Pařizek Jakub Tomassko, Jana Pulkrabova		Lenka Puncochařova	
		Analysis of the Mixing Process Performance in Mixtures for Direct Tablet Compression Using Segregation Test. . . .	128
		Simona Romerova Adam Karaba, Petr Zamostny	
		The authenticity of Poppy Seeds: How to Detect the Undeclared Hydrothermal Treatment?	130
		Kateřina řebelova Monika Beneřova, Lucie Chytilova, Vladimır Kocourek, Jana Hajřlova,	

Inorganic Thermal insulation material for masonry elements. .132

Martin Sedlačík
Tomáš Opravil

**Mixotrophic growth and increased salinity – possible tools
for increasing the PHB production in cyanobacteria?134**

Zuzana Šedrlová
Eva Slaninová, Petr Sedláček, Ines Fritz, Stanislav Obruča.

An isolation of a protein from a wheat bran 136

Zuzana Slavíková
Jaromír Pořízka, Pavel Diviš

**Utilization of recycled brick waste for growing the agricultural
plants 138**

Ing. Barbora Šmírová
doc. Ing. Tomáš Opravil, Ph.D.

**Characterization of SiO₂ Nanofluid by High Resolution Ultrasonic
Spectroscopy 140**

Sarka Sovova,
Miloslav Pekar
Determination of biogenic amines in Swiss and Dutch type cheeses
Michal Sýkora
Eva Vítová, Agnieszka Pluta-Kubica

**Study of Liposomes Membrane Properties by Fluorescence
Spectroscopy143**

Jana Szabová
Filip Mravec

**Contamination of Vegetable Oils by Mineral Oils and Polycyclic
Aromatic Hydrocarbons: A Czech Market Survey144**

Jakub Tomáško
Veronika Vondrášková, Jana Pulkrabová

**The Effect of Freezing Rate on Properties of PVA Hydrogels
Prepared by Cyclic Freezing/Thawing 146**

Monika Trudičová
Jan Zahradka, Petr Sedláček, Miloslav Pekař

**The Effect of Substitution and Aromatic Ring Condensation on
the Optical Properties of Alloxazine: a Theoretical Study . . 148**

Jan Truksa
Denisa Cagardová, Martin Michalík, Jan Richtár, Jozef Krajčovič,
Martin Weiter,
Vladimír Lukeš

**Occurrence of chlorinated paraffins in human blood serum and
problems of their quantification. 150**

Denisa Turnerová
Jakub Tomáško, Jana Pulkrabová

**Can high-resolution mass spectrometry (HRMS) –based
metabolomics be used for a varietal classification of wines? . .
152**

Leos Uttl
Vaclav Kadlec, Zbynek Dzuman, Mona Ehlers, Carsten Fauhl-Hassek,
Jana Hajslova

Utilization of Mica Separated from Washed Kaolin154

Ing. Josef Vaculík
doc. Ing. Tomáš Opravil, Ph.D.

Antidepressants and Anxiolytics in the Environment155

Petra Venská¹, Martina Repková

**Use of a pilot scrubber separation device for specific pollutant in
the air157**

Jaroslav Vlasák
Tomáš Svěrák, Ondřej Krištof, Josef Kalivoda, Petr Horvát

**Police Officer Exposure to Polycyclic Aromatic Hydrocarbons in
Three Locations of the Czech Republic. 158**

Veronika Vondrášková
Ondřej Pařízek
Kateřina Urbančová
Jana Pulkrabová

**Utilization of Grape Seed Lignin in Polyhydroxyalkanoate Blends .
160**

Pavel Vostrejš^{1, 2*}
Adriana Kovalcik¹

Transport Properties of Biopolymeric Hydrogels 162

David Vyroubal, Martina Klučáková

**Preparation of Mg-Ti Based Bulk Materials via Powder Metalurgy
164**

Martin Žilinský

Utilization of Grape Seed Lignin in Polyhydroxyalkanoate Blends

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Lignin is one of the most widespread biopolymers in the world. It is a complex polyphenol compound with a branched three-dimensional structure. This structure is formed by aromatic monolignols derived from hydroxycinnamyl alcohol. Nowadays, lignin is mostly obtained as a by-product in the pulp and paper industry. Lignin is most often used as a waste fuel. Laboratory lignin can be isolated by various technics, including the most common methods such as Kraft, sulfite, soda or organosolv process. the fundamental effect on lignin properties has the presence of sulfur in the structure. Sulfur compounds arise through Kraft and sulfite processes. Lignin obtained from the sulfite process is soluble in water, Kraft lignin only in alkaline solutions. the main advantage of organosolv and soda lignin is that they are sulfur-free. However, both are insoluble in water.

Lignin due to its bio-origin, aliphatic-aromatic composition and high abundancy possess theoretically a wide range of applica-

tions. Attention is mostly focused on the copolymerization and blending of lignin with various kinds of polymers, such as polyurethanes, phenol-formaldehyde and epoxy resins, polyesters and others.

In our research, we used lignin isolated from grape seeds that are waste products in the wine industry. Lignin was isolated by soda process and showed a high antioxidant activity thanks to its phenolic structure. Our work summarizes the effect of lignin addition on the properties of polyhydroxyalkanoate films. Principally, grape seeds lignin was mixed with crystalline poly(3-hydroxybutyrate) and amorphous polyhydroxyalkanoate via solution casting. the PHA/lignin films showed improved mechanical, thermal and gas barrier properties. the further advantage of these films was high antioxidant efficiency. All prepared samples proved their compostability comparable with a paper standard. Moreover, the obtained biomass after composting enhanced the plant growing.

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Keywords: lignin, grape seeds, polyhydroxyalkanoates, films, composting, physico-mechanical properties