10th Jubilee International Conference of FMNS - 2023

14 - 18.06.2023, Blagoevgrad, BULGARIA

BOOK OF ABSTRACTS

Patronized by
Prof. Borislav Yurukov
Rector of the South-West University

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BOOK OF ABSTRACTS

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Conference Program

Registration (14.06.2023)
13:00 – 18:30
University Conference Centre "Bachinovo"

Opening Ceremony (15.06.2023)
10:00 – 10:30
Central Auditorium of Conference Center

Plenary Lectures (15.06.2023)

Central Auditorium of Conference Center
Chairman: Assoc. Prof. Lidia Sakelarieva, PhD

10:30 – 11:15

Prof. Boštjan Genorio - University of Ljubljana, Slovenia
"Electrosynthesis of Hydrogen Peroxide using Graphene derivatives"

11:15 – 12:00

Acad. Oleg Mushkarov - Bulgarian Academy of Science, Bulgaria
"History and the present state of the well-known Sendov hypothesis for critical distribution points of a polynomial with complex coefficients"

Plenary Lectures (16.06.2023)

Central Auditorium of Conference Center
Chairman: Assoc. Prof. Lidia Sakelarieva, PhD

10:00 – 10:45

Dr. Manfred Schütze - Otto-von-Guericke University Magdeburg, Germany
"Which model is best for me? - Some examples from urban water engineering"

10:45 – 11:30

Assoc. Prof. Tatyana Kutsarova – Bulgarain Academy of Science, Bulgaria
"Hexaferrites – single phase magneto-electric multiferroics"

Section sessions: 15 - 16.06.2023
13:30 - 18:00
University Conference Center “Bachinovo”

Poster sessions (Physics): 15.06.2023
14:30 – 15:30
Poster sessions (all other sections): 16.06.2023
18:00 – 19:00

Special sessions

"**STEAM Education - Reality and Perspectives**"
16.06.2023
14:00 – 17:00
Conference Hall

Workshop of project № KP-06-H67/6 – 12.12.2022
"**Bioelectrochemical systems for organic pollutants remediation**"
16.06.2023
9:00 - 18:00
Hall 3

Welcome party
18:00 – 15.06.2023
University Conference Center “Bachinovo”

Official dinner
19:30 – 16.06.2023
University Conference Center “Bachinovo”

Social program
17.06.2023

Section: Chemistry
Hall 4

Thursday, June 15th	
Chairman:	***Assoc. Prof. Zhivko Velkov***
13:30-13:45	**O-C-1** Ferrocene ligands with Sb-donor groups *Petr Stepnicka*
13:45-14:00	**O-C-2** Proton Conductivity in Solids – Determination of Proton Transfer Trajectory in Proton Conductors by In-situ X-Ray Powder Diffraction *David Havlíček, Jiří Plocek, Róbert Gyepes*
14:00-14:15	**O-C-3** Study on Natural and Modified zeolites from Bulgaria and Serbia *Mitko Stoev, Bostjan Genorio, Vesna Stankov Jovanovic*
14:15-14:30	**O-C-4** Evaluation of some chemical characteristics of spirulina from different manufacturers *Krastena Nikolova, Nadejda Petkova, Ginka Antova, Jana Petkova, Galia Gentscheva*
14:30-14:45	**O-C-5** Chemical composition and optical properties of refined sunflower oil with added various oils *Galia Gentscheva, Nadejda Petkova, Krastena Nikolova, Aleksandar Pashev, Tinko Evtimov*
Coffee break	
Chairman:	***Assoc. Prof. Mitko Stoev***
15:30-15:45	**O-C-6** Theoretical study of hepatic metabolic activation of oxidized propyl sulfide *Neli Koicheva, Yana Koleva, Yordanka Tasheva*
15:45-16:00	**O-C-7** Effectiveness of Glycerol, DMSO and Trehalose in the process of cryopreservation of drone semen from the species Apis mellifera *Tsvetan Tsvetkov, Nadya Petrova, Hristina Blagova, Denica Daskalova, Detelina Vitanova, Rositsa Shumkova*
16:00-16:15	**O-C-8** Biochemical Secretome Analysis of Mesenchymal Stem Cell Conditioned Media and Their Use in Treatment of Women with Diminished Ovarian Reserve *Nadya Petrova, Tsvetomira Dimitrova*
16:15-16:30	**O-C-9** Investigation of the properties of pure and doped thin ZnO films obtained by spray pyrolysis technique *Pavlina Bancheva, Vesko Zhelev, Plamen Petkov, Tamara Petkova*
16:30-16:45	**O-C-10** Inorganic Salts of Aminoguanidines – Crystal Structures, Vibrational Spectra and Optical Properties *Ivan Nemec, Sona Kohutekova, Irena Matulkova, Ivana Cisarova, Zorka Machackova, Petr Nemec*

Friday, June 16th	
Chairman:	***Assist. Prof. Petranka Petrova***
13:30-13:45	**O-C-11** Antioxidant Activity of Arylhydrazone Derivatives of Indole Acetic acid *Miroslav Marinchev, Nadya Hristova-Avakumova, Neda Anastassova, Maria Argirova, Denitsa Yancheva*

13:45-14:00	**O-C-12** In vitro Antioxidant effect of Unsubstituted Benzimidazole Derivatives *Stefan Federchev, Maria Argirova, Liliya Atanasova, Nadya Hristova-Avakumova, Denitsa Yancheva*
14:00-14:15	**O-C-13** The Antimicrobial and Hemolytic Activity of Various Heterocyclic N-oxide Series *Nurgali Akylbekov, Elena Chugunova, Vladimir Samsonov, Alexandra Voloshina, Alexander Burilov, Nurbol Appazov, Rakhmetulla Zhapparbergenov, Rakhymzhan Turmanov, Banu Diyarova, Mukhtar Zhanakov*
14:15-14:30	**O-C-14** Relative molecular mass and relationship to other natural sciences *Ruska Draganova-Hristova, Snejana Iordanova*
14:30-14:45	**O-C-15** Structural requirements of angiotensin receptor: preferred modifications for antagonist design *Tatyana Dzimbova, Atanas Chapkanov*
14:45-15:00	**O-C-16** Evaluation of measurement uncertainty associated with the sample preparation procedure *Ava Amideina, Petranka Petrova, Mitja Kolar, Jernej Imperl, Petko Mandjukov*
15:00-15:15	**O-C-17** Biodiversity of macroalgae in the Marchica lagoon of Nador (Morocco) *Ouiam EL MEKKI 1, Mostafa LAYACHI, Noreddine REZZOUM, Mourad BAGHOUR, Nassir KADDOURI, Najib ELOUAMARI, Mustapha AKODAD, Petranka PETEOVA, Hakima ZIDANE, Ali SKALLI*
Coffee break	

Section: Physics
Hall 3

Thursday, June 15th	
Chairman: ***Assoc. Prof. Lyuben Ivanov***	
13:30-13:45	**O-P-1** Investigations of Giant Monopole Resonance and Nuclear Incompressibility in Spherical Nuclei *Yordan Katsarov, Mitko Gaidarov, Martin Ivanov, Anton Antonov*
13:45-14:00	**O-P-2** 5-Fluorouracil encapsulated chitosan microspheres *Sofia Milenkova, Svetoslav Tashkov, Nikolay Zahariev, Bissera Pilicheva, Maria Marudova*
14:00-14:15	**O-P-3** Chitosan/rosehip seed oil multicomponent edible films *Biser Gechev, Maria Marudova, Angel Iliev, Gabor Zsivanovits*
14:15-14:30	**O-P-4** Theoretical and kinetic parameters in oxidative cleaning of oil fractions *Yordanka Tasheva*
Coffee break	

Section: Geography
Hall 8

Thursday, June 15th	
Chairman**:** ***Assoc. Prof. Krasimir Stoyanov***	
13:30-13:45	**O-G-1** How to publish in Journal of the Bulgarian Geographical Society: guidelines and submission demonstration Hristina Prodanova
13:45-14:00	**O-G-2** Trend analysis of water discharge in the Kutinska River Basin, Serbia *Milena Gocić, Nataša Martić Bursać, Ljiljana Stričević*
14:00-14:15	**O-G-3** The Significance of Relief Characteristics in Sustainable Development of Mountain Regions. A Case Study: The Mountain Šljivovička Planina and its Foothill in Eastern Serbia *Jelena Živković, Tatjana Djekić, Marija Bratić*
14:15-14:30	**O-G-4** Europe's Southernmost Perennial Glacieret Found in Nemercka Mountain, Southern Albania *Emil Gachev, Martin Iliev, Georgi Gachev, Erald Meshini, Simeon Matev*
14:30-14:45	**O-G-5** State of the surface waters in the Mesta River basin after the reclamation of the "Eleshnitsa" uranium deposit Nadezhda Nikolova
14:45-15:00	**O-G-6** Mining as an anthropogenic source of pollution in Bosilegrad municipality Milena Milenova, Ivan Drenovski
Coffee break	
Chairman: ***Assoc. Prof. Emil Gachev***	
15:30-15:45	**O-G-7** Physical Geographic Characteristics of the Hadzhidimovo Gorge (South-Western Bulgaria and Northern Greece) *Krasimir Stoyanov, Galina Bezinska, Alexander Pulev*
15:45-16:00	**O-G-8** Drought Hazard in Bulgaria in XX and XXI century *Mariyana Nikolova, Miroslav Ivanov*
16:00-16:15	**O-G-9** Multi criteria GIS based flood susceptibility mapping in the area of Berkane city, Morocco *Miroslav Ivanov, Imad Zerhoudi, Konstantin Tyufekchiev*
16:15-16:30	**O-G-10** GIS based flood susceptibility mapping in the area of Port Nador, Morocco *Miroslav Ivanov, Lamiae El Hadri, Konstantin Tyufekchiev*
16:30-16:45	**O-G-11** Remote Sensing based monitoring to Assess Water Quality of Lamiae port Lagune, Marocco *Miroslav Ivanov, Ouiam El Mekki, Konstantin Tyufekchiev*

Friday, June 16th	
Chairman**:** ***Assoc. Prof. Emilia Patarchanova***	
13:30-13:45	**O-G-12** Trends and challenges for the health system in Kyustendil region *Emilia Patarchanova, Gergana Nikolova*
13:45-14:00	**O-G-13** Education Infrastructure in the Kyustendil Region - Current State and Trends *Gergana Nikolova, Emilia Novachka-Girginova*

14:00-14:15	**O-G-14** Challenges in development and energy security of peripheral areas *Plamen Patarchanov, Emilia Patarchanova*
14:15-14:30	**O-G-15** The effect of COVID-19 on poverty in Bulgaria: mapping and analysis *Galina Bezinska, Krasimir Stoyanov*
14:30-14:45	**O-G-16** Demographic profile of the border municipalities of the Southwest region *Vasil Pandurski, Emilia Patarchanova*
14:45-15:00	**O-G-17** Digital marketing strategies for Black Friday and Christmas *Vladimir Karadzhov*
Coffee break	

Section: Ecology and Environmental Protection
Hall 9

Thursday, June 15th	
Chairman**: *Assoc. Prof. Lidia Sakelarieva***	
13:30-13:45	**O-EEP-1** Are humans allies or opponents of nature? *Ryszard Sadowski*
13:45-14:00	**O-EEP-2** Exploitation of common resources – simple reasons to be different *Janusz Uchmański*
14:00-14:15	**O-EEP-3** Hidden diversity of fungi parasitizing ladybird beetles in the Canary Islands *Piotr Ceryngier, Jerzy Romanowski, Danny Haelewaters*
14:15-14:30	**O-EEP-4** Strip tillage and conventional sugar beet cultivation: do they have the same effect on the density and structure of soil nematode communities? *Krassimira Ilieva-Makulec, Dominika Dymitrowicz*
14:30-14:45	**O-EEP-5** The Caspian Whip Snake, Dolichophis caspius (Gmelin, 1789) (Reptilia: Colubridae), in Bulgaria: distribution and activity *Alexander Pulev, Lidia Sakelarieva, Emanuil Mitrevichin, Borislav Naumov, Georgi Popgeorgiev*
Coffee break	
Chairman: ***Assoc. Prof. Emilia Varadinova***	
15:30-15:45	**O-EEP-6** Seasonal activity of *Xerotyphlops vermicularis* (Merrem, 1820) (Reptilia: Typhlopidae) in Bulgaria, with first records of autumn activity *Alexander Pulev, Lidia Sakelarieva, Emanuil Mitrevichin*
15:45-16:00	**O-EEP-7** The populations of Testudo hermanni boettgeri and T. graeca ibera (Testudines: Testudinidae) in the northwestern foothills of the Pirin Mountains, Bulgaria *Emanuil Mitrevichin, Lidia Sakelarieva, Hristo Peshev, Alexander Pulev*
16:00-16:15	**O-EEP-8** Important Vulture Sites in the Middle East revealed from GPS tracking migrating Griffon Vultures from the Balkans *Hristo Peshev, Emilian Stoynov, Emanuil Mitrevichin, Atanas Grozdanov, Konstantin Tyufekchiev*

16:15-16:30	**O-EEP-9** Conservation of fish species from Annex 2 of the Habi-tats Directive in protected sites of the Natura 2000 Network along the Bulgarian section of the Danube River – modern perspective ***Luchezar Pehlivanov, Apostolos Apostolou***
16:30-16:45	**O-EEP-10** Methodological Approach for Long-term Ecological Research in Forest sites *Toma Tonchev, Svetoslav Anev, Violeta Dimitrova, Sonya Damyanova*
16:45-17:00	**O-EEP-11** Current state of population of autochthonous (Stanushina, Plovdina, Prokupec, Temjanika) varieties of grapevine in the Republic of North Macedonia *Aleksandar Klincarov, Konstantin Tyufekchiev, Violeta Dimovska*

Friday, June 16th	
Chairman**: *Assist. Prof. Miroslav Ivanov***	
13:30-13:45	**O-EEP-12** From sites to a research infrastructure: establishing network level standard observations for the Bulgarian Long-Term Ecosystem Research Network *Kremena Gocheva, Radka Fikova, Kostadin Katrandzhiev, Lyudmila Lozanova, Valeri Georgiev, Vladimir Petrov, Tsvetan Tsvetanov, Petar Dimov, Tzvetan Zlatanov, Emilia Varadinova, Ventsislav Karamfilov, Nevena Ivanova, Kremena Stefanova, Sonya Damyanova, Miglena Zhiyanski, Stela Lazarova, Svetla Bratanova-Doncheva*
13:45-14:00	**O-EEP-13** Ecology-Health-City *Maria Shishmanova, Veselina Dalgacheva*
14:00-14:15	**O-EEP-14** The Green City – evaluation of the urban environment to define the city as green *Veselina Dalgacheva, Maria Shishmanova*
14:15-14:30	**O-EEP-15** Moral issues in the science ot ecology: technological directions *Nikolai Mihailov, Lidia Sakelarieva*

Sections: Mathematics and Informatics
Hall 7

Thursday, June 15th	
Chairman: ***Prof. Vitor Fernandes***	
13:30-13:45	**O-MI-1** About the Solutions of Modified Lorenz System *Biljana Zlatanovska, Donco Dimovski, Mirjana Vitanova*
13:45-14:00	**O-MI-2** Products of Distributions in Colombeau Algebra *Marija Miteva, Limonka Lazarova, Biljana Zlatanovska, Natasha Stojkovikj*
14:00-14:15	**O-MI-3** Modeling, Analysis and Simulation of Tuberculosis *Natasha Stojkovikj, Biljana Zlatanovska, Maja Paneva, Limonka Lazarova*
14:15-14:30	**O-MI-4** Using ChatGPT for numerical solution of first and second order ordinary differential equations *Saso Koceski, Natasa Koceska, Limonka Lazarova, Marija Miteva, Biljana Zlatanovska*

14:30-14:45	**O-MI-5** Social Network Development Using the Firebase Platform *Verica Ivanova, Limonka Lazarova, Natasha Stojkovikj, Cveta Martinovska Bande*
14:45-15:00	**O-MI-6** Theoretical proof for the number of errors that one linear code detects when linear quasigroups of order 4 are used for coding *Natasha Ilievska*
15:00-15:15	**O-MI-7** Simulation of the number of surely detected errors of an error-detecting code *Natasha Ilievska*
Coffee break	
Chairman: ***Prof. Joerg Koppitz***	
15:45-16:00	**O-MI-8** Chain relation in a family of sets and chain function *Zoran Misajleski, Emin Durmishi*
16:00-16:15	**O-MI-9** Methods of solving systems of linear equations mxn, m=1,2,3; based on the geometrical interpretations of the equations *Zoran Misajleski, Daniel Velinov, Aneta Velkoska*
16:15-16:30	**O-MI-10** Geometric properties of a free boundary problem *Martin Lukarevski*
16:30-16:45	**O-MI-11** Predator-prey interactions under the Allee effect in prey and multiple predator harvesting strategies *Petar Ćirković*
16:45-17:00	**O-MI-12** One result about products of distributions and ultradistributions *Petar Sokoloski*
17:00-17:15	**O-MI-13** Some results for the serial RL parallel C circuit using Laplace transform *Jasmina Buralieva, Maja Paneva*
17:15-17:30	**O-MI-14** Abelian-and Tauberian-type results for the generalized Stockwell and wavelet transforms *Jasmina Buralieva*

Friday, June 16th	
Chairman: ***Assoc. Prof. Ilinka Dimitrova***	
13:30-13:45	**O-MI-15** Conformable Evolution Inclusions With Causal Operators *Tzanko Donchev, Iveta Nikolova, Mikhail Kolev, Boiana Garkova, Alina Lazu*
13:45-14:00	**O-MI-16** Evolution Inclusions with Non Fixed Times of Impulses *Tzanko Donchev, Nikolay Kitanov, Dimitar Kolev, S. Iftikhar, Alina Lazu*
14:00-14:15	**O-MI-17** On Some Applications of Linear Problems in Economy *Boiana Garkova, Sashka Kandilarova, Mikhail Kolev, Iveta Nikolova*
14:15-14:30	**O-MI-18** On Some Nonlinear Problems in Economy *Sashka Kandilarova, Mikhail Kolev, Nikolay Kitanov, Iveta Nikolova,Sevasti Georgiadou*
14:30-14:45	**O-MI-19** On Consumer Demand and Utility Optimization *Sevasti Georgiadou, Mikhail Kolev, Iveta Nikolova, Sashka Kandilarova*
14:45-15:00	**O-MI-20** On some stochastic applications to chemical problems *Iveta Nikolova, Krasimir Yordzhev, Valeri Vachkov, Mikhail Kolev, Ginka Paunova, Radostina Genova-Koleva*

15:00-15:15	**O-MI-21** Deep Learning for Automated Diagnosis of Radiological Images: A Comprehensive Review of Neural Networks and Mathematical Approaches *Irina Naskinova, Mikhail Kolev*
Coffee break	
Chairman: Assoc. Prof. Mikhail Kolev	
15:45-16:00	**O-MI-22** On some monoids of partial isometries on graphs *Vítor Hugo Fernandes*
16:00-16:15	**O-MI-23** The rank of the semigroup of order-, fence-, and parity-preserving partial injections on a finite set *Apatsara Sareeto, Joerg Koppitz*
16:15-16:30	**O-MI-24** The rank of the inverse semigroup of all partial automorphisms on a finite crown *Ilinka Dimitrova, Joerg Koppitz*
16:30-16:45	**O-MI-25** Lucky Rooted Trees *Joerg Koppitz*
16:45-17:00	**O-MI-26** A Class of Integer 3 x 3 Matrices Related to Numerical Semigroups with Embedding Dimension 4 *Merita Bajrami, Donco Dimovski, Violeta Angjelkoska*
17:00-17:15	**O-MI-27** Some fixed point theorems in (3,2)-metric spaces *Tomi Dimovski, Donco Dimovski*
17:15-17:30	**O-MI-28** Expanding the capabilities of robot NAO to enable human-like communication with children with speech and language disorders *Anna Andreeva, Anna Lekova, Paulina Tsvetkova, Miglena Simonska*

Section: Methodology in Education
Conference Hall

Thursday, June 15th	
Chairman: ***Prof. Daniela Dureva***	
13:30-13:45	**O-ME-1** Using Olympic Grading Systems in Education of Programming *Krassimir Manev*
13:45-14:00	**O-ME-2** Diagnostics of the intellectual and personal reflection in the process of biology and health education (Second stage of high school education) *Isa Hadjiali*
14:00-14:15	**O-ME-3** The Effect of Context-Based Chemistry Learning on Student' Motivation and Engagement *Vesela Pavlova, Alexandria Gendjova*
14:15-14:30	**O-ME-4** Application of digital technologies in the chemistry classroom: teachers' attitudes in 2019 and 2022 *Martina Tsenova, Milena Kirova*
14:30-14:45	**O-ME-5** Changes in motivation to learn chemistry through independent group activities *Martina Evgenieva, Milena Kirova*
14:45-15:00	**O-ME-6** Chemistry lesson plan based on 6C's model of CLIL *Irina Andonova, Elena Boadjieva*
Coffee break	

Chairman: ***Prof. Krassimir Manev***	
15:30-15:45	**O-ME-7** Information technology as a means of strengthening the competences acquired by the student from the topic "Numbers from 101 to 1000" *Vilislav Radev*
15:45-16:00	**O-ME-8** How to Increase Students' Interest in Mathematics - Challenging their Understanding of Mathematics Via Solving Problems *Stanislava Stoilova, Mikhail Kolev*
16:15-16:30	**O-ME-9** Teaching Computational Thinking with Python: Enhancing Mathematical Problem-Solving Skills in High School Students *Irina Naskinova, Gabriela Vasileva, Yana Vasileva, Mikhail Kolev, Iveta Nikolova*
16:30-16:45	**O-ME-10** Python Programming for Math Education: Fostering Logical Reasoning and Creativity in High School Students *Irina Naskinova, Gabriela Vasileva, Yana Vasileva, Iveta Nikolova, Mikhail Kolev*
16:45-17:00	**O-ME-11** The Power of Python for Developing Computational Problem-Solving: Integrating Coding into High School Math Curricula *Irina Naskinova, Gabriela Vasileva, Yana Vasileva, Mikhail Kolev, Iveta Nikolova*
17:00-17:15	**O-ME-12** A new view on the golden ratio *Stanislava Stoilova, Mikhail Kolev*
17:15-17:30	**O-ME-13** The Mathematical competition "Beyond all standards" at the university *Mediha Topalova, Boyana Garkova*
17:30-17:45	**O-ME-14** The motivation of bilingual students in mathematics and information technology education *Silvena Stefanova-Milanova*

SPECIAL SESSIONS

Friday, June 16th

Special session
"STEAM Education - Reality and Perspectives"
Conference Hall

Friday, June 16th	
Chairman: ***Assoc. Prof. Ralitsa Stanoeva***	
14:00-14:15	**O-ME-15** STEM *Nayden Chivarov*
14:15-14:30	**O-ME-16** From steam to stream. *Ani Vasileva, Svetla Borisova, Nadejda Deyanova, Anna Jarova, Vanya Kaftandjieva*
14:30-14:45	**O-ME-17** CONCEPT ON STREAM EDUCATION IN ACCORDANCE WITH BULGARIAN CURRICULUM CONTENT OF 8-10TH CLASS *Nadezhda Rajcheva*
14:45-15:00	**O-ME-18** A SYNERGIC MODEL FOR STEAM LEARNING IN SCIENCES (FIRST HIGH SCHOOL STAGE)

	Svetla Bukovska
15:00-15:15	**O-ME-19** Natural zeolites in Green STEM model for education *Mitko Stoev*
15:15-15:30	**O-ME-20** Reflexion and STEM based education in biological educaton *Alexander Milushev*
15:30-15.45	**O-ME-21** STEM as a Math learning motivator *Aharon Goldreich, Elena Karashtranova*
15:45-16.00	**O-ME-22** Design Thinking Skills for Teachers *Daniela Tuparova, Boyana Garkova, Zarina Markova*
16.00	**Discussion** The participants can share good practices applied in the education.

Special session

Workshop of project № KP-06-H67/6 – 12.12.2022 " "Bioelectrochemical systems for organic pollutants remediation"

16.06.2023

9:00 - 18:00

Hall 3

POSTER SESSION

Chemistry	
P-C-1	Micro elements determination in Rosa myriacantha DC. samples by an optimized and validated ICP OES method *Katarina Milenković, Jelena Mrmošanin, Stefan Petrović, Aleksandra Pavlović, Snežana Tošić, Bojan Zlatković, Ivana Rašić, Mišić Emilija, Pecev-Marinković*
P-C-2	Pharmacokinetic studies of selenium supplementation *Natasha Ristovska, Pece Sherovski*
P-C-3	Microbiologically Induced Corrosion of Copper Foil in Different Environments *Desislava Apostolova, Elitsa Chorbadzhiyska, Mario Mitov, Yolina Hubenova*
P-C-4	Reduced graphene oxide functionalized with metallic nanoparticles (Pt, Ni, Co) as a cathodic electrocatalyst for HER in microbial electrolysis cells *Elitsa Chorbadzhiyska, Galin Borisov, Ivo Bardarov, Eva Slavcheva, Mario Mitov, Yolina Hubenova*
P-C-5	Viability of pyrolyzed activated carbon felts as electrodes in sulfide-nitrate fuel cell *Stefan Stefanov, Ljutzkan Ljutzkanov, Elena Razkazova-Velkova*
P-C-6	Metal and Vulcan XC-72R carbon black nanocomposites for purification of organic pollutants *Ivelina Tsacheva, Adriana Gigova, Ognian Dimitrov, Mariela Dimitrova, Dzhamal Uzun*
P-C-7	Electrocatalytic studies of oxidation of organic contaminants in aqueous solution using ZrO_2 catalyst on biochar carbon *Dzhamal Uzun, Ljutzkan Ljutzkanov, Mariela Dimitrova, Adriana Gigova, Ognian Dimitrov, Stefan Stefanov, Elena Razkazova-Velkova, Konstantin Petrov*
P-C-8	Enhancement of the carbon felt anode performance in microbial fuel cell using carboxymethyl chitosan/polyaniline@ferrite nanocomposite for improving the generation bioelectricity and the elimination of COD *Mehrez E. El-Naggar, Bahaa A. Hemdan, Gamila E. El-Taweel, Sherief A. Al Kiey, Mario Mitov, Yolina Hubenova*
P-C-9	Comparison of two algal species of different genera from the perspective of their sustainable use *Stanislava Boyadzhieva, Flora Tsvetanova, Jose Coelho, Dragomir Yankov, Roumiana Stateva*
P-C-10	Green chemistry inspired solvents for the extraction of maleic-fumaric acid mix *Apostol Apostolov, Dragomir Yankov*
P-C-11	Modeling of lactic acid production by means of Lactiplantibacillus plantarum AC11S *Petya Popova – Krumova, Svetla Danova, Dragomir Yankov*
P-C-12	Biohydrogen production by means of newly isolated Clostridium beijerinckii 6A1 strain *Nadya Armenova, Dragomir Yankov*

P-C-13	Phenol tolerance of bacterial strains *Evgenia Vasileva, Tsvetomila Parvanova-Mancheva, Stefan Stefanov, Elena Razkazova-Velkova*
P-C-14	Iron-bearing wood material as peroxydisulfate and hydrogen peroxide activator for enhanced anthraquinone dye degradation *Miljana Radović Vučić, Miloš Kostić, Jelena Mitrović, Nena Velinov, Milica Petrović, Slobodan Najdanović, Aleksandar Bojić*
P-C-15	ZnFe-Layered double hydroxide for sorption of Methyl Orange: Kinetics, isotherm studies, and optimization of process parameters *Miloš Kostić, Kristina Filipović, Miljana Radović Vučić, Nena Velinov, Slobodan Najdanović, Danijela Bojić, Aleksandar Bojić*
P-C-16	The influence of the SARS COV-2 virus infection on the serological level of IgM antibodies in patients with Infectious Mononucleosis *Anamarija Shram, Natasa Ristovska*
P-C-17	Spectral and structural characterization of amino acid salts for application in non-linear optic *Atanas Chapkanov, Tatyana Dzimbova, Kiril Kuntsev, Tzonko Kolev*
P-C-18	A Study of the Metabolic Transformations of α-Phellandrene from Essential Oils in the Liver *Milen Dimov, Yana Koleva*
P-C-19	Possible Hepatic Metabolic Activation of Methylchavicol from the essential oil composition *Yana Koleva, Milen Dimov*
P-C-20	Validation of titration method for determination of BOD5/Dissolved O_2 *Ava Amideina, Kiril Chuchkov, Petko Mandjukov*
P-C-21	Radical Scavenging Activity of Melatonin and its Metabolite *Gergana Ivanova, Kemile Robova, Valeri Vachkov, Zhivko Velkov*
P-C-22	Prediction of skin sensitivity of beta-caryophyllene from essential oil *Elisaveta Todorova-Koynova, Nadezhda Dimitrova, Desislava Sabeva, Yana Koleva*
P-C-23	Possible hepatic effects of the beta-caryophyllene from essential oils *Elisaveta Todorova-Koynova, Nadezhda Dimitrova, Desislava Sabeva, Yana Koleva*
P-C-24	Potential Hepatic Transformations of Intralipid *Yana Koleva,Viktoria Trifonova*
P-C-25	Toxicological Evaluation of Intralipid *Victoria Trifonova, Yana Koleva*
P-C-26	Computational studies for opioid receptors and potent bioactive opioid ligands: computer modeling and molecular docking analysis *Fatima Sapundzhi, Tatyana Dzimbova, Metodi Popstoilov*
P-C-27	Novel boldine amides and their in vitro inhibitory effects on mushroom tyrosinase *Maya Chochkova, Boyka Stoykova, Petranka Petrova, Martin Štícha, Galya Ivanova*
P-C-28	Assessment and Comparison of Heavy Metal Contamination in Surface Sediments from Two Urban Rivers *Jernej Imperl, Mitja Kolar, Petranka Petrova*
P-C-29	Whey Derived Bioactive Peptides with ACE Inhibitory Properties *Boryana Yakimova, Lili Dobreva, Yuliana Raynova, Svetla Danova,Ivanka Stoineva*

P-C-30	Synthesis and Antioxidant Activity of Some Aminoadamantanes *Antoniya Stoymirska, Radoslav Chayrov, Almira Georgieva, Albena Alexandrova, Ivanka Stankova*
P-C-31	Hydrolytic stability of memantine analogues with nootropics *Anna-Mariya Ivanova, Antoniya Stoymirska, Radoslav Chayrov, Ivanka Stankova*
P-C-32	Neurological Recovery-Promoting in Induced Brain Injury by Memantine Derivative *Antoniya Stoymirska, Radoslav Chayrov, Çetin Hakan Karadağ, Ivanka Stankova*
P-C-33	The science of miracles - Chemistry *Elitsa Chorbadzhiyska, Katerina Angelova, Yordan Angelov*
P-C-34	The quantitative Determination of Proanthocyanidins Concentrations in Vicia faba Cultivars from Serbia *Violeta Mitic, Andrea Ivkovic, Jelena Nikolic, Goran Petrovic, Jasmina Milenkovic, Snezana Andjelkovic, Vesna Stankov Jovanovic*
P-C-35	Antioxidant and antimicrobial activities of Lactarius sanguifluus *Violeta Mitic, Jelena Nikolic, Goran Petrovic, Aleksandra Djordjevic, Marija Dimitrijevic, Vesna Stankov Jovanovic*
P-C-36	Analysis of the docking results of some selective MOR ligands *Tatyana Dzimbova, Fatima Sapundzhi, Peter Milanov*
P-C-37	Computational modeling of compounds that interact with opioid and cannabinoid receptors *Fatima Sapundzhi, Tatyana Dzimbova, Metodi Popstoilov*
P-C-38	Clinoptilolite as sorbent for sample preparation in PAH analysis *Milica D. Nikolić, Nikola Radisavljević, Teodora Petreski, Milica G. Nikolić, Jelena Nikolić, Violeta Mitić, Vesna Stankov Jovanović*
P-C-39	ICP-OES Determination of Selenium in Flour Samples *Stefan Petrović, Denis Mitov, Đorđe Savić, Jelena Mrmošanin, Aleksandra Pavlović, Snežana Tošić*
P-C-40	Application of the new kinetic method for quantitative determination of herbicide 4-chloro-2-metylphenoxy acetic acid in baby food samples using SPE followed by HPLC method *Ana Miletic Ciric, Emilija Pecev-Marinkovic, Aleksandra Pavlovic, Snezana Tosic, Ivana Rasic Misic, Jelena Mrmosanin, Katarina Milenkovic*
P-C-41	Antioxidant activity of houseleek *Milan Mitić, Jelena Nikolić, Ivan Palić, Violeta Mitić, Marija Ilić, Vladan Djurić, Vesna Stankov Jovanović*
P-C-42	Antimicrobial activity of Hypericum perforatum L. essential oil *Aleksandra Djordjević, Goran Petrović, Jelena Stamenković, Violeta Mitić, Jelena Nikolić, Jovana Ickovski, Vesna Stankov Jovanović*
P-C-43	Chemical composition of the Anthriscus caucalis headspace volatiles *Aleksandra Djordjević, Goran Petrović, Jelena Stamenković, Violeta Mitić, Jelena Nikolić, Vladan Đurić, Vesna Stankov Jovanović*
P-C-44	Polycyclic aromatic hydrocarbons in soil- application of diatomaceous earth in sample preparation step *Milica D. Nikolić, Jovana Petrović, Mihajlo Halilović, Milijana Zlatković, Jelena Nikolić, Violeta Mitić, Vesna Stankov Jovanović*
P-C-45	X-RAY fluorescence analysis of zeolitic tuffs from Serbia *Vesna Stankov Jovanovic, Violeta Mitić, Jelena Nikolić, Dragan Djordjević , Slobodan Ćirić, Miloš Rajković*

P-C-46	Microbial fuel cell as a biosensor for monitoring the organic load of wastewater *Nikolay Vitanov, Elitsa Chorbadzhiyska, Yolina Hubenova, Mario Mitov*
P-C-47	Evaluation of the antioxidant activity of honeys with variable botanical origin *Jelena Mrmošanin, Stefan Petrović, Vesna Stankov Jovanović, Maya Chochkova, Petranka Petrova*

Physics	
P-P-1	Frequency-tunable Stimulated Raman Scattering in quartz fibers *Lyuben Ivanov*
P-P-2	Composite materials based on nanosized ferrite for microwave application *Svetoslav Kolev, Todor Cholakov*
P-P-3	Laser synthesis and processing of composite nanostructures *Mihaela Koleva, Anna Dikovska, Nikolay Nedyalkov*
P-P-4	Laser-Assisted Synthesis of Water Colloidal Metallic Nanocomposites *Nadya Stankova, Anna Dikovska, Mihaela Koleva, Nikolay Nedyalkov, Daniela Karashanova*
P-P-5	Effect of Beam Power on the Structure and Mechanical Properties of Electron Beam Welded Cu / Al6082T6 Joints *Darina Kaisheva, Georgi Kotlarski, Vladimir Dunchev, Borislav Stoyanov, Maria Ormanova, Angel Anchev, Stefan Valkov, Vladimir Todorov, Milka Atanasova, Stanislava Rabadzhiyska*
P-P-6	Search for decay of the ^{7}Be nucleus in ^{8}B nucleus dissociation *Ralitsa Stanoeva*
P-P-7	Influence of chia gel on starch thermal transitions, measured by DSC during the storage of cakes *Dida Iserliyska, Gabor Zsivanovits, Angel Iliev, Maria Marudova*
P-P-8	Influence of chitosan-based composites on the properties of chemically modified poly-lactic acid films *Aleksandar Grigorov*
P-P-9	Sequential implementation of isoelectric precipitation followed by ultrafiltration for production of sunflower protein isolates *Angel Iliev, Maria Dushkova, Gabor Zsivanovits, Dida Iserliyska*
P-P-10	Benzydamine hydrochloride immobilization in multilayer structures based on lyophilized composite polylactic acid / poly(ε-caprolactone) substrates *Asya Viraneva, Maria Marudova, Aleksandar Grigorov, Temenuzhka Yovcheva*
P-P-11	Chitosan/casein polyelectrolyte multilayers: effect of pH and ionic strength on film growth and morphology *Maria Marudova, Asya Viraneva, Aleksandar Grigorov, Temenuzhka Yovcheva*

Ecology and Environmental Protection	
P-EEP-1	Trophic structure of the macrozoobenthos in the Bulgarian rivers *Emiliya Varadinova, Slavinia Kocakova, Veselina Dalgacheva, Radka Fikova*
P-EEP-2	Comparative analysis of the structure of benthic macroinvertebrate communities in Maritsa River (Bulgaria) and Han River (South Korea) *Jiyoung Park, Lidia Sakelarieva, Emilia Varadinova*
P-EEP-3	Review of the impact of coal fired power plants (CFPP) on the status of surface waters in Bulgaria *Vanina Mitseva, Emilia Varadinova*
P-EEP-4	LTER-BG: Upgrading the distributed research infrastructure "Bulgarian Long-term Ecosystem Research Network" *Svetla Bratanova-Doncheva, Radka Fikova, Kremena Gocheva, Ventsislav Karamfilov, Tzvetan Zlatanov, Emilia Varadinova, Nevena Ivanova, Lachezar Pehlivanov, Kremena Stefanova, Sonya Damyanova, Miglena Zhiyanski, Yanka Videnova, Lyudmila Lozanova, Kostadin Katrandzhiev*
P-EEP-5	Intercropping of vegetables and ornamental plants in the regenerative agriculture context *Desislava Todorova*
P-EEP-6	Plasma technologies in seed germination *Desislava Todorova*
P-EEP-7	Ladybird beetle fauna of the Holy Cross Mountains region in Poland and its changes over time *Małgorzata Czaja, Marek Bidas, Jerzy Romanowski, Piotr Ceryngier*
P-EEP-8	The tributaries contribution of PAHs micro-pollution in Nišava River *Vesna Stankov Jovanović, Violeta Mitić, Jelena Nikolić, Slobodan Ćirić, Goran Petrović, Aleksandra Đorđević, Milan Mitić*

Informatics	
P-I-1	An investigation of barriers and individual characteristics of e-commerce adoption by Greek elders *Vasileios Gerakis, Irena Atanasova*
P-I-2	The Impact of organizational culture on Teaching and learning processes during the Covid-19 Pandemic: South-west University "Neofit Rilski" case study *Irena Atanasova, Elena Karashtranova*
P-I-3	A Comparative Analysis of Advanced Encryption Standard (AES) and Rivest-Shamir-Adleman (RSA) Algorithm: Mathematical,

	Algorithmic, and Performance Comparison *Maria Mpitsi, Nina Sinyagina*
P-I-4	Exploring the Security of Cloud Computing: An Analysis of Threats and Countermeasures for Cloud Computing in the Era of Digital Transformation *Maria Mpitsi, Nina Sinyagina*
P-I-5	Degradation Recoloring CVD Deutan Image From Block SVD Watermark *Zoran Milivojevic, Bojan Prlincevic, Milan Cekic*
P-I-6	Estimation of emotional Normal/Boredom state by fundamental frequency trajectory analysis *Bojan Prlincevic, Zoran Milivojević, Vesna Simovic, Dijana Kostić*
P-I-7	The impact of the Covid-19 pandemic on distance e-learning: South-west university case study *Irena Atanasova, Elena Karashtranova*
P-I-8	Levels of Natural Language Processing *Nadezhda Borisova, Elena Karashtranova*
P-I-9	Some generic tasks which have the lead in NLP technology *Nadezhda Borisova, Elena Karashtranova*
P-I-10	Computer modeling and optimization in the processing of experimental data *Radoslav Mavrevski*

Methodology in Education	
P-ME-1	Overview and development in the professional interests of graduate students *Nataliya Pavlova*
P-ME-2	Application of modern educational technologies in the teaching of physics in the lesson “Radioactivity” *Milena Slavkova, Elena Karashtranova, Ralitsa Stanoeva*
P-ME-3	Interactive GeoGebra simulations as a tool for teaching and learning chemistry *Vesna Stankov Jovanovic, Valentina Kostic, Tanja Sekulic*
P-ME-4	Fractal geometry in GeoGebra environment *Vesna Stankov Jovanovic, Tanja Sekulic*
P-ME-5	Designing a better person and a better society with the help of education and teaching mathematics and computer science in the dialogic approach *Simon Sultan*
P-ME-6	Promoting Environmental Literacy in teachers in a multicultural Education In Israel. *Farid Hamdan, Prof. Emiliya Patarchanova, Prof. Elka Yanakieva*
P-ME-7	Possibilities for teaching the Python language in junior high school *Krasimir Harizanov*

Plenary Lectures

Electrosynthesis of Hydrogen Peroxide using Graphene Derivatives – The Path to Sustainability

Boštjan Genorio

University of Ljubljana, Faculty of Chemistry and Chemical Technology, Večna pot 113, SI-1000 Ljubljana, Slovenia
bostjan.genorio@fkkt.uni-lj.si

Abstract: The electrosynthesis of hydrogen peroxide (H_2O_2) has garnered significant attention due to its potential as a sustainable and environmentally friendly oxidant for various industrial processes. In this study, we investigate the utilization of graphene derivatives as catalysts for the electrochemical production of H_2O_2. Graphene possesses unique properties, including high electrical conductivity, large surface area, exceptional chemical stability, and remarkable mechanical properties, making it an excellent candidate for electrocatalytic applications.

We explore different graphene derivatives, specifically reduced graphene oxide (rGO) and turbostratic flash graphene (FG) decorated with nickel-based nanoparticles and assess their performance in terms of overall electrochemical activity, stability, and H_2O_2 selectivity.[1] The resulting materials are comprehensively characterized using scanning electron microscopy (SEM), transmission electron microscopy (TEM), Raman spectroscopy, X-ray photoelectron spectroscopy (XPS), and X-ray diffraction (XRD) to analyze their structural, chemical, and morphological properties. Electrochemical measurements are conducted in both batch and flow electrochemical cells, utilizing a three-electrode setup. The electrochemical performance is evaluated by monitoring the H_2O_2 production rate and Faradaic efficiency. Our findings demonstrate that both rGO and FG exhibit exceptional catalytic activity, high selectivity, and current efficiency for H_2O_2 production.

The electrosynthesis of H_2O_2 using graphene derivatives presents a promising pathway for sustainable, on-demand, and on-site production of this valuable chemical. This study opens up

avenues for the application of H_2O_2 electrosynthesis in electrochemical microreactors, which can potentially reduce the environmental impact compared to conventional H_2O_2 production methods.[2]

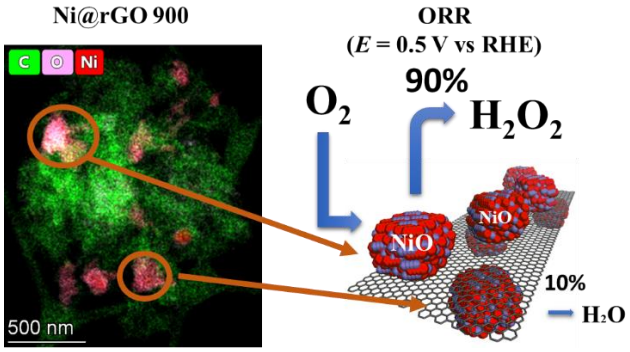

Figure 1. *TEM image and scheme of Nickel-decorated rGO with selectivity performance for H_2O_2 production. Adapted from*[1]

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(2) Martins, P. F. B. D.; Plazl, I.; Strmcnik, D.; Genorio, B. Prospect of Microfluidic Devices for On-Site Electrochemical Production of Hydrogen Peroxide. *Curr. Opin. Electrochem.* **2023**, *38*, 101223. https://doi.org/10.1016/j.coelec.2023.101223.

SENDOV'S CONJECTURE

Oleg Mushkarov

Bulgarian Academy of Science, Bulgaria
muskarov@math.bas.bg;

Abstract: The talk is devoted to the history and the present state of Sendov's conjecture for distribution of the critical points of a polynomial with complex coefficients. Tao's recent proof that the conjecture is true for sufficiently high degree polynomials will also be discussed.

Which model is best for me? – Some examples from urban water engineering

Manfred Schütze

Ifak – Institut f. Automation und Kommunikation e. V.
(Associated Institute of Otto-von-Guericke University Magdeburg)
Department of Water and Energy, Magdeburg, Germany

manfred.schuetze@ifak.eu

Abstract: As numerous applications illustrate, modelling and simulation can be very useful tools for water management, assisting engineers, biologists and many more disciplines in their task of taking care of the water and wastewater systems. However, when someone embarks on building and applying a model, the question arises “Which model is best for me?”, as se-lection of the modelling approach chosen depends on aspects of application area, necessary degree of detail, temporal and spatial resolution and other aspects.

The lecture provides examples on selecting modelling approaches in the application areas sewer network modelling and river water quality modelling. It also mentions recent developments in Germany (e.g. new guidelines of the German Water Association DWA) and concludes with a modelling approach integrating drinking water networks, wastewater infrastructure and river wa-ter systems.

Hexaferrites – single phase magneto-electric multiferroics

Tatyana Koutzarova

Institute of Electronics, Bulgarian Academy of Sciences,
72 Tsarigradsko Chaussee, 1784 Sofia, Bulgaria
e-mail address: tanya@ie.bas.bg, tatyana_koutzarova@yahoo.com

Abstract: The multiferroics are multifunctional materials where two or more of the primary ferroic properties (ferromagnetism, ferroelectricity, ferroelasticity, ferrotoroidicity) coexist. The interest in magneto-electric (ME) multiferroic materials in which ferroelectricity and ferromagnetism are both present is due to the ME effect. The main requirement to the applications of the magneto-electric multiferroic materials is that the magneto-electric coupling be both large and active at room temperature and the magnetic ordering temperature be high. The hexaferrite are a class of materials where the cross-coupling of magnetism and ferroelectricity takes place in non-collinear spin systems and are promising single-phase ME multiferroics. Here we present resent advances in the study of the ME effect in hexaferrites and, in particular, the influence of substitutions on the magnetic phase transition temperature.

Keywords: magneto-electric effect, multiferroics, hexaferrites, magnetic phase transition

Oral Presentations

Ferrocene ligands with Sb-donor groups

Petr Štěpnička

Department of Inorganic Chemistry, Faculty of Science, Charles University, Hlavova 2023, 128 40 Prague, Czech Republic

petr.stepnicka@natur.cuni.cz

Abstract: Ferrocene phosphines are nowadays indispensable ligands for coordination chemistry and catalysis. In contrast, much less attention has been dedicated to their heavier congeners such as arsines and stibines. This contribution will focus on the preparation, detailed structural characterization, reactivity and coordination properties of 1,1′-bis(di-phenylstibino)ferrocene, [Fe(η^5-$C_5H_4SbPh_2$)$_2$] and the mixed-donor compound [Fe(η^5-$C_5H_4SbPh_2$)(η^5-$C_5H_4PPh_2$)], which are novel analogues of the widely studied 1,1′-bis(diphenylphosphino)ferrocene (dppf).

Keywords: ferrocene ligands; phosphines; stibines; reactivity; coordination behavior

Proton Conductivity in Solids – Determination of Proton Transfer Trajectory in Proton Conductors by In-situ X-Ray Powder Diffraction

David Havlíček, Jiří Plocek, Róbert Gyepes

Department of Inorganic Chemistry, Faculty of Science, Charles University, Albertov 6, 128 43 Praha 2, Czech Republic
Institute of Inorganic Chemistry of the Czech Academy of Sciences, Husinec-Řež 1001, 250 68 Řež, Czech Republic
Department of Inorganic Chemistry, Faculty of Science, Charles University, Albertov 6, 128 43 Praha 2, Czech Republic
havlicek@natur.cuni.cz

Abstract: The study of proton conductivity is important in many different fields and disciplines. The conductivities, whilst not high, were still several orders of magnitude higher than for insulators. We have prepared and described new compounds, studied their structural properties by single crystal X-ray and neutron diffraction and measured proton conductivity. We were able to define the direction of conductivity in these crystals.

Proton transfer could occur via either the vehicle mechanism or the Grotthus mechanism. But the application of Grotthus mechanism should cause disorders of the ions through which the protons are transferred at the conditions of proton conductivity.

We have described the changes of X-ray diffraction pattern of CsHSO4 powder sample measured on the “conditions of proton conductivity”, i.e. under high voltage (DC). On approx. 60 % diffraction lines we have observed broadening and in some cases also the significant shift of diffraction lines both to higher and smaller angles. The analysis of such patterns can show, which lines are affected by proton transfer and define the “direction” of conductivity in the crystal, even the measurement is made on powder sample.

Keywords: proton conductors, X-Ray powder diffraction, In-situ measurements

Study on Natural and Modified zeolites from Bulgaria and Serbia

Mitko Stoev[1], Bostjan Genorio[2], Vesna Stankov-Jovanovic[3]

[1] Department of Chemistry, Faculty of Mathematics and Natural Sciences, South-West University "Neofit Rilski", Blagoevgrad, Bulgaria
[2]Department of Chemistry and Biochemistry, Faculty of Chemistry and Chemical Technology, University of Ljubljana, Slovenia
[3]Department of Chemistry, Faculty of Mathematics and Natural Sciences, University of Nis, Serbia
mstoev@mail.bg

Abstract: The natural zeolites are crystalline aluminosilicates with nano- and micro-porous structure built with $[SO_4]^-$ and $[AlO_4]^-$ tetrahedral units and small pores as a tunnels, channels and cavities in this framework contain silicon, aluminum, oxygen and cations, water and other molecules. Bulgarian zeolite deposits in Beli Plast, Beliya Bair-Zhelezni Vrata, Most, Gorna Krepost, Lyscovets and Golobradovo are in the eastern parts of Rhodopes Mountain and Serbian deposit is in Zlatokop. The aim of this research is to study morphology and chemical composition of natural and modified zeolites from Bulgarian and Serbian deposits and to optimize the chemical and temperature treatment for realization of hydrophobic surface for future deposition of graphene-oxide to improve the adsorption properties of natural zeolite for specific applications as a water treatment from Blagoevgradska Bistrica river. Preparation of hydrophobic surface by dealuminitaion of natural zeolites with 0 – 3 mol/l HCl acid in 3 hour stirring and thermal treatment in the range from 120 ^oC to 700 ^oC for 7 hours are discussed. The results from XRD analysis and SEM-EDS analysis for selected samples are presented for discussion.

Keywords: Natural zeolites, modified zeolites, SEM-EDS, XRD

Chemical composition and optical properties of refined sunflower oil with added various oils

Galia Gentscheva[1], Nadejda Petkova[2], Krastena Nikolova[3], Aleksandar Pashev[1], Tinko Evtimov[4, 5]

[1]Medical University—Pleven, Department of Chemistry and Biochemistry, Pleven, Bulgaria
[2]University of Food Technology, Department of Analytical chemistry, Plovdiv, Bulgaria
[3]Medical University-Varna, Department of Physics and Biophysics, Varna, Bulgaria
[4]University of Quebec in Outaouais, Photonics Research Center, Quebec, Canada
[5]Central Laboratory of Applied Physics, Bulgarian Academy of Sciences, Plovdiv, Bulgaria

e-mail address kr.nikolova@abv.bg

Abstract: The physicochemical characteristics of refined sunflower oil were investigated as well as the addition of flaxseed oil; linseed oil and olive oil; truffle and rosemary oil. The purpose of this study is to provide a comparative analysis of the composition, optical and chemical characteristics of refined sunflower samples with and without additives. Liquid chromatography is used to determine the composition of fatty acids; using visible spectroscopy of the color value, the chlorophyll and β-carotene content obtained from the transmission and absorption spectra. Oxidative stability is determined by rancimat. The fluorescence spectra of the samples tested were obtained for excitation wavelengths of 380 nm, and the fluorescence maxima allowed to determine the relationship between the optical and chemical properties of the samples. The concentrations of certain elements in the oils are determined after acid decomposition using inductively coupled plasma mass spectrometry (ICP-MS). Infrared spectroscopic experiments (ATR and transmittance) were used to study the fatty acid profile of the analyzed oil samples.

Keywords: sunflower oil with additives, fluorescence, IR spectra, ICP-MS

Chemical composition and optical properties of refined sunflower oil with added various oils

Galia Gentscheva[1], Nadejda Petkova[2], Krastena Nikolova[3], Aleksandar Pashev[1], Tinko Evtimov[4, 5]

[1]Medical University—Pleven, Department of Chemistry and Biochemistry, Pleven, Bulgaria
[2]University of Food Technology, Department of Analytical chemistry, Plovdiv, Bulgaria
[3]Medical University-Varna, Department of Physics and Biophysics, Varna, Bulgaria
[4]University of Quebec in Outaouais, Photonics Research Center, Quebec, Canada
[5]Central Laboratory of Applied Physics, Bulgarian Academy of Sciences, Plovdiv, Bulgaria
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Abstract: The physicochemical characteristics of refined sunflower oil were investigated as well as the addition of flaxseed oil; linseed oil and olive oil; truffle and rosemary oil. The purpose of this study is to provide a comparative analysis of the composition, optical and chemical characteristics of refined sunflower samples with and without additives. Liquid chromatography is used to determine the composition of fatty acids; using visible spectroscopy of the color value, the chlorophyll and β-carotene content obtained from the transmission and absorption spectra. Oxidative stability is determined by rancimat. The fluorescence spectra of the samples tested were obtained for excitation wavelengths of 380 nm, and the fluorescence maxima allowed to determine the relationship between the optical and chemical properties of the samples. The concentrations of certain elements in the oils are determined after acid decomposition using inductively coupled plasma mass spectrometry (ICP-MS). Infrared spectroscopic experiments (ATR and transmittance) were used to study the fatty acid profile of the analyzed oil samples.

Keywords: sunflower oil with additives, fluorescence, IR spectra, ICP-MS

Theoretical study of hepatic metabolic activation of oxidized propyl sulfide

Neli Koycheva[a], Yana Koleva[b], Yordanka Tasheva[b]

[a]Secondary school 'Hristo Botev', 9 Hr. Botev Street, 8400, Karnobat, Bulgaria
[b]Department of Chemistry, University 'Prof. A. Zlatarov', 1 Prof. Yakimov Street, Burgas, 8010, Bulgaria
[b]Department of Industrial technologies and management, University 'Prof. A. Zlatarov', 1 Prof. Yakimov Street, Burgas, 8010, Bulgaria

jtasheva_2006@abv.bg

Abstract: Oxidation of sulfides from petroleum to sulfoxides is the easiest synthetic route to the latter, and numerous reagents and oxidation processes are available for this transformation. The aim of this study is to predict the probable liver metabolic activity of the oxidized propyl sulfide, as well as to predict the protein and DNA binding of its metabolites by applying in silico methods (OECD QSAR Toolbox). The parent structure of propyl sulfone is not reactive to DNA and protein, but some of its generated metabolites in the liver, exhibit reactivity, i.e. they can have potentially harmful effects on living organisms.

Keywords: propyl sulfone, liver metabolism, prediction, QSAR Toolbox

Effectiveness of Glycerol, DMSO and Trehalose in the process of cryopreservation of drone semen from the species Apis mellifera

Tsvetan Tsvetkov, Nadya Petrova, Hristina Blagova, Denica Daskalova, Detelina Vitanova, Rositsa Shumkova

Institute of Biology and Immunology of Reproduction "Acad. Kiril Bratanov"- Bulgarian Academy of Sciences, Bulgaria
Institute of Biology and Immunology of Reproduction "Acad. Kiril Bratanov"- Bulgarian Academy of Sciences, Bulgaria
Institute of Biology and Immunology of Reproduction "Acad. Kiril Bratanov"- Bulgarian Academy of Sciences, Bulgaria
Institute of Biology and Immunology of Reproduction "Acad. Kiril Bratanov"- Bulgarian Academy of Sciences, Bulgaria
University of Library Studies and Information Technologies, Bulgaria
Research Centre of Stockbreeding and Agriculture, Bulgaria

tsvetan_tsvetkov_88@abv.bg

Abstract: Cryopreservation of economically important or endangered animal species is becoming an increasingly popular practice in the field of reproductive biotechnologies. The mass extinction of honey bee (Apis Mellifera) colonies in the last decade require the use of new chemical components in cryopreservation media for the storage of male gametes. A number of studies demonstrate conflicting data regarding the success rate and cytotoxicity of Glycerol and Dimethyl sulfoxide and to a lesser extent Trehalose. Dimethyl sulfoxide is an organosulfur compound with low cryotoxicity which transforms into solids below room temperature and this property makes it suitable for cryoprotectant. The kosmotropic properties of Glycerol allow it to create hydrogen bonds with water molecules, making it difficult to form intracellular ice crystals in the cryoprotective media. Due to its high water retaining properties Trehalose can be used as cryoprotectant, but its effectiveness has not yet been thoroughly researched in relation to the cryopreservation of bee drone spermatozoa. The research aims to compare the effectiveness of each of the specified cryoprotectants regarding the preservation of spermatozoa from Apis Mellifera drones.

Acknowledgement: Realized thanks to the "Scientific Research" Fund in implementation of project No. KP-06 M66/6 of 15.12.2022/No.KP-06 M66/6 2022.

Keywords: cryoprotectants, bee drones, trehalose, glycerol

Biochemical Secretome Analysis of Mesenchymal Stem Cell Conditioned Media and Their Use in Treatment of Women with Diminished Ovarian Reserve

Nadya Petrova, Tsvetomira Dimitrova, Marina Hristova, Yozlyam Hasanova, Elena Hristova

Institute of Biology and Immunology of Reproduction Acad. "Kiril Bratanov", Bulgarian Academy of Sciences, Bulgaria
Institute of Biology and Immunology of Reproduction Acad. "Kiril Bratanov", Bulgarian Academy of Sciences, Bulgaria
In vitro OB Medical Center Dimitrov, Bulgaria
Medical Center Reprobiomed, Bulgaria
Institute of Biology and Immunology of Reproduction Acad. "Kiril Bratanov", Bulgarian, Bulgaria
crustacea@abv.bg

Abstract: Diminished ovarian reserve (DOR) is a condition in which there is a decrease in the quantity and quality of eggs. Currently, there is still no effective treatment, as fertility outcomes are poor even when assisted reproductive techniques are used.

Great hopes are placed on cell therapy to develop an effective treatment for diminished ovarian reserve. It has been reported some improvements in laboratory animals with primary ovarian insufficiency after mesenchymal stem cell transplantation. However, MSCs are not currently approved for use in clinical practice because of safety reasons. On the other hand, the conditioned media are a promising alternative. Stem cells are known to secrete enzymes, growth factors, cytokines and hormones into the environment. Variation in composition has been reported depending on the source of stem cells, their passage, culture conditions, etc. There is still a lack of systematic information on the optimal secretome composition with a view to developing new therapeutic approaches in patients with DOR. Our aim is to summarize literature data on this matter.

Keywords: Diminished ovarian reserve (DOR), mesenchymal stem cells, secretome, growth factors, conditioned medium

Acknowledgement: This work has been realized by grant KP-06-M63/2 13.12.2022 (КП-06-М63/2 от 13.12.2022), financed by the Bulgarian National Science Fund.

Investigation of the properties of pure and doped thin ZnO films obtained by spray pyrolysis technique

Pavlina Bancheva, Vesko Zhelev, Plamen Petkov, Tamara Petkova

UCTM, Bulgaria
IEES, Bulgaria
UCTM, Bulgaria
IEES, Bulgaria

pavlina_bancheva@abv.bg

Abstract: Recently transparent and conductive ZnO films are receiving more attention because of their properties such as light-emitting semiconductivity, pos-sessing high value of exciton binding energy, etc. Due to these properties the films have been used in varieties of applications such as high temperature thermoelectric device fabrication, active emitter in LED and laser diodes, TFT for real-time sensing of gas molecules, acoustic sensors, etc. Being at the beginning of our investigation, our main task consists of obtaining thin films of ZnO using Zn(CH3COO)2·2H2O undoped and doped with different additives. The thin films were deposited on glass and silicon substrates by spray pyrol-ysis technique. The specific amount of dopant (Na, In (NaOH, InCl3)) influ-ences the conductivity, the transparency and the electrical resistivity of the films. The microstructure and morphology were studied by XRD, SEM and AFM techniques. Spectrophotometer UV-VIS in the region of 300-1800 nm was used to study the transmission spectra of the films.

Keywords: thin films, spray pyrolysis, sensors

Inorganic Salts of Aminoguanidines – Crystal Structures, Vibrational Spectra and Optical Properties

Ivan Němec, Soňa Kohúteková, Irena Matulková, Ivana Císařová, Zorka Macháčková, Petr Němec

Charles University, Faculty of Science, Department of Inorganic Chemistry,

Faculty of Mathematics and Physics, Department of Chemical Physics and Optics

Prague, Czech Republic

e-mail: ivan.nemec@natur.cuni.cz

Abstract: Inorganic salts of aminoguanidines (i.e. aminoguanidine and diaminoguanidine) belong to hybrid materials containing organic carriers of nonlinear optical (NLO) properties. Cations of aminoguanidines are based on the guanidinium skeleton - planar moiety with the high level of □-electron delocalization, which is very useful for crystal engineering of novel molecular crystals for NLO. These new materials also benefit from the existence of hydrogen bonds as the driving force of molecular self-assembly and crystal packing. Hydrogen bonds interconnecting aminoguanidinium cations with suitable inorganic anions not only have a fundamental structural role, but also positively influence the observed NLO effects.

Presented contribution will be focused on crystallographic, spectroscopic and optical aspect concerning prepared novel salts.

Keywords: Nonlinear optics, Crystal structure, Vibrational spectra, Phase transformations

Antioxidant Activity of Arylhydrazone Derivatives of Indole Acetic acid

Miroslav Marinchev[1], Nadya Hristova-Avakumova[1], Neda Anastassova[2], Maria Argirova[2], Denitsa Yancheva[2]

[1]*Department of Medical Physics and Biophysics, Faculty of Medicine, Medical University of Sofia, Sofia, Bulgaria*

[2]*Institute of Organic Chemistry with Centre of Phytochemistry, Bulgarian Academy of Sciences, Sofia, Bulgaria*

nhristova@medfac.mu-sofia.bg

Abstract: Neurodegenerative diseases are characterized by the exposure of the brain tissue to elevated levels of free radicals and increased oxidative stress. Indole scaffold has proven its diverse applications in the medical field. Herein, a series of indole-arylhydrazone hybrids were synthesized and their potency to scavenge the ABTS and DPPH radicals was determined. Their antioxidant abilities were evaluated by suppressing Fe(II) and AAPH-induced oxidation of deoxyribose and lecithin. A comparative evaluation of the Fe (III) reducing power was done. All compounds decreased lecithin oxidative damage. In the deoxyribose assay, both prooxidant and antioxidant effects have been observed. All tested derivatives managed to decrease the absorbance value in the ABTS system. In the DPPH-containing samples, the 2,3- and 3,4-dihydroxy, the syringaldehyde and the vanillin-containing compounds decreased significantly the radical concentration. These compounds have better Fe(III)-reducing power.

Acknowledgements: This work is supported by BNSF – КП06-ПМ59/2

Keywords: indole-arylhydrazone hybrids, DPPH, ABTS, AAPH, Deoxyribose, Lecithin

In vitro Antioxidant effect of Unsubstituted Benzimidazole Derivatives

Stefan Federchev[1], Maria Argirova[2], Liliya Atanasova[1], Nadya Hristova-Avakumova[1], Denitsa Yancheva[2]

[1]*Department of Medical Physics and Biophysics, Faculty of Medicine, Medical University of Sofia, Sofia, Bulgaria*

[2]*Institute of Organic Chemistry with Centre of Phytochemistry, Bulgarian Academy of Sciences, Sofia, Bulgaria*

nhristova@medfac.mu-sofia.bg

Abstract: The benzimidazole ring is a scaffold of significant medical importance because of its wide range of pharmacological activities. We aimed to investigate the antioxidant and anti-radical properties of five 1H-benzimidazole-2-yl hydrazones, unsubstituted in the benzimidazole ring, and to evaluate the effects of the hydroxyl group position in the arylhydrazone fragment. The hydrazones demonstrated good radical scavenging activity against both stable free radicals and ROS (H_2O_2 and OCl^-). In the ABTS system, C-50 values were lower than 12 μM, and in the DPPH the highest value was 26.7 μM. Under the conditions of Fe(II) induced oxidative damage, both prooxidant and antioxidant effects were observed. The presence and number of hydroxyl groups were important regarding the potential to protect against peroxidation in the systems containing lecithin and deoxyribose. This modification was also a crucial factor in the chelation activity of the compounds.

Acknowledgements: This work is supported by BNSF – КП-06-Н39/4.

Keywords: Benzimidazole, antioxidants; TBA-RS; chelation

The Antimicrobial and Hemolytic Activity of Various Heterocyclic N-oxide Series

Nurgali Akylbekov, Elena Chugunova, Vladimir Samsonov, Alexandra Voloshina, Alexander Burilov, Nurbol Appazov, Rakhmetulla Zhapparbergenov, Rakhymzhan Turmanov, Banu Diyarova, Mukhtar Zhanakov

Korkyt Ata Kyzylorda University, Kazakhstan
Arbuzov Institute of Organic and Physical Chemistry, Russian Federation
N.N. Vorozhtsov Novosibirsk Institute of Organic Chemistry of Siberian Branch of Russian Academy of Sciences, Russian Federation
Arbuzov Institute of Organic and Physical Chemistry, Russian Federation
Arbuzov Institute of Organic and Physical Chemistry, Russian Federation
Korkyt Ata Kyzylorda University, Kazakhstan
Rakhmetulla Zhapparbergenov, Kazakhstan
Korkyt Ata Kyzylorda University, Kazakhstan
Kazakh State Women's Teacher Training University, Kazakhstan
L.N. Gumilyov Eurasian National University, Kazakhstan

nurgali_089@mail.ru

Abstract: 2H-benzimidazole 1,3-dioxides exhibit high biological activity and can be used as drugs against parasites Tripanosoma cruzi and Leishmania spp. About 30 millions of people are infected by these parasites and more than 400 millions are constantly under threat of infection according to the World Health Organization [1]. Recently, a report has appeared that 2H-benzimidazole-1,3-dioxides are inhibitors of separase, a cysteine protease that plays an important role in the process of cell division [2]. As a result of our work, we have synthesized new 2H-benzimidazole 1,3-dioxides (2a-d), which according to the literature show high biological activity against the parasites Trypanosoma cruzi and Leishmania spp. as a result of the interaction of benzo[1,2-c][1,2,5]oxadiazole N-oxides derivatives (1a-d) with isopropyl alcohol in sulfuric acid.

Keywords: Benzofuroxan, 2H-benzimidazole 1,3-dioxide, 3H-2,1,4-benzoxadiazine 4-oxide, 2H-benzimidazole mono-N-oxide, antimicrobial activity, hemolytic activity.

Relative molecular mass and relationship to other natural sciences

Ruska Draganova-Hristova[1, 2], Snejana Iordanova[2]

[1]Bacho Kiro Primary School - Veliko Tarnovo
[2]Faculty of Physics, Sofia University, 5, J. Bourchier, BG-1164 Sofia, Bulgaria

rdraganova@bkiro.info

Abstract: This report presents a learning activity conducted in chemistry and environmental science classes. A high degree of inter- and transdisciplinarity was achieved in the course of its implementation. Relative atomic and molecular mass and their relationship to other natural sciences are discussed. A variety of teaching approaches and methods are applied, some of which are: exploratory approach, experiential learning, learning by doing, small group work, etc. In the course of the activities, various electronic applications are used, models of molecules are constructed, and a variety of problems are posed and solved. One of the final products of the lesson is related to the students' creative activity in creating a model of a cave.

Keywords: relative molecular mass, chemistry, model, steam, science literacy

Structural requirements of angiotensin receptor: preferred modifications for antagonist design

Tatyana Dzimbova[1,2], Atanas Chapkanov[1]

[1] *South-West University "Neofit Rilski", 66 Ivan Mihailov str., 2700 Blagoevgrad, Bulgaria*

[2] *Institute of Molecular Biology "Roumen Tsanev", 21 acad. Georgi Bonchev str., 1311 Sofia, Bulgaria*

tania_dzimbova@abv.bg

Abstract: The renin-angiotensin system (RAS) is a hormonal system that regulates blood pressure and fluid balance. Agents acting on RAS include angiotensin-converting enzyme inhibitors (ACE inhibitors), angiotensin receptor blockers (ARBs), as well as direct renin inhibitors. The purpose of the present study is to predict the structures of the potent ACE inhibitors on the base of His-Leu peptide structural element of Angiotensine I. Different modifications were made in the structure of this dipeptide and the energy of binding with the enzyme were calculated. Different parameters were evaluated for these predicted structures as lipophilicity, log P, etc. in order to predict there bioavailability and activity. The most potent analogues will be synthesized and biologically tested.

Keywords: GOLD 5.2, molecular modeling, structure-activity relationship

Evaluation of measurement uncertainty associated with the sample preparation procedure

Ava Amideina, Petranka Petrova, Mitja Kolar, Jernej Imperl, Petko Mandjukov

South-West University "Neofit Rilski", Faculty of Mathematics and Natural Sciences, 66 Ivan Mihajlov Str., 2700 Blagoevgrad, Bulgaria
South-West University "Neofit Rilski", Faculty of Mathematics and Natural Sciences, 66 Ivan Mihajlov Str., 2700 Blagoevgrad, Bulgaria
University of Ljubljana, Faculty of Chemistry and Chemical Technology, Večna pot 113, SI-1000 Ljubljana, Slovenia
University of Ljubljana, Faculty of Chemistry and Chemical Technology, Večna pot 113, SI-1000 Ljubljana, Slovenia
South-West University "Neofit Rilski", Faculty of Mathematics and Natural Sciences, 66 Ivan Mihajlov Str., 2700 Blagoevgrad, Bulgaria

a_amideina@abv.bg

Abstract: The measurement uncertainty (MU) in environmental analyses is usually considered as combination of the contributions of sampling and instrumental analytical procedures. In most of the cases the target MU for environmental analysis is relatively high due to the sample heterogeneity and/or the complicated sample treatment required. In the analytical practice, the sample prepa-ration contribution to the MU is usually not evaluated independently. Thus, it remains a hidden part of the one related to the analysis. However, the separate evaluation of MU related to sample preparation might provide important information and further possibility for optimization of the entire analytical pro-cedure and reduction of the expanded MU.

The aim of the present study is to compare different methods for evaluation of the uncertainty contribution of the sample preparation. The considered approaches are based on, both, classical and robust analysis of variances (ANOVA) applied to data from instrumental analysis of various environmental samples, undergoing microwave digestion.

Keywords: sample preparation, uncertainty, ANOVA, environmental matrixes, optimization

Biodiversity of macroalgae in the Marchica lagoon of Nador (Morocco)

Ouiam EL MEKKI 1 *, Mostafa LAYACHI 2, Noreddine REZZOUM3, Mourad BAGHOUR 1, Nassir KADDOURI2, Najib ELOUAMARI4, Mustapha AKODAD 1, Petranka PETEOVA5, Hakima ZIDANE3, Ali SKALLI 1

[1.]Laboratoire de la Lagune Marchica de Nador pour les Sciences Bio-Géo-Physique et Environnement (LOLMAN-BGPE), Faculté Pluridisciplinaire de Nador, Université Mo-hamed Premier-, Maroc
[2.]Laboratoire Pêche Centre Régional de l'INRH à Nador
[3.]Laboratoire Prospection des Ressources Littorales, Centre Régional de l'INRH à Casablanca
[4.]Centre Régional de l'INRH à Nador
[5.]Faculty of Mathematics and Natural Sciences, South-West University "Neofit Rilski", Ivan Mihailov, 66, 2700 Blagoevgrad, Bulgaria
***Email :** ouiamelmekki@gmail.com*

Abstract: The present work is devoted to determining the algal diversity of the Marchica lagoon. To this end, an initial sampling campaign of the benthic compartment was carried out at 15 stations during the winter of 2022-2023, with the aim of measuring the physical and chemical parameters of the water and establishing the algal diversity (ma-croalgae) in different areas of the Marchica lagoon. The results identified around 52 species of algae belonging to different groups of algae, with chlorophyceae dominating, followed by rhodophyceae and pheophyceae. Chlorophyceae make up the majority of the population during the winter period. With regard to the environmental parameters of the Marchica, the minimum and maximum values measured are as follows : la T° (16.8 - 18.4), O2 (94.5 -130.2), DO mg/l (7.27 - 9.93), S ‰ (36.41 - 36.86), ph (7.24-8.2) et Chl a µg/l (2.18-12.5).

Keywords: Marchica lagoon, Algae, Ecological, New pass.

Investigations of Giant Monopole Resonance and Nuclear Incompressibility in Spherical Nuclei

Yordan Katsarov[1], Mitko Gaidarov[1,2], Martin Ivanov[1], Anton Antonov[1]

[1]*Institute for Nuclear Research and Nuclear Energy, Bulgarian Academy of Sciences, Sofia, Bulgaria*
[2]*South-West University "Neofit Rilski", Blagoevgrad, Bulgaria*
yordankatsarov@gmail.com

Abstract: Experimental and theoretical studies of giant resonances have become a rich source of information on the collective response of the nucleus to its density fluctuations. In particular, the isoscalar giant monopole resonance (ISGMR) plays an important role in constraining the nuclear equation of state. An important issue is that the energy of this resonance is closely related to the nuclear incompressibility. The incompressibility of both nuclear matter and finite nuclei is estimated by the monopole compression modes in nuclei in the framework of a nonrelativistic Hartree–Fock–Bogoliyubov method and the coherent density fluctuation model (CDFM). In the present work, the incompressibility and the centroid energy of ISGMR are investigated for three isotopic chains based on the Brueckner energy-density functional for nuclear matter and using the CDFM. This approach can be applied to analyses of neutron stars properties, such as incompressibility, symmetry energy, slope parameter, and other astrophysical quantities.

Keywords: nuclear matter, incompressibility, energy-density functional, giant monopole resonance, coherent density fluctuation model.

5-Fluorouracil encapsulated chitosan microspheres

Sofia Milenkova[1], Svetoslav Tashkov[1], Nikolay Zahariev[2,3], Bissera Pilicheva[2,3], Maria Marudova[1]

1 Faculty of Physics and Technology, University of Plovdiv "Paisii Hilendarski", 24 Tsar Asen Str.,4000 Plovdiv, Bulgaria
2 Department of Pharmaceutical Sciences, Faculty of Pharmacy, Medical University of Plovdiv, 15A Vassil Aprilov Blvd, 4002 Plovdiv, Bulgaria
3 Research Institute, Medical University of Plovdiv, 15A Vassil Aprilov Blvd, 4002 Plovdiv, Bulgaria

sophiamilenkowa@gmail.com

Abstract: 5-Fluorouracil (5-FU) is a chemotherapeutic agent used in therapies for both systematical and topical treatment of different types of cancers. Depending on the period of application, its administration may lead to different side effects such as nausea, headache, pain or even photosensitivity. To avoid them, the drug may be encapsulated into polymeric particles. In the present study, biopolymeric spheres based on chitosan, a linear polysaccharide, are presented. The spheres are formulated by an emulsion technique with solvent evaporation. Three types of particles are synthesized: without crosslinker, with sodium trypolyphosphate and glutaraldehyde crosslinker. The resultant structures are evaluated regarding their size, morphology, and encapsulation efficiency. The crosslinking process and the drug presence in the particles is confirmed by FT-IR. A drug release study is conducted to examine the release kinetics and understand the release behavior depending on the presence and the type of the crosslinker.

Keywords: chitosan, 5-Fluorouracil, drug delivery, sodium trypolyphosphate, glutaraldehyde

Chitosan/rosehip seed oil multicomponent edible films

Biser Gechev, Maria Marudova, Angel Iliev, Gabor Zsivanovits

University of Plovdiv "Paisii Hilendarski", Bulgaria
University of Plovdiv "Paisii Hilendarski", Bulgaria
Institute of Food Preservation and Quality-Plovdiv Agricultural Academy of Bulgaria, Bulgaria
Institute of Food Preservation and Quality-Plovdiv Agricultural Academy of Bulgaria, Bulgaria

biser.gechev@uni-plovdiv.bg

Abstract: Casting film-forming emulsions based on chitosan and plant oil have facilitat-ed the process of formulating edible films. The latter have been loaded with rosehip seed oil, being a strong antioxidant, and a rich source of vitamin C and polyphenols. The outcome of combining structural, morphological char-acteristics and, mechanical, barrier, antimicrobial and antioxidant properties have been a matter of study in this paper. Rosehip seed oil being part of chi-tosan films have brought to flexibility of films with improved mechanical, gas and water vapor barrier properties and antioxidant activity. The essential characteristic of films' antioxidant activity helps to extend the shelf life of food products which are to be packaged in them.

Keywords: rosehip seed oil, edible films, chitosan, antioxidant, flexibility

Theoretical and kinetic parameters in oxidative cleaning of oil fractions

Yordanka Tasheva, Milena Dimitrova

Department of Industrial technologies and management, University 'Prof. A. Zlatarov', 1 Prof. Yakimov Street, Burgas, 8010, Bulgaria

jtasheva_2006@abv.bg

Abstract: In order to calculate the thermodynamic and kinetic parameters of the individual systems, the distribution coefficients were previously calculated, and for this purpose we calculated the molar concentrations of the sulfur compounds in the raffinate and in the extract, respectively, of each of the raw materials. Thermodynamic and kinetic parameters were investigated by calculating them according to well-known physicochemical equations.

Keywords: oil fraction, oxidation, thermodynamic parameters

Trend analysis of water discharge in the Kutinska River Basin, Serbia

Gocić Milena, Martić Bursać Nataša, Stričević Ljiljana

Abstract: This paper provides the results of the analyzed long-term trend for monthly and annual water discharges for Kutinska River Basin. The aim was to examine changes in water discharge based on the results obtained from the analyzed trends. The water discharges data were taken from the Republic Hydrometeorological Service of Serbia for the period 1961-2020. The non-parametric tests Mann Kendall and Pettitt were used for the calculation. The Mann Kendall test was used to calculate trends in mean annual discharges. The Pettitt test was used to show if there was a change point detection in the data and when it happened. The Mann Kendall test was found that there is a significant downward trend in the data of the mean annual discharges (highest during the summer and winter months). The exeption was for the values of the spring months, March, April and May (no trend). The Pettitt test determined that there was a change point detection in the data. For the year 1980, it was established that there was a significant decrease in discharge on the Kutinska River, from 1.603 m^3/s to 0.982 m^3/s. Sen's slope downward trend is 0.013 m^3/s per year.

Keywords: discharge, trend statistics, non-parametric tests, Kutinska River

The Significance of Relief Characteristics in Sustainable Development of Mountain Regions. A Case Study: The Mountain Šljivovička Planina and its Foothill in Eastern Serbia

Jelena Živković, Tatjana Djekić, Marija Bratić

University of Niš, Faculty of Sciences and Mathematics, Serbia
University of Niš, Faculty of Sciences and Mathematics, Serbia
University of Niš, Faculty of Sciences and Mathematics, Serbia

jelena.zivkovic@pmf.edu.rs

Abstract: As areas with natural constraints to development in Serbia, mountain regions are not paid enough attention. The concept of sustainable development is a regional mountain-specific process that deals with mountains, foothills and adjacent areas. This paper aims to analyze morphological, morphogenetic and morphostructural features of Šljivovička planina mountain and its foothill and to evaluate both stimulating and limiting roles of that characteristics in the sustainable development of the surveyed area. Research results show that the conditions for economic activeness of the concerned population are determined mainly through hypsometric and slope structure. With the increase in elevation and slopes, building, agriculture, housing and general living circumstances have become less favourable. Simultaneously, the opportunities for developing different tourists activities are more significant with the rise in altitude and incline.

Keywords: Relief, Sustainable development, Serbia, Šljivovička planina

Europe's Southernmost Perennial Glacieret Found in Nemercka Mountain, Southern Albania

Emil Gachev, Martin Iliev, Georgi Gachev, Erald Meshini, Simeon Matev

South-west University "Neofit Rilski", Bulgaria
Translog Ltd., Bulgaria
Sofia University "St. Kliment Ohridski", Bulgaria
Central Connecticut State University, United States
Sofia University "St. Kliment Ohridski", Bulgaria

emil.gachev@swu.bg

Abstract: According to the definition of World Glacier Monitoring Service (WGMS), glacierets are tiny forms of snow and compacted snow (firn) that have existed at least two years without melt. Some glacierets are however perennial – they never melt out completely under the present climatic conditions. If indi-cations of motion are found within such persistent bodies, they are consid-ered as small glaciers. Such small glaciers have been found in three moun-tains across the Balkan Peninsula: Prokletije in Northern Albania, Durmitor in Montenegro and Pirin in Bulgaria. However, a new, most probably perennial snow-firn patch has been recently found in Nemerecka Mountain in Southern Albania, 15 km north from the Albanian-Greek border. We visited the site of the glacieret in September 2022, and found two snow patches, one of them with a considerable size (255x150 m, at least 8 m thick). Situated on 40°08' northern latitude, these are probably the southernmost features of this type in Europe. It is kind of a paradox, that the larger glacieret lies at 1550-1650 m a. s. l., lower than any persistent snow-ice body found in the Mediterranean re-gion. The existence of this perennial glacieret is by no doubt a product of the unique geographical setting of the area where it is found. Although known by the locals, the two glacierets are here for the first time mentioned in a scien-tific journal article.

Keywords: glacieret, Nemercka, firn

State of the surface waters in the Mesta River basin after the reclamation of the "Eleshnitsa" uranium deposit

Nadezhda Nikolova

SWU "Neofit Rilski", Bulgaria

nin@swu.bg

Abstract: In the period from 1955 to 1992, uranium ore was mined and processed in the Mesta River basin around the village of Eleshnitsa in Razlog Municipality. The ore processing plant was built and a tailings dam was built next to it. It was reclaimed in 2002-2006, and in 2011-2012, the "Druzhba" 1 and 2 mines were liquidated. For the treatment of the drainage water, a water treatment plant was built in the Valcheto Dere River, a left tributary of the Mesta River. The radiological monitoring carried out by the Basin Directorate "West Aegean Region" and the company "Ecoengineering - RM" Ltd. reveals a generally good quality of the surface waters in terms of the content of natural uranium and radium 226 outside the area of the former uranium mining and the tailings dam.

In this area, high levels of natural uranium are found in some years with concentrations ranging from 0.54 to 67.40 mg/l on average per year. The values significantly exceed the standard regulated by the Regulation for the purposes of radiation protection and safety from the liquidation of the consequences of uranium mining by a factor of 1,8 to 224,6. The spread of uranium is limited to a small area after the sources of contamination, but the potential risk to the local ecosystem should not be neglected. Radium, unlike uranium, has concentrations below the permissible limits in the studied period (2012-2022). Its content ranges from 0.025 to 0.11 Bq/l on average per year. The results show that the waters of the Mesta River near the border with the Republic of Greece are not contaminated with the radionuclides investigated.

Keywords: uranium mining, surface waters, radionuclides, concentrations

Mining as an anthropogenic source of pollution in Bosilegrad municipality

Milena Milenova, Ivan Drenovski

South-West University "NEOFIT RILSKY", PMF, GEOOS Department, Blagoevgrad, Bulgaria

milena_rangelov@abv.bg

Abstract: The report analyzes the mines and geochemical characteristics of the flotation storage facilities, located in the municipality of Bosilegrad, Western Province (R. Serbia). The report presents clarification of the mineral and chemical composition of the ores in Bosilegrad municipality, description of flotation methods and waste products, determination of the period of exploitation and quantities of processed ore tailings material, as well as forecasts and realized reclamation measures.

The geochemical characteristics of the waste materials are determined by heavy metals. People come in contact with heavy metals through water, air and food.

High concentrations of Zn, Cd, Pb, Fe and others from the waste materials reach the river, so the water is classified as fourth and fifth class. The water from these streams cannot be used for irrigation as drinking water according to the applicable standards due to high content of heavy metals. The land around the waste materials is usually agricultural. The main source of soil pollution is the mineralized dust that is scattered from the waste. There are heavy metals in the soil, whose levels are above the normal limit, and are also below remediation concentrations. The presence of heavy metals in the soil represents a constant potential danger for the local population involved in agriculture.

Keywords: Municipality of Bosilegrad, mining, Blagodat mine, "Podvirove" mine, tailings storage facility, prevention, restoration.

Physical Geographic Characteristics of the Hadzhidimovo Gorge (South-Western Bulgaria and Northern Greece)

Krasimir Stoyanov, Galina Bezinska, Alexander Pulev

Department of Geography, Ecology and Environmental Protection,
Faculty of Mathematics and Natural Sciences,
South-West University "Neofit Rilski", Blagoevgrad, Bulgaria

e-mail: krasi_sto@swu.bg, galinabezinskaswu@gmail.com, spu@swu.bg

Abstract: The Hadzhidimovo gorge is a cross-border gorge situated on the territory of Southwest Bulgaria and Northern Greece in the Mesta river valley. So far, no detailed geographical description has been made. The primary objective of this study is to make a geographical characterization of the gorge. The boundary of the Hadzhidimovo Gorge has been identified and the particular features of its natural components have been examined. For detailed analysis of the hydromorphometric parameters, a DEM presented as GRID with a pixel size of 30 m / 30 m has been created. The morphometric maps of the gorge area have been developed and analyses.

Keywords: Physical Geographic Characteristic, Hadzhidimovo Gorge, Mesta River

Drought Hazard in Bulgaria in XX and XXI century

Mariyana Nikolova[1], Miroslav Ivanov[2]

[1]*National Institute of Geophysics, Geodesy and Geography, Bulgarian Academy of Sciences, Sofia, Bulgaria*

2 *South-West University "Neofit Rilski", Blagoevgrad, Bulgaria*

e-mail: *mknikolova@gmail.com*

Abstract: The study aims to make a retrospective analysis of major droughts since 20th century and to track changes in drought conditions on the territory of Bulgaria over the period 1953-2022 based on data for the Standardized Precipitation Evapotranspiration Index (SPEI). The long-term fluctuations in the average SPEI values show a pronounced negative trend of the index since 1984. The average SPEI values varey between 0.8 and -0.8 for the decades in the period 1957-2022, and are permanently negative for each of the last four decades. These results are well in line with the climate change projections for territory of Bulgaria. In this regard, the need for the implementation of measures to adapt to climate change and the associated drought hazard is also commented.

Keywords: climate hazard, SPEI, dry periods

Multi criteria GIS based flood susceptibility mapping in the area of Berkane city, Morocco

Miroslav Ivanov, Imad Zerhoudi, Konstantin Tyufekchiev

South-West University of Neofit Rilski, Bulgaria
University Mohamed First, Ecole nationale des sciences appliquees Quida, Morocco
South-West University of Neofit Rilski, Bulgaria

m_ivanov@swu.bg

Abstract: Flood susceptibility is very important for urban planning. The main goal of this study is to introduce a multi criteria approach for identifying flood susceptibil-ity zones in the area of Berkane city, Morocco. The multi criteria approach in-cludes 10 susceptibility factors: flow accumulation, annual rainfall, slope, run-off, land use/cover, elevation, geology, soil type, distance from the drainage network, and drainage density. The weight of each factor was estimated by analytical hierarchy process. In addition a sensitivity analysis was executed to test how sensitive are the results to changes in the weights of susceptibility factors. Based on this results flood susceptibility maps were developed. To validate the developed flood susceptibility map they were compared with the historical flood records. These maps were found to be in good agreement with historical flood events in Berkane city, Morocco.

Keywords: Flood susceptibility zones, Flood mitigation, Analytic hierarchy process, Multi-criteria analysis

GIS based flood susceptibility mapping in the area of Port Nador, Morocco

Miroslav Ivanov, Lamiae El Hadri, Konstantin Tyufekchiev

South-West University of Neofit Rilski, Bulgaria
University Mohamed First, Ecole nationale des sciences appliquees Quida, Morocco
South-West University of Neofit Rilski, Bulgaria

m_ivanov@swu.bg

Abstract: Flood susceptibility is very important for urban planning. The main goal of this study is to introduce a multi criteria approach for identifying flood susceptibil-ity zones in the area of Port Nador, Morocco. The multi criteria approach in-cludes 10 susceptibility factors: flow accumulation, annual rainfall, slope, run-off, land use/cover, elevation, geology, soil type, distance from the drainage network, and drainage density. The weight of each factor was estimated by analytical hierarchy process. In addition a sensitivity analysis was executed to test how sensitive are the results to changes in the weights of susceptibility factors. Based on this results flood susceptibility maps were developed.

Keywords: Flood susceptibility zones Flood mitigation Analytic hierarchy process Multi-criteria analysis

Remote Sensing based monitoring to Assess Water Quality of Lamiae port Lagune, Marocco

Miroslav Ivanov, Ouiam El Mekki, Konstantin Tyufekchiev

South-West University of Neofit Rilski, Bulgaria
University Mohamed First, faculte pluridisciplinaire de nador, Morocco
South-West University of Neofit Rilski, Bulgaria

m_ivanov@swu.bg

Abstract: Remote sensing techniques is used to monitor water quality parameters (i.e., suspended sediments (turbidity), chlorophyll, and temperature) of Lamiae port Lagune, Marocco. The main goal of this research is to monitoring the change of these parameters for water quality before and after the artificial inlet to the lagune has been opened. Based on the on the findings map with the different values of the researched parameters before and after the opening of the inlet has been prepared.

Keywords: Remote sensing, water quality parameters, suspended sediments (turbidity), chlorophyll, temperature

Trends and challenges for the health system in Kyustendil region

Emilia Patarchanova, Gergana Nikolova

SWU " Neofit Rilski", Blagoevgrad, Bulgaria
emilia_patarchanova@swu.bg, gergananikolova@swu.bg

Abstract: Healthcare is an activity of very high humanitarian and public importance. The policy for its development at the district level is mainly influenced by the number and age structure of the population. Despite the stated principles of accessibility and equality in receiving medical care and the availability of an approved health card, the population of remote settlements in the district encounters serious difficulties in providing it. Hence the specific problem of the health system in the study area, which contributes to the intensification of the processes of depopulation of villages and the concentration of hospitals in the regional center of Kyustendil and the second larger municipal center - Dupnitsa. Good health is an asset and a source of economic and social stability. The health status of the population is crucial for poverty reduction while contributing to sustainable territorial development. The main challenges are related to the deteriorating indicators of the health and demographic condition of the population in the study area, the increase of health inequalities and the inability of the regional health system to adequately respond to the needs for affordable and quality health services.

Keywords: health system, economic and social security, sustainability, health inequalities

"EDUCATION INFRASTRUCTURE IN THE KYUSTENDIL REGION - CURRENT STATE AND TRENDS"

Gergana Nikolova, Emilia Novachka-Girginova,

SWU "Neofit Rilski", Blagoevgrad, Bulgaria
gergananikolova@swu.bg, ema.nvn@abv.bg

Abstract: In recent years, significant political, economic and social changes have taken place in our country. It can certainly be assumed that education as part of the social infrastructure depends on these changes. The education system manages to reach the majority of the population and retain them until the completion of secondary education. The purpose of education is to prepare people for responsible citizenship in a democratic society. The main settlement subsystems function thanks to three types of infrastructure - economic, social and technical. In the present study, we will pay attention to the educational infrastructure in Kyustendil district. Because today, more than ever, the atmosphere affects the educational process, upbringing, training and socialization of children and students. Social infrastructure is a complex set of separate relatively independent subsystems, elements and activities: housing construction, education, culture, health care, etc., which aim to provide complex services to various human activities and their needs. Social infrastructure is one of the main factors for the complex and harmonious development of territorial communities and their living environment.

Keywords: education, educational infrastructure, employment, skills, knowledge

Challenges in development and energy security of peripheral areas

Plamen Patarchanov, Emilia Patarchanova

SU "St. Kliment Ohridski", Bulgaria
SWU"Neofit Rilski", Bulgaria

p_patarchanov@abv.bg

Abstract: The development of energy and the provision of society's needs with green energy is an important aspect of the modern policy of the EU and Bulgaria. The changed geopolitical situation in Europe over the last year has turned this economic activity into a geopolitical factor and part of the national security of some countries in the region, in-cluding Bulgaria. This creates serious problems and challenges for the regional development of peripheral (rural, mountain and border) areas. They are the focus of our research interest. Through the analysis and evaluation of various empirical information, energy problems and challenges at the regional and local level in these ter-ritories are situated and different spatial aspects of the current policy in the energy sector are outlined. Specific recommendations are proposed to improve or change the current situation in peripheral ar-eas in relation to the efficiency in the extraction, use and manage-ment of energy resources. Special attention is paid to increasing the sustainability of production and activities in the sector for the benefit of the natural environment, the rural economy and local communi-ties.

Keywords: energy problems and challenges, energy policy, peripheral regions

The effect of COVID-19 on poverty in Bulgaria: mapping and analysis

Galina Bezinska Krasimir Stoyanov

Department "Geography, ecology and natural protection", Faculty of Mathematics and Natural Sciences
South-West University "Neofit Rilski", Blagoevgrad, Bulgaria

e-mail: galinabezinska@swu.bg

Abstract: The measurement of poverty has always been an important responsibility for any country, and its consideration across disciplines over the last 100 years has made it a key activity for countries and regions. Poverty is a multi-faceted concept that can include social, economic and political elements. Absolute poverty, extreme poverty or poverty refers to the complete lack of resources needed to meet basic personal needs such as food, clothing and shelter. The Covid-19 disease caused by a new coronavirus (SARS-CoV-2) emerged in late 2019 and spread rapidly worldwide. The pandemic has also seriously affected Bulgaria. It has created new challenges for the country - affecting not only the healthcare system, but also the economy and society as a whole. The pandemic forced many businesses to stop work or reduce their employment. As a result, many people lost their jobs. This has led to an increase in unemployment and poverty, as well as a reduction in income for many people. The main objective of this paper is to analyse and map the effect of the Covid-19 on poverty in Bulgaria and to identify the demographic and economic factors for its occurrence. An overview of all conceptions of poverty as a social phenomenon has provided. Several thematic maps illustrate the results. These studies can provide useful data for the development of anti-poverty policies and actions to target the affected groups.

Keywords: COVID-19, poverty, mapping, spatial analysis

Demographic profile of the border municipalities of the Southwest region

Vasil Pandurski, Emilia Patarchanova

South-West University "Neofit Rilski", Blagoevgrad, Bulgaria
vasil.pandurski@mail.bg; emilia_patarchanova@abv.bg

Abstract: Regarding the demographic picture in most European countries, there is currently a very specific problem that is increasingly being commented on and analyzed - the aging of the population. This problem directly affects a number of branches of the economy - employment and workforce structure, pension insurance, economic development, standard of living, health care. This trend is also characteristic of Bulgaria, which is part of the European economic space. The official censuses of 1985 until 2021 also show another negative opinion - a decrease in the population as a result of the reduced birth rate, high mortality and emigration processes after 1989. Demographic problems manifest themselves with different severity on the territory of the country. There are areas where the demographic picture is still positive. In some territories, however, the demographic situation has deteriorated extremely. The border territories in the past had a peripheral status, being primarily associated with their defensive function. The territories that have the greatest loss of demographic resources and the most serious violations in socio-demographic processes, and accordingly need a detailed analysis of the reasons that led to these problems. The demographic profile of the border municipalities of the South-West region is extremely diverse and there are quite specific discrepancies in statistical terms

Keywords: border municipalities, state policy, demographic processes, economic development

Digital marketing strategies for Black Friday and Christmas

Vladimir Karadzhov

South-West University Neofit Rilski, Bulgaria

karadzhov@swu.bg

Abstract: This report explores digital marketing strategies that can be used to drive sales during the Black Friday and Christmas shopping periods. It starts by discussing the importance of these periods for retailers, and how e-commerce has changed how people shop during these events. The research then goes on to formulate different digital marketing strategies that retailers and marketers can utilize during these events, including social media advertising. The article offers some tips for retailers to optimize their digital marketing efforts. It also presents 20 practical solutions for creating suitable advertising messages for both events to personalize the shopping experience for customers. It concludes by emphasizing the importance of having a comprehensive and integrated digital marketing strategy that takes into account the unique characteristics of these shopping periods. Overall, the study provides valuable insights into the best practices for digital marketing during the Black Friday and Christmas shopping periods and offers actionable advice for retailers and marketers looking to maximize their sales during these significant shopping events.

Keywords: e-commerce, social media advertising, personalization, socio-economic analysis, sales optimization, shopping events

ARE HUMANS ALLIES OR OPPONENTS OF NATURE?

Ryszard F. Sadowski

Institute of Philosophy, Cardinal Stefan Wyszynski University in Warsaw, Poland
ORCID: https://orcid.org/0000-0002-5452-2168 - r.sadowski@uksw.edu.pl

Abstract: We are currently observing a systematic increase in the ecological crisis. There is no doubt that this crisis is anthropogenic. However, the question arises whether the current condition of our planet is a consequence of human nature with its hostile attitude towards nature. If it is so, is it possible to change one's attitude towards nature?

The paper will present the concept of the noble savage, which has been present in Western culture since ancient Greece. This concept was propagated in Hellenic culture by Homer and Herodotus and in Roman culture by Virgil, Ovid, Horace, and Tacitus. The concept of man as a noble savage became popular also at the end of the Middle Ages thanks to Marco Polo's accounts of idealized Asian peoples. The popularity of the noble savage also increased thanks to the discoveries of the New World. At that time, people believed that the Americas were inhabited by Indians who descended from Adam and Eve before committing original sin. Hence their righteousness, nobility, and harmony with nature. This belief was confirmed from the 16th to the 19th century through the publications of Shakespeare and other authors promoting the myth of idyllic Arcadia.

However, there have also been ideas that human nature is hostile to man. It was a consequence of the tragic wars experienced by Europeans in the 16th and 17th centuries. The concept of hostile human nature was presented by Thomas Hobbes and popularized by J-J. Rousseau. He claimed that human nature is good, but only in the case of people living in the bosom of nature. Civilized man, on the other hand, is morally depraved and hostile to nature.

Also, nowadays, we can observe attempts to see man as a noble savage. These attempts refer to the thoughts of H. D. Thoreau, and their popularization can be observed in mass culture (Hollywood

productions, e.g. Avatar, Dances with Wolves, etc.). We are currently also observing the promotion of the noble ecological savage (Indians).

All these opinions, however, seem untrue. Humans are not noble savages, although they willingly think so about themselves. Archaeological research and environmental history data indicate that there have never been noble ecological savages. This phenomenon has been called America's Pristine Myth.

The author argues that building a friendly relationship between humans and nature must be based on the truth about humans. By nature, humans are antagonists of the natural environment. Only realizing this truth can make humans reflect and start building a balanced relationship with the world in which they live.

Exploitation of common resources – simple reasons to be different

Janusz Uchmański

Institute of Biological Sciences, Cardinal Stefan Wyszyński University
Wóycickiego 1/3, 01-938 Warsaw, Poland
j.uchmanski@uksw.edu.pl

Abstract: Intraspecific competition in even-aged populations of plants and animals is very rarely the subject of ecological research. Even more rarely are ecologists interested in the important outcomes of this competition - the unequal partitioning of resources for which competition takes place and the resulting from it individual variability in the growth rate of individuals, their survival rate and the production of offspring. There are various reasons for this. The statistical methods used by ecologists deal with average values. Classical models of mathematical ecology describe the dynamics of the densities of populations, and are therefore interested in variables that by their nature neglect the important fact that a population is made up of individuals. It is also not without significance that it is generally very difficult to study interactions between individuals. In my talk, I would like to show that there are very simple examples of how individual variability in the amount of resources taken up by individuals from the environment can arise because of the physical nature of these resources, without considering interactions between individuals. Three examples will be presented: individuals of a phytoplankton species that move chaotically in a column of water illuminated from above, sedentary organisms randomly distributed on a two-dimensional plane, and predators hunting for food in the form of particles. In all these examples, the measures of resources obtained by individuals indicate the existence of individual variability, and their distributions have a positive skewness (there are more individuals that obtained few resources than individuals with many resources). The influence that the costs of obtaining resources from the environment and interactions between individuals may have on such form of individual variability will be discussed

Key words: intraspecific competition, individual variability, resource partitioning

Hidden diversity of fungi parasitizing ladybird beetles in the Canary Islands

Piotr Ceryngier[1], Jerzy Romanowski[1], Danny Haelewaters[2,3,4]

[1]Institute of Biological Sciences, Cardinal Stefan Wyszyński University, Warsaw, Poland; [2]Research Group Mycology, Department of Biology, Ghent University, Ghent, Belgium; [3]Faculty of Science, University of South Bohemia, České Budějovice, Czechia; [4]Biology Centre of the Czech Academy of Sciences, Institute of Entomology, České Budějovice, Czechia

e-mail: p.ceryngier@uksw.edu.pl

Abstract: Fungi of the order Laboulbeniales (Ascomycota) are obligate ectobionts of insects and some other arthropods. Ladybird beetles (Coleoptera: Coccinellidae) are hosts to members of the genera *Hesperomyces* (many species) and *Laboulbenia* (one known species). Recent studies based on integrative taxonomy approaches have revealed that there are many more species of *Hesperomyces* than previously thought, with individual *Hesperomyces* species being specific to a host species or genus. In this report we provide data on the ladybird–*Hesperomyces* associations recorded in the Canary Islands. Recently, the ladybird fauna of this archipelago was systematically surveyed by our team and many collected specimens were infected with *Hesperomyces*. In total, we recorded ten species of Coccinellidae from eight genera (*Adalia*, *Harmonia*, *Hyperaspis*, *Nephus*, *Novius*, *Parexochomus*, *Scymnus*, and *Stethorus*) in association with *Hesperomyces*. The parasites recorded on *Nephus*, *Scymnus*, and *Stethorus* belong to the *Hesperomyces coccinelloides* complex of cryptic species, and those on the remaining host genera to the *H. virescens* species complex. Of at least eight *Hesperomyces* species recorded in this study, only two have so far been formally described: *H. harmoniae* from *Harmonia axyridis* and *H. parexochomi* from *Parexochomus* spp.

Keywords: Laboulbeniales, *Hesperomyces*, Coccinellidae, Canary Islands

Strip tillage and conventional sugar beet cultivation: do they have the same effect on the density and structure of soil nematode communities?

Krassimira Ilieva-Makulec, Dominika Dymitrowicz

Institute of Biological Sciences, Cardinal Stefan Wyszynski University in Warsaw, Poland
e-mail address of the corresponding author: k.makulec@uksw.edu.pl

Abstract: The aim of the study was to compare the effect of two management systems (conventional and strip tillage) in sugar beet crops on the density and structure of nematode communities. Soil samples were taken three times (spring, summer and autumn) during the growing season.

It was found that the beet cropping system had a significant effect on the nematode abundance however the effect varied between the seasons. The density of nematodes in the in conventional crop was higher in spring, while in summer and autumn higher numbers were recorded in the strip-till crops. In the trophic structure of the communities in both growing systems bacterial-feeding nematodes prevailed, with a higher proportion in conventional cropping than in strip-till. An opposite tendency was observed for hyphal-feeding nematodes. Their share in the communities was greater in strip-till crops than in conventional one. The beet growing system had no effect on the other trophic groups or the generic richness of nematodes.

It was inferred that the abundance and trophic structure of nematode communities in both sugar beet management systems were the parameters that reflect in a good way the soil organic matter supply and the intensity of decomposition and mineralization processes.

Keywords: conventional tillage, nematodes, strip tillage, sugar beet

The Caspian Whip Snake, Dolichophis caspius (Gmelin, 1789) (Reptilia: Colubridae), in Bulgaria: distribution and activity

Alexander Pulev, Lidia Sakelarieva, Emanuil Mitrevichin, Borislav Naumov, Georgi Popgeorgiev

South-West University "Neofit Rilski", Faculty of Mathematics and Natural Sciences, Department of Geography, Ecology and Environmental Protection, Bulgaria
South-West University "Neofit Rilski", Faculty of Mathematics and Natural Sciences, Department of Geography, Ecology and Environmental Protection, Bulgaria
South-West University "Neofit Rilski", Faculty of Mathematics and Natural Sciences, Department of Geography, Ecology and Environmental Protection, Bulgaria
Institute of Biodiversity and Ecosystem Research, Bulgarian Academy of Sciences, 2 Yurii Gagarin Street, 1113 Sofia, Bulgaria
Department of Vertebrates, National Museum of Natural History, Bulgarian Academy of Sciences, 1 Tsar Osvoboditel Blvd., 1000 Sofia, Bulgaria

pulev.alex@abv.bg

Abstract: The purpose of the study was to supplement, analyze, and summarize the data about the distribution of the Caspian Whip Snake (Dolichophis caspius) in Bulgaria. An attempt was made to characterize the species seasonal and 24-hour activity. Many new individuals were recorded in various new localities and the distribution of the species in the country was specified and mapped. The results confirmed that the Caspian Whip Snake is widely distributed in the lower parts of the country. Although the species was rarely found during winter, its usual activity was from the end of March to the beginning of November. The species was registered during the day, which confirmed its diurnal activity pattern.

Keywords: Serpentes, new localities, seasonal activity, circadian rhythm, biogeography.

Seasonal activity of *Xerotyphlops vermicularis* (Merrem, 1820) (Reptilia: Typhlopidae) in Bulgaria, with first records of autumn activity

Alexander Pulev, Lidia Sakelarieva, Emanuil Mitrevichin

South-West University "Neofit Rilski", Faculty of Mathematics and Natural Sciences, Department of Geography, Ecology and Environmental Protection, Bulgaria
South-West University "Neofit Rilski", Faculty of Mathematics and Natural Sciences, Department of Geography, Ecology and Environmental Protection, Bulgaria
South-West University "Neofit Rilski", Faculty of Mathematics and Natural Sciences, Department of Geography, Ecology and Environmental Protection, Bulgaria

pulev.alex@abv.bg

Abstract: The aim of the study was to supplement and summarize the data about the seasonal activity of the Eurasian Blind Snake (Xerotyphlops vermicularis) in Bulgaria. Many new records of this activity were reported in the country, most of which in the southwestern parts. The species was recorded in the Autumn for the first time – three times in September and once in October. Despite these records, it can be stated that the autumn activity of the species remains very rare. In general, the seasonal activity of the Eurasian Blind Snake differs substantially from that of the other snake species in Bulgaria.

Keywords: Serpentes, Eurasian Blind Snake, period of activity, distribution, Balkans.

The populations of *Testudo hermanni boettgeri* and *T. graeca ibera* (Testudines: Testudinidae) in the northwestern foothills of the Pirin Mountains, Bulgaria

Emanuil Mitrevichin[1], Lidia Sakelarieva[1], Hristo Peshev[1,2], Alexander Pulev[1]

[1] Department of Geography, Ecology and Environmental Protection, Faculty of Mathematics and Natural Sciences, South-West University "Neofit Rilski", Blagoevgrad, 66 Ivan Mihaylov Street, 2700 Blagoevgrad, Bulgaria

[2] Fund for Wild Flora & Fauna, 49 Ivan Mikhaylov Str., office 327, P.O. Box 78, www.fwff.org, pirin@fwff.org, Blagoevgrad, Bulgaria

e-mail: mitrevichin.emanuil@abv.bg

Abstract: Two species of tortoises occur in Bulgaria: the Hermann's Tortoise and the Spur-thighed Tortoise. Most of the studies on both species have been focused mainly on determining their distribution. The majority of the local populations have not been studied in detail. The present study aimed at determining some morphological and population characteristics of two local populations of the two species. The specimens were captured, marked, released, and recaptured. The results showed that T. hermanni is much more numerous than T. graeca – the ratio between the number of specimens was 5:1, respectively. The age structure of both species was very similar. The adults strongly predominate over juveniles and subadults. In both species, the sex ratio was almost in parity. It was found that the two species have a diverse diet. An analysis and comparison of the morphometric data showed that T. graeca is larger and heavier than T. hermanni. Additionally, females of both species are larger and heavier than males.

Keywords: Hermann's Tortoise, Spur-thighed Tortoise, morphological and population characteristics

Important Vulture Sites in the Middle East revealed from GPS tracking migrating Griffon Vultures from the Balkans

Hristo Peshev[1,2], Emilian Stoynov[1], Emanuil Mitrevichin[2], Atanas Grozdanov[3], Konstantin Tyufekchiev[2]

[1] Fund for Wild Flora & Fauna, 49 Ivan Mikhaylov Str., office 327, P.O. Box 78, www.fwff.org, pirin@fwff.org, Blagoevgrad, Bulgaria

[2] Department of Geography, Ecology and Environmental Protection, Faculty of Mathematics and Natural Sciences, South-West University "Neofit Rilski", Blagoevgrad, 66 Ivan Mihaylov Street, 2700 Blagoevgrad, Bulgaria

[3] Department of Zoology and anthropology, Faculty of Biology, Sofia University "St. Kliment Ohridski", 8 Dragan Tsankov Blvd,zootribe@gmail.com, Sofia, Bulgaria

e-mail: hristopeshev.eu@gmail.com

Abstract: Migration is a key moment in the life of birds. In the Griffon Vulture only juveniles and immature birds undertake flights of varying lengths in the Balkan Peninsula. They overwinter from the southern part of the Balkan Peninsula to the Near East and North Africa. During this time they are exposed to dangers that differ from the dangers typical of the breeding grounds of the species. Over the past few years, advances in technology have enabled conservationists to track bird movements in detail. Until recently this was either impossible or too expensive to use on a large scale. Here we present the results of tracking 12 Griffon Vultures equipped with GPS/GSM transmitters during their migration in the period 2018–2022. The overlap of their winter home ranges with existing Important Bird Areas (IBA) shows where more conservation work can be focused to help the survival of this species in the Balkan Peninsula.

Keywords: *Griffon Vulture, migration, Near East, mortality*

Conservation of fish species from Annex 2 of the Habitats Directive in protected sites of the Natura 2000 Network along the Bulgarian section of the Danube River – modern perspective

Luchezar Pehlivanov*, Apostolos Apostolou

Institute of Biodiversity and Ecosystem Research, Bulgarian Academy of Sciences, Sofia, Bulgaria

**Corresponding author: luchezarpehlivanov@gmail.com*

Abstract: Nineteen fish species from Annex 2 of the Habitats Directive are declared as subject of conservation in 22 Natura 2000 protected sites along the Bulgarian section of the Danube River. The current status of the target species was assessed and specific conservation objectives were defined based on both the available data and results of field surveys performed in 2021. The areas of the potential habitats within the sites were calculated taking in account the habitat requirements of each fish species. All protected sites cover Danube sections, 8 of them also cover Danube tributarires and within 11 sites occur standing waters as well. For 8 fish species potential habitats occur only or mainly in the Danube and in several protected sites the suitable habitats for these species occupy negligible area. Three species inhabit only middle and upper reaches of Danube tributaries and 2 – only standing waters. The conservation significance of the Natura 2000 sites for each target species was determined based on its habitat area, population size, isolation degree and identified treats.

Keywords: Natura 2000 sites, fish species, conservation significance, specific objectives

Methodological Approach for Long-term Ecological Research in Forest sites

Toma Tonchev, Svetoslav Anev, Violeta Dimitrova,

Sonya Damyanova

University of Forestry,10 'Sv. Kliment Ohridski' Blv.,1797 Sofia, Bulgaria

sonya_damyanova@abv.bg

Abstract: The dynamic of the processes in an ecosystem requires long-term observations. The paper presents a methodology for the estimation of ecosystem characteristics. Permanent sample plots, a part of LTER-network, situated in Western Stara Planina in Bulgaria, are established to monitor the forest stands processes. Methods based on a remotely sensed vegetation index, the main phenology's life cycle events, such as the start, peak, end, and length of the growing season, are commented on. Methods for phytocoenotic structure: complete floristic composition, total projective coverage of horizons, and species abundance are presented. Methods for stand growth and yield estimation, diameter calculation, basal area, volume increment, and description of tree diameter distribution are summarized. Chemical methods for deposition determination are commented on.

Keywords: LTER, forest sites, phenology, stand growth, phytocoenotic structure, deposition

Current state of population of autochthonous (Stanushina, Plovdina, Prokupec, Temjanika) varieties of grapevine in the Republic of North Macedonia

Aleksandar Klincarov[1], Konstantin Tyufekchiev[1], Violeta Dimovska[2]

[1]*Faculty of Natural Sciences End Mathematics, 2700 Blagoevgrad*

[2]*Faculty of agriculture, Goce Delcev University, Krste Misirkov 10A, Stip, Republic of North Macedonia*

aceklincarov@gmail.com

Abstract: Stanushina, Plovdina, Prokupec and Temjanika are indigenous and local grape varieties in the R. of Nord Macedonia. Some of the varieties grape are part of the National Biodiversity Program for of the indigenous varieties of grape in the R. of Nord Macedonia. Because of the economic, cultural and scientific reasons it is very important to protect the biological diversity of autochthonous varieties like Stanushina. During the last several years, the total number of autochthonous grape varieties rapidly declined, which is alarming for the state policy to react fast and effectively to conserve them by ex-city and in-vivo conservation methods.

Keywords: autochthonous, local varieties grapevine, Stanushina, Plovdina, Prokupec and Temjanika,

From sites to a research infrastructure: establishing network level standard observations for the Bulgarian Long-Term Ecosystem Research Network

Kremena Gocheva[1], Radka Fikova[1], Kostadin Katrandzhiev[1], Lyudmila Lozanova[1], Valeri Georgiev[1], Vladimir Petrov[2], Tsvetan Tsvetanov[1], Petar Dimov[1], Tzvetan Zlatanov[1], Emilia Varadinova[1], Ventsislav Karamfilov[1], Nevena Ivanova[1], Kremena Stefanova[3], Sonya Damyanova[4], Miglena Zhiyanski[5], Stela Lazarova[1], Svetla Bratanova-Doncheva[1]

[1] Institute of Biodiversity and Ecosystem Research at the Bulgarian Academy of Sciences, Sofia, Bulgaria, [2] South-West University "Neofit Rilski", Blagoevgrad, Bulgaria, [3] Institute of Oceanology at the Bulgarian Academy of Sciences, Varna, Bulgaria, [4] University of Forestry, Sofia, Bulgaria, [5] Forest Research Institute at the Bulgarian Academy of Sciences, Sofia, Bulgaria

e-mail address of the corresponding author:
kremena.gocheva@gmail.com

Abstract: Long-Term Ecosystem Research (LTER) is undergoing global and regional standardization of the observations and methods for monitoring and research the structure and functioning of ecosystems. This enables studying the long-term, large-scale trends in the rapidly changing environment shaped by climate change and anthropogenic pressures on the ecosystems.

Facing this challenge, the Bulgarian LTER network is transforming from a group of sites that collect data and perform research in the main ecosystems in Bulgaria towards a coherent national research infrastructure. In parallel, the European LTER network is also consolidating towards an European Research

Infrastructure Consortium which designs European level services for researchers, policymakers and businesses. These two processes need to be aligned. We present the progress in network-wide harmonization of site level observations by habitat, and the development of centralized observations using diverse methods such as network wide sampling campaigns for eDNA, remote sensing of phenology, ice and snow cover, and the use of statistical data for socio-ecological research.

Keywords: Whole system approach, eLTER, data science, stakeholder-oriented services

Ecology-Health-City

Maria Shishmanova, Veselina Dalgacheva

South-West University "Neofit Rilski", Blagoevgrad. Bulgaria
dalgacheva@swu.bg

Abstract: The UN's 2030 Agenda, adopted by world leaders in 2015, represents the new global sustainable development framework and sets 17 Sustainable Development Goals (SDGs). Health promotion efforts based on the healthy cities approach can contribute to these goals, including SDG 11: "make the cities and other populated areas inclusive, safe and sustainable". The study is based on the documents regulating the nature and significance of a healthy city. Some good examples of healthy cities were studied. The approach to create a healthy city, based on principles for its healthy spatial planning, was analyzed. The main purpose of the research is to compile a criteria system for determining the achieved level of completion and development of a city, in order to be marked as healthy.

Keywords: sustainable development, healthy city, principles, criteria system

The Green City – evaluation of the urban environment to define the city as green

Veselina Dalgacheva, Maria Shishmanova

South-West University "Neofit Rilski", Blagoevgrad. Bulgaria
dalgacheva@swu.bg

Abstract: The proposed research is based on the philosophy and meaning of green city. To create green cities, they must be considered as living systems that consume, transform and release materials and energy, and also evolve and adapt. Cities interact with living things and other ecosystems. It is believed that they should be managed and protected like any other ecosystem. An analysis of the urban environment assessment approaches to define the city as green has been made. The main objective of the study is to build an index to measure the potential of the "green city" through a combination of different indicators. Urbanization is 'unstoppable' and cities should increasingly be seen as focal points of the so-called 'green revolution'.

Keywords: green city, ecosystems, approaches, index

Moral issues in the science ot ecology: technological directions

Nikolai Mihailov, Lidia Sakelarieva

Sofia University, Bulgaria
SWU Blagoevgrad, Bulgaria

nikolajkm@uni-sofia.bg

Abstract: The text seeks the connection between the achievements of ecology as a science and the questions they raise ??? to contemporary moral philosophy. The problems of technology and their impact on the natural environment, the moral risks of presenting nature only as a source of raw materials and resources are in the center of the study. Authors also try to prove the need to link education with the necessity for specific approaches to environmental problems, based on the achievements of ecology and of the evaluations of moral philosophy. In this sense, the development of ecology as a science is directly related to the moral-philosophical explanation of the consequences of human impact on nature. The concept of "biohumanities" is considered, in which the progress of biological knowledge is connected with the humane meaning of the philosophical. This will help for better understanding the human aspiration to transform the natural world and to create a beneficial for man and nature culture of behaviour, attitude and consumption.

Keywords: ecology, ethics, enviromental protection, education, technological change, enevironment

About the Solutions of Modified Lorenz System

Biljana Zlatanovska[1], Donco Dimovski[2],

Mirjana Kocaleva Vitanova[1]

[1] Faculty of Computer Sciences, University "Goce Delcev", Stip, R. North Macedonia

[2]Faculty of Natural Sciences and Mathematics, University "Ss Cyril and Methodius", Skopje, R. North Macedonia

biljana.zlatanovska@ugd.edu.mk

Abstract: A Modified Lorenz system is a system of three differential equations. The third differential equation in the Lorenz system is replaced with a 5th-order linear homogeneous differential equation with constant coefficients. In the paper [B. Zlatanovska and D. Dimovski, A Modified Lorenz System: Definition and Solution, Asian-European Journal of Mathematics, Vol.13, No.08, 2050164 (2020)], the Modified Lorenz system is defined by offering a solution, but without solving the 5th-order linear homogeneous differential equation with constant coefficients. This differential equation is solved by solving the characteristic equation of 5^{th} degree. A formula for solving the algebraic equation of the 5th degree does not exist. Therefore, solutions for the special cases of the characteristic equation of 5^{th} degree as an algebraic equation of 5^{th} degree will be offered. The solution of the Modified Lorenz system will be completed using these forms of the characteristic equation of the 5^{th} degree.

Keywords: Modified Lorenz system, characteristic equation of the 5^{th} degree, algebraic equation of the fifth degree.

Products of Distributions in Colombeau Algebra

Marija Miteva, Limonka Koceva Lazarova, Biljana Zlatanovska, Natasha Stojkovikj

University "Goce Delcev", Stip, R.N.Macedonia
biljana.zlatanovska@ugd.edu.mk

Abstract: We evaluate some products of distributions in Colombeau algebra of generalized functions. In the classical theory of Schwartz distributions, multiplication of distributions is not defined for two arbitrary singular distributions. The properties of the Colombeau algebra allow us to calculate products of singular distributions which are not defined in the classical theory. The notion of 'association' in Colombeau algebra of generalized functions allows us the results obtained in this way to be considered as products in the classical theory of distributions. The definition of the Colombeau product of distributions can be considered as generalization of their classical product in Schwartz theory.

Keywords: distributions, Colombeau algebra, Colombeau generalized functions, multiplication of distributions

Modeling, Analysis and Simulation of Tuberculosis

Natasha Stojkovikj[1] Biljana Zlatanovska[1],

Maja Kukusheva Paneva[2], Limonka Koceva Lazarova[1],

[1]Faculty of Computer Science, Goce Delcev University, Stip, North Macedonia

[2]Faculty of Electrical Engineering, Goce Delcev University, Stip, North Macedonia

natasa.stojkovik@ugd.edu.mk, biljana.zlatanovska@ugd.edu.mk, maja.kukuseva@ugd.edu.mk, limonka.lazarova@ugd.edu.mk

Abstract: Tuberculosis (TB) is a highly contagious disease caused by Mycobacteria tuberculosis that throughout history has caused a lot of deaths. The analysis of TB is through mathematical models with differential equations describing the dynamics of epidemic spread and its control and prevention. In this paper SEIR model of TB will be represented. According to this model the total population is divided into four compartments: susceptible, exposed, infected and recovered individuals. In this paper an evaluation of rates (transmission rate, contact rate etc.) at which individuals flow from one compartment to another under different scenarios will be represented.

Keywords: Tuberculosis, SEIR model, differential equation, mathematical modeling

Using ChatGPT for numerical solution of first and second order ordinary differential equations

Saso Koceski, Natasa Koceska, Limonka Koceva Lazarova, Marija Miteva, Biljana Zlatanovska

Faculty of Computer Science, Goce Delcev University, Stip, North Macedonia

saso.koceski@ugd.edu.mk

Abstract: In this research we have conducted empirical study to evaluate the capabilities of OpenAI's chat bot ChatGPT for automated software code generation and programming numerical methods for solving various types of differential equations. We have tested the ChatGPT for numerical solution of first and second order ordinary differential equations. Moreover, we have tested the bot for solution of real-life problem such as Newton's law of cooling states. Obtained results suggest that ChatGPT is a promising AI tool for programming numerical algorithms for solving differential equations. It can generate fully usable code in Python, that could be compiled with no or minimal human intervention. However, there are still some limitations and challenges to using AI for numerical solution generation, such as the need for large amounts of high-quality training data, potential biases in the algorithm, and the ability to explain how the algorithm came up with its output. This is especially valid for more complex problems. However, as AI technology continues to develop, it is likely that the use of AI for programming will become more prevalent and effective in the future.

Keywords: differential equations, numerical solution, artificial intelligence, ChatGPT

Social Network Development Using the Firebase Platform

Verica Ivanova, Limonka Koceva Lazarova, Natasha Stojkovikj, Cveta Martinovska Bande

Faculty of Computer Science, Goce Delcev University, Stip, North Macedonia

verica.101781@student.ugd.edu.mk, limonka.lazarova@ugd.edu.mk,*natasa.stojkovik@ugd.edu.mk*, *cveta.martinovska@ugd.edu.mk*

Abstract: Due to the fast development of smart phones in the last couple of years, each day a large dynamic in the application stores is noticed. Today's generation of smart phones and their originality, mass usability, and computer characteristics, represent an ideal platform for constant flow of information and faster access to them via mobile devices. The main goal of this paper is to show development opportunities with Android Studio and the back-end Firebase service. The popularity of social networks has grown steadily, and that is the main reason for the development of this application that pretends to be one kind of social network. The main purpose of the application is to exchange a large amount of information, fast and easy access to information, communication with friends as well as a convenient way to present yourself.

Keywords: Android Studio, Firebase, social networking service, activity.

Theoretical proof for the number of errors that one linear code detects when linear quasigroups of order 4 are used for coding

Natasha Ilievska

Faculty of Computer Science and Engineering, Ss. Cyril and Methodius University, Skopje, R. Macedonia

natasa.ilievska@finki.ukim.mk

Abstract: In the paper we will analyze one linear code from the theoretical point of view. Namely, the code definition is based on linear quasigroups. In the previous work we classified the quasigroups of order 4 according to their probability of undetected errors. Now, in this paper we will conclude whether the quasigroups that are in a same class in this classification obtain equal number of incorrectly transmitted bits. Also, we will classify the linear quasigroups of order 4 according to the number of errors that the code surely detects when they are used for coding. At the end we will make conclusion which quasigroups of order 4 are overall best for coding having in mind both important parameters for every code for error detection: the number of errors that the code surely detects and the probability of undetected errors.

Keywords: linear code, Humming distance, quasigroup

Simulation of the number of surely detected errors of an error-detecting code

Natasha Ilievska

Faculty of Computer Science and Engineering, Ss. Cyril and Methodius University, Skopje, R. Macedonia

natasa.ilievska@finki.ukim.mk

Abstract: Ensuring as much as possible error-free transmission is of extraordinary importance for any communication system. It is not possible to guarantee completely reliable and accurate communication, but it is possible to guarantee that the probability that there will be errors in transmission that will not be detected will be very small and that the errors in transmission will be detected in all incorrectly transmitted messages with up to some number of incorrectly transmitted bits. In this paper we will analyze an error-detecting code which uses quasigroups in the coding process. Using simulations, we will obtain the number of incorrectly transmitted bits up to which the code will always detect the errors in transmission when quasigroups of order 4 are used for coding.

Keywords: error-detecting code, quasigroup, error-detecting capability, number of surely detected errors

Chain relation in a family of sets and chain function

Zoran Misajleski, Emin Durmishi

Ss. Cyril and Methodius University, Skopje, Macedonia
misajleski@gf.ukim.edu.mk

Abstract: In [1] a characterization of connectedness of a topological space is given by using the notion of a finite chain in a covering, while in [2] it is generalized into the notion of a chain connected set in a topological space. In [3] the notion of a chain connected set in a space consisting of a set and a family of coverings is introduced.

In this paper we will define connectedness of a family of sets, by defining the terms finite chain in the family and chain relation between two sets. Furthermore, we will define a chain function between two families of sets. Some properties of connected families and chain functions will be obtained.

[1] N. Shekutkovski, **On the concept of connectedness**, Matematicki Bilten, Vol. 40, No. 1 (2016), 5-14.
[2] Z. Misajleski, N. Shekutkovski, A. Velkoska, **Chain Connected Sets In A Topological Space**, Kragujevac Journal of Mathematics, Vol. 43 No. 4 (2019), 575-586.
[3] Z. Misajleski, E. Durmishi, A. Velkoska, **Chain connected set in a space**, Proceedings of the Codema 2022 (2022), 35-42.

Keywords: Connectedness, Chain Connectedness, Family of sets.

Methods of solving systems of linear equations $m \times n$, $m \in \{1,2,3\}$, based on the geometrical interpretations of the equations

Zoran Misajleski, Daniel Velinov, Aneta Velkoska

Ss. Cyril and Methodius University, Skopje, Macedonia
misajleski@gf.ukim.edu.mk

Abstract: In the paper [1], a classification of systems of linear equations based on the mutual position of the geometrical interpretations of the equations, called geometrical classification, is given. In this paper we will determine methods of solving systems of linear equations, using the geometrical classification and terminology of the types of linear equations or systems of two equations introduced in [1]. The analysis specifically refers to systems of linear equations that reduce to a quadratic system of the second or third order in which all determinants of the system are zero. The methodological significance of the methods is also discussed.

[1] Z. Misajleski, D. Velinov, A. Velkoska, **Classifications Of Systems Of Linear Equations Based On Its Geometrical Interpretations**, Proceedings of the Codema 2020 (2021), 39-49.

Keywords: System of linear equaions, Geometric slassification

Geometric properties of a free boundary problem

Martin Lukarevski

University 'Goce Delcev' – Stip, Macedonia

martin.lukarevski@ugd.edu.mk

Abstract: The introduction of a relaxation function in a particular type of a Stefan problem, which is a free boundary problem, allows for a priori estimates for the surface area. The evolution of the free boundary in time is not arbitrary. We will show that the model we consider is volume-preserving and area-shrinking.

Keywords: free boundary problem; volume-preserving; area-shrinking

Predator-prey interactions under the Allee effect in prey and multiple predator harvesting strategies

Petar Ćirković

Mathematical Institute of the Serbian Academy of Sciences and Arts, Serbia

petarc@turing.mi.sanu.ac.rs

Abstract: A Holling-Tanner predator-prey model with Allee effect in prey, Holling type-II functional response, and different types of predator harvesting are investigat-ed. Both strong and weak Allee effects will be considered. As harvesting func-tion, the most used are constant, linear, and Michaelis-Menten-type nonlinear functions. We will make a comparation between the number of equilibria, their stability, and different types of bifurcations such as transcritical and Hopf bi-furcation. The importance of transcritical bifurcation in ecology provides the limits for continuous harvesting without putting the predator species at risk of extinction. The appearance of a stable limit cycle through supercritical Hopf-bifurcation gives the oscillatory coexistence of the species. To confirm the theoretical results, we will provide numerical simulations.

Keywords: predator-prey model, Allee effect, harvesting, bifurcations

One result about products of distributions and ultradistributions

Petar Sokoloski

Sts Cyril and Methodius University, Skopje, Macedonia
petar@pmf.ukim.mk

Abstract: The multiplicative product of distributions cannot be defined in general. In this paper the equivalence between the product of distributions using the Fourier series coefficients of their localizations and the classical definition by Hörmander using the wave front sets is shown. Also the relations between this definition of the product of distributions with the most popular ones are presented.

Keywords: distributions, ultradistributions, product of distributions, wave-front set.

Some results for the serial RL parallel C circuit using Laplace transform

Jasmina Veta Buralieva[1] Maja Kukuseva Paneva[2]

[1]Faculty of Computer Science
[2]Faculty of Electrical Engineering
University Goce Delcev, 2000 Stip, North Macedonia

jasmina.buralieva@ugd.edu.mk

Abstract: The Laplace transform is a wonderful tool for solving various problems, such as ordinary differential equations. In the present paper we provide the solution of the ordinary differential equation from second order, that describes the serial RL parallel C circuit, using Laplace transform. The results of the simulations are also given.

Keywords: Laplace transform, inverse Laplace transform, serial RL parallel C circuit, ordinary differential equation, simulations.

Abelian-and Tauberian-type results for the generalized Stockwell and wavelet transforms

Jasmina Veta Buralieva

Faculty of Computer Science,
Goce Delcev University, Stip, North Macedonia,
jasmina.buralieva@ugd.edu.mk

Abstract: Tauberian-type results characterizing the quasiasymptotic behavior of polynomial multiplication of Lizorkin distributions in terms of their Stockwell transform are obtained. Some Abelian-type results relating the quasiasymptotic behavior and quasiasymptotic boundedness of Lizorkin distributions to the asymptotic behavior of their Stockwell transform are given. Several Abelian-type results for the generalized wavelet transform are also presented.

Keywords: Stockwell transform, wavelet transform, distributions, quasiasimptotics, Abelian-and Tauberian-type results.

Conformable Evolution Inclusions with Causal Operators

Tzanko Donchev[1], Iveta Nikolova[1], Mikhail Kolev[2*], Boiana Garkova[2], Alina I. Lazu[3]

[1]*University of architecture, civil engineering and geodesy, Sofia, Bulgaria*

[2]*South West University, Blagoevgrad, Bulgaria*

[3]*"Gh. Asachi" Technical University, Iasi, Romania*

**mkkolev@abv.bg*

Abstract: In this paper we study local and nonlocal problems of conformable semilinear evolution inclusions with causal operators, which include time lag system and a large classes of parabolic multivalued differential equations. We first investigate the problems with the help of measure of noncompactness and afterwards with the help of compact semigroup in order to prove existence of solutions. The advantages and disadvantages of both approaches are then pointed out.

Keywords: conformable semilinear evolution inclusions, local and nonlocal problems, time lag systems, parabolic multivalued differential equations

Evolution Inclusions with Non Fixed Times of Impulses

Tzanko Donchev, Nikolay Kitanov, Dimitar Kolev, S. Iftikhar, Alina Lazu

University of architecture, civil engineering and geodesy, Bulgaria
University of architecture, civil engineering and geodesy, Bulgaria
South West University , Bulgaria
Gh. Asachi" Technical University, Romania

nkitanov@abv.bg

Abstract: Parabolic evolution inclusions on Gelfand (evolution) triple, given as a multivalued perturbations of nonlinear maximal dissipative operator with non fixed times of impulses are studied. We assume that the multifunction is almost upper semicontinuous with closed convex values to prove existence of solutions. Then we prove a continuous dependence of the solution set on the initial conditions, impulsive surfaces and the right hand side when the multifunction is one sided Lipschitz (Peron). The problems considered in this paper are also a class of switching systems. Illustrative examples of partial differential inclusions are provided.

Keywords: evolution triple, impulsive differential inclusions, evolution systems.

On Some Applications of Linear Problems in Economy

Boiana Garkova[1], Sashka Kandilarova[1], Mikhail Kolev[1*],

Iveta Nikolova[2]

[1]*South-West University "Neofit Rilski", Blagoevgrad, Bulgaria*

[2]*University of architecture, civil engineering and geodesy, Sofia, Bulgaria*

**mkkolev@abv.bg*

Abstract: We consider some applications of linear modeling in the field of economy. Theoretical background is reviewed. In particular, the Simplex method as well as the Transportation Problem are recalled. The theoretical concepts are applied to specific economic problems. The obtained results are discussed from the viewpoint of economy.

Keywords: Simplex method, Transportation problem, Linear optimization

On Some Nonlinear Problems in Economy

Sashka Kandilarova[1], Mikhail Kolev[1*], Nikolay Kitanov[1], Iveta Nikolova[2], Sevasti Georgiadou[1]

[1]*South-West University "Neofit Rilski", Blagoevgrad, Bulgaria*

[2]*University of architecture, civil engineering and geodesy, Sofia, Bulgaria*

**mkkolev@abv.bg*

Abstract: We consider some applications of nonlinear modeling in the field of economy. Theoretical background is reviewed. In particular, the method of Lagrange multipliers as well as the Kuhn-Tucker theory are recalled. The theoretical concepts are applied to specific economic problems. The obtained results are discussed from the viewpoint of economy.

Keywords: Lagrange multipliers, Kuhn-Tucker conditions, Constrained optimization

On Consumer Demand and Utility Optimization

Sevasti Georgiadou[1], Mikhail Kolev[1*], Iveta Nikolova[2], Sashka Kandilarova[1]

[1]*South-West University "Neofit Rilski", Blagoevgrad, Bulgaria*

[2]*University of architecture, civil engineering and geodesy, Sofia, Bulgaria*

**mkkolev@abv.bg*

Abstract: We consider the problem of consumer demand and maximization of utility, which is often occurring in the field of economy. Theoretical background is reviewed. In particular, the method of Lagrange-multipliers is recalled. The theoretical concepts are applied to specific economical problems.

Keywords: Lagrange multipliers, Bordered Hessian, Consumer Demand, Utility Maximization

On some stochastic applications to chemical problems

Iveta Nikolova*, Krasimir Yordzhev, Valeri Vachkov, Mikhail Kolev, Ginka Paunova, Radostina Genova-Koleva

University of architecture, civil engineering and geodesy, Sofia, Bulgaria

Iveta.nikolova@abv.bg

Abstract: In addition to the deterministic models, stochastic models are successfully used for the mathematical description of real-world processes and phenomena. They use knowledge from the mathematical probability theory to analyze specific properties of complex systems. In this paper main combinatorial definitions and theorems are reviewed. They are related to events when choices of discrete objects should be done or some sequences of objects must be calculated. Classical and geometrical probabilities as well as randomized algorithms are also reviewed. These notions can be related to various real phenomena. As examples some chemical phenomena and processes are considered. Their main characteristics are modelled and analyzed by the use of concepts introduced earlier. The results are discussed from scientific and practical point of view.

Keywords: stochastic models, chemical processes, randomized algorithms

Deep Learning for Automated Diagnosis of Radiological Images: A Comprehensive Review of Neural Networks and Mathematical Approaches

Irina Naskinova[1], Mikhail Kolev[1*]

[1]South-West University "Neofit Rilski", Blagoevgrad, Bulgaria
**mkkolev@abv.bg*

Abstract: This article provides a comprehensive review of the use of deep learning neural networks for the automated diagnosis of radiological images. It covers the latest mathematical approaches used in designing and training neural networks, as well as the challenges and limitations of current techniques The article also explores promising new directions for research in this field.

Keywords: Machine learning, Mathematical modeling, Image recognition

On some monoids of partial isometries on graphs

Vítor Hugo Fernandes

FCT NOVA | NOVA Math, Lisbon, Portugal

vhf@fct.unl.pt

Abstract: Let G = (V,E) be a finite undirected connected graph. The distance between two vertices x and y of G, denoted by d(x,y), is the length of a shortest path between x and y, i.e. the number of edges in a shortest path between x and y. Denote by I(V) the symmetric inverse monoid on V, i.e. the monoid of all partial permutations of V. Let f be an element of I(V). We say that f is a partial isometry (or a distance preserving partial transformation) of G if d(xf,yf) = d(x,y), for all elements x and y in the domain of f. Denote by DP(G) the subset of I(V) of all partial isometries of G. Clearly, DP(G) is an inverse submonoid of I(V).

We will survey properties of several monoids of partial isometries on some undirected graphs, namely paths, cycles and stars, which were published in several papers due to the author and his co-authors, as well as other authors. New results about the monoid of the partial isometries on a wheel graph will also be presented.

Keywords: partial isometries, rank, transformations, graphs

The rank of the semigroup of order-, fence-, and parity-preserving partial injections on a finite set

Apatsara Sareeto, Jörg Koppitz

Institue of Mathematics, University of Potsdam, Potsdam, 14476, Germany

(E-mail: channypooii@gmail.com)

Abstract: The monoid of all partial injections on a finite set (the symmetric inverse semigroup) is of particular interest because of the well-known Wagner-Preston Theorem. In this presentation, we step forward the study of a submonoid of the symmetric inverse semigroup. We study the monoid of all order-preserving partial injections on an n-element chain such that $|I_i|$ and $|J_i|$ have the same parity for $i \in \{1,\ldots,k\}$, where $I_1<I_2<\cdots<I_k$ (and $J_1<J_2<\cdots<j_k$) are the maximal intervals of the codomain of α (and gap of α). We characterize the transformations in that monoid and show that it has a rank 3n-6. In particular, we provide a generating set A_n of minimal size and exhibit concrete normal forms for the transformations generated by A_n.

Keywords: Transformation semigroup, Order-preserving, Fence-preserving, Generating set, Rank

The rank of the inverse semigroup of all partial automorphisms on a finite crown

Ilinka Dimitrova, Joerg Koppitz

Faculty of Mathematics and Natural Science
South-West University "Neofit Rilski"
2700 Blagoevgrad, Bulgaria
e-mail: ilinka_dimitrova@swu.bg

Institute of Mathematics and Informatics
Bulgarian Academy of Sciences
1113 Sofia, Bulgaria
e-mail: koppitz@math.bas.bg

Abstract: For $n \in N$, let $[n] = \{1, 2, \ldots, n\}$ be an n - element set. As usual, we denote by I_n the symmetric inverse semigroup on [n], i.e. the partial one-to-one transformation semigroup on [n] under composition of mappings. The crown (cycle) C_n is an n-ordered set with the partial order < on [n], where the only comparabilities are

$1 < 2 > 3 < 4 > \ldots < n > 1$ or $1 > 2 < 3 > 4 < \ldots > n < 1$.

We say that a transformation $\alpha \in I_n$ is order-preserving if $x < y$ implies that $x\alpha < y\alpha$, for all x, y from the domain of α. In this paper, we study the inverse semigroup IC_n of all partial automorphisms on a finite crown C_n. We consider the elements, determine a generating set of minimal size and calculate the rank of IC_n.

Keywords: finite transformation semigroup, inverse semigroup, crown, order-preserving injections, generators, rank

Lucky Rooted Trees

Jörg Koppitz

Institute of Mathematics and Informatics, Bulgarian Academy of Science, Sofia, Bulgaria

e-mail: koppitz@math.bas.bg

Abstract: Trees are important graphs. We consider rooted trees and make a vertex coloring. This gives an edge coloring by adding the colors of the colors of the endpoint of the edge. We say that the coloring is lucky if any two edge with joint vertex have different colors. The least number of colors appear by such an edge coloring is called lucky number. We determine the lucky number for complete rooted trees.

Keywords: Graphs, Lucky Number, Rooted Tree

A Class of Integer 3 x 3 Matrices Related to Numerical Semigroups with Embedding Dimension 4

Merita Bajrami[1], Donco Dimovski[2], Violeta Angjelkoska[3]

[1] Faculty of Natural Sciences and Mathematics, "University of Tetova", Tetova, Republic of North Macedonia
e-email:merita.azemi@unite.edu.mk

[2] Macedonian Academy of Sciences and Arts Skopje", Skopje, Republic of North Macedonia

[3] Faculty of Informatics, "American University of Europe – FON", Skopje,Republic of North Macedonia

Abstract: The aim of this paper is to present a class of integer 3 x 3 matrices related to numerical semigroups with embedding dimension 4, generated by four integers n, x, y and z such that $x \equiv 1(\mathrm{mod} n)$, $y \equiv j(\mathrm{mod} n)$, $z \equiv k(\mathrm{mod} n)$ and $n < x < y < z$. For a matrix M of this class, we use the GAP Package, in order to describe the Apéry set of the numerical semigroup related to M.

Keywords: Numerical semigroups, GAP Package, nice matrix, (n,j,k)-good matrix.

Some fixed point theorems in (3,2)-metric spaces

Tomi Dimovski[1], Dončo Dimovski[2]

[1]Faculty of Mechanical Engineering, Skopje, North Macedonia

e-mail:tomi.dimovski@gmail.com

[2]Macedonian Academy of Sciences and Arts, Skopje, North Macedonia

e-mail: ddimovskid@gmail.com

Abstract: In this article we consider (3,2)-metric spaces and prove several fixed point theorems for self mappings on (3,2)-metric spaces satisfying some conditions similar to contractions in ordinary metric spaces.

Keywords: .(3,2)-metric space, Metric space, Self mapping, Fixed point

Expanding the capabilities of robot NAO to enable human-like communication with children with speech and language disorders

Anna Andreeva [1,2], Anna Lekova[1], Paulina Tsvetkova [1], Miglena Simonska[2]

[1]*Institute of Robotics, Bulgarian Academy of Sciences, Sofia, Bulgaria*

[2]*South-West University "Neofit Rilski", Faculty of Public Health, Health Care and Sport, Blagoevgrad, Bulgaria*

anna_andreeva@swu.bg

Abstract: The humanoid robot NAO is widely used in the therapy scenarios for children with special needs, however it has poor speech recognition and dialog based on a predefined lexicon that results in limited vocabulary and limited number of predefined dialog scenarios causing unsatisfactory interactions. The integration of Conversational Artificial Intelligence in NAO (ConvAI in NAO) can enhance and expand the capabilities of communication between the robot and children with speech and language disorders in two ways: 1) by supporting the development of language and verbal communication in a human-like manner and 2) by improving the integrated ConvAI through the physical presence of the robot, which increases engagement of the child. The authors see the potential of Natural Language Processing (NLP) services for speech recognition and text classification as an instrument for providing real-time feedback and assistance in the context of speech and language therapy. This can make the treatment more personalized and accessible for children to participate from home. The authors present a software architecture for ConvAI in robot NAO and its successful implementation by integrating NLPcloud, MS Azure and OpenAI NLP services with NAO native software via NodeRED as a platform. However, integrating ConvAI in NAO robot for speech and language therapy puts some technical and ethical challenges, such as the need

for accurate and multilingual speech recognition, human-like text generation and text-to-speech synthesis, as well as the development of ethical framework for both developers and therapists. An Ethical Codex to be followed by the developers that integrate in general ConvAI in robots for children is proposed, as well.

Keywords: conversational AI, speech recognition, humanoid robot NAO, speech and language disorders, Ethical Codex

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Using Olympic Grading Systems in Education of Programming

Krassimir Manev

Journal "Mathematics and Informatics"

k.manev@azbuki.bg

Abstract. Computer programing is the main subject of teaching in Informatics. But computers and computer programs are powerful instrument for teaching, too. Competitions in programming are organized since 80's of the past century. Soon after their beginning the organizers implemented first Contest Grading (Management) Systems (shortly Grading Systems, GS). GS are complex software systems but their main component is the component that evaluate programs. With their evaluation functionality GS are powerful instrument for teaching programming. In this presentation we will discus different aspects of using GS in programming education

Diagnostics of the intellectual and personal reflection in the process of biology and health education (Second stage of high school education)

Isa Hadjiali,

University of Sofia "St. Kliment Ohridski", Sofia, Bulgaria

isa.hadjiali@abv.bg

Abstract: Due to its multifunctionality and broad potential for development in the educational process, reflection is raised to a rank of a substantial element in the structure of key competences, which are necessary for each individual in the "Society of knowledge". This defines the importance of reflection for the quality of the end product of education. The key purpose of the presented material is the development of diagnostics scale for the measurement of the levels at which intellectual and personal reflection is present in the process of biology and health education - 11 grade (Module 1. The cell as elementary biological system).

Keywords: intellectual reflection; personal reflection; reflection levels

The Effect of Context-Based Chemistry Learning on Student Motivation and Engagement

Vesela Pavlova, Assoc. prof. Alexandria Gendjova, PhD

Faculty of Chemistry & Pharmacy at Sofia University

"St. Kliment Ohridski", Sofia, Bulgaria

vessela.pavlova@gmail.com, agendjova@chem.uni-sofia,bg

Abstract: For the successful science education is very important to link science content with context from everyday life. In chemistry lessons teachers can use contexts related to the environment or health. This study aims to establish the effect of the use of context-based approach on high school students' motivation for learning chemistry. For the evaluation is used the instrument Context-Based Chemistry Motivation Scale with three indicators: enthusiasm, efficiency and performance. The participants are 113 students in 9th grade at a Public High School. As results is registered high levels of students' motivation in three aspects - enthusiasm, efficiency and performance. Approximately 80% of the students claimed that after the use of context - based learning they have better understanding and memorizing the topics. At the end of the study the students demonstrate high level of engagement with environmental problems.

Keywords: Chemistry, Context-Based Learning, Students' Motivation, Secondary School

Application of digital technologies in the chemistry classroom: teachers' attitudes in 2019 and 2022

Martina Tsenova, Milena Kirova

Sofia University "St. Kliment Ohridski", Sofia, Bulgaria
mkirova@chem.uni-sofia.bg

Abstract: The successful integration of digital technologies in teaching depends on the skills and attitudes of the teachers. The presented research compares the attitudes of Bulgarian chemistry teachers for the application of digital technologies in the classroom before and after the distance learning, which became necessary in the period 2020-2022. The research instrument is a questionnaire containing 35 items and the survey was conducted online. Forty-eight chemistry teachers participated in the survey in 2019 year, and in 2022 - 49 teachers. Data were compared by non-parametric Mann-Whitney test. The results show significant differences in the attitudes of the chemistry teachers towards the application of digital technologies in the classroom, especially regarding their benefits in teaching and learning.

Keywords: teachers' attitudes, digital learning, chemistry education

Changes in motivation to learn chemistry through independent group activities

Martina Evgenieva, Milena Kirova

Sofia University "St. Kliment Ohridski", Sofia, Bulgaria
mkirova@chem.uni-sofia.bg

Abstract: The presented research was conducted with 48, 9th grade, students during chemistry classes. Students' activities for independent learning in small groups through the application of worksheets, tasks and projects are planned and implemented during the study. The students' motivation to learn chemistry was studied before and after the experimental activities using the Students' Motivation Towards Science Learning Questionnaire, which was validated in the Bulgarian language (BG SMTSLQ). The results indicate that a large number of participants increase or maintain their motivation to learn chemistry on all scales of the instrument.

Keywords: students' motivation, chemistry education, independent learning

Chemistry lesson plan based on 6C's model of CLIL

Irina Andonova, Elena Boiadjieva

32 Secondary Language School " St. Kliment Ohridski", Sofia

Sofia University " St. Kliment Ohridski", Sofia

Bulgaria

Email: irina.andonova@32school.com

Abstract: Nowadays CLIL (Content and Language Integrated Learning) is recognized as one of modern approaches of acquiring foreign languages while learning a content subject. CLIL offers the opportunity for learners to broad their intercultural knowledge and understanding as well as their communication skills in a language that is not their mother tongue. The aproach promotes the development of diverse learning strategies, the application of innovative teaching methods and techniques and the increase of learner motivation.

In this paper is presented the 6C's model –Content, Communication, Cognition, Culture, Context and key Competencies, that is an extended model based on Do Coyle's 4C's model. As an approach based on competencies CLIL is highly admired by practitioners, so we decided to implement it in our practice. Here will be presented a plan of CLIL Chemistry lesson delivered in English based on the 6C's model. The template of the lesson plan will be useful for each Subject teacher willing to implement CLIL approach in their practice.

Key words: *6C's model, CLIL, key competencies, Chemistry lesson plan*

Information technology as a means of strengthening the competences acquired by the student from the topic "Numbers from 101 to 1000"

Vilislav Radev

Plovdiv University "P. Hilendarski", Bulgaria

vradev@uni-plovdiv.bg

Abstract: The article is devoted to the use of information technology to create animated educational content in the form of a game as an aid in mathematics classes. Specialized Scratch software was examined and implemented for the realization of the animated module and increasing the digital competences of the students. The basis for the developed animated module is the mathematics textbook for the third grade, authored by Prof. Dr. Vladimira Angelova and Zhana Koleva, "Prosveta Plus" publishing house, Sofia, 2017. The proposed version includes a task that visualizes the numbers represented by their units, tens and hundreds. The main objective of this paper is to develop on Scratch, experiment and determine the effectiveness of a software package of an animated module based on the teaching content of mathematics in third grade and to compare the learning outcomes achieved in a class in which the animated tasks were implemented and such , in which they were not implemented.

Keywords: Scratch, information technology, mathematic, competences

How to Increase Students' Interest in Mathematics - Challenging their Understanding of Mathematics Via Solving Problems

Stanislava Stoilova[1], Mikhail Kolev[2*]

[1]University of architecture, civil engineering and geodesy, Sofia, Bulgaria

[2]South-West University, Blagoevgrad, Bulgaria

**mkkolev@abv.bg*

Abstract: The National Student Olympiad in Mathematics is a mathematics competition between undergraduate and graduate students and has been organized annually since 1974 by higher education institutions in Bulgaria. The aim is to increase students' interest in mathematics and to create conditions for exchange of experience among teaching teams. In this paper we present our impressions about the organization of the tournament in 2023, the problems given to students and possible solutions of some of them.

Keywords: competitions in mathematics; understanding of mathematics; solving mathematical problems

Teaching Computational Thinking with Python: Enhancing Mathematical Problem-Solving Skills in High School Students

Irina Naskinova[1], Gabriela Vasileva[2], Yana Vasileva[3], Mikhail Kolev[1*], Iveta Nikolova[4]

[1]South-West University "Neofit Rilski", Blagoevgrad, Bulgaria

[2]Varna Free University "Chernorizets Hrabar", Bulgaria

[3]Private Lebanese school "Gibran Khalil Gibran", Sofia, Bulgaria

[4]University of architecture, civil engineering and geodesy, Sofia, Bulgaria

**mkkolev@abv.bg*

Abstract: This article provides a comprehensive review of the use of deep learning neural networks for the automated diagnosis of radiological images. It covers the latest mathematical approaches used in designing and training neural networks, as well as the challenges and limitations of current techniques The article also explores promising new directions for research in this field.

Keywords: understanding of mathematics; solving mathematical problems, Python

Python Programming for Math Education: Fostering Logical Reasoning and Creativity in High School Students

Irina Naskinova[1], Gabriela Vasileva[2], Yana Vasileva[3], Iveta Nikolova[4], Mikhail Kolev[1*]

[1]South-West University "Neofit Rilski", Blagoevgrad, Bulgaria

[2]Varna Free University "Chernorizets Hrabar", Bulgaria

[3]Private Lebanese school "Gibran Khalil Gibran", Sofia, Bulgaria

[4]University of architecture, civil engineering and geodesy, Sofia, Bulgaria

**mkkolev@abv.bg*

Abstract: This article discusses the role of Python programming in fostering logical reasoning and creativity in high school math education. By engaging students in coding exercises that require them to design, test, and refine algorithms, educators can help students develop more robust problem-solving skills, while also promoting a deeper understanding of mathematical concepts.

Keywords: understanding of mathematical concepts; coding exercises, Python

The Power of Python for Developing Computational Problem-Solving: Integrating Coding into High School Math Curricula

Irina Naskinova[1], Gabriela Vasileva[2], Yana Vasileva[3], Mikhail Kolev[1*], Iveta Nikolova[4]

[1]South-West University "Neofit Rilski", Blagoevgrad, Bulgaria

[2]Varna Free University "Chernorizets Hrabar", Bulgaria

[3]Private Lebanese school "Gibran Khalil Gibran", Sofia, Bulgaria

[4]University of architecture, civil engineering and geodesy, Sofia, Bulgaria

**mkkolev@abv.bg*

Abstract: This article explores the integration of Python programming into high school math curricula, with a focus on developing computational problem-solving skills. By combining traditional math instruction with coding exercises that emphasize problem-solving and logical reasoning, educators can help students develop the skills they need to succeed in a rapidly evolving technological landscape.

Keywords: math curricula; computational problem-solving skills, Python programming

A new view on the golden ratio

Stanislava Stoilova[1], Mikhail Kolev[2*]

[1]University of architecture, civil engineering and geodesy, Sofia, Bulgaria

[2]South-West University, Blagoevgrad, Bulgaria

**mkkolev@abv.bg*

Abstract: The first mention of the golden ratio dates from Ancient Greece. In particular, it can be found in Euclid's Elements, the Classical Greek work on mathematics and geometry. Later it was studied and used in many areas of science and art. In our presentation we discuss some new ideas related to a mathematical problem faced during the preparation of students to National Student Olympiad in Mathematics.

Keywords: competitions in mathematics; golden proportion; solving mathematical problems

The Mathematical competition "Beyond all standards" at the university

Mediha Topalova, Boyana Garkova

South-West University, Blagoevgrad, Bulgaria
medihatopalova@gmail.com

Abstract: We present the mathematical competition "Beyond all standards" organized in the Department of Mathematics at South-West University with the special technical support of a University Students' Council. The tasks are described and classified according to their type. An analysis of the results of the competition, held on April 12, 2023, is provided.

Keywords: competition, mathematical competence, brainstorming

The motivation of bilingual students in mathematics and information technology education

Silvena Stefanova-Milanova

Bulgaria

silvena1167@abv.bg

Abstract: This article examines what bilingualism is in school. What is education for these students. What difficulties do bilingual students face in mathematics and information technology and whether teachers succeed in motivating them. Whether education is important to them and to what extent. What are the peculiarities of teaching bilingual students? What is the role of mathematics and information technology (IT) education in the integration of students in a bilingual environment? How can bilingual students acquire practical knowledge and skills for correct use in mathematics and IT?

Keywords: motivation of bilingual students, bilingualism in secondary school, education, online learning, different ways for teaching.

From STEAM to STREAM

Ani Vasileva, Anna Dzharova, Vanya Kaftandzhieva, Svetla Borisova, Nadezha Deyanova

St. st. Cyril and Methodius, Velingrad, Bulgaria

e-mail address of the corresponding author: v_kaftandzhieva@sukim.eu

Abstract: The concept of the educational system development at Innovative Comprehensive School St. St. Cyril and Methodius and the im-provement of our students' daily learning is strongly linked to the STEM movement that continues to dominate global education. Moreover, modern education is becoming more and more attractive with the inclusion of STEAM and STREAM.

The STEM movement calls for the integration of important science and math subjects into local curricula to prepare students for the technology age and professions of the future. Furthermore, the complex challenges present-ed need sophisticated solutions and require a set of unique life skills. More-over, STEM education helps students gain access to the most up-to-date knowledge and training to tackle the problems of the 21st century.

STEAM adds "Arts" to STEM elements that capitalize on the creative and innovative thinking sparked by the arts. Moreover, arts and humanities help teach morals, values, ethics, and responsibility. Thus, the arts make STEM-induced growth and development inclusive and sustainable.

STREAM adds another level to STEM and STEAM by adding "Reading" into the equation. Reading or literacy fosters critical thinking and creativity. By introducing Reading as an essential element for discovering new knowledge, STREAM provides a holistic learning experience. Overall, it empowers people from all backgrounds of life to become meaning-ful participants in the 21st-century workforce.

Utilizing the strengths that build each of us is important to success. However, it is more important to grow as well-rounded human beings. Es-pecially for young children, a well-rounded education is critical to the devel-opment of their overall well-being. Moreover, the challenges of tomorrow are complex and unpredictable. Therefore, today's children need extensive in-terdisciplinary knowledge and skills as well as the ability to work together to succeed in the future. The humanities and literacy, combined with STEM learning, provide the necessary foundation for students to thrive in life.

Keywords: STEM, STEAM, STREAM, education, students

CONCEPT ON STREAM EDUCATION IN ACCORDANCE WITH BULGARIAN CURRICULUM CONTENT OF 8-10TH CLASS

Nadezhda Rajcheva

СУ „Св. Климент Охридски“, Биологически факултет, катедра Методика на обучението по биология
n.rajcheva@biofac.uni-sofia.bg

Abstract: Main concept in STREAM education is implementing of synergetic potential of connections across different disciplines. It must be based on their results and broaden their comprehension by interpreting in applied context for achieving new meanings. In the report is presented a concept for STREAM education on the ground of Bulgarian curriculum for disciplines in 8-10th class. The concept is described as relationship learning outcomes-content-sample tasks for implementation.

Keywords: STREAM education, competency-based approach

A SYNERGIC MODEL FOR STEAM LEARNING IN SCIENCES (FIRST HIGH SCHOOL STAGE)

Svetla Bukovska

Center for Assessment in Pre-school and School Education, Bulgaria

s.bukovska@mon.bg

Abstract: The presentation presents information about what the synergistic learning model is when studying complex systems such as the education system. In-formation is also presented on what STEAM education is, as a more devel-oped version of STEM education. The results of tasks included in external assessment in natural sciences - biology and targeted education for the first high school stage are presented, meeting the set conditions for two groups of students intensively studying a foreign language and without intensive foreign language study. The sample is representative of the country, but not representative of the regions, and includes 2,682 students. From the test, only individual tasks that correspond to the synergistic model are included, and the length of the tests for the three years is 15 tasks - 13 with a se-lectable answer and 2 with a free answer. The results of the single trial test show that the tasks have good statistical characteristics. There is a statisti-cally significant difference in student achievement in favor of those with in-tensive foreign language study

Keywords: synergistic learning, STEAM, testing

Natural zeolites in Green STEM model for education

Mitko Stoev

Department of Chemistry, Faculty of Mathematics and Natural Sciences, South-West University "Neofit Rilski", Blagoevgrad, Bulgaria
mstoev@mail.bg

Abstract: The Green STEM model of education for students in chemistry oriented to pedagogy teachers is presented. The basic topics of Green Chemistry, Environmental Chemistry to achieve a sustainable environment are discussed. The natural zeolite samples from Beli plast in Rhodope Mountains to purify water from toxic metals, gases, pesticides and to improve soil quality is demonstrated. The natural zeolite samples and green technologies have been selected for the Green STEM model that incorporates interdisciplinary knowledge in science, technology, engineering and mathematics together and meets the requirement of building a Green STEM environment in schools. The virtual experiment is based on a real experiment in a chemical laboratory including cleaning with natural zeolites waters contaminated with dyes, heavy metals, pesticides, flue gas adsorption which and the information is stored in digital form and after that is presented for discussion in the STEM center. Discussion is oriented to the concepts in the Green STEM model such as Problem, Solution, Setting and Resources, Outcome and Reflection. The aim is to enable students to study natural sciences using modern digital technologies, a virtual experiment based on a real experiment i.e. integrating a cabinet and a laboratory to create an innovative environment in the field of joint use of natural sciences, technologies, engineering solutions and mathematics for problem-oriented education. The final project including applications of natural zeolites for improving the quality of drinking water and soils for growing ecological green plants is presented.

Keywords: Green STEM education, natural zeolites, digitalization, virtual experiment, drinking water purification

Reflexion and STEM based education in biological educaton

Alexander Milushev

Sofia university St.Kliment Ohridski, Bulgaria

a.milushev@npmg.org

Abstract: In the article are presented some basic theorethical understandings of STEM education and praxeological reflexion - study of determination of the knowledge. In the study are proposed some conceptual models of STEM based education in school. In order to research the student's opinion on STEM based eduational technologies is proposed an analysis on survey.

Keywords: reflexion, STEM, biological education, praxeological study

STEM as a Math learning motivator

Aharon Goldreich, Elena Karashtranova

South-West University "Neofit Rilski", Blagoevgrad, Bulgaria

Aharon436@gmail.com

Abstract*:*

Research goal: The purpose of the research is to examine the effects of exposure, study, and assimilation of high-quality PBL units of study in areas of interest from the daily lives of students needing STEM skills in 9th grade on their motivation to continue learning high-level math and science subjects in high school compared to a reference group. The study will also identify key variables of such an intervention program, such as gender distribution and knowledge levels within the sample group.

Research plan: We developed a unique intervention program, tested its impact on the defined target groups, and attempt to identify the key variables that influence the outcomes of this program.

We will check the impact of the program by 3 dimensions:

a. comparative statistical test: the number of students who chose science subjects (physics, chemistry, computer science, etc.) and high-level mathematics in the schools where the intervention program was implemented compared to others.
b. pre and post questionnaires and ability feeling, the perception of relevance, and the motivation. MMQ questioner (Fiorella et al. (2021)).
c. in-depth interviews with students and teachers.

Intermediate results: The intervention program is ongoing, and the preliminary results are positive: students report on increasing of the sense of relevance and value of math studying, and the teachers report on having a better answer for the students' question about the importance and usage of math in real life.

Keywords: STEM, Math, motivation

Design Thinking Skills for Teachers

Daniela Tuparova, Boyana Garkova*, Zarina Markova

South-West University "Neofit Rilski", Blagoevgrad, Bulgaria
**big@swu.bg*

Abstract: The paper presents the Project "Professional Development of Teachers to promote Design Thinking Skills and Academic Success of Students" (DTS) founded by Erasmus+/KA201 program. Project aims are directed to increasing the academic success of students, supporting the professional development of educators and teachers, by empowering them with resources to teach design thinking skills.

Keywords: design thinking, teachers skills, primary and secondary school, school subjects, STEM

POSTER SESSION

Micro elements determination in *Rosa myriacantha* DC. samples by an optimized and validated ICP OES method

Katarina Milenković,[1]* Jelena Mrmošanin,[1] Stefan Petrović,[1] Aleksandra Pavlović,[1] Snežana Tošić,[1] Bojan Zlatković,[2] Ivana Rašić Mišić,[1] Emilija Pecev-Marinković[1]

[1]Department of Chemistry, Faculty of Sciences and Mathematics, University of Niš, Višegradska 33, 18000 Niš, Serbia
[2]Department of Biology and Ecology, Faculty of Sciences and Mathematics, University of Niš, Višegradska 33, 18000 Niš, Serbia

**e-mail: katarina.milenkovic@pmf.edu.rs*

Abstract: An optimized and validated inductively coupled atomic emission spectrometry (ICP AES) method was used to analyze micro elements (Al, As, B, Ba, Be, Cd, Co, Cr, Cu, Fe, Mn, Ni, Pb, Se, Si, V and Zn) in Rosa myriacantha DC. samples. Mg II (280.270 nm)/Mg I (285.213 nm) line ratio proved to be useful and efficient in optimization ICP operating conditions as well as the use of a plasma in robust conditions. For axial and radial observation modes, robust conditions were established by setting an applied power of 1150 W and a nebulizer gas flow rate of 0.5 L min^{-1}. Validation procedure includes selection of analytical wavelengths, linearity, precision, accuracy, the detection and quantification limits of the studied elements. The calibration curves for all the elements have a good linearity, with correlation of coefficients higher than 0.999. To assess the accuracy and precision of the method, addition and recovery tests were carried out. Method recovery was between 91% and 107%. The major microelement is Mn, followed by Si, Fe, and Zn. The contents of toxic elements, such as Cd, and Pb are below WHO recommendation of 0.3 mg kg^{-1} and 10 mg kg^{-1}, respectively for medicinal plants.

Keywords: Rosa myriacantha DC., micro elements, ICP AES, optimization, validation

Pharmacokinetic studies of selenium supplementation

Natasha Ristovska, Pece Sherovski

Institute of Chemistry, Faculty of Natural Sciences and Mathematics, Ss. Cyril and Methodius University, Skopje, North Macedonia
natasa@pmf.ukim.mk

Abstract: In many European countries, selenium intake is relatively low due to selenium concentration in soil or low bioavailability, so selenium supplementation is recommended. The aim of this study was to evaluate the pharmacokinetics of selenium absorption and concentration in plasma with different selenium doses and forms at short- and long-term daily intake. Selenomethionine is better absorbed than inorganic sodium selenite, and the maximum plasma concentration is reached and maintained after 6-8 hours. 48 hours after taking the pill, the selenium concentration is higher than at the beginning of the intake. In terms of daily dose, plasma concentrations of selenium are increased by 30% with 200 μg/day supplementation and by approximately 25% with 100 μg/day supplementation compared to baseline levels. Long-term studies have shown that plasma selenium concentrations increase significantly after the first month of supplementation and increase slightly in the following months. After supplementation is stopped, the selenium level immediately drops again.

Keywords: selenium, selenomethionine, pharmacokinetics; absorption

Microbiologically Influenced Corrosion of Copper Foil in Different Environments

Elitsa Chorbadzhiyska[1,2], Desislava Apostolova[1], Mario Mitov[1,2], Yolina Hubenova[3,4]

[1]Department of Chemistry, South-West University "Neofit Rilski", Blagoevgrad, Bulgaria

[2]Innovative Center for Eco Energy Technologies, South-West University "Neofit Rilski", Blagoevgrad, Bulgaria

[3]Institute of Electrochemistry and Energy Systems "Acad. Evgeni Budevski" - Bulgarian Academy of Sciences (IEES-BAS), Sofia, Bulgaria

[4]Department of Biochemistry and Microbiology, Plovdiv University "Paisii Hilendarski", Plovdiv, Bulgaria

desislava19991@gmail.com

Abstract: Microbiologically Influenced corrosion (MIC) is a corrosion of various metals, cement and other structural materials in the presence of microorganisms. Corrosion of pipelines as a phenomenon has been proven to cause environmental pollution. For this reason, it is of great importance to find suitable methods for research and evaluation of corrosion. In this study, we investigated the MIC of copper foil in different environments using electrochemical methods. Copper foils were exposed to wastewater and wastewater inoculated with active sludge from municipality Waste Water Treatment Plant. Identical electrodes were also exposed to pre-autoclaved samples of the same wastewater to eliminate the influence of the microorganisms. The corrosion behavior of the tested samples was periodically explored by different electrochemical methods – polarization resistance method, linear sweep voltammetry (LSV) and electrochemical impedance spectroscopy (EIS). The values of corrosion potential, polarization resistance and corrosion rate were evaluated and compared.

Keywords: Microbiologically Influenced corrosion, Copper foil, Linear sweep voltammetry, Electrochemical Impedance spectroscopy.

Acknowledgments: This study was supported by Bulgarian National Science fund through a Contract № KP-06-COST/5/2022.

Reduced graphene oxide functionalized with metallic nanoparticles (Pt, Ni, Co) as a cathodic electrocatalyst for HER in microbial electrolysis cells

E. Chorbadzhiyska[1,2], G. Borisov[3], I. Bardarov[1], E. Slavcheva[3], M. Mitov[1,2], Y. Hubenova[3,4]

[1]Department of Chemistry, South-West University, Blagoevgrad, Bulgaria
[2]Innovative Centre for Eco Energy Technologies, South-West University "Neofit Rilski", Blagoevgrad, Bulgaria
[3]Institute of Electrochemistry and Energy Systems "Academician Evgeny Budevski", Bulgarian Academy of Sciences, (IEES-BAS), Sofia, Bulgaria
[4]Department of Biochemistry and Microbiology, Plovdiv University, Plovdiv, Bulgaria

elli_e1@swu.bg

Abstract: In this study, we examined the electrochemical behavior of reduced graphene oxide, functionalized with metallic nanoparticles (Pt, Ni, Co), as a cathodic electrocatalyst for hydrogen evolution reaction (HER) in microbial electrolysis cells (MEC). The presented research illustrates the preparation, physicochemical and electrochemical characterization of this new hybrid material. The electrochemical behavior of the materials was investigated in a three-electrode cell in a neutral environment, by using different electrochemical techniques: linear voltammetry, chronoamperometry. The structure of the catalysts was studied by X-Ray diffraction (XRD). Pt and Ni modified materials exhibit higher electrocatalytic activity towards HER than the reduced graphene oxide.

Keywords: graphene oxide, reduced graphene oxide, metallic nanoparticles – Pt, Ni, Co, HER, MEC.

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Viability of pyrolyzed activated carbon felts as electrodes in sulfide-nitrate fuel cell

Stefan Stefanov*, Ljutzkan Ljutzkanov, Elena Razkazova-Velkova

Institute of Chemical Engineering – Bulgarian Academy of Sciences

"Acad. G. Bonchev" str., bldg. 103, 1113, Sofia, Bulgaria

e-mail: s.stefanov@iche.bas.bg

Abstract: One of the most hazardous modern anthropogenic pollutants is hydrogen sulfide, a bi-product from leather, pulp and paper industries, among others. Often it is accompanied by other contaminants such as organic pollutants, making their combined treatment difficult. Another pollutant with serious environmental impact are the nitrate rich wastewaters generated by the agricultural industry due to excessive use of synthetic fertilizers.

Fuel cells offer a way to remediate both contaminants while additionally generating electrical energy (sulfides are oxidized in the anodic compartment while nitrates are reduced in the cathodic one).The two crucial components in a fuel cell are the membrane and electrodes used. Our study investigates four electrode material candidates – pyrolyzed carbon felts – in terms of their viability as anode and cathode electrodes compared to electrode-grade graphite plates, as well as their chemical and mechanical stability for long-term use. Carbon felts were chosen for this ecology-focused application of fuel cell technology as they are chemically inert to nearly any contaminant, relatively cheap, easy to produce and maintain, malleable into virtually any shape and form and very importantly – offer electrical conductivity comparable to that of graphite, metal and metal alloy electrodes.

Keywords: pyrolyzed activated carbon felts, novel electrode materials, sulfide-nitrate fuel cell, ecology, wastewater treatment.

Acknowledgements: The authors kindly acknowledge the financial support of the National Science Fund at the Bulgarian Ministry of Education and Science of the project № КР-06-Н67/6 – 12.12.2022 – "**Bioelectrochemical systems for organic pollutants remediation**". S. Stefanov also acknowledges the partial support by the Bulgarian Ministry of Education and Science under the National Research Programme "**Young scientists and postdoctoral students – 2**" approved by DCM 206 / 07.04.2022.

Metal and Vulcan XC-72R carbon black nanocomposites for purification of organic pollutants

IvelinaTsacheva[1], Adriana Gigova[2], Ognian Dimitrov[2], Mariela Dimitrova[2], Dzhamal Uzun[*2]

[1]Institute of Polymers, Bulgarian Academy of Sciences, Acad. G. Bonchev Street, Sofia, 1113, Bulgaria

[2]Institute of Electrochemistry and Energy Systems "Academician Evgeni Budevski", Bulgarian Academy of Sciences, Acad. G. Bonchev Street., Sofia, 1113, Bulgaria

Corresponding author: dzhamal.uzun@iees.bas.bg

Abstract: Nanocomposite electrocatalysts were prepared by chemical deposition of manganese nanoparticles on Vulcan XC-72R carbon black (catalytic mass) using microwave irradiation. The microwave irradiation time during the reduction step and metal weight percentage were varied. The surface of the new catalytic material was characterized by XRD. From the resulting catalytic mass, double-sided coated electrodes on a Nickel mesh conductor were made by pressing and heating at 300° C. The studied electrodes have a geometric areas are2,5 and 6 cm2. Electrochemical studies were carried out to oxidize phenol in an aqueous solution in model electrolyte: phenol solution 200 mg l-1 and supporting electrolyte 1M NaCl. The electrodes were fabricated and studied regarding the amount of catalyst and 35 % teflonized Vulcan XC-72R. The electrodes were investigated by electrochemical techniques.

Keywords: MnO_2/C-catalyst, organic pollutants, microwave technique.

Acknowledgments: The authors kindly acknowledge the financial support of the National Science Fund at the Bulgarian Ministry of Education and Science of the project № KP-06-N67/6 – 12.12.2022 – "Bioelectrochemical systems for organic pollutants remediation".

Electrocatalytic studies of oxidation of organic contaminants in aqueous solution using ZrO_2 catalyst on biochar carbon

Dzhamal Uzun*[1], Ljutzkan Ljutzkanov[2], Mariela Dimitrova[1], Adriana Gigova[1] , Ognian Dimitrov[1], Stefan Stefanov[2],Elena Razkazova-Velkova[2], Konstantin Petrov[1]

[1]*Institute of Electrochemistry and Energy Systems* 'Academician Evgeni Budevski' *I* Bulgarian *Academy of Sciences, Sofia 1113, Bulgaria*
[2]*Institute of Chemical Engineering, Bulgarian Academy of Sciences, Sofia 1113, Bulgaria*
Corresponding author: dzhamal.uzun@iees.bas.bg

Abstract: Biochars are environmentally friendly materials for removal of organic pollutants. A ZrO_2-catalyst incorporated in an activated carbon matrix - sunflower seed hulls at a ratio of 1:3 was synthesized. The surface of the new catalytic material was characterized by iodine adsorption and investigated by XRD, BET and SEM. The catalytic mass obtained was used as basis to produce double-sided coated electrodes on a nickel mesh (current collector) by pressing and heating techniques. The electrodes produced have a geometric surface area of 2,5 cm^2. Electrochemical studies were carried out for the electrochemical remediation of waters contaminated with organic pollutants. Methylene blue was chosen as model organic pollutant at initial concentration of 200 $mg.l^{-1}$. Aqueous solutions of NaCl at different concentrations were used as electrolyte.

Key words: ZrO_2-catalyst, biochar, organic contaminants.

Acknowledgments: The authors kindly acknowledge the financial support of the National Science Fund at the Bulgarian Ministry of Education and Science of the project № KP-06-N67/6 – 12.12.2022 – "Bioelectrochemical systems for organic pollutants remediation".

Enhancement of the carbon felt anode performance in microbial fuel cell using carboxymethyl chitosan/polyaniline@ferrite nanocomposite for improving the generation bioelectricity and the elimination of COD

Mehrez E. El-Naggar[a], Bahaa A. Hemdan[b*], Gamila E. El-Taweel[b], Sherief A. Al Kiey[c], Mario Mitov[d], Yolina Hubenova[e,f]

[a] *Textile Research and Technology Institute, National Research Centre, 33 El-Bohouth St., Dokki, Giza 12622, Egypt*
[b] *Water Pollution Research Department, National Research Centre, 33 El-Bohouth St., Dokki, Giza 12622, Egypt*
[c] *Electrochemistry and Corrosion Laboratory, National Research Centre, Dokki, Cairo, 12622, Egypt*
[d] *Innovative Center for Eco Energy Technologies, South-West University "Neofit Rilski", Blagoevgrad, Bulgaria*
[e] *Institute of Electrochemistry and Energy Systems "Acad. E. Budevski" – Bulgarian Academy of Sciences, Sofia, Bulgaria*
[f] *Department of Biochemistry and Microbiology, Plovdiv University "Paisii Hilendarski", Plovdiv, Bulgaria*

bahaa_nrc@yahoo.com *(Bahaa Hemdan)*

Abstract: This research aimed to increase the anode's surface area and compare the amount of current produced biologically from various types of wastewater using dual-chamber MFCs. The electrode made of pristine carbon felt (CF) was used as both the anode and cathode, and the anode was modified by covering it with carboxymethyl chitosan/polyaniline@ferrite (CCs/PANI@Fe) nanocomposite. The results of this study point to a more helpful use of MFC in wastewater treatment and energy generation. Compared to a pristine CF anode and a pristine CE electrode, the MFC system with a modified anode made of a CCs/PANI@Fe nanocomposite performed 30% better. Additionally, the highest power density in a modified CF-based MFC was discovered to be 188.8, 124.2, and 103.2 mW/m3,

respectively. The incorporation of CCs/PANI@Fe nanocomposite into the CF anode has shown significant improvements in both bioelectricity generation

Keywords: Microbial fuel cell, carbon felt anode, CCs/PANI@Fe nanocomposite, electrogenic biofilm, COD removal.

Acknowledgments: This study is supported by project IC/EG/02/2022-2024.

Comparison of two algal species of different genera from the perspective of their sustainable use

Stanislava Boyadzhieva[1], Flora Tsvetanova[1], Jose Coelho[2], Dragomir Yankov[1*], Roumiana Stateva[1]

[1] *Institute of Chemical Engineering, Bulgarian Academy of Sciences, Sofia, Bulgaria*
[2] *Instituto Superior de Engenharia de Lisboa, Instituto Politécnico de Lisboa, Lisboa, Portugal*

yanpe@bas.bg

Abstract: Algae show a number of important advantages as compared to conventional land plants: 10-15 times higher biomass productivities, higher CO_2 fixation rate, and sufficiency of arid or low-quality agricultural land for their cultivation. Algae are advertised as a futuristic resource of bioactives, and as the most sustainable third generation feedstock for the production of bioenergy.

Scenedesmus obliquus BGP (green algae) and Porphyridium cruentum (red algae) were selected as targets of our research.

The aim of our investigation was to obtain extracts from the two species applying a green technique –extraction with $scCO_2$, either neat or with the GRAS co-solvent ethanol. Extraction yields were compared with a conventional method with organic solvents - Soxhlet with ethanol and n-hexane.

The chemical composition of the extracts was analyzed by GC-FID and revealed the S. obliquus BGP contains oleic, palmitic, linoleic and alpha linoleic acids. Palmitic acid is the most abundant acid in the P. cruentum, followed by arachidonic, linoleic and eicosapentaenoic acids. The large amounts of arachidonic acid in the species makes this marine alga a potential source for its production.

Keywords: *Supercritical extraction, fatty acids, Scenedesmus obliquus, Porphyridium cruentum*

Acknowledgements: *This work was supported by the National Science Fund, Ministry of Education and Science, Grant number КП-06-ОПР04/ 1.*

Green chemistry inspired solvents for the extraction of maleic-fumaric acid mix

Apostol Apostolov, Dragomir Yankov

Institute of Chemical Engineering, Bulgarian Academy of Sciences, Sofia, Bulgaria

a_apostolov@iche.bas.bg;

Abstract: Nowadays more technologies and chemicals are synthesized based on the green chemistry principles. Extraction is one of the processes in the chemical engineering that has a significant negative impact on the environment. When speaking about chemical engineering the problems and their solutions must be studied in detail. This is because of the strong connection between the processes in the technological cycle.

The research's focus is on extraction using deep eutectic solvents (DES). The DES solutions are synthesized based on the green chemistry principles. Nevertheless, it is important to understand the extraction capacity of the solvents. For that purpose, a mixture of maleic and fumaric acid (structural isomers of the butenedioic acid) was used. Referring to their differences in structure, and consequently in some physicochemical properties it is assumed that they can be separated using simple liquid-liquid extraction processes.

Based on the existing knowledge, gathered experimental data and synthesis of deep eutectic solvents (DES) the extraction process of mixture of structural isomers is studied. The revealed results show the correlation between the type of used DES and the efficiency of the extraction process. Based on this a conclusion for the use of this method of extraction could be made.

Keywords: green chemistry, deep eutectic solvents, extraction, maleic acid, fumaric acid

Acknowledgements: This work is supported by Project of Fundamental Scientific Research, conducted by RFBR and the National Science Fund of Bulgaria under contract No KP 06 RUSSIA-10 from 11 Dec. 2020,

Modeling of lactic acid production by means of *Lactiplantibacillus plantarum* AC11S

Petya Popova – Krumova[1], Svetla Danova[2], Dragomir Yankov[1]

[1] *Institute of Chemical Engineering, Bulgarian Academy of Sciences, Sofia, Bulgaria*
[2] *The Stephan Angeloff Institute of Microbiology, Bulgarian Academy of Sciences, Sofia, Bulgaria*

p.krumova@iche.bas.bg

Abstract: Lactic acid production by means of lactobacilli is generally inhibited by high substrate concentrations and/or by products. The use of mathematical models is helpful in describing, understanding and predicting of the fermentation processes. In the present study we have composed and compared unstructured model and different models considering both substrate and product inhibition. The experiments were carried out at five different initial substrate concentrations. A good agreement between experimental data and model simulations was demonstrated. Using the least square function minimization method, the values of the model parameters were determined and their importance was verified.

Keywords: Lactiplantibacillis plantarum, lactic acid, kinetics, modeling, least-square method

Acknowledgements: This work is supported by the National Science Fund of Bulgaria under contract No KP-06-OPR-03/16

Biohydrogen production by means of newly isolated *Clostridium beijerinckii* 6A1 strain

Nadya Armenova, Dragomir Yankov

Institute of Chemical Engineering, Bulgarian Academy of Sciences, Sofia, Bulgaria

nadq.armenova@gmail.com

Abstract: Biological hydrogen production can be realized by four different processes – photofermentation, dark fermentation, direct and indirect biophotolysis. In this study we present hydrogen production by a newly isolated strain, Clostridium beijerinckii 6A1. The strain was isolated from chickpea fermentation. The strain is capable of producing hydrogen from different carbon sources. Experiments were carried out with different initial glucose concentrations as well as lignocellulosic hydrolysates and lactic acid. Attempts were made for co-fermentation of Lactiplantibacillus plantarum and Clostridium beijerinckii 6A1 in consecutive and simultaneous mode. The results showed that lignocellulosic acid hydrolysates were toxic towards C. beijerinckii 6A1 and not to L. plantarum. Feasibility of hydrogen production by consecutive fermentation of lignocellulosic acid hydrolysates was demonstrated.

Keywords: Biohydrogen, Clostridium beijerinckii, glucose, cellulosic hydrolysate

Acknowledgements: The authors kindly acknowledge the financial support of project. BG05M2OP001-1.002-0014 “Center of competence HITMOBIL—Technologies and systems for generation, storage and consumption of clean energy”, funded by Operational Programme “Science and Education for Smart Growth” 2014–2020, co-funded by the EU from European Regional Development Fund.

Phenol tolerance of bacterial strains

Evgenia Vasileva, Tsvetomila Parvanova-Mancheva, Stefan Stefanov*, Elena Razkazova-Velkova

Institute of Chemical Engineering – Bulgarian Academy of Sciences
"Acad. G. Bonchev" str., bldg. 103, 1113, Sofia, Bulgaria
e-mail: s.stefanov@iche.bas.bg

Abstract: Phenol is a waste product from the petroleum, pharmaceutical and plastic industries. It is one of the major anthropogenic environmental pollutants. There are a variety of methods for treatment of phenol containing wastewaters but the physico-chemical methods usually applied are often economically unfeasible and may generate additional toxic by-products. For this reason, microbiological treatment methods are preferred because the microorganisms present use phenol as the sole source of carbon and energy, completely degrading the toxic compounds.

Based on the literature available a screening procedure was conducted on various microorganisms. The current work presents the results of four microorganisms being tolerant of up to 0.3 $g \cdot L^{-1}$ phenol in the culture medium – Xhantobacter autotrophicus GJ10, Pseudomonas denitrificans, Bradyrhisobium Japonicum and Pseudomonas putida. The former two strains show tolerance to phenol while the latter two successfully degrade it, making them promising candidates for future work on biodegradation of phenol and phenolic compounds contaminated wastewaters.

Keywords: phenol, biodegradation, tolerance, feeding processes

Acknowledgements: The authors kindly acknowledge the financial support of the National Science Fund at the Bulgarian Ministry of Education and Science of the project № KP-06-N67/6 – 12.12.2022 – "**Bioelectrochemical systems for organic pollutants remediation**".

Iron-bearing wood material as peroxydisulfate and hydrogen peroxide activator for enhanced anthraquinone dye degradation

Miljana Radović Vučić, Miloš Kostić, Jelena Mitrović, Nena Velinov, Milica Petrović, Slobodan Najdanović, Aleksandar Bojić

Department of Chemistry, Faculty of Sciences and Mathematics, University of Niš, Višegradska 33, 18 000 Niš, Serbia

mimaradovic@gmail.com

Abstract: The iron-bearing catalyst from wood sawdust was common as peroxy disulfate (PDS) and hydrogen peroxide (H_2O_2) activators to degrade organic pollutants but limited catalytic efficiency and increased risk of ferrous ion leaching restricted their use. This study aims to assess the catalytic performance of iron(III) immobilized on wood sawdust as a heterogeneous catalyst for anthraquinone Reactive Blue 19 (RB 19) dye degradation, which was economical and environmentally friendly. The results showed that the modified wood sawdust can effectively remove RB 19, and also has significantly improved the stability and reusability of the catalyst. The RB 19 degradation efficiency of the catalyst by PDS was faster than that of H_2O_2. The highest RB 19 removal efficiency by PDS and H_2O_2 system is 89.53 and 84.01%. Acidic conditions were more convenient for the degradation of the dye than neutral or basic. Sulfate radicals ($SO_4^{\bullet-}$) and hydroxyl radicals (•OH) were the major reactive oxygen species in PDS and H_2O_2 system. In the actual wastewater test, COD values were significantly reduced after 60 minutes of treatment for both processes. The new catalyst can be potentially utilized as a universal catalyst for the degradation of different kinds of organic pollutants in water using solar light as an environmentally friendly and low-cost energy resource.

Keywords: Hydrogen peroxide; peroxydisulfate; wood sawdust; Reacrive Blue 19; Wastewater treatment

ZnFe-Layered double hydroxide for sorption of Methyl Orange: Kinetics, isotherm studies, and optimization of process parameters

Miloš Kostić, Kristina Filipović, Miljana Radović Vučić, Nena Velinov, Slobodan Najdanović, Danijela Bojić, Aleksandar Bojić

Department of Chemistry, Faculty of Sciences and Mathematics, University of Niš, Višegradska 33, 18 000 Niš, Serbia

mimaradovic@gmail.com

Abstract: Novel material ZnFe-LDH was synthesized by the coprecipitation method in order to purification of Methyl Orange-polluted water. ZnFe-LDH was characterized by using XRD, FT-IR, TGA, BET, SEM and EDX analysis. In batch experiments, the impacts of several operating parameters such as contact time, initial pH, initial Methyl Orange concentration, sorbent dose and temperature, were investigated. Synthesized ZnFe-LDH showed high efficiency for the removal of Methyl Orange from water, with a sorption capacity of 520.45 mg g^{-1} at optimal conditions: the sorbent dose of 0.4 g dm^{-3}, pH 3, stirring speed of 210 rpm and temperature of 20 °C. Kinetics studies determined that the best data fitting for Methyl Orange sorption can be provided by pseudo-second-order kinetics. The isotherm study showed that the experimental data of Methyl Orange sorption onto ZnFe-LDH could be best fitted with the Langmuir model indicating uniform surface energies. Finally, ZnFe-LDH can be recommended as a low-cost, efficient and reusable sorbent for the removal of Methyl Orange-polluted water.

Keywords: Layered double hydroxide, Sorption, Kinetics, Isotherms

The influence of the SARS COV-2 virus infection on the serological level of IgM antibodies in patients with Infectious Mononucleosis

Anamarija Shram[1], Natasha Ristovska[2]

[1]Affiliation: anamarija.Shram@yahoo.com

[2] Affiliation: Institute of Chemistry, Faculty of Natural Sciences and Mathematics,Ss. Cyril and Methodius University, Skopje, North Macedonia

natasa@pmf.ukim.mk

Abstract: The aim of this study was to detect coinfection with Epstein-Barr virus (EBV) in serum during coronavirus disease (COVID -19). EBV, a member of the herpesvirus family, is the causative agent of infectious mononucleosis in young adults. It manifests mainly as fever, pharyngitis, and lymphadenopathy. In addition to hepatitis, splenomegaly, and skin rash, it can affect various organs. We included 80 serum samples from diseased patients, from January 2020 to December 2022 and analyzed them by ELISA (enzyme-linked immunosorbent assay), which is a suitable method for diagnosis and determination of EBV IgM stage. Patients were classified into EBV/SARS-CoV-2 coinfection group based on serum EBV IgM serological results. We found a high frequency of EBV coinfection in patients with COVID -19. C-reactive protein (CRP) and aspartate aminotransferase (AST) were elevated in EBV SARS -CoV-2 coinfection during the disease. EBV coinfection may be associated with disease severity in COVID-19 .

Keywords: EBV, COVID-19, Clinical blood symptoms, ELISA

Spectral and structural characterization of amino acid salts for application in non-linear optic

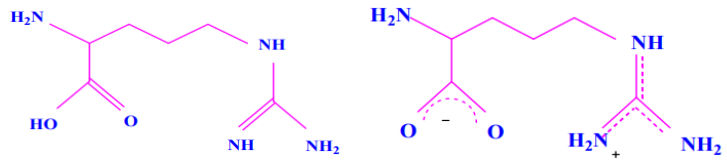
Atanas Chapkanov[1], Tatyana Dzimbova[1, 2], Kiril Kuntsev[1],

Tzonko Kolev[2]

Department of Chemistry, Faculty of Mathematics and Natural Sciences,
[1]South-West University "Neofit Rilski", Blagoevgrad, Bulgaria,
[2]Institute of Molecular Biology "Roumen Tsanev", BAS, Sofia, Bulgaria
chapkanov@swu.bg

Abstract: The widespread attention gained by the organic molecules in the field of nonlinear optics (NLO) is mainly due to the presence of conjugated π-electron system, which provides asymmetry to the molecule for NLO activity. Amino acids, due to the presence of proton donor carboxyl acid and proton acceptor amino groups, form better option than inorganic molecules for NLO applications. One such derivative that has NLO efficiency three times greater than the widely used potassium dihydrogen phosphate (KDP) crystal is L-arginine phosphate monohydrate (LAP). Several chemical analogs of LAP have been developed by reacting L-Arg with various acids [8] or by adding dopants to the LAP crystal itself and some new crystals have been synthesized.

Arginine (Arg) often exists in the zwitterionic form with the positive charge distributed over three nitrogen atoms in the guanidyl group, which makes it capable of forming long-range hydrogen-bonding and electrostatic interactions with negatively charged groups.



a) b)

Scheme 1. a) Neutral form; b) Zwitterion form of Arginine

Keywords: amino acid, Arginine, spectral analysis

A Study of the Metabolic Transformations of α-Phellandrene from Essential Oils in the Liver

Milen Dimov[a], Yana Koleva[b]

[a]*Trakia University, 8600 Yambol, Bulgaria*

[b]*University "Prof. Assen Zlatarov", 8010 Burgas, Bulgaria*

E-mail: milen.dimov@trakia-uni.bg

Abstract: The composition of essential oils is significantly determined by the geographical and climatic conditions in which the aromatic plants were grown. Two types of essential oils are obtained from dill (Anethum graveolens L.) from the aerial parts (grass oil) and from the fruit (seed oil). The two oils differ in aromatic components, color, taste, smell and application.

Determining the smell and taste are: phellandrene, limonene, oxy-p-ment-1-ene and carvone. The main components are: α-phellandrene (17.0-56.4 and even up to 66.5 %), limonene (5.7- 44.9 %), carvone (4.3-54.5 %), 3,9-oxy-p-ment-1-ene (2.8-21.6 and up to 37.5 %), dihydrocarvone (up to 16.0 %). It also contains β-phellandrene (0.3-8.5 %), p-cymene (0.1-4.2 and even 14.4 %), α-pinene (1.0-3.2 %), dilapiol and myristicin (about 0.3% each), β-myrcene, camphene, terpinolene, carvacrol, and others.

For Bulgarian dill oil, typical components (BDS 17380:1996) are: α-phellandrene (17.0 – 32.0 %), limonene (17.0–32.0 %), dihydrocarvone (4.0–9.0 %) and carvone (25.0–45.0 %).

In this work, the substance α-phellandrene, which is contained in essential oil obtained from dill originating in Bulgaria, is examined.

The aim of this study is to predict the probable liver metabolic activity of the alpha-phellandrene, as well as to predict the protein and DNA binding of their metabolites by applying in silico methods (OECD QSAR Toolbox).

Keywords: α-phellandrene, essential oil, metabolic transformation, liver, QSAR Toolbox

Possible Hepatic Metabolic Activation of Methylchavicol from the essential oil composition

Yana Koleva[a], Milen Dimov[b]

[a]*University "Prof. Assen Zlatarov", 8010 Burgas, Bulgaria*

[b]*Trakia University, 8600 Yambol, Bulgaria*

E-mail: milen.dimov@trakia-uni.bg

Abstract: The composition of essential oils is significantly determined by the geographical and climatic conditions in which the aromatic plants were grown. Two types of essential oils are obtained from dill (Anethum graveolens L.) - from the aerial parts (grass oil) and from the fruits (seed oil). The two oils differ in aromatic components, color, taste, smell and application.

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In the present work, the substance methylhavicol, which is the main component in essential oil obtained from dill originating in Bulgaria, from the village of Gavrailovo, Sliven region, was examined.

The aim of this study is to predict the possible hepatic metabolic activity of the methylchavicol, as well as to predict the protein and DNA binding of their metabolites by applying in silico methods (QSAR Toolbox).

Keywords: methylchavicol, essential oil, metabolic activation, liver, QSAR Toolbox

Validation of titration method for determination of BOD5/Dissolved O_2

Ava Amideina, Kiril Chuchkov, Petko Mandjukov

South-West University "Neofit Rilski", Faculty of Mathematics and Natural Sciences, 66 Ivan Mihajlov Str., 2700 Blagoevgrad, Bulgaria
Water Supply and Sewerage, Laboratory for analysis of groundwater, surface and drinking water, 3 Anton Chehov Str., 2700 Blagoevgrad, Bulgaria
South-West University "Neofit Rilski", Faculty of Mathematics and Natural Sciences, 66 Ivan Mihajlov Str., 2700 Blagoevgrad, Bulgaria

a_amideina@abv.bg

Abstract: Biochemical Oxygen Demand after 5 days incubation (BOD5) is a parame-ter used in natural waters quality evaluation. It is regulated by the internation-al standards: for BOD5 - ISO 5815-2:2003 (last confirmed in 2019), and for dissolved O2 - ISO 5813:1983 (last confirmed in 2023), based on the refer-ence Wikler's method. In some aspects, however, the methods described in these standards does not meet the requirements for validation parameters, such as LOQ and measurement uncertainty (MU). Providing metrological traceability of the results (by use of CRM) is also not a trivial task. Another validation parameter, rather rarely evaluated, although required by SD CEN: TS16800 2021, is the robustness.

An aim of the present study is the validation of method for BOD5 evaluation. A different approach based on the application of CRM was applied. In addi-tion, the robustness, was evaluated for several critical factors. A real samples of surface water were used as a case of study.

Keywords: BOD5, validation, Winkler method, traceability, robustness

Radical Scavenging Activity of Melatonin and its Metabolite

G. Ivanova, K. Robova, V. Vachkov, Zhivko Velkov

South-West University, Bulgaria
South-West University, Bulgaria
South-West University, Bulgaria
South-West University, Bulgaria

jivko_av@swu.bg

Abstract: In years past, many scientific publications have reported that melatonin can effectively scavenge free radicals in the body. During the reactions with active radicals it undergoes transformations to metabolites which are also capable of scavenge free radicals. One such metabolite is N1 -acetyl-N2 -formyl-5-methoxykynuramine (AFMK), which is produced when melatonin reacts with H2O2 during the scavenging process. It is shown in in vitro tests that AFMK possess strong radical-scavenging properties. However, the specific structural features of AFMK that are responsible for these properties remain unclear.

To shed light on this question, we conducted a DFT (B3LYP) quantum-chemical investigation with melatonin and its derivative AFMK.

The computed descriptors enable us to compare their activities, develop hypotheses regarding reaction mechanisms with active radicals, and identify the structural factors underlying their activity

Prediction of skin sensitivity of beta-caryophyllene from essential oil

Elisaveta Todorova-Koynova[a], Nadezhda Dimitrova[a], Desislava Sabeva[a],Yana Koleva[a]

[a]University "Prof. Assen Zlatarov", 8010 Burgas, Bulgaria
E-mail: ykoleva@btu.bg

Abstract: Essential oils are organic compounds that are extracted from plants and have medicinal properties. They have an antibacterial, antiviral, antiparasitic effect, which helps the body to overcome various infections. Copaiba essential oil contains a large amount of beta-caryophyllene (up to 72%), which has strong anti-inflammatory properties. Improper use of essential oils can also lead to harmful effects.

The aim of this study is to predict the possible skin metabolic activity of the β-caryophyllene, as well as to predict the protein and DNA binding of its metabolites by applying in silico methods (OECD QSAR Toolbox).

Keywords: β-caryophyllene, essential oil, metabolic transformation, skin, QSAR Toolbox

Possible hepatic effects of the beta-caryophyllene from essential oils

Elisaveta Todorova-Koynova[a], Nadezhda Dimitrova[a], Desislava Sabeva[a], Yana Koleva[a]

[a]University "Prof. Assen Zlatarov", 8010 Burgas, Bulgaria
E-mail: ykoleva@btu.bg

Abstract: The dosage of essential oils is important for achieving therapeutic benefits and minimizing the risks of negative reactions. Lipophilic substances (essential oils) that are soluble in fat quickly enter the blood and are processed by the liver in contrast to hydrophilic substances that tend to remain in the blood or are transported to water compartments in the body. The liver metabolizes the essential oil compounds for elimination in two phases, through a process called biotransformation. Essential oils are naturally detoxifying, but toxicity is also possible, causing damage to the liver.

The aim of this study is to predict the possible hepatic activity of the β-caryophyllene from copaiba essential oil, as well as to predict the protein and DNA binding of its metabolites by applying in silico methods (OECD QSAR Toolbox).

Keywords: β-caryophyllene, essential oil, metabolic transformation, liver, QSAR Toolbox

Potential Hepatic Transformations of Intralipid

Yana Koleva[a], Viktoria Trifonova[a]

[a]University "Prof. Assen Zlatarov", 8010 Burgas, Bulgaria
E-mail: vikitrend26@gmail.com

Abstract: Intralipid, which is available as an infusion emulsion, is an important source of long-chain, essential and non-essential fatty acids required for energy metabolism and membrane lipid synthesis. The preparation has properties similar to endogenous chylomicrons - very low density lipoproteins - except that it does not contain cholesterol esters or apolipoproteins, and its phospholipid content is significantly higher. In usual therapy, intralipid is recommended for patients who need to supplement their energy intake and essential fatty acids (DAGE), as well as those with essential fatty acid deficiency who cannot assimilate or maintain the balance of oral DAGE.

The aim of this work is to predict the probable liver metabolic activity of the intralipid, as well as to predict the protein and DNA binding of its metabolites by applying in silico methods (QSAR Toolbox).

Keywords: intralipid, metabolic transformation, liver QSAR Toolbox

Toxicological Evaluation of Intralipid

Viktoria Trifonova[a], Yana Koleva[a]

[a]University "Prof. Assen Zlatarov", 8010 Burgas, Bulgaria
E-mail: vikitrend26@gmail.com

Abstract: The lipid emulsion is a mixture of soybean oil, egg-phospholipids and glycerol. The main unsaturated fatty acids-are the polyunsaturated alpha-linolenic acid linseed and linoleic acid; and the monounsaturated oleic acid. It also contains saturated fat-acids, stearic acid and palmitic acid. The high content of vitamin E in soy-the oil acts as a powerful antioxidant, by stimulating the immune system and supporting the elimination of free radicals, because chronic diseases like cancer etc.

THE AIM OF THIS WORK IS TO PREDICT THE PROBABLE TOXILOGICAL BEHAVIOR OF THE INTRALIPID BY APPLYING IN SILICO METHOD (COMPTOX CHEMICALS DASHBOARD).

Keywords: intralipid, toxilogical evaluation, CompTox Chemicals Dashboard

Computational studies for opioid receptors and potent bioactive opioid ligands: computer modeling and molecular docking analysis

Fatima Sapundzhi[1], Tatyana Dzimbova[1, 2], Metodi Popstoilov[1]

[1]South-West University "Neofit Rilski", Blagoevgrad, Bulgaria
[2]Institute of Molecular Biology "Roumen Tsanev", BAS, Sofia, Bulgaria
sapundzhi@swu.bg

Abstract: Opioid receptors belong to the class a G protein-coupled receptors (GPCRs) and are vital to the body's pain control. In recent years, the published crystal structures of opioid receptors have allowed many experimental and computational studies to be carried out. The application of computer-aided drug design (CADD), homology modeling, and molecular docking approaches help to discover new opioid compounds and understand the activation mechanism of target receptors. In the present work, we reviewed computational studies on opioid receptor models for the discovery of new active and selective opioid ligands and their mechanisms of interaction.

Keywords: computational modeling, GPCRs, computer-aided drug design, homology modeling, molecular docking, opioid receptors

Novel boldine amides and their *in vitro* inhibitory effects on mushroom tyrosinase

Maya Chochkova[1], Boyka Stoykova[1], Petranka Petrova[1], Martin Štícha[2], Galya Ivanova[3]

[1]Faculty of Mathematics and Natural Sciences, South-West University "Neofit Rilski" Bulgaria
[2]Department of Chemistry, Faculty of Science, Charles University, Prague 2, Czech Republic
[3]LAQV-REQUIMTE, Faculdade de Ciências, Universidade do Porto, Rua do Campo Alegre s/n, 4169-007 Porto, Portugal

e-mail: mayachochkova@swu.bg

Abstract: Boldine ((S)-2,9-dihydroxy-1,10-dimethoxy-aporphine) has been defined as the major alkaloid in Chilean boldo tree. Besides its diverse pharmacological activities, e.g. neuroprotective, cytoprotective, anti-inflammatory activities, boldine also exhibits tyrosinase-inhibiting effect.

Tyrosinase [EC 1.14.18.1] is well known as a bifunctional enzyme that is responsible for the melanin biosynthesis. Considering the diphenolic structural feature of the alkaloid, which is associated with its tyrosinase inhibitory properties [1], herein we first modified the boldine core and then linked it with the natural phenolic antioxidants such as: caffeic-, ferulic- and sinapic acids. Furthermore, the newly amides were tested in vitro on the mushroom tyrosinase. Our results indicated, that amongst the tested boldine derivatives, caffeoyl- and feruloylamides have shown the anti-tyrosinase activity closely correlated with a hydroquinone, used as a standard.

Keywords: boldine, phenolic acid amides, hydroquinone, antioxidant activity, anti-tyrosinase activity

References:

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Assessment and Comparison of Heavy Metal Contamination in Surface Sediments from Two Urban Rivers

Jernej Imperl[1], Mitja Kolar[1], Petranka Petrova[2]

[1]Faculty of Chemistry and Chemical Technology, University of Ljubljana, Večna pot 113, SI-1000 Ljubljana, Slovenia

[2]Faculty of Mathematics and Natural Sciences, South-West University "Neofit Rilski", Ivan Mihailov, 66, 2700 Blagoevgrad, Bulgaria

e-mail: ppd@swu.bg

Abstract: In this study the anthropogenic impact on surface water environment is assessed based on analysis of the spatial elemental distribution in sediments from two urban rivers with different level of pollution. Through sediments analysis, the extent, distribution and source of heavy metal contamination in rivers can be determined and traced.

Concentrations of Cd, Cr, Cu, Mn, Ni, Pb, and Zn in sediments were determined at six sampling stations in the watershed of Bistritsa River and at five sampling stations from the Struma River in the area of Blagoevgrad city.

An Inductively Coupled Plasma Optical Emission Spectrometry (ICP-OES) was used to quantify the concentrations of the studied elements after microwave-acid digestion of the samples.

Sediment quality guidelines (SQGs) were utilized to examine the river sediment quality in the current study.

Results showed that the heavy metal concentrations in Bistritsa River were generally lower than those of the Struma River.

Keywords: heavy metals; sediment quality; pollution assessment

Whey Derived Bioactive Peptides with ACE Inhibitory Properties

Boryana Yakimova1,3, Lili Dobreva2, Yuliana Raynova1, Svetla Danova2 and Ivanka Stoineva1

[1]*Institute of Organic Chemistry with Centre of Phytochemistry, Bulgarian Academy of Sciences, Sofia, Bulgaria*

[2]*The Stephan Angeloff Institute of Microbiology, Bulgarian Academy of Sciences, Sofia, Bulgaria*

[3]*Institute of Neurobiology, Bulgarian Academy of Sciences, Sofia, Bulgaria*

e-mail: boryana.yakimova@orgchm.bas.bg

Abstract: Hypertension is known as a risk factor for development of stroke, myo-cardial infarction, heart failure, heart and chronic kidney diseases and often referred to colloquially the "silent killer". In modern medicine the inhibitors of Angiotensin I converting enzyme (ACE) are a first line of therapy for hyper-tension, heart failure, myocardial infarction and diabetic nephropathy. One promissing approach is to focus on ACE inhibitors from peptide hydrolysates obtain from alternative sources, using different strains of lactic acid bacteria (LAB). The main purpose of the present study was to isolation and charac-terization of novel bioactive peptides from fermented with selected Lactoba-cillus strains (LAB) skimmed and/or whole cow milk. The whey protein samples were separated by centrifugation at 4°C at 10000 × g for 20 min, with molecular weight cutoff (MWCO) membranes of 3 and 10 kDa to collect peptide fractions (<3 kDa, >3 kDa, >10 kDa, <10 kDa, 3-10 kDa). All the tested samples (1 kDa) exhibit ACE-I inhibitory activ-ity. The detailed kinetic studies are in progress.

Acknowledgements: This work was supported by the BNSF under pro-ject CP-06-N 21/5.

Synthesis and Antioxidant Activity of Some Aminoadamantanes

Antoniya Stoymirska[1], Radoslav Chayrov[1], Almira Georgieva[2], Albena Alexandrova[2], Ivanka Stankova[1]

[1]South-West University
"Neofit Rilski", 2700 Blagoevgrad, Bulgaria
[2]Institute of Neurobiology, Bulgarian Academy of Science,
1000 Sofia, Bulgaria
e-mail: ivastankova@abv.bg

Abstract: Chronic fatigue syndrome (CFS) and neurocognitive deficits are a major problem of modern society. The etiology of CFS remains unclear, however, a large number of recent studies have shown oxidative stress may be involved in its pathogenesis. Fatigue is frequent and important in the lives of Parkinson's disease (PD) patients. 1-amino-adamantane derivatives has been proposed to be useful in the treatment of Parkinson's and Alzheimer's diseases. Its beneficial effect has been related to its novel properties as an NMDA receptor blocker which can neutralize the effect of glutamate at striatal and subthalamic levels. We synthesized and evaluated the antioxidant activity of eleven new aminoadamantane derivatives. Their antioxidant activity have been evaluated using different radical generating systems. The compound with s highest anti-oxidative capacity contain 2-(Benzhydrylsulfinyl) substituent.

Keywords: amantadine, rimantadine, memantine, antioxidant activity, fatigue

Hydrolytic stability of memantine analogues with nootropics

Anna-Mariya Ivanova[1], Antoniya Stoymirska[1], Radoslav Chayrov[1], Ivanka Stankova[1]

[1]South-West University
"Neofit Rilski", 2700 Blagoevgrad, Bulgaria
e-mail: ivastankova@abv.bg

Abstract: One purpose of the chemical modifications of existing drugs is to achieve higher bioavailability and improve transport across cell membranes. This approach is basic for creating prodrugs. Prodrugs are also essential when slow-release effect. It is important for constant bioavailability and reduce the often taking doses within the day. In our previous investigations we discover that some amantadine derivatives with nootropics has significant neuroprotective effect invitro. Here in we report the hydrolytic stability of memantine analogues with tri types of nootropics. The investigations were conducted, at different pH values, corresponding to the human biological liquids. In order to complete our studies HPLC method was developed and applied. All tri compounds are more than 48 hours stable in pH 2.0 and 69 hours in pH 7.4.

Keywords: memantine, stability, prodrugs, nootropics, physiologic pH.

Neurological Recovery-Promoting in Induced Brain Injury by Memantine Derivative

Antoniya Stoymirska[1], Radoslav Chayrov[1], Çetin Hakan Karadağ[2], Ivanka Stankova[1]

[1]South-West University "Neofit Rilski", 2700 Blagoevgrad, Bulgaria
[2]Trakya University, 22030, Edirne, Turkey
e-mail: ivastankova@abv.bg

Abstract: The brain is the most highly perfused organ in the human body. Due to this feature the brain is extremely sensitive to disorders even in capillary blood flow and a slight decrease in the inflow quickly leads to metabolic disorders, hypoxia and tissue ischemia. Memantine and some nootropics are commonly used in the rehabilitation following brain injuries. The purpose of this study is to describe the effects of action for memantine derivative with the strong nootropic and a wakefulness-promoting agent modafinil in induced brain injury in mice. Modafinil-Memantine showed statistically significant improvement in memory loss at the dose of 10 mg/kg. We could not test the higher doses of the compound because of its solubility problem.

Keywords: memantine, brain injury, neurological recovery

The science of miracles – Chemistry

E. Chorbadzhiyska, Katerina Angelova, Yordan Angelov

Department of Chemistry, South-West University "Neofit Rilski", Blagoevgrad, Bulgaria

elli_e1@swu.bg

Abstract: The chemical experiment (laboratory or demonstration) motivates the study of chemistry as a field of science. Our earlier report has revealed the relationship between the scientific side of the chemical experiment and the attractiveness. The purpose of the current communication is to demonstrate the connection between science of Chemistry and miracles, especially studying the second main group of the periodic system. The names of the selected experiments are wonderful, which excites the interest of learners: "Magical light", "The Gin", "Poppin candy", "Snake of fire", "Falling clouds", "Jellyfishes", "Cotton candy", "Devil's milkshake". The selected experiments are not just miracles, but also reveal the basic properties of the metals from the second main group of the periodic system and their compounds. These experiments are appropriate for a great variety of students of different ages: pupils and students.

Keywords: chemistry, chemical experiment, education, second main group.

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The quantitative Determination of Proanthocyanidins Concentrations in *Vicia faba* Cultivars from Serbia

Violeta Mitic[1], Andrea Ivkovic[1], Vesna Stankov Jovanovic[1]. Jelena Nikolic[1],Goran Petrovic[1] Jasmina Milenkovic[2]

1 Faculty of Science and Mathematics, University of Nis, Serbia
2 Institute for forage crops Kruševac, Serbia
violeta.mitic@pmf.edu.rs

Abstract: Proanthocyanidins (PAs), better known as condensed tannins, have been shown to have potential health benefits. They are ubiquitous and present as the second most abundant natural phenolic after lignin. Total procyanidins in fifteen samples were estimated using the vanillin assay. Results were expressed as mg gallic acid equivalents (GAE) per g dry extract weight (mg GAE g^{-1} DE). The lowest determined proanthocyanidins content was 4,34 mg GAE/g DW. In the largest number of samples, the proanthocyanins content ranged from 6.08 to 6.81 mg GAE/g DW. Only three samples had higher values 9.71, 10.17, 11.47 mg GAE/g DW. Tannins are associated with a somewhat disagreeable bitter flavour, which makes tannin-free cultivars preferred in many crop species. So, this research can contribute to the selection of varieties with a lower (better taste) or higher (better antioxidant characteristics) proanthocyanidins content.

Keywords: Vicia faba, proanthocyanidins, vanillin assay.

Antioxidant and antimicrobial activities of *Lactarius sanguifluus*

Violeta Mitic[1], Vesna Stankov Jovanovic[1], Jelena Nikolic[1], Goran Petrovic[1] and Marija Dimitrijevic[2]

1 Faculty of Science and Mathematics, Department of Chemistry, University of Nis, Serbia

2 Faculty of Medicine, Department of Pharmacy University of Nis, Serbia

violeta.mitic@pmf.edu.rs

Abstract: Considering the interest in mushrooms and research of antioxidants in natural food resources, the aim of this study was to investigate the content of phenolic compounds and antioxidant activities of the methanol extract of L. sanguifluus. A broth microdilution method was used to determine the minimum inhibitory concentration (MIC) for the estimation of antimicrobial activities.

Methanol extract of L. sanguifluus was a good source of total phenolic (76.24 mg GAE/g DE) contents, leading to a high reducing power of 0.48 mg AAE/g DE. The ABTS scavenging activity and cupric-reducing antioxidant capacity of L. sanguifluus extract were recorded as 9.15 mg TE/g DE and 14.96 mg TE /g DE. Examined extract gave moderate DPPH radical-scavenging activity (38.90 %). Methanol extract of L. sanguifluus shown an inhibitory effect against, Enterococcus faecalis (MIC 2.35 mg/mL), E. aerogenes (MIC 4.69 mg/mL), Bacillus cereus (MIC 4.69 mg/mL). Significant results can be observed in the inhibitory activity against Listeria monocytogenes, Salmonella enteritidis, Staphylococcus aureus, Pseudomonas aeruginosa, but there are no inhibitory activities against Proteus mirabilis and Escherichia coli.

Keywords: L. sanguifluus, Antioxidant activity, Antibacterial activity

Analysis of the docking results of some selective MOR ligands

Tatyana Dzimbova[1, 2], Fatima Sapundzhi[1], Peter Milanov[1, 3]

[1]South-West University "Neofit Rilski", Blagoevgrad, Bulgaria
[2]Institute of Molecular Biology "Roumen Tsanev", BAS, Sofia, Bulgaria
[3]Institute of Mathematics and Informatics, BAS, Sofia, Bulgaria
sapundzhi@swu.bg

Abstract: Endogenous opioid produce the same effects as the chemicals known as classic alkaloid opiates, which include morphine and heroin. Endogenous opioid peptides function both as hormones and as neuromodulators. The aim of the present study was to analyse the results of docking of ligands with MOR to identify the key elements required for selectivity. Many of the ligands have been synthesized and biologically tested by our colleagues. The other part are compounds known in the literature. The analysis of the obtained ligand-receptor complexes makes it possible to determine the key structural elements associated with the manifestation of specificity with respect to the receptor. These results will assist in the design of new compounds with potential MOR agonistic or antagonistic effects.

Keywords: docking, ligand-receptor complexes, MOR, GOLD 5.2, Molegro Molecular Viewer

Computational modeling of compounds that interact with opioid and cannabinoid receptors

Fatima Sapundzhi, Tatyana Dzimbova

[1]*South-West University "Neofit Rilski", Blagoevgrad, Bulgaria*
[2]*Institute of Molecular Biology "Roumen Tsanev", BAS, Sofia, Bulgaria*
sapundzhi@swu.bg

Abstract: The present study was designed to investigate the structure-activity relationship between cannabinoid and opioid ligands with models of cannabinoid and opioid receptors. There are differences in the mechanisms of pain control for these two types of receptors, but targeting the creation of compounds that bind to both opioid and cannabinoid receptors leads to more effective solving of this problem. This will lead to the development of new and improved strategies to prevent opiate addiction and its consequences.

Keywords: computational modeling, drug design, structure-activity relationship, opioid receptor, cannabinoid receptor

Clinoptilolite as sorbent for sample preparation in PAH analysis

Milica D. Nikolić, Nikola Radisavljević, Teodora Petreski, Milica G. Nikolić, Jelena Nikolić, Violeta Mitić, Vesna Stankov Jovanović

Faculty of Science and Mathematics, University of Nis

milica.nikolic2@pmf.edu.rs

Abstract: Polycyclic aromatic hydrocarbons (PAH) are pollutants of great concern due to their toxic and carcinogenic properties. Analysis of 16 priority PAHs could be time and money-consuming, so applying new methods to save time and money is of great importance. QuEChERS technique, with acetonitrile-water as extraction mixture, is used in soil sample preparation for PAH analysis, with clinoptilolite as dSPE sorbent, followed by GC-MS analysis. QuEChERS technique, using clinoptilolite as dSPE sorbent, is accurate and precise, simple and cheap, and can be used in sample pretreatment for PAH analysis. Recovery values varied between 50,19 % for benzo[g,h, i]perylene to 109.93 % for phenanthrene for three spiking levels (5, 0.5 and 0.05 ppm of total PAH in soil). LOD values varied between 0.39 μg kg^{-1} for anthracene to 1.53 μg kg^{-1} for phenanthrene, whereas LOQ values were in the range between 1.3 μg kg^{-1} – 5.1 μg kg^{-1} za anthracene and phenanthrene. Calibration curves were linear in the range 0.1923 – 19.2307 μg ml^{-1} for all analyzed compounds.

Acknowledgment. The authors acknowledge the Ministry of Education, Science and Technological Development of Serbia for the financial support (Project No. 451-03-47/2023-01/ 200124).

Keywords: PAH, clinoptilolite, QuEChERS

ICP-OES Determination of Selenium in Flour Samples

Stefan Petrović, Denis Mitov, Đorđe Savić, Jelena Mrmošanin, Aleksandra Pavlović, Snežana Tošić

University of Niš, Faculty of Sciences and Mathematics, Niš, Serbia

snezana.tosic@pmf.edu.rs

Abstract: In this paper, the content of selenium was determined in 19 samples of flour from wheat, emmer, millet, flax, pumpkin, sesame, barley, rice, corn, rye, buckwheat, oat, and spelt using Optical emission spectrometry with inductively coupled plasma at 196.090 nm. The samples were prepared by wet digestion (nitric acid and hydrogen peroxide). The instrument parameters were optimized to achieve the so-called robust plasma. The method was validated through the following elements: the accuracy and repeatability of the calibration line, the influence of the matrix using the method of the slope ratio of the external calibration line and the calibration line spiked with the sample, the repeatability of the sample preparation, checking the accuracy of the content determination by the direct method by comparison with the method of the standard addition. The content of selenium in the analyzed flour samples ranges from 172 μg/kg in white corn flour to 1009 μg/kg in pumpkin flour. The obtained results were statistically processed using hierarchical cluster analysis. Pumpkin and sesame flour stand out for the highest content, while white corn and rye flour have the lowest selenium content. In a sequence of wheat flours type 400, 500, 1100, the content of selenium increases.

Keywords: selenium, flour samples, ICP-OES determination

Application of the new kinetic method for quantitative determination of herbicide 4-chloro-2-metylphenoxy acetic acid in baby food samples using SPE followed by HPLC method

Ana Miletic Ciric, Emilija Pecev-Marinkovic, Aleksandra Pavlovic, Snezana Tosic, Ivana Rasic Misic, Jelena Mrmosanin, Katarina Milenkovic

Faculty of Sciences and Mathematics Department of Chemistry, Serbia
Faculty of Sciences and Mathematics Department of Chemistry, Serbia
Faculty of Sciences and Mathematics Department of Chemistry, Serbia
Faculty of Sciences and Mathematics Department of Chemistry, Serbia
Faculty of Sciences and Mathematics Department of Chemistry, Serbia
Faculty of Sciences and Mathematics Department of Chemistry, Serbia
Faculty of Sciences and Mathematics Department of Chemistry, Serbia

ana.nis.86@hotmail.com

Abstract: The aim of this paper was application of kinetic-spectrophotometric meth-od for determination of herbicide 4-chloro-2-metylphenoxy acetic acid (MCPA) in baby food samples after preparation of samples by solid phase extraction SPE. Twenty one commercially available baby food samples were used for the application of the kinetic method. The samples were first extracted with Acetone/Water/Acetic Acid (80:19:1) for 1 day and then samples centrifuged at 3000 rpm for 15 min. Then the samples were reex-tracted with 20 cm3 of the same solvent mixture for 3 hour an then centri-fuged again. The supernatants were diluted with 200 cm3 of water, and pre-concentrated on a solid-phase cartridge with methanol and eluate was con-centrated using the rotary evaporator near dryness. The dry residue was transferred into volumetric flask

and filled up with acetonitrile:wather (70:30, v/v) for HPLC analysis, the second part was filled up with 10% methanol and used for kinetic determination of pesticide. Kinetic method was successfully applied for determination of MCPA with recovery of 95.40-102.65 %. Statistical comparison of the results with HPLC method showed good agreement and indicates no significant difference in accuracy and precision.

Keywords: MCPA, kinetic method, SPE, HPLC, baby food

Antioxidant activity of houseleek

Milan Mitić[1], Jelena NIkolić[1], Ivan Palić[1], Violeta Mitić[1], Marija Ilić[2], Vladan Djurić[3], Vesna Stankov Jovanović[1]*

[1]Universitiy of Niš, Faculty of Science and Mathematics, Department of Chemistry, Višegradska 33, 18000 Niš, Serbia,

[2] Veterinary Specialized Institute "Niš", Laboratory Sector, Laboratory for Analytical Chemistry, DimitrijaTucovića 175, Niš, 18106, Serbia

[3]University of Priština-Kosovska Mitrovica, Faculty of agriculture, Kopaonička bb, 38219 Lešak, Serbia

**milan.mitic1@pmf.edu.rs*

Abstract: Houseleek is used in Serbian folk medicine, primarily in otitis treatment. Its health benefits can be ascribed to phenolics and flavonoids- proven antioxidants. This study aimed to evaluate antioxidant activity and total phenolic and flavonoid content of houseleek ethanolic extracts collected in Vlasotince during May using DPPH, ABTS and FRAP assays.

Total phenolic content was 44.87±0.08 mg GAE/100g f.w, whereas total flavonoid content was 16.72±0.04 mg CE/100g f.w. According to the DPPH assay, antioxidant activity was 0.166±0.011 mmol TE/100 g f.w., whereas using the other two assays was slightly lower (0.099±0.007 and 0.106±0.010 mmol TE/100 g f.w. for ABTS and FRAP, respectively). Houseleek could be considered a valuable source of antioxidants, and it is highly appreciated in Balkan peninsula folk medicine.

Keywords: Houseleek, antioxidants, phenolics

Antimicrobial activity of *Hypericum perforatum* L. essential oil

Aleksandra Djordjević[1]*, Goran Petrović[1], Jelena Stamenković[2], Violeta Mitić[1], Jelena Nikolić[1], Jovana Ickovski[1], Vesna Stankov Jovanović[1]

[1]Department of Chemistry, Faculty of Science and Mathematics, University of Niš, Višegradska 33, 18000 Niš, Serbia,

[2]Department of Chemistry, Faculty of Medicine, University of Niš, Bul. dr Zorana Đinđića 81, 18000 Niš, Serbia

*e-mail: * sanjadj81@yahoo.com*

Abstract: Hypericum L. is a genus represented by more than 480 species, widespread in warm-temperate areas. Among them, Hypericum perforatum L. is the best known and widely used as medicinal herb. The present study aimed to evaluate the antimicrobial potential of H. perforatum essential oil. Antibacterial activity of the oil was determined by using a broth microdilution assay against Bacillus subtilis ATCC 6633, Staphylococcus aureus ATCC 6538, Escherichia coli ATCC 8739, Pseudomonas aeruginosa ATCC 9027 and Salmonella abony NCTC 6017. Antifungal activity was tested against Aspergillus niger ATCC 16404 and Candida albicans ATCC 10231. The essential oil mainly showed moderate antimicrobial activity being the most effective against P. aeruginosa with the minimum inhibitory concentration of 1.56 mg/ml and bactericidal concentration of 3.125 mg/ml while E. coli was the most resistant strain. Our results indicate that H. perforatum essential oil possesses antimicrobial potential, which may justify the usage of Hypericum species in traditional medicine.

Keywords: Hypericum perforatum, essential oil, antimicrobial activity, broth microdilution assay.

Acknowledgment. The authors acknowledge the Ministry of Education, Science and Technological Development of Serbia for the financial support (Project No. 451-03-47/2023-01/ 200124).

Chemical composition of the *Anthriscus caucalis* headspace volatiles

Aleksandra Djordjević[1]*, Goran Petrović[1], Jelena Stamenković[2], Violeta Mitić[1], Jelena Nikolić[1], Vladan Đurić[3], Vesna Stankov Jovanović[1]

[1]Department of Chemistry, Faculty of Science and Mathematics, University of Niš, Višegradska 33, 18000 Niš, Serbia

[2]Department of Chemistry, Faculty of Medicine, University of Niš, Bul. dr Zorana Đinđića 81, 18000 Niš, Serbia

[3] Faculty of agriculture, University of Priština-Kosovska Mitrovica, Kopaonička bb, 38219 Lešak, Serbia

*e-mail: * sanjadj81@yahoo.com*

Abstract: Anthriscus caucalis M. Bieb, also known as burr chervill or bur beak chervil is a species from the carrot family, native to Western, Southern and Central Europe, Western Asia and Northern Africa. It has been introduced into the North America, New Zealand, and South America through the centuries. Above-ground parts of the A. caucalis were collected in May 2014 in the vicinity of Niš, the village of Hum, Serbia. From the fresh specimen, the chemical composition of the volatile compounds in the native sample, was analyzed by static headspace GC-MS. Headspace analysis showed the presence of 28 components with a share of 99.3% of the total. The major class of compounds was found to be monoterpenoids with the share of 92.8% with respect to the ratio of hydrocarbon to oxygenated compounds (58.2% to 34.6%, respectively). The most abundant components were: cis-Chrysanthenol (28.4%), Myrcene (17.7%), α-Pinene (15.1%), (Z)-β-Ocimene (11.2%) and Limonene (6.1%).

Keywords: Anthriscus caucalis, chemical composition, headspace volatiles, GC-MS.

Polycyclic aromatic hydrocarbons in soil-application of diatomaceous earth in sample preparation step

Milica D. Nikolić, Jovana Petrović, Mihajlo Halilović, Milijana Zlatković, Jelena Nikolić, Violeta Mitić,

Vesna Stankov Jovanović

Faculty of Science and Mathematics, University of Nis
milica.nikolic2@pmf.edu.rs

Abstract: Analysis of 16 polycyclic aromatic hydrocarbons (PAHs) in the soil is of great importance due to its proven or potential toxic and carcinogenic properties. QuEChERS technique, with acetonitrile/water as extraction mixture and diatomaceous earth as dSPE sorbent, is used for soil sample preparation collected near petrol stations in Niš, Serbia, followed by GC-MS analysis. Total PAHs concentration varied between 0,385±0,002 to 0,40±0,04 mg kg^{-1}. PAH, with the highest concentration in analyzed samples, was acenaphthene, with a concentration of 0,373±0,002 mg kg^{-1}. The concentration of 1 mg of Σ10PAU per 1 kg of dry soil was set as the limit value according to Serbian law regulative. None of the analyzed samples exceeded the value of 1 mg kg^{-1}Σ10PAU, so it can be concluded that according to Serbian legislation, the studied soil samples Niš are not polluted by PAHs.

Keywords: PAH, soil, pollution

X-RAY FLUORESCENCE ANALYSIS OF ZEOLITIC TUFFS FROM SERBIA

Vesna Stankov Jovanovic[1] Violeta Mitic[1], Jelena Nikolic[1], Dragan Djordjević[1], Slobodan Ćirić and Miloš Rajković[2]

1 University of Nis, Faculty of Science and Mathematics, Departament of Chemistry, Višegradska 18 000 Niš, Serbia

2 Institute of Field and Vegetable Crops, National Institute of the Republic of Serbia, Maksima Gorkog 30, 21101 Novi Sad, Serbia

vesna.stankov-jovanovic@pmf.edu.rs

Abstract. The zeolites found in the Vranjska Banja area of south Serbia are predominantly clinoptilolite-type zeolites, whose chemical composition can vary depending on the location within the deposit. Since the application of this material for various purposes is related to their safety, the absence of toxic elements must be proven. In zeolite analysis, XRF is typically used to quantify major and trace elements.

The analyzed sample contained 15.05% Mg, 11.67% Si, 10.80% Al and 4. 53% Fe. Metals K and Ca were present in 1,71 and 1,73%, respectively. The relatively high contents of Ti (1,62%), Mn (0,12%) and Sr (0,11%) were registered. Among toxic metals, significant amounts of Cr, Pb and As were recorded (75.47, 51.91 and 15.09 ppm, respectively). These results are significantly higher than previously reported but still below the limits for agricultural soil. Regardless of higher reported values, the studied zeolitic tuff is acceptable for applications in agriculture and environmental purposes.

Keywords: zeolite, volcanic tuffs, clinoptilolite, elemental composition, toxic metals

Microbial fuel cell as a biosensor for monitoring the organic load of wastewater

Nikolay Vitanov[1,2], Elitsa Chorbadzhiyska[1,2], Yolina Hubenova[3,4], Mario Mitov[1,2]

[1]Department of Chemistry, South-West University "Neofit Rilski", Blagoevgrad, Bulgaria

[2]Innovative Center for Eco Energy Technologies, South-West University "Neofit Rilski", Blagoevgrad, Bulgaria

[3]Institute of Electrochemistry and Energy Systems, Bulgarian Academy of Sciences, Sofia, Bulgaria

[4]Department of Biochemistry and Microbiology, Plovdiv University "Paisii Hilendarski", Plovdiv, Bulgaria

Abstract: The aim of this study is to develop a microbial fuel cell (MFC) as a biosensor for simultaneous measurement of both biological oxygen demand (BOD) and chemical oxygen demand (COD), which will significantly shorten the analysis time. These two parameters are basic for the wastewater quality. Double-chamber MFCs with carbon felt anodes and air-breathing cathodes separated by a Zirfon membrane were used in the experiments. Synthetic wastewater with different concentrations of COD, inoculated with activated sludge from the Municipal Wastewater Treatment Plant (WWTP) – Blagoevgrad, served as anolyte. The MFCs were run consequently at open circuit (OC) and close circuit (CC) modes using wastewater with different COD concentrations. A linear correlation between the generated current and the BOD/COD values was established, demonstrating the applicability of the used MFC setup as a biosensor. As a next step, the developed MFC-based biosensor will be tested with real wastewater from WWTPs.

Keywords: microbial fuel cell, biosensor, electroactive biofilm, BOD, COD, wastewater treatment.

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Evaluation of the antioxidant activity of honeys with variable botanical origin

Jelena Mrmošanin[1], Stefan Petrović[1], Vesna Stankov Jovanović[1], Maya Chochkova[2], Petranka Petrova[2]

[1]*Department of Chemistry, Faculty of Sciences and Mathematics, University of Niš, Višegradska 33, 18000 Niš, Serbia*

[2]*Faculty of Mathematics and Natural Sciences, South-West University "Neofit Rilski", Ivan Mihailov, 66, 2700 Blagoevgrad, Bulgaria*

e-mail: ppd@swu.bg

Abstract: Bioactive foods and their chemical composition have attracted research attention in the field of human health and nutrition. Biologically active compounds in food such as polyphenols, minerals, and vitamins were widely studied, along with their synergistic or antagonistic interactions so that the antioxidant, microbiological, antifungal and other activities to be evaluated. Between natural foods honey stands out with special importance due to numerous redox-active substances, contributors to its antioxidant activity. However, honey is a food with a variable composition and, accordingly, with a variable activity. As the plants differ by their naturally synthesized radical scavenging compounds, the biochemical profile of honey varies with the floral source used by bee for food.

The purpose of this study was to evaluate the influence of honey botanical origin on the biological activity, including total phenolic content and antioxidant activity. Four different assays were used to evaluate the antioxidant capacity of honeys, between them ABTS, DPPH, FRAP, and CUPRAC. The results indicate that honeydew honey exhibits the highest total phenolic content and antioxidant activity among the tested samples. On the other hand, acacia honey demonstrates the lowest biological activity in terms of phenolic content and antioxidant properties.

Keywords: honey; antioxidant activity; phenolic content, radical scavenging activity

Frequency-tunable Stimulated Raman Scattering in quartz fibers

Lyuben Ivanov

South West University "Neofit Rilski", Blagoevgrad, Bulgaria

and

Institute of Electronics, Bulgarian Academy of Sciences, Sofia, Bulgaria

e-mail: mihovli@abv.bg

Abstract: The process of occurrence of Stimulated Raman scattering in a medium with inhomogeneous vibrational resonances when pumped with laser radiation at different pulse durations was investigated. In this particular case, an optical light guide based on fused quartz was used as a nonlinear medium. The influence of the group velocities dispersion on the effective interaction length of the pump and Stokes waves is evaluated. The studies were carried out in the spectral range 1.17-1.35 μm, which is around the point of zero of group velocities dispersion in fused quartz. It is shown that changing the wavelength of the pump pulses in the region of positive dispersion of the group velocities of the medium effectively excites the Stokes component of the Stimulated Raman scattering with a wavelength in the region of negative group velocities dispersion. At the same time, its frequency shift from the pumping wave can vary practically from 0 to 1000 cm^{-1} and does not coincide with the maximum in the amplification line of the spontaneous Raman scattering.

Keywords: optical fibers, Stimulated Raman scattering, group velocities dispersion

Composite materials based on nanosized ferrite for microwave application

Svetoslav Kolev1,2*, Todor Cholakov2

1Institute of Electronics, Bulgarian Academy of Sciences, 72 Tsarigradsko Chaussee, 1784 Sofia, Bulgaria
2Neofit Rilski South-Western University, 66 Ivan Mihailov Str., 2700 Blagoevgrad, Bulgaria

svet_kolev@swu.bg

Abstract: Protection from electromagnetic radiation (EMR) in the microwave (MW) range has lately become a problem of pressing interest due to the world-wide spreading of technologies such as cellular phones. MW radiation shielding in medical research and in MW domestic appliances has also focused the attention of researchers.

The object of this work is to investigate the microwave absorbing proerties of nanocomposite bulk samples. As filler we used magnetite (Fe3O4) with different particle size in a silicone rubber matrix and investigated the influence of the filler concentration and particle size in the polymer matrix on the microwave nonlinearity in a large frequency range (1 ÷ 18 GHz). We found that the intensity and the frequency at the reflection loss minimum depend on the particle size and particle concentration of magnetite in the samples.

Keywords: nanoparticles, magnetite, microwave absorption

Laser synthesis and processing of composite nanostructures

Mihaela Koleva1,2, Anna Dikovska 1, Nikolay Nedyalkov1

1Institute of Electronics, Bulgarian Academy of Sciences, 72 Tsarigradsko Chaussee blvd., Sofia 1784, Bulgaria
2South-West University "Neofit Rilski", 66 Ivan Mihailov Str., Blagoevgrad, 2700, Bulgaria

mihaela_ek@yahoo.com, mihaela_ek@swu.bg

Abstract: In the recent years, the open-air pulsed laser deposition (PLD) technique (at atmospheric pressure) has been proven to be a practical and comparatively inexpensive method for simple preparation of high-porosity nano-structures made up of nanoparticles. The laser ablation in open air results in nanoparticles and/or nanoparticle aggregates formation in the plasma plume realized via a fast condensation of the ablated material. The investigated composite nanostructures demonstrate unique properties not observed in the separate materials. The present work reports the fabrication of porous composite ZnO/nobel metal (Ag, Au) nanostructures using pulsed laser deposition at atmospheric pressure. The PLD grown samples are laser annealed, which led to a modification of the nanoparticles. The effect of laser annealing procedure on the morphology, structure and optical properties of composite nanostructures is studied. The laser modification causes the appearance of a resonance absorption band at about 360 nm, which contributes to an enhancement of the photoluminescence band-edge UV emission.

Keywords: atmospheric pulsed-laser deposition, nanostructure, nanoparticles, composites

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Laser-Assisted Synthesis of Water Colloidal Metallic Nanocomposites

Nadya Stankova1, Anna Dikovska1, Mihaela Koleva1,2, Nikolay Nedyalkov1, Daniela Karashanova3

1Institute of Electronics, Bulgarian Academy of Sciences, 72 Tzarigradsko Chaussee blvd., Sofia 1784, Bulgaria,
2South-West University "Neofit Rilski", 66 Ivan Mihailov Str., Blagoevgrad, 2700, Bulgaria,
3Institute of Optical Materials and Technologies, Bulgarian Academy of Sciences, Acad. Georgy Bonchev Str. 1113 Sofia, Bulgaria

mihaela_ek@yahoo.com , mihaela_ek@swu.bg

Abstract: The method of pulsed laser ablation in liquids (PLAL) is utilized for synthesis of composite nanostructures on the basis of Zn combined with noble metals like Ag, Au, Pt or Pd. The fundamental wavelength of 1064 nm of nanosecond and picosecond laser irradiation of Nd:YAG laser systems is used. The synthesis procedure of composite nanostructures consists of the following consecutive steps: metallic plate of Zn immersed in bidistilled water is ablated first, then after the zinc target is removed from the water, a noble metal target (Ag, Au, Pt or Pd) is immersed in the aqueous colloid and is ablated, as a third step the water colloids of the metallic nanocomposites are post-ablation irradiated with UV nanosecond laser pulses. The morphological and structural characteristics of the composite nanostructures are evaluated by means of Transmission Electron microscopy in its corresponding main modes. The study of the optical transmission and absorption of the water colloidal metallic nanocomposites allows to indirectly evaluate their morphological characteristics. Control on the colloids properties is possible to perform by varying the laser beam parameters.

Keywords: laser-assisted synthesis, water colloids, metallic nanocomposites, noble metals

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Effect of Beam Power on the Structure and Mechanical Properties of Electron Beam Welded Cu / Al6082T6 Joints

Darina Kaisheva, Georgi Kotlarski, Vladimir Dunchev, Borislav Stoyanov, Maria Ormanova, Angel Anchev, Stefan Valkov, Vladimir Todorov, Milka Atanasova, Stanislava Rabadzhiyska

Institute of Electronics - Bulgarian Academy of Sciences; SWU Neofit Rilski, Bulgaria
Institute of Electronics - Bulgarian Academy of Sciences, Bulgaria
Technical University of Gabrovo, Bulgaria
Technical University of Gabrovo, Bulgaria
Institute of Electronics - Bulgarian Academy of Sciences, Bulgaria
Technical University of Gabrovo, Bulgaria
Institute of Electronics - Bulgarian Academy of Sciences, Bulgaria,
Technical University of Gabrovo, Bulgaria
University of Gabrovo, Bulgaria
University of Gabrovo, Bulgaria
Institute of Electronics - Bulgarian Academy of Sciences, Bulgaria

darinakaisheva@abv.bg

Abstract: The results of electron-beam welding of copper and Al6082T6 aluminum alloy are presented in this study. The influence of the beam's power on the structure and mechanical properties of the welded joints was studied. The experiments were realized at a beam deflection of 0.4 mm to the aluminum alloy plate and with beam oscillation at a circular trajectory with a radius of 0.2 mm. The beam power of 1800 W, 2400 W, 3000 W, and 3600 W was applied. The welding speed was 15 mm/s. The phase composition of the obtained welded joints was studied by using X-ray diffraction (XRD). The microstructure and the chemical composition were investigated by scanning electron microscopy (SEM) and energy-dispersive X-ray spectroscopy (EDX). The mechanical properties were studied by microhardness investigations. In the fusion zone of the weld seam of the four samples were detected three phases – an aluminum matrix, an ordered solid solution of copper and aluminum in the form of

CuAl2, and pure copper. Power does not affect the phase composition of the compounds formed. With increasing the power, the depth of the weld increases. As the power increases, the spacing between the grains of the CuAl2 intermetallic phase increases. The finest structure is obtained in the weld formed by applying the lowest power. The values of the microhardness within the fusion zone are much higher than that in the surrounding regions due to the formation of intermetallic phases.

Acknowledgments: This work was supported by the Bulgarian National Scientific Fund under Grant KP 06-N47/6.

Keywords: electron-beam welding; beam oscillation; dissimilar materials; aluminum alloy; copper

Search for decay of the 7Be nucleus in 8B nucleus dissociation

R. Stanoeva1,2

1South-West University "Neofit Rilski", Blagoevgrad, Bulgaria
2Institute of Electronics, Bulgarian Academy of Sciences, Sofia, Bulgaria

rstanoeva@swu.bg

Abstract: The technique of nuclear track emulsions makes it possible to study in detail the fragmentation of light relativistic nuclei. The registration of all charged particles and their identification enable one to explore the isotopic composition of fragments and the projectile fragmentation channels. In the present paper results of an analysis of decay of the 7Be nucleus in dissociation of 8B nuclei are presented and a comparative analysis of the experimental data with the Monte Carlo model calculations is made. The paper is illustrated with characteristic images, obtained by means of a microscope, equipped with a CCD camera.

Keywords: Monte Carlo modelling, nuclear track emulsion technique, peripheral interactions of nuclei

Influence of chia gel on starch thermal transitions, measured by DSC during the storage of cakes

Dida Iserliyska[1*], Gabor Zsivanovits[1], Angel Iliev[1] Maria Marudova[2]

1. Institute of Food Preservation and Quality – Plovdiv, Agricultural Academy, Bulgaria

2. Plovdiv University "Paisii Hilendarski", Faculty of Physics, Bulgaria

dida_isser@yahoo.com

Abstract: The effect of polysaccharide chia gel, used as fat replacer by substitution of egg incorporation level in cakes on the starch retrogradiation during the storage was analyzed by the method of differenctial scanning calorimetry (DSC). The retrogradiation transition appeared in the DSC curves as an endothermic peak with maximum and area correlating to the retrogradiation temperature and enthalpy respectively. The process was monitored during 21 days after cake's preparation and some other product's physical characteristics (weight loss, crumb firmness, crumb color) were also measured. The lowest degree of retrogradiation was observed on the 21 day for the 20% replacement samples, while the highest one was established for the control samples. Therefore, chia gel exhibited the expected retarding effect on starch retrogradation at 15 and 20% level of egg replacement in the cake batter (low enthalpy values). In general, with increasing chia gel concentration, starch retrogradation slowed down in all storage stages.

Keywords: starch retrogradation**,** enthalpy, egg replacement, staling, cake storage, phase transition

Influence of chitosan-based composites on the properties of chemically modified poly-lactic acid films

Aleksandar Grigorov

University of Plovdiv "Paisii Hilendarski", Plovdiv, Bulgaria
Aleksandar.grigorov@uni-plovdiv.bg

Abstract: The presented paper investigates the creation of chitosan based composites on the surface of chemically modified poly-lactic acid (PLA). PLA was dissolved in chloroform and cast into a metal dish until the complete evaporation of the solvent. The surface of the created PLA films were modified with 1,6 hexanediamine and glutaraldehide for the creation of free aldehyde side groups. Composite layers of chitosan (Ch), polyethylene glycol (PEG) and polyvinyl alcohol (PVA) were deposited on the surface of the modified films. The mechanical properties of the composite films were investigated using a dynamometer. The surface of the created composite films was studied under polarized light microscope. Sessile drop method was used to determine the surface free energy of the created chitosan-based composite layers.

Keywords: chitosan, composite, poly-lactic acid, modification

Sequential implementation of isoelectric precipitation followed by ultrafiltration for production of sunflower protein isolates

Angel Iliev1, Maria Dushkova2, Gabor Zsivanovits1, Dida Iserliyska1

1. *Institute of Food Preservation and Quality-Plovdiv Agricultural Academy of Bulgaria, Plovdiv, Bulgaria*
2. *Department of Process Engineering, University of Food Technologies, 26 Maritza Blvd.,4002 Plovdiv, Bulgaria*

a.iliev@canri.org

Abstract: The aim of this study was to improve yield of protein isolates obtained from sunflower oil cakes by means of sequential implementation of isoelectric precipitation and ultrafiltration. Proteins was extracted from sunflower oil cake in mild acidic condition with pH=6 with solution of NaCl with concentration of 0.5, 1 and 2M. First fraction of protein isolate was obtained by means of isoelectric precipitation at pH=4, 3.5 and 3. Total protein, ash and dry matter content and residual chlorides, of raw material and precipitates were determinated. Second fraction was obtained from supernatant taken from highest yield precipitate by means of ultrafiltration. The experiments were conducted with a UF10-PAN membrane at a transmembrane pressure of 0.2, 0.35 and 0.5 MPa, and a volume reduction ratio (VRR) of 2, 3, 4, and 5. Total protein, ash, and dry matter contents of retentates and permeate were determined.

The obtained fractions might be used like components of edible coatings.

Keywords: Protein isolates, isoelectric precipitation, ultrafiltration

Benzydamine hydrochloride immobilization in multilayer structures based on lyophilized composite polylactic acid / poly(ε-caprolactone) substrates

Asya Viraneva, Maria Marudova, Aleksandar Grigorov, Temenuzhka Yovcheva

Department of Physics, University of Plovdiv, 24, Tzar Assen, str, 4000, Plovdiv, Bulgaria

asia83@uni-plovdiv.bg

Abstract: In the present paper the polyelectrolyte multilayers (PEMs) deposited on lyophilized composite polylactic acid / poly(ε-caprolactone) substrates were investigated. The substrates were charged under either positive or negative corona discharge for 1 minute with 5kV voltage applied to the corona electrode and 1kV voltage of the same polarity applied to the grid. The dependences of the normalized surface potential on the storage time for positively and negatively charged substrates were studied. The results obtained show that the values of the normalized surface potential of negatively charged substrates decay faster than those of positively charged ones. Layer-by-layer (LbL) technique was used for multilayer deposition on the substrates. The first built-up layer always possesses an electric charge opposite to that of the substrate. The loading efficiency and drug release kinetics of the chosen model drug were carried out spectrophotometrically.

Keywords: corona discharge, composite substrates, polyelectrolyte multilayer structures

Chitosan/casein polyelectrolyte multilayers: effect of pH and ionic strength on film growth and morphology

Maria Marudova, Asya Viraneva, Alexandar Grigorov, Temenuzhka Yovcheva

University of Plovdiv "Paisii Hilendarski", Plovdiv, B

margo@uni-plovdiv.bg

Abstract: The growth process of chitosan/casein polyelectrolyte films deposited by layer-by-layers assembly at different pH and ionic strength was studied in this work. The films were investigated using surface plasmon resonance (SPR), and quartz crystal microbalance with dissipation monitoring (QCMD) to examine the build-up kinetics, and atomic force microscopy (AFM) to visualize the surface topography. Each deposition step resulted in a progressive increase in mass. The film growth and thickness strongly depended on the polyelectrolyte charge density and complexation between the used polyelectrolytes. The film surface changed from smooth to rough when the ionic strength increased. The results achieved could be used in estimating the potential of the multilayers to be applied as drug delivery systems.

Keywords: polyelectrolyte, charge density, growth electrostatic interaction, hydration

Trophic structure of the macrozoobenthos in the Bulgarian rivers

Emilia Varadinova[1,2], Slavinia Kocakova[1], Veselina Dalgacheva[1], Violeta Tyufekchieva[2], Radka Fikova[2]

[1]South-West University "Neofit Rilski", Blagoevgrad. Bulgaria

[2]Institute of Biodiversity and Ecosystem Research, Bulgarian Academy of Science, Sofia, Bulgaria

e-mail address of the corresponding author

emily.varadinova@gmail.com

Abstract: Study on the macrozoobenthos trophic structure in the Bulgarian rivers was conducted. A total of 139 sites located in representative water bodies which belong to 16 river types were investigated. Macroinvertebrate taxa were assigned to six functional feeding groups (FFG) – shredders, scrapers, deposit feeders, filtrators, collectors and predators. Dynamics of the taxa composition and abundance of the functional feeding groups were presented. Similarity between the benthic communities of the studied sites in each FFG was made. The dependence of the distribution of the FFG abundance on the aquatic environmental parameters was discussed. Shredders and scrapers dominated in mountainous and semi-mountainous river types, while more tolerant groups of deposit feeders prevailed in lowland river stretches.

Keywords*:* macroinvertebrates, functional feeding groups, rivers

Comparative analysis of the structure of benthic macroinvertebrate communities in Maritsa River (Bulgaria) and Han River (South Korea)

Jiyoung Park*, Lidia Sakelarieva, Emilia Varadinova

Department of Geography, Ecology and Environmental Protection, South-West University "Neofit Rilski", 2700 Blagoevgrad, Bulgaria

** J. Park; sungsol2@hotmail.com*

Abstract: The aim of this paper is to compare the taxonomic composition and species diversity of the macrozoobenthos in the Maritsa River (Bulgaria) and Han River (South Korea). Samples were collected from 15 selected sites in each river, including some of their main tributaries, during the summers of 2020 and 2021. The number of taxa found in the Maritsa River was twice as high as that of the Han River: 192 taxa belonging to 19 systematic groups registered in Maritsa River compared to 88 taxa affiliated to 18 groups found in the Han River. The order Ephemeroptera had the highest species richness for both rivers, with 31 taxa in Maritsa River and 26 taxa in Han River. The highest species richness was recorded at the reference sites: site 1 in the Maritsa River and site 2 in the Han River. The species diversity of macrozoobenthos was very low at sites 6 and 8 in the Maritsa River in 2021, as well as sites 11 (in both years), 13 (in 2021), and 14 (in 2020) in the Han River. Overall, the macrozoobenthic communities' structure of the Maritsa River and its studied tributaries was characterized with higher values of the Margalef's index of species richness (d) and Shannon Wiener diversity index (H), and lower values of the Simpson's index of dominance (c).

Keywords: lotic ecosystems, community ecology, biodiversity indices

Review of the impact of coal fired power plants (CFPP) on the status of surface waters in Bulgaria

Vanina Mitseva, Emilia Varadinova

South-West University "Neofit Rilski", Faculty of Mathematics and Natural Sciences, Department „Geography, Ecology and Environmental Protection", Blagoevgrad, Bulgaria,

e-mail address of the corresponding author: vanim@abv.bg

Abstract: The coal fired power plants (CFPP) cause negative effects on the water. The pollutants from coal combustion wastes migrate and contaminate groundwater and surface water, causing degradation of the aquatic ecosystems.

Two surface water bodies in Struma catchment – Struma river and Razmetanitsa river are directly affected by the CFPP „Republika" and the CFPP „Bobov dol". Totally five CFPPs: CFPP "Brikel", CFPP "AES 3C Maritsa East 1", CFPP "Maritsa East 2", CFPP "Contour Global Maritsa East 3" and CFPP "Maritsa - 3" have an impact on Maritsa catchment specifically on five surface water bodies – Maritsa River, Sokolitsa River, Ovcharitsa River, Sazlijka River, Rozov kladenets Dam.

The data of the Biotic index based on the biological quality element - macrozoobenthos, basic physico-chemical parameters, specific pollutants and priority substances in monitoring sites, d before and after the discharge points from CFPP in the Struma and Maritsa catchments, are reviewed and analyzed. The impact of the pressure from the observed CFPP on the worsened ecological status of the influenced surface water bodies for the period 2013-2022 was assessed. A relation between the worsened ecological status of the observed surface water bodies and the values of monitored parameters and pollutants (suspended substances, electroconductivity, pH deviations, sulphates, hardness of water, turbidity, BOD5, heavy metals, etc.) was established.

Keywords: coal combustion, waste discharges, water pollutants, ecological status

LTER-BG: Upgrading the distributed research infrastructure "Bulgarian Long-term Ecosystem Research Network"

Svetla Bratanova-Doncheva1, Radka Fikova1, Kremena Gocheva1, Ventsislav Karamfilov1, Tzvetan Zlatanov1, Emilia Varadinova1, Nevena Ivanova1, Lachezar Pehlivanov1, Kremena Stefanova2, Sonya Damyanova3, Miglena Zhiyanski4, Yanka Vidinova1, Lyudmila Lozanova1, Kostadin Katrandzhiev1

1Institute of Biodiversity and Ecosystem Research at the Bulgarian Academy of Sciences, Sofia, Bulgaria; 2Institute of oceanology at the Bulgarian Academy of Sciences, Varna, Bulgaria; 3University of Forestry, Sofia, Bulgaria; 4Forest Research Institute at the Bulgarian Academy of Sciences, Sofia Bulgaria

e-mail address of the corresponding author: radkafikova@gmail.com

Abstract: Long-Term Ecosystem Research (LTER) is an essential component of world-wide efforts to better understand ecosystem structure, functions, and long-term response to environmental, societal and economic drivers, contributing to the knowledge base informing policy and to the development of management options in response to the Grand Challenges of Global Change. LTER studies the structural and functional elements of ecosystems-biodiversity, abiotic heterogeneity, balance of energy, matter and water, at all ecosystem levels and at different scales-from site through landscape and catchment to continental scale.

LTER-BG shares the research objectives of the European Network eLTER in terms of fundamental ecosystem and socio-environmental issues. In addition, an important direction in the work of the Bulgarian network is the development of socially significant applied science and innovation activity, which will increase the public understanding of the ecosystem issues and create a favourable environment for ecosystem management and development of business and social innovation.

Keywords: Ecosystem research, eLTER, Whole system approach, scientific services, open science

Intercropping of vegetables and ornamental plants in the regenerative agriculture context

Desislava Todorova

Institute of Agriculture, Kyustendil 2500, Bulgaria

desi_todorovaiz@abv.bg

Abstract: Agriculture is entering an era of transformation. Although the Green Revolution was successful in feeding a rapidly growing human population, it also depleted the Earth's soil and biodiversity and contributed to climate change. These extraction practices are not sustainable. We must rapidly transform agriculture using a set of practices known as regenerative agriculture that combines sustainable innovation with tradition. Regenerative agriculture improves soil, provides high productivity and high-quality food, and helps combat climate change and restore lost biodiversity. One of the key practices of regenerative agriculture – intercropping, where multiple crops are planted together – have their roots in local farmers working with the land, not against it.

This article reviews the interaction between two varieties of cabbage, marigold and tagetes. And how the intercropping of a vegetable and an ornamental plant affects the vegetative, productive manifestations and quality to each other.

Keywords: intercropping, cabbage, ornamental plants, interaction

Plasma technologies in seed germination

Desislava Todorova

Institute of Agriculture, Kyustendil 2500, Bulgaria

desi_todorovaiz@abv.bg

Abstract: In vegetable production, everything starts with the seeds. The final success of growing and obtaining a product depends on the quality of the seeds. There are many practices to improve seed quality. One of these is the use of plasma technologies in the germination of vegetable seeds. In the present study, the influence of different variants of the use of plasma technologies - plasma spheres, structured water, etc. - has been traced. The starting material for the research is the seeds of white and red cabbage.

The use of plasma-activated water (PAW) treatment is a promising technology that has many advantages, such as high efficiency, flexibility, environmental safety, and no residue.

Keywords: plasma technology, seed germination, cabbage

Ladybird beetle fauna of the Holy Cross Mountains region in Poland and its changes over time

Małgorzata Czaja[1,2], Marek Bidas[3], Jerzy Romanowski[4], Piotr Ceryngier[4]

[1I]Faculty of Biology and Environmental Science, Cardinal Stefan Wyszyński University in Warsaw, Poland; [2]Students' Association of Field Biologists, Cardinal Stefan Wyszyński University in Warsaw, Poland; [3]Society for the Study and Conservation of Nature, Kielce, Poland; [4]Institute of Biological Sciences, Cardinal Stefan Wyszyński University in Warsaw, Poland

e-mail: malgorzata.a.czaja@gmail.com

Abstract: The Holy Cross Mountains (in Polish: Góry Świętokrzyskie) are an old (uplifted during the Caledonian orogeny), low mountain range in central Poland. The region is very valuable in terms of ecosystem and species diversity. Based on literature data and our unpublished material collected between the late 1970s and 2022, we traced temporal changes in the species composition and species richness of ladybird beetles (Coleoptera: Coccinellidae) of this region. A total of 61 species were recorded, which is about 80% of all ladybird species known from Poland. Some species (*Coccinella undecimpunctata, Hippodamia septemmaculata*) showed a clear regression, while others (*Adalia conglomerata, Clitostethus arcuatus, Harmonia axyridis, Scymnus abietis*) appeared in the region recently and subsequently became relatively abundant.

Keywords: Coccinellidae, range shift, species richness, zoogeography

The tributaries contribution of PAHs micro-pollution in Nišava River

Vesna Stankov Jovanovic[1] Violeta Mitic[1], Jelena Nikolic[1], Slobodan Ćirić[1], Goran Petrović[1], Aleksandra Đorđević[1], Milan Mitić[1]

[1] *University of Niš, Faculty of Science and Mathematics, Department of Chemistry, VIšegradska 33, 18 000 Niš, Serbia*

vesna.stankov-jovanovic@pmf.edu.rs

Abstract. Among various pollutants present in water, polycyclic aromatic hydrocarbons - PAHs, represent the most significant concern for the envi-ronment due to their proven toxic, potentially toxic and bioaccumulative properties. The Nišava river and its tributaries in South-Eastern Serbia are used as sanitary water and in agriculture. This work aims to determine PAHs' concentration in Nišava's tributaries and their contribution to total PAHs' micro pollution in Nišava. Dispersive micro-solid phase extraction was preceded as the samples' preparation technique for quantifying PAHs by GC-MS. Analyzed left Nišava tributaries: Jerma, Blatasnica, Jelašnička, and Kutinska rivers contributed to total PAHs micro-pollution via 7,1±0,2 ppb, 8,05±0,08 ppb, 7,25±0,04 ppb, 9,84±0,05 ppb, respectively Analyzed right Nišava tributaries: Gradašnička River and Temštica, contributed via 6,74±0,08 and 7,08±0,01 ppb. The total PAHs' concentration determined af-ter mentioned tributaries flow in Nišava river was increased to 15,6±0,1 ppb, which was higher than official legislation.

Keywords: PAH, Nišava River, pollution, dispersive micro-solid phase ex-traction

An investigation of barries and individual characteristics of e-commerce adoption by greek elders

Irena Atanasova[1], Vasileios Gerakis[2]

[1,2] South-West University "Neofit Rilski", Blagoevgrad, Bulgaria
irenatm@swu.bg

Abstract: E-commerce has the potential to improve the standard of living and the state of the economy. However, websites are generating barriers for older people, which prevent them from using the internet or limit their access to it. The proportion of elderly respondents who have adopted e-commerce to any significant degree is relatively low. Results show that factors such as age, education level, residence status, and employment status are key factors that influence e-commerce adoption. Factors such as difficulties in comprehending the information on websites, reading, and navigation are barriers to adoption. There are concerns over personal information and the unauthorized use of credit cards.

Keywords: e-commerce adoption, older people, Greece, individual characteristics

The Impact of organizational culture on teaching and learning processes during the Covid-19 pandemic: South-west University "Neofit Rilski" case study

Irena Atanasova[1], Elena Karashtranova[2]

[1,2] South-West University "Neofit Rilski", Blagoevgrad, Bulgaria

irenatm@swu.bg

Abstract: This study aims to determine how organizational culture affects the transition from face-to-face learning to distance learning in an electronic environment during the Covid-19 pandemic. The academic crisis caused by Covid-19 has caused a mandatory shift from face-to-face learning to a distance form of learning. Organizational culture was put to the test by this crisis, thus creating a favorable opportunity to study the process of changing the form of learning.

This study examines the organizational culture during the Covid-19 pandemic and the resulting crisis to assess the factors that determine the adoption of distance e-learning as a necessity of South-west University "Neofit Rilski" (SWU). The survey data reveal that organizational culture plays a positive and important role in the adoption of distance (synchronous and asynchronous) learning. In addition, organizational culture has also been shown to influence the effectiveness of distance teaching and learning. The obtained results show that the senior management staff of SWU has formed the correct policies for a smooth transition to electronic distance learning (synchronous and asynchronous) during a crisis situation such as the Covid-19 pandemic.

Keywords: Covid-19 pandemic, data mining, distance e-learning, organizational culture

A Comparative Analysis of Advanced Encryption Standard (AES) and Rivest-Shamir-Adleman (RSA) Algorithm: Mathematical, Algorithmic, and Performance Comparison

Maria Mpitsi*, Nina Sinyagina**

** PhD Candidate South-West University "Neofit Rilski", Blagoevgrand, Bulgaria*
*** Professor of Informatics South-West University "Neofit Rilski", Blagoevgrand, Bulgaria*

bitsimaria27@gmail.com nisina36@abv.bg

Abstract: Encryption algorithms play a crucial role in securing data communication and storage systems. In this paper, we compare two encryption algorithms, namely the Advanced Encryption Standard (AES) and the Rivest-Shamir-Adleman (RSA) algorithm. We discuss the mathematical and arithmetic comparison between these two algorithms, and evaluate their performance in terms of security, speed, and implementation complexity. Our analysis shows that while AES provides better performance for symmetric key encryption, RSA offers a secure mechanism for asymmetric key encryption. We also highlight the importance of selecting the appropriate encryption algorithm based on the specific application requirements.

Keywords: Encryption algorithms, Advanced Encryption Standard, AES, Rivest-Shamir-Adleman, RSA, security, speed, implementation complexity.

Exploring the Security of Cloud Computing: An Analysis of Threats and Countermeasures for Cloud Computing in the Era of Digital Transformation

Maria Mpitsi*, Nina Sinyagina**

** PhD Candidate South-West University "Neofit Rilski", Blagoevgrand, Bulgaria*
*** Professor of Informatics South-West University "Neofit Rilski", Blagoevgrand, Bulgaria*

Emails: bitsimaria27@gmail.com nisina36@abv.bg

Abstract: Cloud computing has gained immense popularity for the delivery of computing resources over the internet, enabling organizations to efficiently and cost-effectively store, process, and access data from any location worldwide. However, the security of data stored and processed outside of the organization's premises has raised concerns. This article provides an in-depth analysis of the security threats and countermeasures for cloud computing in the era of digital transformation. The paper defines cloud computing, explores its advantages and disadvantages, identifies major security threats in cloud computing, including data breaches, insider threats, and denial-of-service attacks, and discusses the countermeasures that can be implemented to mitigate these threats.

Keywords: Cloud computing, security, threats, countermeasures, digital transformation.

Degradation Recoloring CVD Deutan Image From Block SVD Watermark

Zoran N. Milivojević*, Bojan Prlinčević, Milan Cekić*****

** Academy of Applied Technical and Preschool Studies, Niš, SERBIA*
*** Kosovo and Metohija Academy of Appl. Studies, Leposavić, SERBIA*

**** Mikkelsen Electronics, Niš, SERBIA*
e-mail: zoran.milivojevic@akademijanis.edu.rs

Abstract: People with color vision deficiency (CVD), which arose as a deformation of the M cones in the eye (the amplitude characteristic of the M cone is sifted in the direction of the amplitude characteristic of the L cones), cannot detect the color green in the image (deutan anomaly). In the first part of this work, deutan anomalous is described. After that, the image Recoloring algorithm, which was implemented with the aim of expanding the color spectrum, and thus enabling Deutan CVD people to see a wider spectrum in images, is described. In the second part of the paper, the effect of the Recoloring algorithm on images with inserted watermark in order to protect copyright, is analyzed. An experiment was conducted in which the effect of the Recoloring algorithm on the quality of: a) extracted watermark and b) Recoloring image was analyzed. Watermark is inserted with different insertion factor α. By applying objective measures (MSE, PSNE and NC) and visual inspection of the quality of extracted watermark and recoloring image, the optimal insertion factor α was determined. All results are presented in the form of pictures, numerical form and graphics.

Keywords: trichromacy, deutanomaly, image recoloring, digital image watermark, SVD algorithm.

Estimation of emotional Normal/Boredom state by fundamental frequency trajectory analysis

Bojan Prlinčević[1], Zoran Milivojević[2], Vesna Simović[1], Dijana Kostić[2]

[1]*Department of Information-communication technology, Kosovo and Metohija Academy of Applied Studies, Leposavić, Serbia*

[2]*Department of Information-communication technology Academy of Applied Technical and Preschool Studies, Niš, Serbia*

bojan.prlincevic@akademijakm.edu.rs

Abstract: In this paper, the algorithm for the detection of the emotional state (normal and bored emotions) of speakers, applying speech analysis was performed. The algorithm is based on the analysis of the trajectory of the fundamental frequency F0(t). A detailed analysis was performed in the planes (F0, σ^2) and (F0, T). First, in the training phase, based on the test signal, the Normal/Boredom decision criterion was defined (the decision line was defined in planes). After that, the performance of the algorithm for emotional state detection in the testing phase, using the confusion matrix (TP, TN, FP, FN and ACC) was performed. Based on the detection precision parameters, a comparative analysis was performed with the results obtained for the detection of the Normal/Anger emotional state. The results of the accuracy of the emotional state detection algorithm are presented in the tables and graphically.

Keywords: Fundamental frequency, emotional state, confusion matrix.

The impact of the Covid-19 pandemic on distance e-learning: South-west university case study

Irena Atanasova[1], Elena Karashtranova[2]

1,2 South-West University "Neofit Rilski", Blagoevgrad, Bulgaria

e-mail address of the corresponding author: irenatm@swu.bg

Abstract: The Covid-19 pandemic makes people live in social isolation, which has a huge impact on the field of education as well. Providing education to students through alternative channels is becoming a top priority of the university. Their main goal was to minimize the impact of the pandemic on the quality of the "teaching" and "learning" processes, already implemented in new (atypical and not widely applied by universities) ways with new methods and new technologies - distance e-learning and online learning in the digital environment. One of the serious challenges in moving from traditional learning (face-to-face in a classroom) to learning in the digital environment is the mass and widespread application of distance e-learning. The academic crisis caused by the Covid-19 pandemic has led to the compulsory adoption of distance e-learning and online learning by South-west University "Neofit Rilski" (SWU). This change leads to modification of teaching approaches, assessment tools, and ways of communication between students and teachers.

This study aims to understand how students' attitudes and their perception of quality learning change when transitioning to distance learning at SWU during the Covid-19 pandemic. The data collected by surveying the student participants in distance e-learning and online learning (conducted in LMS Blackboard after the end of each academic year - 2019/2020, 2020/2021, 2021/2022) were analyzed. The obtained results prove the hypothesis that in the second year of the Covid-19 pandemic, the SWU easily implemented distance e-learning and online learning, and quality electronic learning materials and resources were created and used when it is placed in a crisis situation.

Keywords: Covid-19 pandemic, distance e-learning, students' attitude, students' perception

Levels of Natural Language Processing

Nadezhda Borisova, Elena Karashtranova

South-West University "Neofit Rilski", Blagoevgrad, Bulgaria

helen_k@abv.bg

Abstract: Undoubtedly, the Internet plays a role in contemporary society's day-to-day activities. This worldwide system offers a wide range of information resources and services to billions of users. Books, news, a range of reports, scientific studies, and other sorts of material are continuously produced. A system must be able to process natural language in order to retrieve a significant amount of the data kept on computers. The interaction between computers and human languages, or natural languages, is the focus of the field of artificial intelligence and linguistics known as natural language processing.

Some generic tasks which have the lead in NLP technology

Nadezhda Borisova, Elena Karashtranova

South-West University "Neofit Rilski", Blagoevgrad, Bulgaria

helen_k@abv.bg

Abstract: Since the 1950s, techniques for automatic natural language processing have been developed. Various NPL tasks can be performed in different sectors, but a set of fundamental tasks recur frequently and that set is much more in-depth studied and reliably implemented. In recent years, technological advancement may have increased the efficiency of NLP applications in a variety of fields, including speech recognition, machine translation, spam detection, and natural language interfaces.

Computer modeling and optimization in the processing of experimental data

Radoslav Mavrevski

South-West University "Neofit Rilski", Blagoevgrad, Bulgaria

mavrevski@swu.bg

Abstract: The processing and analysis of experimental data have an important role in various scientific areas, enabling researchers to gain valuable information and make informed decisions. In recent years, computer modeling and optimization techniques have become powerful tools for improving the efficiency and accuracy of data processing. This study aims to explore the application of computer modeling and optimization methods in the context of experimental data processing in bioinformatics. In this study are demonstrated the benefits of using computer modeling and optimization techniques to improve data analysis outcomes, reduce experimental costs, and accelerate scientific discoveries.

Keywords: computer modeling, regression, model selection, optimization

ОБЗОР И РАЗВИТИЕ В ПРОФЕСИОНАЛНИТЕ ИНТЕРЕСИ НА СТУДЕНТИТЕ-ДИПЛОМАНТИ

Наталия Христова Павлова

Шуменски университет "Епископ Константин Преславски"

Абстракт: В тази статия ще анализираме потребностите, интересите и реализацията на студентите от Факултета по математика и информатика (ФМИ) на ШУ „Константин Преславски", които се подготвят да станат учители по математика, информатика, информационни технологии и компютърно моделиране. Групата, която разглеждаме, са студенти от образователно-квалификационна степен "Бакалавър" и "Магистър". Проучват се данните за студентите, избрали да завършат своята степен със защита на дипломна работа. Целта е да се проследят тенденциите и отразяването на съвременните методически насоки в интересите на студентите. Предложена е класификация по основните области, в които студентите избират да работят. Направен е контент анализ на защитените разработки в периода 2014-2022 г. Проследена е реализацията на учениците. Отбелязани са идеи, които предстои да бъдат реализирани в дипломна работа в бъдеще.

Ключови думи: дипломна работа, защита, степен, интереси

Application of modern educational technologies in the teaching of physics in the lesson "Radioactivity"

Milena Slavkova[1,2,*], Elena Karashtranova[1], Ralitsa Stanoeva[1]

[1]*South-West University "Neofit Rilski", Blagoevgrad, Bulgaria*

[2]*Math and Science High School "Akad. S. Korolyov", Blagoevgrad, Bulgaria*

[*]*mslavkova75@gmail.com*

Abstract: In the current paper the focus is on the application of modern educational technologies in the teaching of physics in the lesson "Radioactivity". For example, simulation program, social networks and online resources that are discussed provide opportunities for interactive learning through visualization of the radioactive process, teamwork and information sharing. The use of the technologies can enhance physics learning in a Radioactivity lesson and help students achieve better results.

Keywords: modern educational technologies, physics lesson, radioactivity

Interactive GeoGebra simulations as a tool for teaching and learning chemistry

Vesna Stankov Jovanovic, Valentina Kostic, Tanja Sekulic

University of Nis, Faculty of Sciences and Mathematics, Department of Chemistry, Serbia

Academy of Applied Technical and Preschool Studies Nis - Department Pirot, Serbia

Technical College of Applied Sciences in Zrenjanin, Serbia

sjvesna@pmf.ni.ac.rs

Abstract: Mastering the ability to understand and use different representations of chemistry concepts is crucial to learning chemistry. To achieve this, the chemistry education community regards animations and simulations that support the use of multiple representations as essential. In this article, we will show how the dynamical mathematical software GeoGebra can be used for this purpose. GeoGebra has a great possibility for the creation of simulation which can be a powerful tool for teaching chemistry, as they allow students to visualize complex concepts and explore them in an interactive way. On the example of a 3D model of molecules and interactive simulations of the quantitative composition of solutions and Beer's Law, we will demonstrate how a digital learning environment can support and be useful for both, teachers and students. Also, we will explore how these examples in GeoGebra can be incorporated into lectures, laboratories, and independent students` activities to support chemistry learning.

Keywords: GeoGebra, Chemistry, simulations, dynamical models

Fractal geometry in GeoGebra environment

Valentina Kostic, Tanja Sekulic, Vesna Stankov Jovanovic

Academy of Applied Technical and Preschool Studies Nis - Department Pirot, Serbia

Technical College of Applied Sciences in Zrenjanin, Serbia

University of Nis, Faculty of Sciences and Mathematics, Department of Chemistry, Serbia

vesna.stankov-jovanovic@pmf.edu.rs

Abstract: Fractals are a fascinating topic in mathematics education, as they provide students with a unique visual representation of mathematical concepts. Fractals are self-similar, meaning that they exhibit the same pattern at different scales. This property makes them ideal for introducing students to concepts such as infinity, recursion, and iteration, as well as for exploring geometric concepts such as symmetry, similarity, and dimension. Fractals can be used to teach a wide range of mathematical topics, including geometry, algebra, calculus, and even number theory. In this paper, we will show how GeoGebra software can be used for creating different examples of fractals and how this material can be incorporated into the mathematical education process. We will also discuss how the study of fractals can help students develop important skills such as critical thinking, problem-solving, and creativity, while also deepening their understanding of fundamental mathematical concepts.

Keywords: Fractals, GeoGebra, animations, mathematical concepts

Designing a better person and a better society with the help of education and teaching mathematics and computer science in the dialogic approach

Simon Sultan

Yeshivat beit Yehuda, Israel

simonsultan63@gmail.com

Abstract: The purpose of education is not only to teach students what the teachers already know, but also to teach them how to ask open-ended questions, guide themselves in solving tasks in general and mathematical tasks in particular, locating difficulties and finding ways to handle them and how to learn new things for themselves through engaging in dialogical inquiry. In view of the size and centrality of the educational system, the expectations of the educational systems are high: shaping the student in terms of personality and behavior, and intellectually and his intellectual functions. The article refers to male and female students aged 13-18 in 3 6-year high schools in three different areas in the Western Negev in the State of Israel, over about 35 years. The article shows to what extent it is possible to influence the shaping of a better person and a better society with the help of dialogic teaching for a year in middle school or a year in upper school or 3 years for 4-5 study units in mathematics and computer science.

Keywords: mathematics, computer science, education, dialogic approach, person; society;

Promoting Environmental Literacy in by STEM in teachers in a multicultural Education In Israel .

Farid A. Hamdan1; Prof. Emiliya Patarchanova2 , PhD Prof. Elka Yanakieva, PhD

1National Coordinator of International Environmental Projects. Ministry Of Education SOUTH WEST UNIVERSITY "NEOFIT RILSKI"

Abstract: Values education, empowerment, and active citizenship are emphasized in Israel through environmental education and multicultural education, each based on the principles of respect, compassion, environmental responsibility, and celebrating diversity. These educational approaches view education from a social perspective, promoting societal reform by facilitating personal and social change. Nowadays, environmental studies is a part of Science and Technology Studies, which covers a broad range of scientific topics, ethical concerns. STEM is an acronym that stands for Science, Technology, Engineering, and Mathematics. It refers to a curriculum and educational approach that integrates the teaching and learning of these four subjects to prepare students for the 21st-century workforce.

As such, many schools, both in developed and developing countries, are now prioritizing STEM education and providing more opportunities for students to study these subjects. In this study, the level of environmental behavior of new students in two major teacher-training colleges in Israel have been measured to investigate the relation between behavior and back-ground culture. An analysis of students' responses resulted in grouping of environmental behavior items into four categories that represent increasing levels of environmental commitment. The findings of the study indicated that graduates of the educational system who chose to become teachers had a low level of environmental literacy, as evidenced by their limited performance of behaviors that require a high level of commitment.

Conversely, those who demonstrated a high level of environmental literacy tended to engage in behaviors that required a high level of environmental responsibility and multicultural education. Together, these educational trends emphasize collaboration for

sustainability and global citizenship, reflect a growing awareness of the interconnectedness of our environment and the need for collective action to address global challenges.

Keywords: environmental education, multicultural education, sustainability, Environmental Responsibility Behavior .

Possibilities for teaching the Python language in junior high school

Krasimir Harizanov

Konstantin Preslavsky University of Shumen, Bulgaria

kr.harizanov@shu.bg

Abstract: The article examines some possibilities for teaching scripted text language, in the junior high school stage and more specifically in the Computer Modeling classes in the 7th grade. Attention is paid to some features related to teaching the Python language. Several sample tasks related to knowledge in other academic disciplines are indicated.

Keywords: computer modeling; informatics education; Python for middle school

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