



THE ACADEMY OF APPLIED  
TECHNICAL STUDIES  
BELGRADE



INTERNATIONAL SCIENTIFIC  
AND PROFESSIONAL CONFERENCE  
**POLITEHNIKA 2023**

# CONFERENCE PROCEEDINGS

Belgrade, 15<sup>th</sup> December 2023



INTERNATIONAL SCIENTIFIC  
AND PROFESSIONAL CONFERENCE  
**POLITEHNIKA 2023**

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**ENVIRONMENT AND  
SUSTAINABLE DEVELOPMENT**

**OCCUPATIONAL HEALTH  
AND SAFETY AND FIRE SAFETY**

**SMART MANAGEMENT SYSTEMS**

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## FOREWORD

The International Scientific and Professional Conference POLITEHNIKA 2023 represents the seventh edition of the POLITEHNIKA scientific and professional events, occurring biannually since its inaugural event in 2011. POLITEHNIKA 2023 upholds a distinguished tradition and commitment to integrating higher education and practical application across a diverse spectrum of disciplines represented by defined thematic scopes.

Organized with the patronage of the Ministry of Education of the Republic of Serbia, the Ministry of Environmental Protection of the Republic of Serbia, the Ministry of European Integration of the Republic of Serbia, the Directorate for Occupational Safety and Health, the Office for Dual Education and National Qualifications Framework, the Conference of Academies of Applied Studies in Serbia, the Chamber of Commerce of Serbia, the Chamber of Commerce of Belgrade, the Institute for Standardization of Serbia, the Association of Belgrade Architects, the City of Požarevac and the Tourist Organization of the City of Požarevac, POLITEHNIKA 2023 stands as a collaborative platform at the intersection of academia, governmental institutions and industry.

This year heralds a notable progression with its international status and the incorporation of 10 conference scopes. Expanding beyond the thematic domains featured in previous events, the Conference now encompasses Environment and Sustainable Development, Occupational Safety and Health and Fire Safety, Smart Management Systems, Graphic Engineering, Design, Traffic Engineering, Biotechnology and Healthcare, Mechanical Engineering, Ecotourism and Rural development, and Mechatronics. By engaging experts, emerging professionals, and practitioners from these domains, the conference unifies fields of study programs of the Academy of Applied Technical Studies Belgrade. The thematic scopes, coupled with the structure of the compiled papers in this Proceedings, exhibit a rich diversity and multidisciplinary approach, fundamentally contributing to a holistic examination and resolution of societal and scientific challenges.

Comprising over 220 peer-reviewed contributions, the Proceedings represent a substantial intellectual asset, aligning with the conference's overarching objective of fostering the exchange of knowledge, research findings, and professional experiences among experts from industry, research institutions, and higher education establishments.

The Proceedings of the International Scientific and Professional Conference POLITEHNIKA 2023 serve as a comprehensive snapshot of the current landscape within the thematic realms of the conference, offering both insights and directives for ongoing scientific and professional development. Moreover, they proffer concrete solutions to practical challenges grounded in contemporary trends and pertinent insights.

The Academy of Applied Technical Studies Belgrade extends its sincere appreciation to all conference supporters whose financial contributions played a pivotal role in its successful realization. Special acknowledgment is reserved for the authors of the papers, whose diligence and eagerness to present their work to a wider audience, alongside the reviewers and members of the International Scientific Committee, Program Committee and Organizational Committee, have collectively contributed to the triumph of the International Scientific and Professional Conference POLITEHNIKA 2023.

Belgrade, December 2023  
EDITORS



## ENVIRONMENT AND SUSTAINABLE DEVELOPMENT

### INVITED PAPERS

**Srećko Stopić, PhD, Bernd Friedrich, PhD, Process Metallurgy and Metal Recycling, RWTH Aachen University, Germany**

*Advances in understanding of a role of unit metallurgical operations for recycling*

**Svetlana Grujić, PhD, Faculty of Technology and Metallurgy, University of Belgrade**

*Emerging pollutants in the environment: contamination of the Danube river basin in Serbia*

**Marija Nikolić, PhD, Faculty of Technology and Metallurgy, University of Belgrade**

*Biodegradable polyesters – from ecology to medicine*

## DESIGN

### INVITED PAPER

**Jelena Ristić Trajković, PhD, Faculty of Architecture, University of Belgrade**

*Society, Ecology and Design Education: Transformative Learning for Future Sustainable and Healthy Environments*

## MECHANICAL ENGINEERING

### INVITED PAPERS

**Tamara Bajc, PhD, Faculty of Mechanical Engineering, University of Belgrade**

*Energy savings and CO<sub>2</sub> emission reduction potential through the existing building renovation*

**Marko S. Jarić, PhD, Innovation Centre of Faculty of Mechanical Engineering in Belgrade**

*Analysis of remediation of horizontal cylindrical tank for oil storage*

## ECOTURISAM AND RURAL DEVELOPMENT

### INVITED LECTURES

**Marko Perić, PhD, Faculty of Tourism and Hospitality Management, University of Rijeka, Croatia**

*Challenges of sustainable tourism: Example of Croatia*

**Snežana Štetić, PhD, Balkan Network of Tourism Experts, Igor Trišić, PhD, Faculty of Geography, University of Belgrade**

*Selective forms of tourism and sustainable development of rural tourist destinations*

### INVITED PAPERS

**Radomir Stojanović, PhD, Western Serbia Academy of Applied Studies**

*Education as a pillar of sustainable agritourism in Serbia*

**Jelena Premović, PhD, Faculty of Economics, University of Priština & Faculty of Economics and Engineering, University Business Academy in Novi Sad**

*Cultural heritage as a generator of sustainable development of tourism in local communities in the countries of the Western Balkans*

**Vladimir Živanović, Nevena Majstorović, Zlatibor Tourism Organization, Zlatibor**

*Analysis of the real number of tourist overnights based on the estimation of water consumption in Zlatibor*

## MECHATRONICS

### INVITED PAPER

**Andrea Matta, PhD, Dept. of Mechanical Engineering, Politecnico di Milano, Italy Mohsen Jafari, PhD, Dept. of Industrial and Systems Engineering, Rutgers University, USA**

*Towards a theory of digital twins: fundamental definition*

# TABLE OF CONTENTS

## SCOPE 1. ENVIRONMENT AND SUSTAINABLE DEVELOPMENT

<b>Srećko Stopić, Bernd Friedrich</b> <i>Advances in understanding of a role of unit metallurgical operations for recycling</i>	26
<b>Svetlana Grujić</b> <i>Emerging pollutants in the environment: contamination of the Danube river basin in Serbia</i>	32
<b>Marija Nikolić</b> <i>Biodegradable polyesters – from ecology to medicine</i>	38
<b>Alessandro Gasparetto, Stefano Grimaz</b> <i>The ESPeRT project: a “polytechnic” strategic plan focused on sustainability</i>	44
<b>Ana Stojković, Miodrag Stanisavljević, Ivan Krstić, Nenad Krstić, Dragan Đorđević</b> <i>Physical-chemical characterization of waste glass of general use</i>	50
<b>Ljiljana Tolić Stojadinović, Svetlana Grujić, Nikolina Antić, Tatjana Đurkić</b> <i>Impact of wastewater antibiotics on river water quality in Belgrade area</i>	54
<b>Nataša Karić, Marija Vukčević, Marina Maletić, Mirjana Ristić, Aleksandra Perić Grujić, Katarina Trivunac</b> <i>Removal of organic and inorganic pollutants from aqueous solutions using starch-diatomaceous earth adsorbent</i>	60
<b>Nataša Karić, Marina Maletić, Sara Živojinović, Marija Vukčević, Milena Milošević, Katarina Trivunac, Aleksandra Perić Grujić</b> <i>Alkali modification of fly ash for adsorption of selected dyes</i>	66
<b>Katarina Popović, Davor Antanasijević, Jelena Antanasijević, Viktor Pocajt</b> <i>Carbon footprint of bio-based and recycled plastic materials</i>	71
<b>Katarina Popović, Davor Antanasijević, Jelena Antanasijević, Viktor Pocajt</b> <i>Application of machine learning for the simulations and modeling in environmental science</i>	77
<b>Jasmina Bašić, Danijela Pecarski, Dragana Dragaš Milovanović, Slavica Krsmanović, Daka Tešić</b> <i>Air quality according PM concentration in the city of Belgrade in September 2023</i>	83
<b>Jelena Vesković, Milica Lučić, Slavica Ražić, Ivana Deršek-Timotić, Andrijana Miletić, Maja Đolić, Antonije Onjia</b> <i>Multivariate analysis of the Morava river plain groundwater</i>	89
<b>Eleonora Gvozdić, Ivana Matić Bujagić, Tatjana Đurkić, Svetlana Grujić</b> <i>Ecological risk assessment of aspartame and neotame in river sediments</i>	95
<b>Mirjana Ocokoljić, Djurdja Petrov</b> <i>Impact of urban heat island on butterfly-bush (<i>buddleja davidii franch.</i>)</i>	100
<b>Mirjana Ocokoljić, Djurdja Petrov, Dragan Vujičić</b> <i>Effects of urbanisation on <i>simplicarpos orbiculatus moench</i> in the green infrastructure of Belgrade</i>	106
<b>Anja Bubik, Katrin Školnik Škrabe</b> <i>Chemical variability of personal care and cosmetic products</i>	112
<b>Miloš Tošović</b> <i>Technical-technological disasters, risk assessment and environmental security</i>	118

<b>Radule Tošović</b> <i>Economic considerations of the relationship of national income, mineral reserves and environmental accounting</i>	124
<b>Slavica Krsmanović, Danijela Pecarski, Jasmina Bašić</b> <i>Quality of swimming pool water and hygiene</i>	130
<b>Jelena D. Lukić, Latinka J. Slavković-Beškoski, Katarina V. Trivunac, Antonije E. Onjia</b> <i>Analysis of heavy metal(loid)s in coal fly ash leachate by inductively coupled plasma optical emission spectrometry</i>	134
<b>Andrijana Miletić, Antonije Onjia</b> <i>Analysis of carbon monoxide in ambient air using passive sensors</i>	139
<b>Ivana Trajković, Milica Sentić, Slobodan Cvetković, Andrijana Miletić, Antonije Onjia</b> <i>Analysis of BTEX in sediments by purge-and-trap gas chromatography-mass spectrometry</i>	145
<b>Saša Marković, Darja Žarković</b> <i>Economic instruments in the function of environmental protection</i>	150
<b>Jelena Milosavljević, Snežana Šerbula, Tanja Kalinović, Jelena Kalinović, Ana Radojević</b> <i>Overview of air pollution in the city of Bor during the period of 2020–2022</i>	156
<b>Milan Trumić, Vladimir Nikolić, Mirjana Marić, Jelena Janković</b> <i>Mining solid waste around Bor, yesterday, today, tomorrow</i>	162
<b>Danijela M. Jašin, Ljubica Lazić Vulićević, Valentina Mladenović, Aleksandar Rajić</b> <i>The solution for reusing non-recyclable plastic-based materials</i>	167
<b>Filip Živković, Milica Stojković, Maja Đolić, Mirjana Čujić</b> <i>Elemental analysis of rare earth elements in coal fly ash from thermal power plants in the Republic of Serbia</i>	173
<b>Darja Žarković, Saša Marković</b> <i>Sustainable production in cardboard industry</i>	177
<b>Marija Prosheva, Jadranka Blazhevskaja Gilev</b> <i>Sensors for ammonia detection based on carbon nanofiller</i>	182
<b>Marija Prosheva, Jadranka Blazhevskaja Gilev</b> <i>Investigation of the UV stability of lignin/polymer composites</i>	188
<b>Ana Momčilović, Marta Trninić</b> <i>A comprehensive analysis: offshore renewable energy methodologies, benefits, and limitations</i>	193
<b>Danijela Đurić Mijović, Danijela Milanović, Jelena Savić, Miloš Nedeljković, Dušan Randelović</b> <i>Wind comfort design based on building position</i>	199
<b>Zaga Trišović, Tomislav Trišović, Ana Virginia Socalici, Corneliu Banesa Birtok</b> <i>Innovative system for electrochemical active chlorine production in coaxial and cabinet-type reactors</i>	204
<b>Đorđe Karić, Aleksandra Sretenović-Dobrić</b> <i>Analysis of energy-saving measures in residential buildings connected to district heating systems using information technology</i>	209
<b>Bosiljka Srebro, Stefan Milojević, Miljan Adamović</b> <i>Environmental accounting education for sustainable development: a comprehensive overview</i>	214
<b>Vladana Đurđević, Aleksandra Janićijević, Dominik Brkić, Ana Popović, Marina Stamenović, Aleksandra Božić</b> <i>Validation of the ICP-OES method for determining the elemental composition of water</i>	219
<b>Vladana Đurđević, Jelena Pavlović, Bojan Obradović, Ana Popović, Marina Stamenović, Aleksandra Božić</b> <i>Proficiency testing as a tool for quality control of laboratory test results in environmental pollution analysis</i>	225

<b>Radmila Marković, Zoran Stevanović, Zoran Štirbanović, Vojka Gardić, Renata Kovačević, Vesna Marjanović, Jelena Petrović</b> <i>Monitoring of the surface water quality in copper mining and metallurgy operation areas in Bor</i>	231
<b>Biljana Angjusheva, Ildiko Merta, Emilja Fidancevski</b> <i>Sustainable synergy: alkali-activated coal fly ash and CDW in sustainable construction</i>	237
<b>Vaishnavi Inamdar, Ana Popović</b> <i>Global ESG perspectives and the changing world of 2023: a sustainability odyssey</i>	242
<b>Nikola Stojković, Dominik Brkić, Svetlana Čupić, Aleksandra Božić, Sladjana Glišić, Vladana Đurđević</b> <i>Determination of polychlorinated biphenyls in waste oil</i>	247
<b>Dejan Vasić, Vladana Đurđević, Marina Stamenović, Aleksandra Božić, Aleksandra Janićijević, Dominik Brkić</b> <i>Determination of PAHS in medical waste</i>	252
<b>Vesna Alivojvodić, Aleksandra Vučinić</b> <i>EU taxonomy as a framework for a functioning circular economy</i>	256
<b>Milica Marković, Ana Momčilović, Maja Stanković</b> <i>Environmental concerns of lithium battery disposal</i>	261

## STUDENTS PAPER

<b>Miloš Kovačević, Nataša Radić</b> <i>Air pollution caused by modern-day armed conflict</i>	266
<b>Danijela Jeremić, Daniela Ristić</b> <i>Influence of “Stubo-Rovni” dam on climate change in the city of Valjevo</i>	272

## SCOPE 2. OCCUPATIONAL HEALTH AND SAFETY AND FIRE SAFETY

<b>Marta Trninić</b> <i>Application of 3D random e-glass fiber composites in construction hardhat design</i>	278
<b>Drago Pupavac, Ljudevit Krpan, Josip Knežević</b> <i>Cost-benefit analysis in employee health and safety protection</i>	284
<b>Svetozar Sofijanić, Vladan Pantović, Željko Ognjanović</b> <i>Centralized information system for monitoring workplace injuries</i>	290
<b>Dragan Živanić, Nikola Ilanković</b> <i>Safety concerning cableways</i>	296
<b>Dragan Živanić, Nikola Ilanković</b> <i>Basic safety measures for chain conveyors</i>	302
<b>Nataša Ćirović, Ana Petrović, Marija Burilo</b> <i>Testing of microclimate and physical harms in the sawmills</i>	308
<b>Ana Petrović, Nataša Ćirović</b> <i>Noise level investigation in production process</i>	314
<b>Vesna Marjanović, Jelena Jelisić</b> <i>Comparative analysis of risk assessment in the field of construction</i>	320
<b>Saša Kuzmanović</b> <i>Analysis of assessed professional risks at the workplace of forklift drivers in the Logo company with comparative risk assessment methodologies and reference to the current law</i>	325

<b>Marija Mićanović, Tanja Radović</b> <i>Implementation of strategies for the development of critical thinking in English language teaching among the students of the Occupational safety and health study program at the Academy of applied technical studies Belgrade</i>	331
<b>Tanja Radović, Marija Mićanović</b> <i>Business communication obstacles in English language in occupational health and safety education</i>	335
<b>Radenko Rajić, Ivan Arandjelović, Nikola Tanasić</b> <i>A novel tabular method for estimation of waterflow rate at the hydrant nozzle</i>	338
<b>Goran Đorđević, Martina Petković, Ljubinko Rakonjac, Marko Tomić, Anita Klikovac</b> <i>Selection and use of mechanized equipment for extinguishing forest fires in order to increase efficiency - methodological approach</i>	342
<b>Darko Marković, Nebojša Ćurčić</b> <i>Prevention of occupational risks in transport and installation of concrete prestressed T-girders on project Iverak-Lajkovac</i>	350

## STUDENTS PAPER

<b>Milena Andrejević</b> <i>“Near miss” events in the TPS Zemun reconstruction project: a research and analysis</i>	357
<b>Maja Đikić, Novak Milošević</b> <i>Research and analysis of professional stress issues among employees in security roles</i>	363
<b>Lazar Milićević, Novak Milošević</b> <i>The impact analysis of stress accumulated outside the workplace on the occupational safety and health of employees in Institute of Nuclear Sciences „VINČA”</i>	368
<b>Jelena Tintor, Jasmina Rajić, Igor Babić</b> <i>Researching the harmful effects of cooling liquid on employees</i>	374
<b>Jelena Tintor, Jasmina Rajić, Igor Babić</b> <i>Employee safety during plastic deformation metal processing</i>	380
<b>Milica Marković</b> <i>Chemical hazards in horticulture from the aspect of occupational safety and health</i>	385
<b>Marijana Drakulić</b> <i>Potentially explosive atmospheres in flour production</i>	391

## SCOPE 3. SMART MANAGEMENT SYSTEMS

<b>Radoslav Raković</b> <i>Information security management standard and personal data protection – practical experiences</i>	398
<b>Miloš Jelić, Ana Aksentijević Jelić</b> <i>Deficiencies and advancement in organizational strategic decision - making</i>	404
<b>Igor Milić</b> <i>Civil protection management model at the local government level</i>	410
<b>Dragan Zlatković, Kostadinka Stojanović, Mirjana Tomić, Nebojša Denić</b> <i>Artificial Intelligence as support for quality 4.0: a review of current applications and future directions</i>	415
<b>Koviljka Banjević, Jovana Femić</b> <i>Adult education in Serbia and countries in the region</i>	421



<b>Dragana Gardašević, Dragana Rošulj, Mina Radišić, Koviljka Banjević</b> <i>Application of the Pareto analysis in quality control</i>	428
<b>Aleksandra Nastasić, Dragana Rošulj, Koviljka Banjević, Aleksandra Pavlović</b> <i>The influence of digital transformation on customer perception</i>	433
<b>Ana Maksimović</b> <i>The effectiveness of environmental social and governance due diligence in driving sustainable outcomes in the outdoor apparel industry</i>	439
<b>Aleksandra Pavlović, Aleksandra Nastasić, Andrea Ivanišević</b> <i>QMS and EMS implementation in Serbian organizations – a driving factor for sustainable development</i>	445
<b>Ana Maksimović</b> <i>Socially responsible chains: investigating the social implications of supply chain due diligence in corporate sustainability</i>	453
<b>Aleksandra Pavlović, Aleksandra Nastasić, Predrag Drobnjak, Ana Langović Milićević, Andrea Ivanišević, Ivana Katić</b> <i>PPP projects and economic growth in Serbia</i>	459
<b>Marija Marčetić, Danijela Misoloska, Bojan Kocić</b> <i>The threats and opportunities in modern forwarding business</i>	467
<b>Jelena Pavlović, Dragica Stanković</b> <i>Contemporary approach to leadership, management, knowledge and innovation</i>	472
<b>Marko Pavlović, Ana Petrović, Đorđe Pavlović</b> <i>Study on the attitudes of electronic banking users in Serbia</i>	477
<b>Jelena Pavlović, Dragica Stanković</b> <i>New technologies, labor market and human resources</i>	484
<b>Zorica Baroš</b> <i>The impact of the kelvin redefinition within the SI System on the improvement of temperature measurement technologies</i>	490
<b>Ana Đokić, Hana Stefanović</b> <i>Analysis and visualisation of COVID 19 data set in Python programming language</i>	496
<b>Sanja Pavlović, Dejan Crnoglavac, Aleksandar Starčević</b> <i>Examining the role of drones as educational tools: an practical teaching example in enhancing learning experiences in STEM education</i>	501
<b>Đorđe Dihovični, Dragan Kreculj, Nada Ratković Kovačević</b> <i>Experiences in teaching and mastering materials in WEB applications in vocational education</i>	507
<b>Marko Pavlović, Ana Petrović, Đorđe Pavlović</b> <i>E-learning: study on students' opinions</i>	513

## SCOPE 4. GRAPHIC ENGINEERING

<b>Aleksa Milovanović, Tomáš Babinský, Aleksandar Sedmak, Miloš Milošević</b> <i>Printing parameter impact on PLA material fracture toughness results</i>	520
<b>Bojan Banjanin, Neda Milić Keresteš, Jelena Kerac, Rastko Milošević, Savka Adamović</b> <i>Applications of real-time rendering game engine in education through practices and initiatives</i>	526
<b>Slađana Glišić, Predrag Živković, Aleksandra Janićijević</b> <i>Examination of the possibility of dyeing printing papers with plant extracts</i>	532

## SCOPE 5. DESIGN

<b>Jelena Ristić Trajković</b> <i>Society, Ecology and Design Education: Transformative Learning for Future Sustainable and Healthy Environments</i>	539
<b>Biljana Pejić, Bojana Škorc</b> <i>The effects of style on an aesthetic assessment of design</i>	545
<b>Biljana Pejić, Bojana Škorc</b> <i>Familiarity as aesthetic category in design</i>	551
<b>Dragica Nikodinović</b> <i>Analogous principle as an added value in graphic design in the post-industrial era</i>	557
<b>Dužanka Komnenić</b> <i>Design as a form of communication, deconstructive approach to design</i>	563
<b>Duško Trifunović, Anamarija Vartebedijan</b> <i>Graphic design by Miodrag Vartebedijan Varta, Vatra's graphic mark in Yugoslavian and world design</i>	567
<b>Emmanouil Tzimitzimis, Alexandros Papoutsis, Nikolaos Koumartzis, Konstantinos Tsongas, Dimitrios Tzetzis</b> <i>Utilizing parametric computer-aided design and modal analysis for the redesigning of Anglo-Saxon medieval lyres</i>	573
<b>Emmanouil Tzimitzimis, Dimitrios Sagris, Constantinos David, Dimitrios Tzetzis</b> <i>Evaluating the influence of infill pattern and density in fused filament fabrication 3D printing technology through multimedia data analysis business communication</i>	579
<b>Ivana Desnica</b> <i>Leather recycling in the context of Haute Couture</i>	585
<b>Jelena Jocić, Maida Gruden</b> <i>Design and education: traditional and online environment</i>	590
<b>Jelena Zdravković</b> <i>Design fashion and the industry: The context of the emergence of fashion and ready-to-wear clothing production</i>	596
<b>Katarina Nikolić, Danica Glodović, Aljoša Ninković</b> <i>Design, ideology and propaganda</i>	602
<b>Ljubomir Maširević</b> <i>The social significance of video games</i>	607
<b>Maja Milinić Bogdanović</b> <i>Interdisciplinaryness of sustainable design</i>	613
<b>Marija Mićanović, Tanja Radović</b> <i>Motivation for English language learning among the students of the design study programs at the Academy of Applied Technical Studies Belgrade</i>	619
<b>Natalija Gaković</b> <i>Does Frank Lloyd Wright's Fallingwater House represent a precursor to sustainable design?</i>	623
<b>Natalija Gaković</b> <i>Children without parental care in social protection institutions – Park of support design</i>	628
<b>Natalija Đukić</b> <i>Analysis of the spatial organization of a modern apartment in Belgrade, case study New Dorcol</i>	634



<b>Predrag Maksić</b> <i>Design to the measure of marketing</i>	639
<b>Sandra DePalo</b> <i>The experiance and percepton of the light colour in the spatial contex</i>	644
<b>Suzana Polić</b> <i>Techno - praxeological opinions about design: views from perspective of protection of cultural heritage</i>	650
<b>Suzana Polić</b> <i>Visuality, method and Laban's orthography: one parallel</i>	656
<b>Željko Zdravković</b> <i>Bioart and our creative biotechnological future</i>	662

## STUDENTS PAPERS

<b>Jelica Živković</b> <i>Use of gold color in interior design</i>	668
<b>Sara Todorović</b> <i>Use of coper color in interior design</i>	674

## SCOPE 6. TRAFFIC ENGINEERING

<b>Dejan Jovanov, Daniel Pavleski, Kosta Jovanov</b> <i>Road safety management capacity review – use of Tailor-made checklists</i>	680
<b>Željko Ranković, Nemanja Deretić, Aleksandra Obradović</b> <i>Consequences of traffic accidents in the Republic of Serbia in the period from 2013 to 2022 with proposed measures to reduce fatal consequences</i>	686
<b>Aleksandra Obradović, Dalibor Pešić, Željko Ranković</b> <i>Statistical analysis of traffic accidents on state roads in the work zone on the territory of the Republic of Serbia for the period from 2014 to 2021</i>	692
<b>Lazar Kocić, Aleksandra Obradović</b> <i>Analysis of safety of cyclists in traffic in the city of Smederevo from 2018 to 2022</i>	697
<b>Biljana Ranković Plazinić, Aleksandra Obradović</b> <i>The length of dilemma zone at signalized intersections</i>	702
<b>Kristina Milić</b> <i>Role of the rescue coordination centre in land in case of aircraft accidents</i>	708
<b>Dejan Kožović, Dragan Đurđević</b> <i>Trends of artificial intelligence in aviation: cyber security of ADS-B system</i>	713
<b>Saša Marković, Svetozar Sofijanić</b> <i>The importance of low-cost and differentiation strategies for the business of traffic companies</i>	719
<b>Svetlana Živanović</b> <i>Analysis of the competitiveness of logistics providers in the area of the Western Balkan countries</i>	725
<b>Svetlana Živanović, Gordana Radivojević, Milorad Kilibarda</b> <i>Selection of logistics provider in the field of e-commerce</i>	730
<b>Class “Tecnico Superiore della Logistica per la GDO” biennio 2022-24, ITS Logistica Puglia Bari, Michele Minenna, Nataša Gojković Bukvić</b> <i>Market research aimed towards the analysis of the possibility of launching an operational Start up in the field of LCL (Less Than Container Load) transport at the ports of Bari and/or Taranto (Italy)</i>	736

**Miloš Nikolić, Ivana Jovanović, Milica Šelmić** 742  
*A survey on the vehicle routing problem with occasional drivers and its variants*

**Marina Milovanović Arandelović** 748  
*Application of probability and stochastic analysis to traffic improvement*

## STUDENT PAPER

**Jelena Vajović, Marina Stevanović** 754  
*Improvement of traffic safety on the chosen intersection in the town of Pancevo*

## SCOPE 7. BIOTECHNOLOGY AND HEALTHCARE

**Tatjana Sekulić, Zlata Živković, Marija Perkunić** 761  
*Biological control as an evolving technology in pest management*

**Zlata Živković, Goran Nestorović, Milan Vasić, Darko Stojićević, Tatjana Sekulić, Markola Saulić** 767  
*Smart farming and long-term sustainability*

**Zlata Živković** 772  
*Varroa destructor, the parasitic mite of Apis mellifera: a review*

**Dorin Dumitru Camen, Mădălina Elena Dumitrașc, Maria Mihaela Moatăr** 777  
*Research on the photosynthesis rate in the species Salvia Officinalis in vitro and in vivo*

**Aleksandar Stevanović, Vera Popović, Milica Jevtić, Jelena Bošković** 783  
*Application of new technologies for adaptation to climate changes in agricultural production*

**Aleksandar Stevanović, Goran Nestorović, Vera Popović** 789  
*Information systems in organic agriculture - a review*

**Vladanka Stupar, Darko Stojićević, Aleksandar Stevanović** 795  
*Raising the vineyard - pruning and agrotechnical measures: a review*

**Markola Saulić, Darko Stojićević** 801  
*Crop modelling: a new tools for crop production*

**Darko Stojićević, Markola Saulić** 805  
*Basic concepts of ANN model and its application in agricultural research*

**Milica Blažić** 810  
*Applications of molecular markers in animal genetics and breeding: a review*

**Milica Blažić, Markola Saulić, Vladanka Stupar** 816  
*Precision agriculture technologies and methodologies used to crop yield prediction – a review*

**Vladanka Stupar, Darko Stojićević, Aleksandar Stevanović, Milan Vasić** 822  
*Implementation of robotic technologies on apple pruning: a review.*

**Milica Jevtic, Vladanka Stupar, Milica Blažić** 828  
*Precision agriculture in vegetable farming*

**Milica Jevtić, Goran Nestorović, Milan Vasić, Darko Stojićević** 833  
*The agricultural smart systems*

**Milan Vasić, Zlata Živković, Goran Nestorović, Darko Stojićević** 838  
*Drive units in robots for controlled pesticide application*

**Dubravka Mandušić, Lucija Blašković** 844  
*Deep learning in fruit detection*

<b>Dobriła Randelović, Svetlana Bogdanović, Ivana Zlatković, Dragana Stanisavljević</b> <i>Chemical properties and microbiological quality control of frozen plum fruit</i>	847
<b>Aleksandra Stojićević, Tatjana Marinković, Aleksandar Stevanović, Miloš Purić</b> <i>Application of medicinal herbs and spices as a food additive – challenges and limitations</i>	852
<b>Milica Sentić, Ivana Trajković, Ivana Deršek-Timotić, Slobodan Cvetković, Zoran Stojanović, Antonije Onjia</b> <i>Polycyclic aromatic hydrocarbons in medicinal herbs: analytical method development</i>	856
<b>Jana Klopcevska, Zoran Kavrakovski, Marija Srbinoska, Vesna Rafajlovska</b> <i>Nanoemulsions of pumpkin seed oil with turmeric extract</i>	861
<b>Jana Klopcevska, Zoran Kavrakovski, Marija Srbinoska, Vesna Rafajlovska</b> <i>Formulations of carboxymethyl cellulose-based emulgels with turmeric extract</i>	867
<b>Maja Nujkić, Žaklina Tasić, Sonja Stanković, Dragana Medić, Snežana Milić, Vladan Nedelkovski</b> <i>Potential application of mullein leaf as biosorbent for efficient biosorption of Cu(II) ions from synthetic solutions</i>	873
<b>Višnja Sikimić, Slavica Čabrilo, Nada Jelić</b> <i>Possibilities of production of a new functional product - mayonnaise with reduced fat content</i>	878
<b>Miloš Purić, Aleksandra Stojićević</b> <i>Utilization of apple pomace to obtain functional bakery and confectionery products</i>	884
<b>Slavica Čabrilo, Višnja Sikimić, Miloš Purić</b> <i>Alternative packaging in wine packaging technology</i>	889
<b>Jasmina Rajić, Tanja Petrović, Dragana Mihajlović</b> <i>Potential migration of phthalates from different polymers into food</i>	894
<b>Marko Jauković, Tatjana Marinković, Aleksandar Stevanović, Svetozar Sofijanić</b> <i>Food labelling – monitoring of allergen info in bakery retail stores</i>	900
<b>Veroslava Kocić, Dušica Ćirković, Dragana Stanisavljević, Dobriła Randelović, Milica Stojanović, Jelica Lazić Saković, Aleksandar Veličković</b> <i>The Influence of Raw Materials and the Production Process on the Quality of Rosé Wine</i>	904
<b>Danka Mitrović, Nikolina Živković, Jelena Pavlović, Marko Jauković</b> <i>Occurrence of ochratoxin a in wine in Serbia in 2022</i>	910
<b>Anja Vuksan, Jelena Pavlović, Marina Stamenović, Marko Jauković</b> <i>Aflatoxin M1 levels in milk in Serbia in 2022</i>	914
<b>Danijela Pecarski, Dubravka Marinović, Dragana Dragaš Milovanović, Svetlana Karić</b> <i>Adverse effects of pesticides on public health</i>	918
<b>Milica Lučić, Ivana Sredović Ignjatović, Steva Lević, Jelena Lukić, Antonije Onjia</b> <i>Exposure to potentially toxic elements due to consumption of Capsicum annuum in different parts of Serbia</i>	924
<b>Milica Ivanović, Gordana Stefanović, Aleksandra Janković, Sandra Stanković</b> <i>Identification of the optimal co-substrate for co-composting with grape pomace by using multiple criteria analysis</i>	930
<b>Dragan Marinkovic, Tatjana Marinkovic, Aleksandra Jelic</b> <i>Perspectives and challenges in cognitive enhancement based on the neurotechnology approach</i>	936
<b>Snežana Knežević, Tamara Gajić, Dragan Vukolić, Miloš Zrnić, Slavica Đorđević</b> <i>Prescribing wellness in primary care: integrating health and healthcare</i>	942
<b>Snežana Knežević, Tamara Gajić, Dragan Vukolić, Miloš Zrnić, Slavica Đorđević</b> <i>Lifestyle medicine: empowering health through behavior modifications</i>	948

<b>Aleksandra Vracaric, Zeljko Karganovic, Slavka Mitricevic, Ivanka Djuricic</b> <i>Complications of pertussis infection in neonate: a case report</i>	954
<b>Vuk Aleksić, Radmila Aleksić</b> <i>Sport related injuries in Brazilian jiu jitsu</i>	957

## SCOPE 8. MECHANICAL ENGINEERING

<b>Tamara Bajc</b> <i>Energy savings and CO<sub>2</sub> emission reduction potential through the existing building renovation</i>	964
<b>Marko S. Jarić</b> <i>Analysis of remediation of horizontal cylindrical tank for oil storage</i>	970
<b>Kuznetsov Yu. A., Kolomeichenko A.V., Logachev V. N., Kravchenko I. N., Kalashnikova L.V., Dobychin A.YYakovlev D.D., Gribakin A.A.</b> <i>Study of porosity and oil capacity of coatings formed by electric arc metallization method</i>	978
<b>Aggoune Mohammed-Salah, Bensedira Nouredine, Milles Abdessmad</b> <i>Effect of the voltage and the magnetic field variations on the velocity field in a MH pump – simulation and experimental analysis</i>	983
<b>Milan Milutinović, Goran Vasilić</b> <i>The effects of tool wear on cutting forces during the turning operation of workpiece with coatings</i>	989
<b>Đorđe Đurđević, Andrijana Đurđević, Nina Anđelić, Katarina Antić</b> <i>Dynamic calculation of friction stir welding tools using the finite element method</i>	997
<b>Dragana Velimirović, Milan Marković, Milan Velimirović</b> <i>Critical review on the safety barriers from the structural and deformation parameters aspects</i>	1002
<b>Elisaveta Doncheva, Aleksandra Krstevska, Marjan Djidrov, Filip Zdraveski, Trajche Velkovski</b> <i>Wire-arc additive manufacturing: recent developments and potential</i>	1010
<b>Andrijana Đurđević, Ljubiša Bučanović, Đorđe Djurdjević, Aleksandar Živković, Aleksandar Sedmak, Đorđe Dihovični</b> <i>Production of a lap joint using friction stir welding and microhardness measurement using the Leeb method</i>	1016
<b>Danijela Živojinović, Aleksandra Božović</b> <i>Comparative analysis of the manufacturing time of a part on a CNC lathe obtained by calculation and simulation of machining using the CAD/CAM software system</i>	1021
<b>Aleksandra Mitrović, Ivan Banjac</b> <i>Optimization of FGD process in TPP Kostolac 'B'</i>	1026
<b>Milan Marković, Dragana Velimirović, Andrijana Đurđević</b> <i>Mathematical model of car rotating during overtaking in a left roadway curve</i>	1032
<b>Misković Žarko, Zoran Stamenić, Jovana Antić, Radivoje Mitrović</b> <i>The latest standards of rolling bearing testing</i>	1039
<b>Murat Ispir, Ilker Goktepel, Muharrem H. Akso</b> <i>Solar-powered farming: evaluating the viability of PV water pumping in Turkish agriculture</i>	1045
<b>Bojan Ivljanin, Andrijana Đurđević, Đorđe Đurđević, Nada Ratković Kovačević</b> <i>The phenomena of rigid and reverse waterhammer and their influence on maintenance of hydropower plants with Kaplan turbines</i>	1052
<b>Miloš Mihailović, Miloš Božić, Tomislav Simonović, Aleksandra Božović</b> <i>The influence of insulation thickness on investment and operational costs in heating systems with a heat pump in Serbia</i>	1058

<b>Aleksandar Petkovic, Jovan Ilic, Ivan Bozic</b> <i>Headwater level governing at small hydropower plants with open channel conveying system</i>	1063
<b>Nenad Mitrovic, Zorana Golubovic, Aleksandra Mitrovic, Milan Travica, Isaak Trajkovic, Milos Milosevic, Aleksandar Petrovic</b> <i>Application of 2D digital image correlation method on three-point bending in material testing</i>	1068
<b>Dorđe Dihovični, Nada Ratković Kovačević, Andrijana Đurđević</b> <i>Application of smart production systems in vocational education</i>	1072
<b>Elisaveta Doncheva, Aleksandra Krstevska, Martin Petreski, Nikola Avramov, Jelena Djokikj</b> <i>A study on the environmental and health impact of hazardous substances during welding</i>	1078
<b>Stojko Biočanin, Milica Timotijević</b> <i>Analysis of research on optimization models and algorithms for planning preventive maintenance of machine systems</i>	1084
<b>Ana Maksimovic, Bojana Zečevic, Ljubica Milovic, Vujadin Aleksic</b> <i>Experimental investigation on the use of JIC for a HSLA Steel Welded Joint</i>	1092
<b>Dragan Šaler, Milan Grujić</b> <i>Landing optimization of a small sounding rocket</i>	1097
<b>Milanka Plavsic, Milenko Plavsic</b> <i>System scaling renormalization problems in bio-thermodynamics: I) Yeast cell colony size scaling, as an opportune model</i>	1103
<b>Aleksa Maljević, Milan Ignjatović</b> <i>Influence of laminate stacking and fiber volume fraction on natural frequencies of composite kevlar 49 aramid – 3501 – 6 epoxy plates</i>	1109
<b>Milivoje Filipović, Ivan Arandelović</b> <i>Fire resistance of boiler room the building structure</i>	1115
<b>Bojana Zečević, Ana Maksimović, Ljubica Milović, Vujadin Aleksić, Srdjan Bulatović</b> <i>Effects of temperature on fatigue crack growth rate of a low carbon microalloyed steel</i>	1121
<b>Goran Nestorović, Dragan Kreculj, Milan Vasić</b> <i>Large-scale three-dimensional printers in Industry 4.0</i>	1125
<b>Milan Travica, Nenad Mitrović, Aleksandar Petrović</b> <i>Strain behavior analysis of steel S235JRH ring specimens</i>	1131
<b>Nataša Trišović, Wei Li, Marko Gavrilović, Corneliu Banesa Birtok, Ognjen Ristić, Milica Milić, Radoslav Radulović, Zaga Trišović, Ana Virginia Socalici</b> <i>Effects of changing design parameters</i>	1135
<b>Stojko Biočanin, Milica Timotijević</b> <i>Selected achievements in the research of the diagnostics of the lack of combustion in the engine and changes in the instantaneous angular velocity of the crankshaft</i>	1142
<b>Neda M. Sokolović, Ivana Gavrilović-Grmuša, Nenad Šekularac</b> <i>Panel shear properties of carbon fiber reinforced LVL board</i>	1149
<b>Vule Reljić, Dragan Šešlija, Vladimir Jurošević, Valentina Mladenović</b> <i>The influence of refrigerated dryers on the compressed air quality</i>	1155
<b>Ivana Jevtić, Obrad Drakulović, Goran Mladenović, Miloš Milošević</b> <i>Types of bee drinkers</i>	1161
<b>Tamara Tešić, Milica Rančić, Danica Bajuk Bogdanović, Ivana Gavrilović Grmuša</b> <i>Effect of tannin on increasing UF adhesive performance</i>	1165

## SCOPE 9. ECOTOURISM AND RURAL DEVELOPMENT

<b>Radomir Stojanović</b> <i>Education as a pillar of sustainable agritourism in Serbia</i>	1172
<b>Jelena Premović</b> <i>Cultural heritage as a generator of sustainable development of tourism in local communities in the countries of the Western Balkans</i>	1177
<b>Vladimir Živanović, Nevena Majstorović</b> <i>Analysis of the real number of tourist overnights based on the estimation of water consumption in Zlatibor</i>	1182
<b>Radomir Stojanović, Branko Radeljić</b> <i>Safety and security standards and procedures of modern hotels</i>	1188
<b>Slobodanka Stankov, Branko Radeljić</b> <i>Guided tour as a type of animation in cultural tourism</i>	1194
<b>Miloš Spasojević, Marija Popović, Jasmina Đurašković</b> <i>Incentives for agriculture in the city of Belgrade</i>	1200
<b>Jelena Basarić, Andrijana Golac Čubrilo</b> <i>The role and significance of cultural-historical heritage in the development of cultural tourism – example of the Mileševa monastery</i>	1205
<b>Zlata Živković, Markola Saulić, Vladanka Stupar, Ben Mladenović, Dragan Šaler</b> <i>The potential for rural development in the Braničevo district through the tourist sights</i>	1212
<b>Marija Perić, Ben Mladenović</b> <i>Protection, development and management in a protected natural asset - analysis of the Petnička cave</i>	1218
<b>Marija Perkunić, Tatjana Sekulić, Markola Saulić, Vladanka Stupar</b> <i>The faunal diversity of memorial park Čačalica</i>	1224

## STUDENT PAPER

<b>Sara Ilanković</b> <i>Cultural heritage of Italy</i>	1230
<b>Sara Ilanković</b> <i>Italian cinematography</i>	1235

## SCOPE 10. MECHATRONICS

<b>Andrea Matta, Mohsen Jafari</b> <i>Towards a theory of digital twins: fundamental definitions</i>	1240
<b>Đorđe Dihovični</b> <i>An analysis of a process of decentralized control of a robot powered by a direct current motor</i>	1246
<b>Milan Vasić, Mirko Blagojević, Goran Nestorović</b> <i>Primary criteria for selecting gearboxes for axes of 6-axis industrial robots</i>	1250
<b>Dragan Kreculj, Đorđe Dihovični, Nada Ratković Kovačević, Siniša Minić, Sanja Jevtić</b> <i>MQTT protocol in the IoT</i>	1255



<b>Srđan Barzut</b> <i>The post-quantum cryptography and challenges in network security and Industry 4.0</i>	<b>1261</b>
<b>Nebojša Andrijević, Vladan Radivojević, Duško Radaković, Dragan Milovanović, Suad Suljović</b> <i>Conceptual model of a system for optimizing the temperature and humidity of honeybee hives using artificial intelligence</i>	<b>1266</b>
<b>Goran Nestorović, Vladimir Petrović, Nebojša Andrijević, Nenad Petrović, Suad Suljović</b> <i>The channel capacity of wireless communication system with L-branch SC combining in rayleigh short term fading and co-channel interference</i>	<b>1270</b>
<b>Dragan Milovanović, Srđan Đorđević, Đorđe Miladinović, Nenad Petrović, Radiša Stefanović, Suad Suljović</b> <i>The outage probability in system limited by Nakagami fading and co-channel interference for classification-based QoS estimation</i>	<b>1276</b>
<b>Dragoslav Perić, Slobodan Obradović, Mirjana Nešić, Dragana Đurić</b> <i>Computer devices and the Serbian language - interface and application</i>	<b>1282</b>



## EXPOSURE TO POTENTIALLY TOXIC ELEMENTS DUE TO CONSUMPTION OF CAPSICUM ANNUM IN DIFFERENT PARTS OF SERBIA

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**Abstract:** Potentially toxic elements (PTEs) are transferred to vegetables primarily through agricultural soil or irrigation water. PTEs in agricultural soil originate from pedogenic and anthropogenic sources. In most cases, soil contamination with these elements happens via river systems or air pollution. Furthermore, food is now imported from many regions and countries, where it is grown in various conditions and on various agricultural lands. Peppers (*Capsicum annuum*) are popular vegetables in Serbia and worldwide. They are consumed in numerous dishes as fresh fruits, spices, or ingredients. Peppers are reach source of carotenoids, vitamins, antioxidant compounds, and other nutritive compounds. This study aimed to estimate the human exposure to thirteen PTEs present in fresh, dried, and processed peppers obtained from the Serbian market. The exposure assessment was conducted for people in four regions of Serbia by calculating the target hazard quotient (THQ) and carcinogenic risk (CR). The comparison across areas was made due to significant disparities in pepper consumption between them.

**Keywords:** Heavy metal(loid)s, Cancer Risk, Hazard Quotient, Non-carcinogenic risk, Vegetables

### 1. INTRODUCTION

Peppers (*Capsicum annuum*) are one of the most widely cultivated vegetables in the world. Pepper fruits are consumed fresh and processed (as a condiment, spice, and ingredient in numerous dishes) [1]. These vegetables represent an excellent source of vitamins, phenolic compounds, carotenoids, and other antioxidant compounds [2]. Fruits differ in shape, color, and whether they are pungent or non-pungent [3]. Capsicum is also a very popular vegetable species in Serbia, which is the most cultivated vegetable after potatoes. Serbia has many traditional processed pepper foods such as stuffed peppers, pickled peppers, peppers in sour cream, ajvar, pinđur, ljutenica, trljenica and many others [4].

Vegetables as well as other plants can accumulate potentially toxic elements (PTEs) in different parts. Food contamination with PTEs occurs through soil, water, air, dust, and the application of fertilizers and pesticides [4,5]. PTEs in soil originate from lithogenic or anthropogenic sources [6,7]. Anthropogenic activities include urbanization and industrialization, particularly mining activities. Additionally, contamination of agricultural soils happens due to wastewater irrigation, which causes aggregation of PTEs in the crops [8]. Vegetables are one of the main routes for PTEs exposure in humans. Therefore contaminated vegetables could cause human health risks [9]. Consumption of vegetables contaminated with PTEs can cause serious problems, such as damage to the kidney and

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heart, nervous, cardiovascular, and gastrointestinal systems, development of cancers, and many other health issues [8,10]. Special concern has to be taken for toxic elements such as As, Pb and Cd which are classified as carcinogen of first category by the International Agency for Research on Cancer (IARC) [11]. The safety of vegetables is always a concern, so it is essential to monitor and evaluate human health risks arising from the accumulation of PTEs. Besides that, consumption of the same vegetables isn't the same in various regions. Therefore, exposure to PTEs for population from two regions can be different even if they eat the vegetables grown in the same agriculture field.

The aim of this study was to compare the health risk due to PTEs in pepper fruits between four regions in Serbia. The samples were purchased in local markets in Belgrade, and were imported from different countries in Europe.

## 2. MATERIALS AND METHODS

### 2.1 Samples and chemicals

The selected pepper fruits were obtained from local markets in Belgrade in February 2021. Selected samples (n=28) were fresh and processed pepper (pickle peppers, peppers in sour cream, stuffed pepper, and dried peppers). We assumed that peppers of the same or comparable origin are available on the markets in other parts of Serbia. Consumption of fresh and dried peppers in four regions in Serbia is given in Table 1. Nitric acid (65%), hydrogen peroxide and hydrochloric acid were supplied from Sigma Aldrich. Standard solutions were purchased from AccuStandard (New Haven, USA).

**Table 1.** Ingestion rates of peppers for adults and children in four regions of Serbia [12].

	Adults		Children	
	Dried	Raw or processed	Dried	Raw or processed
IR (g/day) Belgrade region	0.276	24.43	0.110	9.77
IR (g/day) The region Vojvodina	0.265	23.51	0.106	9.40
IR (g/day) The region of Šumadija and Western Serbia	0.443	39.23	0.177	15.70
IR (g/day) Region of Southern and Eastern Serbia	0.733	64.92	0.293	25.97

### 2.2 Sample preparation and analysis

The microwave digestion was carried out in PTFE containers, where 0.5 g of homogenized sample was mixed with 7 cm<sup>3</sup> 65% HNO<sub>3</sub> and 2 cm<sup>3</sup> 30% H<sub>2</sub>O<sub>2</sub>. A microwave oven system model CEM Mars 6 (Matthews, USA) was used to digest pepper samples.

The obtained supernatants were used for analysis of thirteen PTEs: As, Pb, Cd, Hg, Fe, Zn, Cu, Mn, Co, Cr, Li, Ni, and Al. The concentrations of elements were determined by ICP MS (iCAP Q, Thermo Scientific, UK). Good linearity was assumed since the correlation coefficients (R<sup>2</sup>) were greater than 0.999. The detection limits ranged from 0.19 µg/kg to 12.5 µg/kg. The recovery ranged from 82.2% to 151%. Relative standard deviation (RSD) percentages vary from 5.12% to 42%. The value 42% represent RSD obtained for Hg (concentration level of 1 ppb). The accuracy of the results of the analysis was acceptable.

### 2.3 Health risk assessment

Health risks of PTEs ingested via food consumption can be estimated by calculating non-carcinogenic (NCR) and carcinogenic risk (CR). Those risks are calculated using the formulas introduced by the USEPA [13]. The NCR is determined by calculating target hazard quotient (THQ) (Eq. 1):

$$THQ = \frac{C \times IR \times EEr \times ED \times 10^{-3}}{AT \times BW \times RfD} \quad (1)$$

THQ is the ratio of chronic daily intake and oral reference dose (RfD) of pollutants. When  $THQ > 1$  risk is unacceptable and can cause adverse health effects. Table 2 shows parameters that were used for calculation of THQ. Data for ingestion rates for adults and children were calculated based on to the Household budget survey data in Serbia for 2019 [12]. Ingestion rate for children was assumed to be 40% of ingestion for adults. RfD for Hg, As, Cd, Cr (VI), Mn, Ni, Zn, Cu, Fe, Al, Co, Mo and Pb were 0.0001, 0.0003, 0.001, 0.003, 0.14, 0.02, 0.3, 0.04, 0.7, 1, 0.0003, 0.005 and 0.0035 mg/kg-day [14,15].

The CR is calculated using Eq. 2:

$$CR = \frac{C \times IR \times EEr \times ED \times 10^{-3} \times CSF}{AT \times BW} \quad (2)$$

Input parameters for calculation of CR are given in Table 2. Carcinogenic slope factors (CSF) for Cr, As, Pb, Cd and Ni were 0.5, 1.5, 0.0085, 0.38 and 1.7 mg/kg/day, respectively [1,15,16].

**Table 2.** Input parameters for calculation of THQ

Exposure parameter	Symbol	Unit	Value
mean concentration of element	C	mg/kg	-
daily ingestion rate	IR	g/day	0.411 of dried pepper for adults 36.39 of raw pepper for adults 0.164 of dried pepper for children 14.56 of raw pepper for children
exposure frequency	EEr	day/year	350
exposure duration	ED	years	20 for adults 6 for children
averaging time for non-carcinogenic	AT	days	365×20 for adults 365×6 for children
averaging time for carcinogenic	AT	days	25550
average body weight	BW	kg	70 for adults 15 for children

Total target hazard quotient (TTHQ) and incremental lifetime cancer risk (ILCR) were used to estimate non-carcinogenic and carcinogenic risk when the health risk of more than one PTE is considered. Those two cumulative risks are calculated as the sum of THQ, i.e. as the sum of the CR for individual elements (Eq. 3 and Eq. 4).

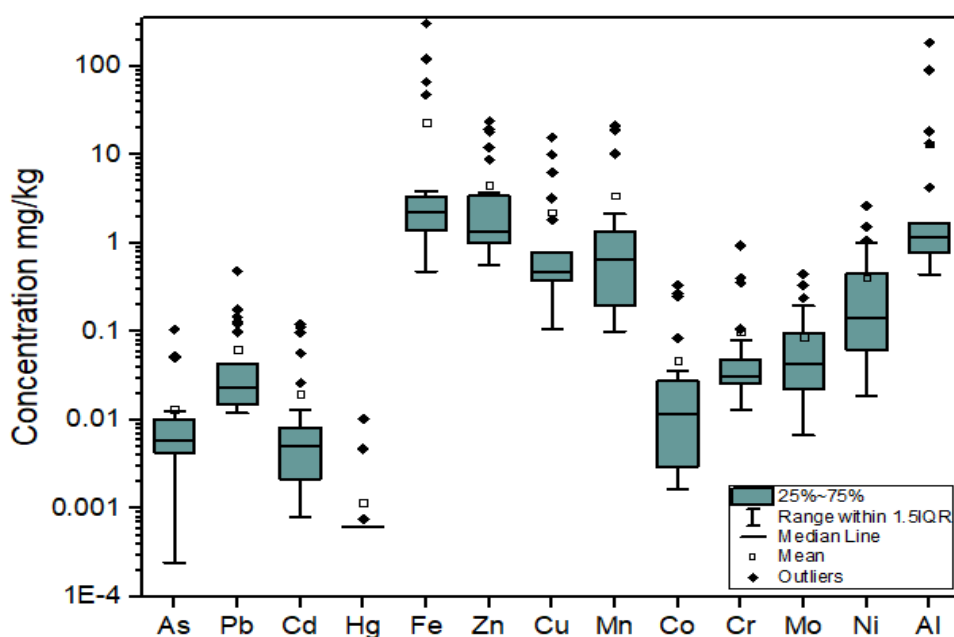
$$TTHQ = THQi + THQii \dots + THQn \quad (3)$$

$$ILCR = CRi + CRii \dots + CRn \quad (4)$$

### 3. RESULTS AND DISCUSSION

#### 3.1 Descriptive statistics

The summary of PTEs concentrations in pepper samples is presented in Figure 1 using box-plots. This figure shows two groups of elements, the right that consists of elements with higher concentrations - mg/kg fresh weight (Fe, followed by Al, Zn, Mn, Cu, Ni, Cr, and Mo) and the left that represents elements found in lower concentrations - µg/kg fresh weight (Pb, Co, As, Cd and Hg). Mercury is the only element that wasn't detected in all samples (10 out of 28).



**Figure 1.** Boxplot of concentration of elements in pepper samples. Lognormal scale was used for element concentrations.

Dried pepper had higher concentrations of all analyzed elements due to lower water content. Generally, dried samples had higher Fe and Al content compared to fresh even when results are expressed on dried mass. For dried peppers concentrations of analyzed element were in following ranges: Fe from 48.0 to 306 mg/kg, Al from 13.4 to 184 mg/kg, Zn from 12.2 to 23.8 mg/kg, Mn from 10.3 to 21.4 mg/kg, Cu from 6.37 to 15.8 mg/kg, Ni from 0.447 to 2.73 mg/kg, Cr from 0.108 to 0.937 mg/kg, Mo from 0.188 to 0.449 mg/kg, Pb from 0.114 to 0.484 mg/kg, Co from 0.085 to 0.340 mg/kg, As from 0.013 to 0.106 mg/kg, Cd from 0.019 to 0.134 mg/kg and Hg from not detected to 0.011 mg/kg.

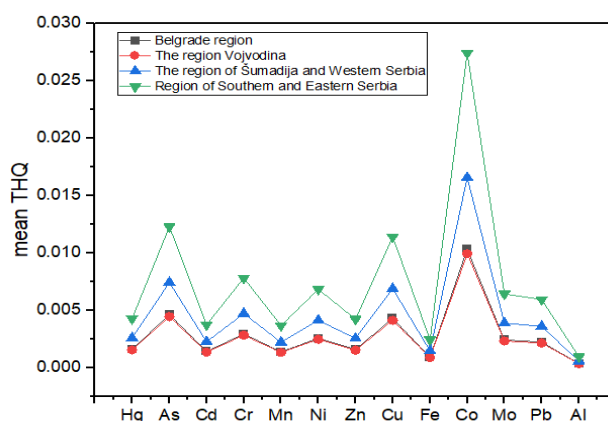
For fresh and processed peppers concentrations of analyzed element were in following ranges: Fe from 479 to 3880  $\mu\text{g/kg}$  fresh weight, Al from 738 to 2636  $\mu\text{g/kg}$  fresh weight, Zn from 559 to 8893  $\mu\text{g/kg}$  fresh weight, Mn from 101 to 2146  $\mu\text{g/kg}$  fresh weight, Cu from 108 to 3228  $\mu\text{g/kg}$  fresh weight, Ni from 18.6 to 1011  $\mu\text{g/kg}$  fresh weight, Cr from 13.1 to 79.6  $\mu\text{g/kg}$  fresh weight, Mo from 6.69 to 196  $\mu\text{g/kg}$  fresh weight, Pb from 11.9 to 125  $\mu\text{g/kg}$  fresh weight, Co from 1.64 to 36.0  $\mu\text{g/kg}$  fresh weight, As from 0.245 to 11.32  $\mu\text{g/kg}$  fresh weight, Cd from 0.816 to 26.1  $\mu\text{g/kg}$  fresh weight, and Hg from 0.62 to 0.759  $\mu\text{g/kg}$  fresh weight.

## 3.2 Health risk assessment

### 3.2.1. Non-carcinogenic risk

The non-carcinogenic risk indicated that consumption of peppers and pepper products does not pose a risk to human health when considering four regions in Serbia (1 - Belgrade region, 2 - The region Vojvodina, 3 - The region of Šumadija and Western Serbia and 4 - Region of Southern and Eastern Serbia). THQ values for all elements were lower than 1, therefore it can be concluded that peppers and pepper products are safe for consumption.

Contribution of analysed PTEs to non-carcinogenic risk, based on average pepper consumption in four regions in Serbia is shown in Figure 2. The highest mean value of non-carcinogenic risk (THQ value) was found for Co, while the lowest mean value was found for Al. People from the region of Southern and Eastern Serbia are at the highest risk of non-carcinogenic risk due to highest consumption of peppers compared to other three regions.

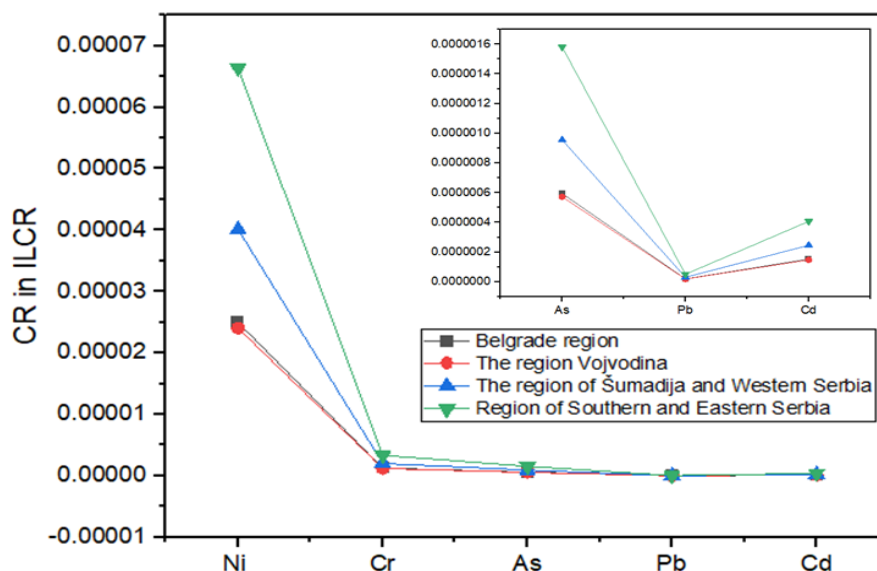


**Figure 2.** Contribution of analysed PTEs to non-carcinogenic risk due to pepper consumption in four regions in Serbia

Total target hazard quotient (TTHQ) that combine effect of all toxic elements showed that all samples had  $TTHQ < 1$  and were safe for consumption both for adults and children. Comparing results between regions, it was found that Southern and Eastern Serbia's people are at the highest risk.

### 3.2.2. Carcinogenic risk

The evaluation of carcinogenic risk indicated that consumption of peppers and pepper products do not pose a risk to children and adults when considering individual elements in one sample. However, consumption of some peppers does pose a risk when all five potentially carcinogenic elements are observed at the same time (As, Pb, Cd, Cr and Ni). Incremental life time cancer risk (ILCR) that combine effect of five toxic elements showed that same samples had ILCR value higher than  $1 \times 10^{-4}$ . For adults in Belgrade region and region of Vojvodina,  $ILCR > 1 \times 10^{-4}$  was found for one sample of yellow bell pepper. For adults in region of Šumadija and Western Serbia,  $ILCR > 1 \times 10^{-4}$  was found for three samples (one yellow bell pepper, and two green peppers), while for children ILCR higher than  $1 \times 10^{-4}$  was in one yellow bell pepper. As in the case of non-carcinogenic risk, the greatest carcinogenic risk exists for residents of Southern and Eastern Serbia where for adults  $ILCR > 1 \times 10^{-4}$  was found in six samples (one yellow bell pepper, one red pepper and four green peppers). For children ILCR higher than  $1 \times 10^{-4}$  was in three samples (one yellow bell pepper, and two green peppers).



**Figure 3.** Contribution of analysed PTEs to carcinogenic risk due to pepper consumption in four regions in Serbia.

## 4. CONCLUSION

This study revealed that concentrations of potentially toxic elements (PTEs) varied significantly in peppers and pepper products. Estimation of non-carcinogenic risk indicated that peppers are safe for consumption by adults and children. On the other hand, the carcinogenic risk assessment showed that some samples of fresh peppers may pose a risk to adults and children due to the incremental lifetime risk (ILCR) values higher than  $1 \times 10^{-4}$ . People from the Southern and Eastern Serbia region are most at risk since in this region people consume greater quantities of these vegetables. In both cases (non-carcinogenic and carcinogenic risk) children are at the lowest risk because children consume smaller quantities of peppers than adults according to their body weight.

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## LITERATURE

- [1] Lučić, M.; Miletić, A.; Savić, A.; Lević, S.; Sredović Ignjatović, I.; Onjia, A. Dietary Intake and Health Risk Assessment of Essential and Toxic Elements in Pepper (*Capsicum Annuum*). *Journal of Food Composition and Analysis*, Vol 111 (2022), pp. 104598. doi:10.1016/j.jfca.2022.104598.
- [2] Lučić, M.; Potkonjak, N.; Sredović Ignjatović, I.; Lević, S.; Dajić-Stevanović, Z.; Kolašinac, S.; Belović, M.; Torbica, A.; Zlatanović, I.; Pavlović, V.; Onjia, A. Influence of Ultrasonic and Chemical Pretreatments on Quality Attributes of Dried Pepper (*Capsicum Annuum*), *Foods*, Vol 12 (2023), pp. 2468. doi:https://doi.org/10.3390/foods12132468.
- [3] Tripodi, P.; Kumar, S. The Capsicum Crop: An Introduction. In *The Capsicum Genome. Compendium of Plant Genomes.*; Ramchiary, N., Kole, C., Ed.; Springer, ISBN 9783319972176, Cham (2019).
- [4] Danojević, D.; Glogovac, S.; Moravčević, Đ.; Medić-Pap, S. Preferences of Serbian Consumers towards Different Pepper Fruits. *Food and Feed Research*, Vol 48 (2021), pp. 155–163. doi:10.5937/ffr48-34434.
- [5] Radulović, J.; Lučić, M.; Nešić, A.; Onjia, A. Multivariate Assessment and Risk Ranking of Pesticide. *Foods*, Vol 12 (2023), pp. 2454. doi:https://doi.org/10.3390/foods12132454.
- [6] Miletić, A.; Lučić, M.; Onjia, A. Exposure Factors in Health Risk Assessment of Heavy Metal(Loid)s in Soil and Sediment. *Metals*, Vol 13 (2023), pp. 1266. doi: 103390/met13071266.
- [7] Miletić, A.; Radomirović, M.; Đorđević, A.; Bogosavljević, J.; Lučić, M.; Onjia, A. Geospatial Mapping of Ecological Risk From Potentially Toxic Elements in Soil in the Pannonian-Carpathian Border Area South of the Danube. *Carpathian Journal of Earth and Environmental Sciences*, Vol 17 (2022), pp. 351–363, doi:10.26471/cjees/2022/017/227.
- [8] Atamaleki, A.; Yazdanbakhsh, A.; Fakhri, Y.; Mahdipour, F.; Khodakarim, S.; Mousavi, A. The Concentration of Potentially Toxic Elements (PTEs) in the Onion and Tomato Irrigated by Wastewater : A Systematic Review ; Meta-Analysis and Health Risk Assessment. *Food Research International*, Vol 125 (2019), pp. 108518. doi:10.1016/j.foodres.2019.108518.
- [9] Rahman, M.; Islam, M.A. Concentrations and Health Risk Assessment of Trace Elements in Cereals, Fruits, and Vegetables of Bangladesh. *Biological Trace Element Research*, Vol 191 (2019), pp. 243–253. doi:10.1007/s12011-018-1596-3.
- [10] Heshmati, A.; Mehri, F.; Karami-Momtaz, J.; Khaneghah, A.M. Concentration and Risk Assessment of Potentially Toxic Elements, Lead and Cadmium, in Vegetables and Cereals Consumed in Western Iran. *Journal of Food Protection*, Vol 83 (2020), pp. 101–107. doi:10.4315/0362-028X.JFP-19-312.
- [11] IARC (International Agency for Research of Cancer) Agents Classified by the IARC Monographs. [Internet] Available on: <https://monographs.iarc.who.int/list-of-classifications> (Accessed: 10.07.2023.).
- [12] Statistical Office of the Republic of Serbia Household Budget Survey, 2021. [Internet] Available on: <https://urlis.net/ugkizcih> (Accessed: 10.07.2023.).
- [13] USEPA Human Health Risk Assessment Available online: <https://urlis.net/yxp0fwif> (Accessed: 23.08.2023.).
- [14] Li, X.; Li, Z.; Lin, C.J.; Bi, X.; Liu, J.; Feng, X.; Zhang, H.; Chen, J.; Wu, T. Health Risks of Heavy Metal Exposure through Vegetable Consumption near a Large-Scale Pb/Zn Smelter in Central China. *Ecotoxicology and Environmental Safety*, Vol 161 (2018), pp. 99–110. doi:10.1016/j.ecoenv.2018.05.080.
- [15] USEPA Regional Screening Levels (RSLs) - Generic Tables | US EPA. [Internet] Available on: <https://urlis.net/60jajfvi> (Accessed: 20.08.2022.).
- [16] Lučić, M.; Momčilović, M.; Marković, J.; Jović, M.; Smičiklas, I.; Onjia, A. Monte Carlo Simulation of Health Risk from Cadmium, Lead, and Nickel in Cigarettes. *Toxicological & Environmental Chemistry*, (2023), pp. 1–19. doi:10.1080/02772248.2023.2177291.

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