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THE BOOK OF ABSTRACTS

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BOOK OF ABSTRACTS

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NOTE:

The authors have full responsibility for the originality and content of their own papers.

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SADRŽAJ

PLENARY LECTURERS
PLENARNA PREDAVANJA

EUROPEAN UNION GREEN DEAL

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ABSTRACT

In this century, when we are faced with the climate crisis, states and individuals are taking various measures. The European Green Deal stands out as the most comprehensive of the regulations in this context. Addressing the European Green Deal only in terms of environmental pollution and climate change and not taking into account the economic transformation that this deal will bring carries a great risk for countries. In particular, if Turkey, which makes the majority of its exports to Europe, cannot achieve this economic transformation in the short term, deterioration in the current foreign trade balance is inevitable.

If companies delay this transformation, they will face a carbon tax of approximately 85 Euros per metric ton, with sectoral differences (EMBER: Carbon Price Viewer, 2023). This tax will threaten the profit margins of many sectors and trigger a process that could result in the bankruptcy of businesses. In this context, special country targets have been determined for Turkey, with Turkey becoming a party to the Paris Climate Agreement in 2021. When the historical process is examined, the liberalization process has accelerated as the period when foreign trade was regulated by customs duties or quotas is over. Trade freedom has been encouraged with the guidance of the World Trade Organization. In today's world economy, measures regarding the restriction of foreign trade will be shaped through environmentally friendly production. In this context, the Green Deal harmonization process must be completed as soon as possible so that our country's exports do not get stuck in these restrictions. For this reason, it is essential that companies operating in our country do not remain indifferent to this adaptation process.

The Emissions Trading System, which should be established within the framework of the Green Agreement, is very important. The most important feature of this system is that companies that cause pollution above the specified limits can purchase quotas from companies that do not exceed the specified limits. In this way, companies that complete their transformation will have access to an additional source to finance their transformation, while companies that cause pollution above the limits will purchase quotas from other companies in the country instead of paying carbon tax to the country they export to. Many countries have started to establish their own Emissions Trading Systems in this sense. One of the most important conditions for the establishment of this system is the existing carbon footprint information of the companies that register. Thanks to ETS, companies that produce environmentally friendly products in particular will be encouraged to use this advantage in the marketing of their products. The Green Product market is developing every day in our country and in the world, and is becoming indispensable for consumers with high awareness. In this book, while examining the historical process of the Green Deal, its environmental and economic impacts, Turkey's Green Deal Roadmap is presented with a comprehensive analysis.

Keywords: The European Green Deal, Carbon Price, The Emissions Trading System, Foreign Trade.

NON-INVASIVE OPTICAL SPECTROSCOPY IN PLANT STRESS RESEARCH: CIRCADIAN RHYTHM AS A DIAGNOSTIC MARKER

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ABSTRACT

In the context of environmental changes and the increasing demand for sustainable agricultural practices, real-time monitoring of plant health is increasingly important. This work provides an overview of the development and application of non-invasive optical spectroscopy for early detection of stress across a wide range of plant species. The approach combines high-resolution time tracking of leaf transmission with circadian rhythm analysis, allowing the identification of subtle physiological changes that precede visible stress symptoms.

This work presents results from several experimental studies, including hydroponically grown herbs, forest species, aquatic plants, ornamentals, and agricultural crops. The methodology enables early detection of stress caused by nutritional deficiencies, pathogenic infections, and sudden changes in light intensity. Integration of the 640 nm and 665 nm spectrum bands significantly improved system sensitivity, allowing precise characterisation of metabolic responses. These advances are supported by comprehensive metrological validation, which ensures the repeatability and robustness of the data under experimental conditions.

The lecture highlights circadian rhythm not only as a fundamental biological process, but also as a new diagnostic marker of the physiological state of the

plant. Through a variety of case studies and practical applications, we demonstrate how this optical platform contributes to improving understanding the response of plants to stress and offers new perspectives in plant science, forest monitoring, and precision agriculture.

Keywords: Non-invasive spectroscopy, Circadian rhythm, Plant stress detection, Real-time plant monitoring, Leaf transmittance.

ECOLOGY, ENERGY EFFICIENCY
EKOLOGIJA, ENERGETSKA EFIKASNOST

THE IMPACT OF HALAL CERTIFICATION ON ENVIRONMENTAL STANDARDS IN THE SERBIAN MEAT INDUSTRY

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ABSTRACT

This paper explores the impact of Halal certification on environmental standards in the Serbian meat industry, with particular emphasis on sustainable resource use and the reduction of the environmental footprint in meat production. Although Halal certification is primarily a religious regulatory framework, it encompasses specific requirements related to animal welfare, strict hygiene practices, and meat handling procedures - all of which can contribute to enhancing environmental standards in the meat industry. The aim of this research is to analyze the environmental aspects associated with Halal certification and assess its influence on the sustainability of meat production in Serbia. The methodology includes an analysis of relevant literature focusing on the ecological dimensions of Halal production, as well as an examination of the practices employed by domestic meat producers who hold Halal certificates. Special attention is given to the environmental protection measures these producers implement and the challenges they face in adopting sustainable practices. The paper also discusses opportunities for improving existing ecological practices by further aligning Halal standards with sustainable production principles. In this way, Halal certification can contribute not only to meeting the religious requirements of consumers but also to reducing the environmental impact of the meat industry.

Keywords: Halal certification, environmental standards, sustainable production, meat industry, environment.

THE ROLE OF ECOLOGICAL FACTORS IN FREE-RANGE ANIMAL FARMING: IMPLICATIONS FOR FEASIBILITY AND ANIMAL WELFARE

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ABSTRACT

Ecological conditions play a crucial role in the success and sustainability of free-range animal farming. Factors such as climate, vegetation, water availability, and terrain directly influence not only the feasibility of managing animals in open or semi-open systems but also the quality of their welfare. In restrictive environments like cages or small enclosures, animal welfare is often compromised due to lack of space, limited stimulation, and inability to express natural behaviors. Although such systems allow for easier management and safety, they rarely meet the animals' biological needs. In contrast, free-range and semi-free systems offer animals access to more natural habitats, promoting physical health, mental stimulation, and natural behaviors such as grazing, roaming, and social interaction. However, these systems require careful ecological planning, as poor environmental conditions can lead to health issues, resource scarcity, and increased human–animal conflict. Ensuring animal welfare in free-range farming depends on aligning management practices with environmental conditions and species-specific needs. Proper oversight, sufficient resources, and ecological compatibility are essential to create systems that are both ethically responsible and practically viable. Ultimately, ecological factors are foundational to designing humane, functional, and sustainable free-range animal farming systems.

Keywords: ecological conditions, free-range animal farming, animal welfare, feasibility, natural behaviors.

REDUCING GHG EMISSIONS THROUGH IMPROVED WASTE MANAGEMENT: CASE STUDY OF THE CITY OF PRNJAVOR

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ABSTRACT

Waste management is becoming an increasingly important factor in the context of climate change, particularly due to methane emissions from landfills, which have a significantly stronger warming effect than carbon dioxide. The City of Prnjavor, facing challenges related to the growth of municipal waste and limited infrastructure, represents a representative example of a local community in transition toward a more sustainable waste management system. The aim of this research is to assess greenhouse gas (GHG) emissions from the waste sector and identify optimal strategies for their reduction.

The methodology is based on the IPCC Tier 1 approach for GHG emission estimation, applied to three waste management scenarios: full landfilling, partial recycling, and a combination of recycling and composting. The analysis includes emissions from waste collection, transport, and final treatment, as well as avoided emissions resulting from the processing of recyclable and biodegradable fractions.

Results show that the scenario combining recycling and composting can reduce total GHG emissions by 37% compared to the baseline scenario.

The conclusions suggest that transitioning to selective waste collection and treatment, along with strengthening institutional capacities, has the potential to enable efficient emission reductions and improve the waste management system, without the need for major infrastructure investments.

Keywords: GHG emissions, waste management, IPCC.

AIR POLLUTION FROM CRUISE SHIPS IN BOKA BAY: ENVIRONMENTAL AND PUBLIC HEALTH IMPACTS IN THE PORT OF KOTOR

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ABSTRACT

The continuous growth in the number, size, and engine power of passenger vessels—especially cruise ships—has led to a substantial increase in air pollution, including greenhouse gas (GHG) emissions and harmful substances such as nitrogen oxides (NOx), sulfur oxides (SOx), carbon dioxide (CO_2), and particulate matter (PM). Current international regulations, such as MARPOL Annex VI, are becoming increasingly inadequate in mitigating these effects in environmentally sensitive regions. This issue is particularly pronounced in geographically constrained areas like Boka Bay, where limited air circulation intensifies the accumulation of harmful emissions.

The Port of Kotor in Montenegro is one such location, facing growing pressure from cruise traffic and its environmental consequences. In response, the Maritime Faculty of Kotor has installed monitoring stations at multiple sites to measure pollutant levels and assess their impact. These efforts aim to provide empirical data for informed decision-making and policy development. On a global scale, mitigation strategies include the use of low-sulfur fuels, exhaust gas cleaning systems (scrubbers), and the designation of Sulphur Emission Control Areas (SECA) and Emission Control Areas (ECA). Notably, as of May 1, 2025, the entire Mediterranean Sea will be designated as a SECA zone, requiring all ships operating in the region to use fuel with a sulfur content not exceeding

0.10%. This regulatory change will have a direct impact on ships entering Boka Bay and the Port of Kotor, potentially contributing to a significant reduction in SOx emissions and overall improvement in air quality.

Given that some cruise ships operating in the region are over 30 years old and often lack modern emission-reduction technologies, it is essential to conduct detailed emission calculations for all ships entering or departing Montenegrin territorial waters. This should be followed by comprehensive analyses of their environmental impact, especially in enclosed and ecologically sensitive areas like Boka Bay.This study emphasizes the urgent need for coordinated action to balance the economic importance of cruise tourism with environmental protection. Ongoing collaboration between academic institutions, port authorities, and regulatory bodies is essential to developing sustainable solutions for managing ship emissions in Kotor and similar coastal areas.

Keywords: Cruise ships, air pollution, Boka Bay, ship exhaust gases, environmental impact and sustainable tourism.

TREATMENT OF MUNICIPAL AND MEDICAL WASTE WITH PLASMA TECHNOLOGY

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ABSTRACT

This paper describes a system that solves landfill problems. The presented system is based on a new technology for waste treatment based on plasma technology. This is the only system that recycles 100% of municipal waste, whereby the metals remain metals, the inorganic part is turned into construction material, and the organic part into combustible gas that is later used to generate electricity.

Waste, defined in Article 3 paragraph 1 of Directive 2008/98/EC as "any scrap or object that the owner discards or intends or must discard", potentially represents a large waste of resources in the form of materials and energy. In addition, waste removal and disposal can have a serious impact on the environment. For example, landfills take up space and can cause air, water and land pollution, while burning can lead to the release of polluted things into the air.

After 15 years with depreciation costs, you can buy a new system without taking out a loan. It should be emphasized that the profitability calculation did not take into account the profit that would be realized from the sale of the inorganic part such as construction material, metals and unrealized income from hot water. The most important profit, greater than the economic one, is the protection of the environment by eliminating landfills and their overcrowding.

Keywords: Waste treatment, environmental protection, Plasma technology, economic profitability.

ECONOMY AND MANAGEMENT
EKONOMIJA I MENADŽMENT

REVENUE VULNERABILITY TO ECONOMIC DEVELOPMENT: RETHINKING TAX POLICY IN BOSNIA AND HERZEGOVINA

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ABSTRACT

This study examines tax revenue elasticity in Bosnia and Herzegovina from 2006 to 2023 to evaluate the responsiveness of tax collections to economic development measured by GDP per capita. The results show an average elasticity of 1.2, suggesting that tax revenues generally grow slightly faster than the economy. However, performance varied significantly—revenues contracted more than five times faster than GDP per capita during crises (2009, 2020) and at times declined even during periods of economic growth (2007–2008). Only during stable periods (post-2015) did revenues move proportionally with GDP per capita. These findings highlight structural weaknesses in tax system design, particularly oversensitivity to downturns and inconsistent revenue capture during expansions. To strengthen Bosnia and Herzegovina's tax system, the study proposes expanding the tax base, implementing automatic stabilizers such as progressive tax adjustments, and enhancing compliance measures to achieve stable revenue growth. Such targeted interventions could mitigate revenue volatility and promote predictable growth alignment, offering a policy model for emerging markets seeking to build resilient tax systems.

Keywords: tax revenue, economic development, elasticity, Bosnia and Herzegovina.

THE USE OF ARTIFICIAL INTELLIGENCE IN THE RECRUITMENT PROCESS

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ABSTRACT

Redesigning artificial intelligence algorithms to support an efficient, balanced, and objective hiring process is becoming a critical step in achieving and maintaining a competitive advantage in the labor market. This paper aims to highlight the importance of stored data and information generated by individuals, whose neutrality and objectivity cannot always be determined, and which, as such, influence AI algorithms. In this context, the potential ethical and discriminatory implications of using AI in attracting and selecting qualified candidates are examined. The paper underscores the relevance of implementing artificial intelligence in human resource management by promoting fairness, inclusivity, and employee well-being while minimizing potential legal and ethical risks. Its contribution lies in advocating for AI adoption across all stages of the hiring process, while also encouraging both employers and job seekers to maximize AI's potential to achieve their respective goals. To reinforce ethical standards and principles, the paper addresses the issue of assigning responsibility and certifying practitioners, thereby fostering long-term sustainability and broader societal well-being. Theoretical and practical significance is reflected in the paper's conceptualization as a stable foundation for future scientific and research advancements on the impact and application of artificial intelligence in employment processes.

Keywords: Human Resiurces, Recruitment Process, Artificial Intelligence, Ethics.

CREDIT AVAILABILITY AND INCLUSIVE GROWTH IN NIGERIA

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ABSTRACT

The broad objective of the study is to examine credit availability and inclusive growth in Nigeria from 1990 to 2022. To achieve this objective, the study gathered relevant data on total private sector credit (CPS), agriculture credit (AGR_CPS) - the ratio of CPS to bank loans to agriculture, prime lending rates (INT) - a proxy for interest rate, credit to the manufacturing sector (MAN_CPS) - the ratio of CPS to bank loan to manufacturing, and per capita income (a proxy for inclusive growth). The ARDL approach was adopted to analyze the specified econometric model. The findings revealed a long-run relationship between all the variables. Specifically, total private sector credit is significant and negative in the long run. Moreover, the impact of agriculture credit is positively significant in both the short and long run, whereas, manufacturing sector credit is positively significant only in the long run. The study concluded that the current commitment of the monetary authority in upscaling value chain activities in agriculture is commendable. Also, interest rates and the pattern of allocation and access to bank credit for the private sector should be monitored to ensure that it is equitable.

Keywords: Credit availability, Inclusive growth, ARDL, Financial intermediaries, Private sector credit.

ELECTRONIC MANAGEMENT OF THE PUBLIC ADMINISTRATION, A PROCESS THAT INFLUENCES ITS EFFECTIVENCESS AND RESPONSIBILITY

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ABSTRACT

Electronic governance of the administration affects the increase of the effectiveness, efficiency, responsibility and motivation of the administration. Hence, the subject of the research is to consider all issues related to the electronic governance system, as well as to analyze the state of the field of electronic governance in the Republic of North Macedonia. The methodology of the work is based on the use of a quantitative method, interviews with administrative officials in 30 state bodies at the central and local levels. In addition, a content analysis of all legal, regulatory acts, research results and other documents relevant to the research was made. The questionnaire contains three groups of questions: the first group of questions refers to the regulatory framework and its applicability, the second group of questions refers to the financial, technical and personnel capacities necessary for the implementation of the electronic governance system, the third category of questions refers to the implementation and acceptance of the electronic governance system by all relevant factors. The results indicate partiality in the establishment of electronic governance systems, lack of financial resources and professional capacities for the establishment and applicability of such systems, as well as resistance to changes at all levels of governance. The final conclusion is the necessity to establish a unified public sector management software in all state bodies that will cover all segments of efficient administration management at the central and local levels.

Keywords: efficiency, electronic governance, state and local bodies, administration.

MODELS FOR ESTIMATING PRODUCTION PHASE DURATION AS A FOUNDATION FOR EFFICIENT PRODUCTION MANAGEMENT

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ABSTRACT

In modern manufacturing systems, accurately defining and managing the duration of individual production phases is crucial for achieving high efficiency and reliable delivery timelines. This paper presents two methodologically grounded models for estimating the duration of the production phase: one based on the technological (ideal) cycle, and the other on the projected (realistic) cycle that incorporates organizational and logistical constraints. A case study is provided involving the packaging of a 20 mm round into a crate, part of the production program of the 'Sloboda' Co. - Cacak, Serbia.

By analyzing the flow coefficient, defined as the ratio between the actual and ideal/projected cycle durations, potential inefficiencies within the production process can be identified. The results suggest that predefining projected durations for each production phase significantly improves planning accuracy and coordination across the production flow. The proposed models serve as a practical decision-support tool within production management systems.

Keywords: production management, production phase, production cycle, flow coefficient.

RANKING OF THE SOFTWARE PACKAGES FOR PROJECT MANAGEMENT USING INTEGRATED MCDM METHODS

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ABSTRACT

In this paper, the ranking of selected software packages for project management is performed. The aim is to rank project management software packages based on predefined criteria and to show that MCDM methods can yield varying results even when analyzing the same problem. This shows that MCDM can be a useful tool for simplifying the observed problem, but the final decision should be given by the decision-maker.

When making a decision using quantitative MCDM methods, it is necessary to know the criteria weights and input data that will be used for comparing alternatives. In this paper, AHP, CRITIC and CILOS methods for determining criteria weights and VIKOR, TOPSIS, COPRAS, SAW and GRA methods for alternative ranking will be used.

A brief literary review of the chosen methods will be presented, followed by a comparative analysis of the software packages. Finally, tabular and graphic representations of the alternative rankings obtained from the different methods are provided.

Keywords: project management, MCDM method, ranking, alternative, criteria.

THE IMPACT OF PROMOTIONAL SALES ON CONSUMER BEHAVIOR

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ABSTRACT

The constant advancement of information technology is making billions of consumers more educated and informed about everything every day, making it far easier for them to make purchasing decisions. Good promotion significantly affects the growth of consumer interest in certain products and directly influences the consumer to make a purchase.

For marketing experts, the behavior of consumers in the process of purchasing products where they can buy them at lower, or promotional prices, is particularly interesting. The results of numerous surveys carried out so far show us that more products and services are bought at promotional prices, and the reason for such increased purchases is most often given by the profitability of the purchase. Buying products of the same quality, but at a lower and more favorable price, is the second most important reason for buying products at events organized by sellers.

Promotional sales become a special lure for consumers, so those products that they don't really need at that moment are also sold. In this way, the customer thinks that it is a good decision to buy a product on sale, regardless of the fact that he will not use it immediately for the simple reason that he can direct the funds thus saved to the purchase of another product or service.

Keywords: product, marketing, promotion, consumer, promotional price.

AI IN IT BUSINESS: PERCEPTIONS OF SERBIAN IT PROFESSIONALS ON THE IMPACT OF ARTIFICIAL INTELLIGENCE ON INDIVIDUAL PRODUCTIVITY

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ABSTRACT

This paper explores the perceptions of Serbian IT professionals regarding the impact of artificial intelligence (AI) tools on individual productivity in the context of IT business. As AI technologies become increasingly integrated into everyday work environments, particularly in knowledge-intensive industries, understanding user attitudes and experiences becomes essential. The research is based on a quantitative study conducted through an online questionnaire, which gathered responses from IT professionals working in various roles across Serbia. The questionnaire assessed the frequency of AI tool usage, perceived benefits and challenges, and self-reported changes in work efficiency. The results indicate a generally positive perception of AI tools, especially in relation to time-saving and task automation. This study contributes to a better understanding of how AI adoption is shaping modern IT workflows and provides insights relevant to business leaders and digital entrepreneurs in the tech industry.

Keywords: artificial intelligence, IT professionals, IT business, business applications, job productivity.

ENTREPRENEURIAL MARKETING AND ORGANIZATIONAL PERFORMANCE: INSIGHTS FROM THE MORAVICA DISTRICT IN SERBIA

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ABSTRACT

Entrepreneurial marketing represents a non-traditional, opportunity-driven marketing approach that is particularly relevant for small and medium-sized enterprises (SMEs) operating in dynamic environments. The aim of this study is to examine how the implementation of various aspects of entrepreneurial marketing influences the organizational performance of manufacturing SMEs in the Moravica District of the Republic of Serbia. The study sample consisted of 50 manufacturing SME owners, selected using a simple random sampling method. Data were collected through a structured questionnaire primarily composed of closed-ended questions. The research findings indicate that respondents demonstrate low levels of innovation and proactiveness. In contrast, they exhibit a strong commitment to effectively utilizing available resources and addressing customer needs and expectations. However, this focus is accompanied by a limited willingness to take risks.

Keywords: entrepreneurial marketing, organizational performance, small and medium-sized enterprises, entrepreneurship.

OPPORTUNITIES FOR ENCOURAGING INTERNAL ENTREPRENEURIAL INITIATIVES AMONG EMPLOYEES IN MANUFACTURING COMPANIES – CASE STUDY OF THE COMPANY VENDOM

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ABSTRACT

Internal entrepreneurship refers to a process based on the creation of innovative ideas within existing companies with the aim of improving business strategy and achieving long-term success. Creative and innovative solutions arising from the concept of internal entrepreneurship represent a new product, a new service, or a new value that the organization can deliver to other companies. Employee innovativeness largely emerges as a result of individual characteristics, which should represent a significant potential for any company.

The subject of this paper is entrepreneurial initiatives and the possibilities for encouraging them within companies. To that end, the paper presents a case study of a company in the metal industry, showcasing examples of internal entrepreneurial initiatives.

Despite certain risks and challenges that may accompany individual entrepreneurial initiatives by employees, the conclusion is that companies can gain multiple benefits and that the future of modern business must support employee innovativeness through the encouragement and stimulation of their ideas.

Keywords: internal entrepreneurship, manufacturing company, key factors, innovation, management.

APPLICATION OF MODERN TECHNOLOGIES TO IMPROVE THE PROCUREMENT PROCESS: CASE STUDY OF THE COMPANY "VENDOM"

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ABSTRACT

In today's globalized and increasingly dynamic market, the importance of the procurement process in the context of managing overall business costs is growing steadily. To ensure the smooth and continuous flow of the production process in every modern company, procurement should be viewed as one of the strategic processes. An efficient procurement process entails the application of best practice models as well as modern information and communication technologies in all stages of the procurement process: planning, ordering, execution, and control.

The subject of this research is the improvement of the procurement process through the application of modern information and communication technologies, primarily business information systems, with the aim of digitalizing operations. The main advantages that digitalization brings to the procurement process include strengthening the principles of transparency, efficiency, cost-effectiveness, healthy competition, and the procurement of quality materials.

The research was conducted on a real company, "Vendom", which operates in the metal industry sector. In this company, the PANTHEON business information system, an ERP *(Enterprise Resource Planning)* class system tailored for rapidly growing companies, is used in the procurement process. The introduction of this information system into the procurement process at "Vendom" has led to significant improvements in business performance values,

reflected in: reduction of procurement costs, optimization of warehouse operations, procurement of higher quality raw materials, reduction of finished product delivery time, improvement of production quality, enhancement of supplier relationships, better market positioning, increased number of customers, total quantity of delivered goods, and more.

Keywords: improvement, procurement process, suppliers, modern business information system, company "Vendom".

THE STRATEGIC ROLE OF THE SERVICE ENVIRONMENT IN THE PROCESS OF ACHIEVING A COMPETITIVE ADVANTAGE ON THE EXAMPLE OF THE KRAS COMPANY

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ABSTRACT

In today's business environment, where traditional methods of differentiation are becoming less effective, strategic management of the service environment is becoming crucial for maintaining a competitive advantage. Through a strategically designed service environment, companies can directly influence the shaping of consumer perception by creating a positive experience that reflects on the overall brand. Understanding and strategically applying the elements of the service environment allows companies to clearly differentiate themselves in the market by enhancing the customer experience and strengthening the emotional connection with consumers. This approach enables businesses to transform everyday interactions into key points of loyalty and trust, thereby not only strengthening brand reputation, but also ensuring its long-term sustainability in the market. The research goal of this paper is an analysis of the impact of the service environment on brand perception and consumer satisfaction, as well as how the strategic application of its elements can contribute to strengthening the competitive advantage and long-term business success of the company Kraš. The scientific-research character of this work is based on the analysis of relevant scientific literature and modern sources using the methods of analysis, comparison, examination, description and deduction. The results of the empirical research showed that a strategically designed service environment significantly contributes to the realization of the competitive advantage of the company Kraš, influencing the increase in user satisfaction, brand recognition and overall business performance.

Keywords: strategic management, service environment, Kraš.

THE ROLE OF EMOTIONAL LITERACY IN MODERN MANAGEMENT

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ABSTRACT

The challenges of the dynamic global market, whose effects are reflected in successful business, impose the need for every organization to deal more intensively with the management of employees' emotions in order to become and remain competitive. That is why more and more organizations are paying great attention to the development of emotional literacy of human resources, because it is a very influential factor when it comes to organizational performance, change management, work performance, negotiation, motivation, creativity, conflict management and leadership. The aim of this research is to analyse the role of emotional literacy in modern management and the impact it has on achieving business excellence. The scientific-research character of this work is based on the analysis of relevant scientific literature and contemporary sources using the methods of examination, analysis, description and deduction. The results of empirical research showed that emotional literacy plays a key role in building effective emotional management and responsible organizational behaviour, which directly affect the achievement of competitive advantage and business excellence of the organization.

Keywords: emotional literacy, organizational behavior, management.

ECOLOGICAL, ECONOMIC, AND SOCIAL DIMENSIONS OF CIRCULAR BUSINESS MODELS

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ABSTRACT

The need for new business models based on the principles of sustainability and efficient resource use in modern economic conditions is becoming increasingly evident. These business models strive to eliminate the fundamental weaknesses of the linear economy, such as uncontrolled extraction of natural resources, irreversible waste generation, and their inherently weak management potential. At the same time, they must meet increasingly demanding market needs, both on a national and global level.

Depending on the key characteristics and goals of circular business models based on: a) recycling and reuse, b) design for sustainability, c) services, d) closed-loop supply chain processes, e) digitalization, and f) educational and consultancy nature, the study considers their impact on the ecological, economic, and social dimensions of sustainable business. It concludes that recycling and closed-loop supply chain circular business models most significantly advance ecological goals but may carry moderate economic challenges. On the other hand, service-oriented models and digitalization bring high economic benefits, with moderate ecological impact.

Keywords: circular business models, resource use efficiency, environmental pollution, sustainability principles, sustainability dimensions.

CO-AUDITING AS A TOOL FOR ASSESSING AND SHAPING LONG-TERM SUSTAINABLE BUSINESS STRATEGIES

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ABSTRACT

Intensive activity in operationalizing long-term sustainable business strategies and the increasing technological and commercial affirmation of many of its tools have enabled the emergence of eco-auditing as a process for assessing the environmental performance of organizations, products, or services with the aim of improving the environmental aspects of business. The comprehensiveness of eco-auditing refers to the thoroughness of the assessment, including analysis of environmental impact, compliance with legislation, and identification of opportunities for more sustainable practices.

The paper first reflects on the role of eco-auditing in organizations to: identify environmental risks, improve compliance with legislation and standards, enhance competitiveness, and build trust with consumers and partners by demonstrating responsibility toward the environment.

The emphasis of the paper then shifts to explaining the key standards of eco-auditing and providing practical examples where this tool serves as a foundation for sustainable business and environmental protection. Finally, focusing on the construction industry and companies using the Leadership in Energy and Environmental Design (LEED) standards for design and construction, organizations from Serbia and Bosnia and Herzegovina that have undertaken the LEED certification process are highlighted as tools to improve building energy efficiency and sustainability.

Keywords: environmental management, eco-auditing, LEED, energy efficiency, building sustainability.

POSSIBILITIES AND ASPECTS OF INTEGRATION IN PUBLIC HEALTH CARE INSTITUTIONS

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ABSTRACT

The integration of public health institutions illustrates an insufficiently implemented process, and the public health network is not based on functional integration. There are barriers between public health institutions, and their removal has not yet met the needs of users.

Legal provisions have provided opportunities for integrating health institutions that include parts of primary and secondary levels of care. In Bosnia and Herzegovina, there is no single public health institution organized according to the proposed model. Duplication of medical services is common when patients move from one health institution to another, which results in a waste of time and money.

The subject of this research is primary and secondary public health institutions and their optimal organization in terms of costs and quality through integration.

The research problem is use of different organizational structures in healthcare, limited by a lack of personnel, equipment, funding, and rising costs.

The result of the research suggests that different organizational models for public health can achieve better utilization of available resources in primary and secondary healthcare. Criteria for healthcare integration include economic, functional, medical and organizational aspects, but their implementation depends on the will of healthcare policymakers.

Keywords: health institution, medical care level, integration of health institutions.

BENCHMARKING AS A MANAGEMENT METHOD IN INDUSTRIAL CAPACITIES OF THE RAILWAYS OF THE REPUBLIC OF SRPSKA

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ABSTRACT

Benchmarking in the Railways of the Republic of Srpska is a process that represents the measurement and comparison of the most important technical-technological, economic and financial indicators of the success of the production of parts and assemblies of railway vehicles and maintenance services in the workshop capacities of Doboj, Banja Luka and Prijedor and comparison with the best within the company's area of operation and outside it.

Given the specifics of the Railways of the Republic of Srpska company, the paper proposes benchmarking as a process that is an applicable and efficient management method and would be carried out in four phases, each of which has its own steps. In addition, the role and importance of benchmarking in Railways of the Republic of Srpska is described, as well as methods that would compare the most significant performances within the company with better or best in the system that deal with the same problems in workshop capacities.

The analysis would measure and determine the performance indicator of all three workshop companies and present certain deviations in individual performance indicators of individual workshop capacities.

Benchmarking was conducted based on available technical-technological, economic and financial data from production and service workshop capacities dealing with the maintenance of railway vehicles in Doboj, Banja Luka and Prijedor.

Keywords: benchmarking, competitiveness, efficiency, comparison, parameters and goals.

MODEL OF THE BALANCED SCORECARD CONCEPT IN THE COMPANY

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ABSTRACT

The importance of the application of the Balanced Scorecard Concept in the industrial company, presents a good basis for building a model for measuring and analyzing Key Performance Indicators (KPI's), indentified in the Company. Also, the application of the BSC concepts points out the need for its adjustment to the nature and characteristics of the case, type and size of the Company.

Keywords: benchmarking, competitiveness, efficiency, comparison, parameters and goals.

GLOBAL DEBT AND INSTITUTIONAL EFFICIENCY

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ABSTRACT

Modern economies face a continuous increase in public debt, and this represents a serious global problem. In countries with weak institutions, deficits and borrowing often grow not because of objective need, but because of poor governance and a lack of long-term strategy. It is known from the economic literature that every systemic crisis always implies the emergence of a new model of regulating economic growth, with significant changes in the economic role of the state, which should enable the redistribution of the role of economic institutions. This did not happen in the practice of less developed countries with the emergence of the latest crises, and these weaknesses came to the fore exactly when it was most necessary to react quickly, efficiently and strategically. The subject of research in this paper is the role of institutions in public debt management, with special emphasis on the efficiency of economic institutions in less developed countries. The goal of the research is to prove the importance of institutional pluralism, that is, the existence of independent, transparent and functional institutions that collectively influence the reduction of uncontrolled borrowing and enable a more efficient distribution of economic resources.

Keywords: public debt, institutions, deficit, crisis.

HOW TO BUILD A GOOD SUPPLY CHAIN

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ABSTRACT

In today's competitive business environment, supply chain management (SCM) has become an indispensable part of action management dealing with business improvement and exploring the operational actions that managers and staff need to do to drive better business performance and achieve excellence. The customers' needs are ever-changing at a galloping pace which makes an organization competitive and non-competitive based on fulfilling these needs. With increased supply chain management practices, organizations are putting more emphasis on developing their human resources across the chain to ensure adequate performance through training and retraining of their employees. A systematic literature review is presented in this paper. The supply focuses on managerial skills and abilities needed at various levels of the supply chain. The topic of supply chain management has many implications for a firm; however, in this paper, we focus only on supply chains and how they can be used to achieve success with the role of managers in the management process.

Keywords: supply chain, innovation, business strategy, competitive advantage, leadership.

LAW AND SECURITY SECTION
PRAVO I BEZBJEDNOST

DECRIMINALIZATION OF PROHIBITION AND CRIMINALIZATION OF RISK: LEGAL CHALLENGES OF NUCLEAR ENERGY DEVELOPMENT IN SERBIA

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ABSTRACT

This paper examines the legal challenges arising from the repeal of the longstanding moratorium on the construction of nuclear facilities in the Republic of Serbia, with a particular focus on whether the current criminal law framework provides adequate protection against the risks associated with such infrastructure. The first part presents a theoretical framework on the relationship between energy law and criminal law, emphasizing the concept of preventive legal protection. The second part analyzes the current legislation, particularly the 2024 amendments to the Energy Law and the content of the Criminal Code of Serbia, highlighting potential legal gaps. The third part offers a comparative overview of solutions adopted in neighboring countries with developed nuclear energy sectors, aiming to identify possible models for improving domestic regulation. The paper seeks to underline the need for a systemic legal approach to nuclear safety, including potential amendments to criminal legislation.

Keywords: nuclear energy, criminal law, nuclear safety, legal framework, comparative law.

TERRORISM, COUNTERTERRORISM, AND HUMAN RIGHTS: THE PATH TO SUSTAINABLE SECURITY BASED ON THE RULE OF LAW

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ABSTRACT

Terrorism, as a pervasive and dynamic threat to contemporary societies, has a profound and devastating impact on the enjoyment of fundamental human rights, particularly the rights to life, liberty, and physical integrity of its victims. The consequences of terrorist acts extend beyond individual suffering, resulting in the destabilization of state institutions, disruption of public safety, erosion of civil society, and hindering of social and economic development. In this context, individual security must be viewed not only as a fundamental human right but also as a primary obligation of every sovereign state. This paper examines the challenges faced by states in fulfilling their duty to protect human rights in the context of counterterrorism measures, with a particular focus on the imperative of preserving the rule of law. The authors advocate for the development of national counterterrorism strategies that encompass not only repressive measures and criminal prosecution of the responsible parties but also a comprehensive approach aimed at preventing and addressing the root causes of terrorism, including discrimination, political exclusion, and socio-economic marginalization. Special emphasis is placed on the need to strengthen the role of civil society and protect the rights of victims through legal instruments such as restitution and compensation.

In conclusion, the paper advocates for a model of counterterrorism policy grounded in the principles of human rights and the rule of law, as prerequisites for sustainable security and legitimate institutional action.

Keywords: terrorism, counterterrorism, human rights, sustainable security, rule of law.

INTRODUCING STRICTER PROTECTIVE MEASURES FOR VICTIMS AND HARSHER PENALTIES FOR PERPETRATORS OF DOMESTIC VIOLENCE IN LIGHT OF THE NEW LAW ON PROTECTION FROM DOMESTIC VIOLENCE AND VIOLENCE AGAINST WOMEN IN THE FEDERATION OF BOSNIA AND HERZEGOVINA

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ABSTRACT

The House of Peoples of the Parliament of the Federation of Bosnia and Herzegovina, at its session held on March 4, 2025, unanimously adopted the Law on Protection from Domestic Violence and Violence Against Women, thereby introducing stricter protective measures for victims and harsher penalties for perpetrators of violence within the territory of the Federation of Bosnia and Herzegovina. Compared to the previous law, the new legal provisions impose greater responsibility and provide a broader scope of action for all those involved in the decision-making chain in the fight against domestic violence (police, judicial authorities, social work centers, and educational institutions). This paper will provide a detailed explanation of the innovations introduced by the Law: the expanded definition of a victim, electronic monitoring of offenders, sanctioning of online violence, establishment of an SOS hotline, prohibition of disclosing the identities of victims and perpetrators. Particular significance is given to the tightening of penalties for violating protective measures, which can now result in a prison sentence of up to three years, with no possibility of converting the sentence into a monetary fine.

Keywords: Law on Protection from Domestic Violence and Violence Against Women in the Federation of Bosnia and Herzegovina, protective measures, victims of violence, penalties for perpetrators of violence.

CRIMINOGENICITY LABOR AND FINANCIAL BUSINESS IN CONNECTION WITH EMPLOYEE RIGHTS

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ABSTRACT

Labor and financial legislation regulated all aspects of employment, work of workers, as well as financial business procedures related to the employment relationship. The provisions that regulate the rights and obligations of employees, as well as the responsibility and obligations of the employer in connection with the employment relationship, are particularly significant. In the financial sense, the legality of the payment of salaries, contributions, and taxes is particularly important in order to exercise the rights of workers.

Current practice indicates that in many areas of labor and financial legislation, "intentional/unintentional" errors and omissions are made, to the detriment of employees. Thus, "unofficial work", "envelope pay" and other criminogenic deviations, which essentially give an illegal advantage/profit to the entrepreneur, to the detriment of the employee, are already "traditionally" known.

The paper will analyze the legal provisions in the subject area, through a certain prism of comparability with neighboring countries. In addition, current practice will give examples, practice that is contrary to labor and financial legislation in connection with the employment relationship.

The field of labor and financial legislation has direct negative implications for the status position of employees, workers, both during the employment relationship, especially in relation to retirement, which is why it is necessary to strengthen the legal and other responsibility of employers in the subject area.

Keywords: Work, labor law, finance, financial law, taxes, contributions, pension.

HUMAN DIGNITY AS PART OF THE MATERIAE CONSTITUTIONIS

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ABSTRACT

Over time, the content of the materiae constitutionis has not changed significantly, so even in the oldest constitutional texts, we can find provisions regarding the organization of power, a catalog of constitutional rights and freedoms, and finally, provisions about constitutional amendments. However, in the period after the Second World War, an indispensable part of the materiae constitutionis became those provisions that relate to the constitutional recognition and guarantee of human dignity as one of the core principles of the constitutional order. In this paper, the author will, through a comparative analysis, attempt to determine how constitutions increasingly include provisions on human dignity in their texts. Finally, special attention will be given to the role such provisions play within modern constitutional orders.

Keywords: constitution, materiae constitutionis, human dignity.

INFORMATION TECHNOLOGY
INFORMACIONE TEHNOLOGIJE

"EYES WIDE OPEN" – ONE OF THE FUNDAMENTALS OF INFORMATION SECURITY

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ABSTRACT

This paper presents a contemporary and practically oriented perspective on the field of information security.

In today's digital environment, information security is constantly exposed to various types of attacks and threats, which can result in data loss, service disruption, reputational damage, and even complete business collapse.

The paper will provide a theoretical framework of information security, with a focus on real-world examples. These examples aim to further emphasize the importance of the topic and encourage deeper reflection on the modern challenges of protecting digital assets.

Keywords: information security, cyberattacks, threats, malware, practical examples.

REVOLUTIONIZING SUPPLY CHAINS: THE TRANSFORMATIVE ROLE OF ARTIFICIAL INTELLIGENCE IN LOGISTICS

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ABSTRACT

Artificial Intelligence (AI) is revolutionizing logistics by enhancing efficiency and reducing costs across supply chain processes. This study explores the impact of AI on logistics through a qualitative analysis of secondary data. Data were collected from academic and industry sources using Google searches and AI tools such as ChatGPT, focusing on keywords like “AI in Logistics” and “Logistics Automation.”

The research examines how AI optimizes inventory management, route planning, and warehouse automation, highlighting case studies of industry leaders. Results show that AI can reduce inventory costs by up to 20%, cutt transportation expenses by 10–15%, and boosts warehouse productivity by 30%. Successful implementations demonstrate improved delivery reliability and customer satisfaction, although challenges such as high initial costs and skill shortages persist.

In conclusion, AI is transforming logistics by streamlining operations and promoting sustainability. However, strategic investments are necessary to overcome implementation barriers and unlock future potential, including autonomous delivery systems.

Keywords: Artificial Intelligence, Logistics, Supply Chain, Automation, Optimization.

PERFORMANCE COMPARISON OF VARIOUS DATABASE TYPES IN REACT NATIVE APPLICATIONS

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ABSTRACT

In the modern digital age, mobile devices have become an indispensable part of everyday life. With the growing volume of data we handle daily, the speed of data loading and access becomes a crucial factor for the efficient operation of mobile applications. Given that mobile devices use different operating systems, such as Android and iOS, there is an increasing need for tools that enable the development of cross-platform applications from a single codebase. React Native, as a popular open-source framework, provides exactly this solution. This paper will analyze the performance of different databases in the context of React Native applications, when working with large datasets, such as a German collocation dictionary.

Keywords: Android; database; iOS; performance testing; React Native.

IMPLEMENTATION OF WAVELET SCALOGRAMS FOR AUDIO SIGNAL ANALYSIS

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ABSTRACT

In the past few decades, wavelets have found an important place in many fields due to their nature and advantages compared to other algorithms. When the focus is on signal processing, wavelets can be used as an algorithm for de-noising, frequency analysis, feature analysis, etc. The spectrogram is one of the most common visual representations of the signal in the frequency domain when the Fourier transformation is used. Wavelets have their algorithm for signal representation in the frequency domain, and it's called scalogram due to the nature of the scaling properties of the wavelet function.

This paper explores the application of the Continuous Wavelet Transform (CWT) for generating and analyzing scalograms. Audio signals from different direct current (DC) motor sounds are used as test data to demonstrate the effectiveness of this approach. All implementations and analyses are carried out using MATLAB software. The results highlight the advantages of wavelet-based analysis in capturing time-frequency characteristics that may not be easily observed with traditional Fourier-based methods.

Keywords: wavelets, frequency analysis, scalograms, continuous wavelet transform, direct current motor sounds.

SIMULATING REALITY: TRANSFORMING MARITIME TRAINING THROUGH VR TECHNOLOGY

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ABSTRACT

The development of a Virtual Reality (VR) maritime navigation simulator in Montenegro presents a significant innovation in seafarer education and operational training. Designed to authentically replicate the navigational complexity of the Bay of Kotor, characterized by a dense presence of cruise ships, yachts, speedboats, and other vessels, the simulator offers a comprehensive and immersive training platform. It supports the education and certification of deck officers and boat operators by enabling realistic exercises in ship handling, navigation, and complex maritime operations. Advanced simulation scenarios include dynamic weather conditions — such as fog, rain, sea currents, and high winds — enhancing trainees' adaptability to real-world challenges. Furthermore, the simulator facilitates critical safety drills, including fire protection exercises and lifeboat launching procedures, reflecting accurate shipboard equipment and environmental settings. Through these dynamic, risk-free simulations, users can develop practical competencies in navigation, safety management, and emergency response, thus elevating the standards of maritime education and operational preparedness.

Keywords: VR simulation, maritime training,officer education, boat operator training, fire protection drills, lifeboat launching.

AN ANALYSIS OF KNOWLEDGE SOURCES IN THE FIELD OF THE INTERNET OF THINGS

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ABSTRACT

This research presents an analysis of the application and acceptance of various standards in the field of the Internet of Things (IoT). Employing t-test statistical analysis, the study analyze differences between standard groups in three key categories: implementation complexity, adoption level, and citation frequency. The results have shown that communication and networking standards—such as IEEE 802.15.4, CoAP, and 6LoWPAN—are significantly more frequently cited and demonstrate higher adoption rates in both scientific literature and industry, compared to architectural and security standards, including IEEE P2413, ISO/IEC 30141, and ISO/IEC 27030. However, no statistically significant difference was found in implementation complexity among the analyzed groups. Based on the results, the study recommends continued development and deployment of communication standards, while suggesting that architectural and security standards be enhanced through simplified implementation and stronger integration into industrial solutions. Future research could further examine the influence of various factors on the acceptance and implementation of standards across different industrial sectors.

Keywords: Internet of Things, standards, communication, security, t-test, citation frequency, adoption.

DESIGN OF RECOMMENDER SYSTEMS IN E-COMMERCE

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ABSTRACT

This research presents the design of a recommender system for an online store. The system utilizes user behavior data and purchase history to generate personalized product recommendations. Its main components include a recommender server and client modules. The recommender server performs the core recommendation logic independently of the online store, while the client module integrates with the store interface to display recommendations to users. For data analysis and recommendation generation, the system uses a combination of K-Means clustering and collaborative filtering. K-Means clustering groups users based on similarities in their purchase history, while collaborative filtering suggests products based on the purchases of other users within the same cluster. The research also discusses implementation challenges encountered during system development, such as the selection of appropriate libraries and performance optimization. The results indicate that the system delivers effective product recommendations and shows strong potential for future enhancements, including the incorporation of additional user data and exploration of advanced recommendation algorithms. Future work may focus on algorithm optimization, dataset expansion, and experimentation with emerging technologies.

Keywords: recommender system, e-commerce, K-Means clustering, collaborative filtering, personalized recommendations.

ARTIFICIAL INTELLIGENCE AND EDUCATION: BALANCING DIGITAL TRANSFORMATION AND MENTAL HEALTH

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ABSTRACT

The digital transformation of education, with the key role of artificial intelligence (AI), brings numerous changes to the educational process, enabling personalized learning, automation of administrative tasks, and improved access to educational content. However, the use of AI also poses certain challenges, especially concerning the mental health of students and teachers. Excessive use of digital technologies can lead to technological stress, reduced social interaction, and information overload. Additionally, over-reliance on AI can reduce creativity and critical thinking. While AI offers many benefits, such as increased accessibility to education and improved teaching, it is crucial to find a balance between technological innovations and the preservation of psychological well-being for all participants in the educational process. Proper use of AI, combined with traditional methods, can enhance education while safeguarding mental health.

Keywords: Artificial Intelligence, Digital Transformation in Education, Mental Health.

THE ROLE OF SOCIAL MEDIA IN PUBLIC COMMUNICATION DURING NATURAL DISASTERS

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ABSTRACT

Modern telecommunications and information tools offer significant advantages during crisis situations. The evolution of social media and other digital platforms has transformed the information landscape, often blurring the lines between credible sources and misinformation. Social networks enable rapid interaction and communication, which is crucial not only for informing the public but also for professionals involved in disaster management systems. The speed and accessibility of the internet make it an ideal tool for warning about imminent dangers, as it allows for timely dissemination of critical information to a broad population. However, inaccurate information poses a significant challenge for all types of media. Verified and accurate information during natural disasters is a vital component in the risk management process of emergency situations.

The Republika Srpska is susceptible to numerous threats posed by natural disasters. This study analyzes the extent to which social networks in the Republika Srpska, due to their capabilities for rapid content dissemination and lack of rigorous content control, influence public information during natural disasters.

Keyword: social media, natural disasters, misinformation, verified information, public awareness.

THE ROLE OF ARTIFICIAL INTELLIGENCE IN THE TRANSFORMATION OF EDUCATION: NEW TRENDS AND CHALLENGES

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ABSTRACT

The application of artificial intelligence (AI) in education represents one of the most significant innovations of the modern era, which transforms traditional ways of learning, teaching and organizing educational processes. AI makes it possible to adapt content to individual needs, which increases learning efficiency and student engagement, as well as support for students with special educational needs.

New trends include personalized learning, intelligent tutors, grading automation, integration of tools based on natural language processing, as well as the use of chatbots and predictive learning analytics to monitor student progress.

In addition to a number of advantages, the implementation of AI in education also brings with it numerous challenges. Among the most important are the protection of data privacy, ethical issues, transparency of algorithms, and digital inequalities in access to technology and the need for additional education of teaching staff. It is also necessary to bear in mind the risk of too much automation, which can diminish the human factor in education.

Despite all the challenges, AI has the potential to positively transform the education system if used responsibly and in accordance with pedagogical principles. The key is to find a balance between technology and the human factor so that education remains inclusive, fair and of high quality.

This paper explores how AI is being used in education today, what are the main directions of development, and what ethical and practical challenges the education community is facing.

Keywords: artificial intelligence, education, digital inequalities, data privacy.

INTERACTION OF BIOMEDICAL ENGINEERING AND ARTIFICIAL INTELLIGENCE IN THE DEVELOPMENT OF INTELLIGENT HEARING SYSTEMS

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ABSTRACT

Artificial intelligence (AI) has revolutionized hearing health by improving the functionality and personalization of smart hearing devices. Traditional hearing aids have evolved into intelligent systems capable of real-time environmental analysis, adaptive sound processing, and seamless user interaction.

The integration of artificial intelligence (AI) into smart hearing devices marks a significant advance in biomedical engineering, offering improved hearing assistance through user-centered adaptive technologies. Artificial intelligence algorithms — especially those using machine learning and deep neural networks — enable these devices to distinguish between speech and noise, automatically adapt to changing acoustic environments, and learn user preferences over time.

Modern hearing aids now incorporate artificial intelligence-driven signal processing to distinguish speech from background noise, enabling improved speech intelligibility and listening comfort. These systems use biosignal data, such as acoustic input and user behavior patterns, to provide a personalized hearing experience.

AI also facilitates the integration of health monitoring functions, including fall detection and vital signs monitoring, expanding the usefulness of hearing devices as multifunctional biomedical tools. Moreover, AI integration supports functions such as voice recognition, language translation and health monitoring,

expanding the role of hearing aids and thus enabling users to better socialize in their daily environment as well as improve their overall socio-economic status.

This paper reviews the engineering principles behind AI-based hearing systems, current trends in sensor integration, and challenges in developing energy-efficient real-time signal processing algorithms suitable for wearable biomedical devices. It also explores recent advances in AI-based hearing technologies, discusses the benefits and challenges of their application, and considers their implications for the future development of assistive hearing devices.

Keywords: artificial intelligence, hearing aids, bioengineering, signal processing.

ENGINEERING, TECHNOLOGY AND MATERIALS
INŽENJERSTVO, TEHNOLOGIJE I MATERIJALI

IMPACT OF THAWING METHODS ON THE PHYSICOCHEMICAL AND NUTRITIONAL PROPERTIES OF BEEF MEAT

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ABSTRACT

This study aimed to examine the impact of various thawing methods (refrigerator, room temperature, and microwave oven) on the physicochemical and nutritional properties of beef meat (*Longissimus dorsi*). The following analyses were performed: weight loss, water content, ash, fat and protein content, water-holding capacity, colour, texture, water activity (a_w), pH value, and mineral composition. The results indicated that the thawing method significantly affects meat quality ($p<0.05$).

The highest weight loss was recorded in samples thawed in a microwave oven (2.36%), while the lowest was in samples thawed in the refrigerator (0.81%). The highest water content was found in meat thawed in the refrigerator (74.99%), and the lowest was in samples thawed at room temperature (74.42%). The meat thawed at room temperature had the lowest water-holding capacity and the highest fat content. Colour changes were noted in all treatments, showing a decrease in lightness (L^*) as well as in a^* and b^* values, except for microwave-thawed samples. The highest texture firmness was measured in samples thawed in the refrigerator (4.34 kg). Water activity and pH levels increased after thawing in all treatments. Mineral content varied between fresh and thawed samples, with certain minerals showing notable deviations.

It was concluded that the slow defrosting method (at refrigerator temperature) best preserves the nutritional quality of beef meat.

Keywords: thawing methods, beef meat, quality, nutritional properties.

ANTIOXIDANT AND ANTIMICROBIAL POTENTIAL OF BLACKTHORN AND RED CHERRY EXTRACTS IN NATURAL SAUSAGE CASINGS

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ABSTRACT

This study explores the use of natural plant extracts as a sustainable method to enhance the quality and safety of long-life sausages by incorporating them into natural edible casings. Ethanol (E) and aqueous (A) extracts of blackthorn (BT) and red cherry (RC), as well as their ethanol and water-based solutions, were prepared and analysed for their antioxidant and antimicrobial properties. The analyses included the quantification of total phenols, non-flavonoids, flavonoids, flavonols, and anthocyanins, along with antioxidant activity assessments using FRAP, DPPH, and ABTS assays. Antimicrobial efficacy was tested against Gram-positive and Gram-negative bacteria (*Staphylococcus aureus*, *Bacillus cereus*, *Escherichia coli*, and *Salmonella enterica*) and mold *Penicillium expansum* via agar dilution methods to determine MIC and MBC/MFC.

Results showed that ethanol extracts had higher antioxidant activity than aqueous ones ($p<0.05$), with the ethanol extract of blackthorn (EBT) containing the highest levels of phenolics (54.11 mg GAE/g d.e.) and exhibiting the strongest antioxidant, antimicrobial, and antifungal activities. Casings treated with EBTE (ethanol BT extract dissolved in ethanol) demonstrated significant antibacterial properties, particularly against Gram-negative bacteria. This study confirms that plant-extract-enriched natural casings can act as active packaging, offering protection against oxidation and microbial spoilage, thereby extending the shelf life and ensuring the safety of long-life sausages.

Keywords: plant extracts, edible casings, antioxidants, antimicrobial activity.

THE INFLUENCE OF THE ADDITION OF SELECTED PLANT SPECIES ON THE BIOLOGICAL PROPERTIES OF JANJ CHEESE

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ABSTRACT

The aim of this study was to examine the influence of the addition of selected plant species on the biological (antioxidant and antimicrobial) properties of Janj cheese. For the purpose of this study, twelve cheese samples were produced, in two series with six samples. Each of the series had one control sample (without plants) and five samples with plants (*Origanum vulgare, Ocimum basilicum*, *Petroselinum crispum*, *Rosmarimus officianalis* and *Allium schoenoprasum*) in the concentration of 0.50% (the first series) and 1.00% (the second series). The determination of the content of total phenols, non-flavonoids, flavonoids, as well as the determination of antioxidant activity by FRAP, DPPH and ABTS test was carried out. Antimicrobial testing of cheese extracts was performed using the agar dilution method, on four types of bacteria (*Escherichia coli, Pseudomonas aeruginosa, Staphylococcus aureus and Bacillus cereus*) and two strains of *Candida albicans*. Based on the obtained results, it was determined that the addition of selected plant statistically significantly ($p<0.05$) effects on increasing the antioxidant activity of the tested cheeses. However, all tested cheese extracts did not show antimicrobial activity. It can be concluded that these plant species represent a potential source of natural antioxidants with possible application in the production of Janj cheese.

Keywords: Janj cheese, plant species, biological properties.

Acknowledgements

This paper is a part of the project titled "Improvement of functional properties of autochthonous milk products using selected plant species", co-financed by the Ministry of Scientific and Technological Development and Higher Education of the Republic of Srpska.

SENSORY PROPERTIES OF JANJ CHEESE WITH THE ADDITION OF SELECTED PLANT SPECIES

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ABSTRACT

In many countries of the world, cheese is a highly valued milk product that, due to its high nutritional value, is recommended in the regular diet of every individual. Cheesesmade by the traditional method using the indigenous technology are especially valued and represent culture and tradition of some country. Janj cheese has been produced by such a traditional technology and it is the research subject of this study. The aim of this study was to examine the influence of the addition of selected plant species (*Origanum vulgare, Ocimum basilicum*, *Petroselinum crispum*, *Rosmarimus officianalis* and *Allium schoenoprasum*) in the concentration of 0.5% and 1% on the sensory properties of Janj cheese. A team of 5 evaluators has performed sensory analysis of tested cheese samples using a 5-point scoring system (1=very considerable deviation from expected quality to 5=no deviation from expected quality) to assess appearance, color, smell, taste, and consistency. The addition of selected plants gave positive results and statistically significantly ($p<0.05$) effects on sensory properties of the tested cheeses. The highest score being given to samples with *Origanum vulgare* and *Allium schoenoprasum* in both series, i.e., with both concentrations (0.5 and 1%), so production of this type of cheese is recommended with the addition of these plant species.

Keywords: sensory properties, Janj cheese, plant species.

Acknowledgements

This paper is a part of the project titled "Improvement of functional properties of autochthonous milk products using selected plant species", co-financed by the Ministry of Scientific and Technological Development and Higher Education of the Republic of Srpska.

USING OF MINT ESSENTIAL OIL IN ANTIFUNGAL PROTECTION OF PHYLLO PASTRY

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ABSTRACT

The aim of this study was to investigate the effects of using mint essential oil in the antifungal protection of phyllo pastry made from white wheat flour with the addition whole grain buckwheat flour and corn flour in quantity of 10%.

The phyllo pastry were stored and examined at intervals of 0, 5, 7, 14 and 21 days at a temperature of 8°C. The examinations included mycological analyses to determine the total mold count and the identification of isolated species.

The mycopopulation of the samples of phyllo pastry made from white wheat flour with the addition whole grain buckwheat flour in quantity of 10%, without the addition of essential oil, was classified into 4 genera and 5 species. The genus *Penicillium* was represented by two species: *P. aurantiogriseum* and *P. expansum*, while the genera *Aspergillus, Cladosporium* and *Rhizopus* were each represented by one species, *A. candidus, C. cladosporioides* and *R. stolonifer* respectively. The mycopopulation of the samples of phyllo pastry made from white wheat flour with the addition corn flour in quantity of 10%, without the addition of essential oil, was classified into 5 genera and 7 species. The genus *Penicillium* was represented by three species: *P. aurantiogriseum, P. commune* and *P. oxalicum,* while the genera *Aspergillus, Cladosporium, Fusarium* and *Rhizopus* were each represented by one species, *A. flavus*, *C. cladosporioides, F. proliferatum* and *R. stolonifer* respectively.

When mint essential oil was applied at concentrations of 0.255%, it exhibited the best antifungal effects on the examined phyllo pastry during 7 days of storage. The greatest differences in the total mold count of the phyllo pastry compared to the control samples were observed, being 1.7 log cfu/g for the phyllo pastry made from white wheat flour with the addition whole grain buckwheat flour and corn flour in quantity of 10%.

Keywords: molds, mint essential oil, antifungal protection, phyllo pastry.

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PHYSICO-CHEMICAL AND ANTIOXIDANT PROPERTIES OF COLD-PRESSED ARONIA JUICE

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ABSTRACT

Aronia, as a berry fruit rich in nutrients, represents a suitable raw material for obtaining cold-pressed juices. The chemical composition of aronia indicates the presence of a large amount of polyphenolic compounds and anthocyanins, which contribute to its antioxidant and antimicrobial properties. This study describes the process of producing cold-pressed juice from organically grown aronia (Organic Control System certified), which is frozen immediately after pressing without pasteurization and the addition of additives. Physico-chemical analyses included determination of acidity, pH value, dry matter content, and pectin content. Based on the analysis results of antioxidant properties, which involved determination of total phenols, flavonoids, FRAP, DPPH, and ABTS tests, the study showed that cold-pressed aronia juice has high antioxidant properties. Considering that aronia juice is cold-pressed, aimed at reducing the effects of elevated temperatures on the quality of aronia juice, without the addition of additives, preservatives, colors, sweeteners, etc., it can be said that its good antioxidant properties originate from the raw material, i.e., aronia berries.

Keywords: aronia, cold-pressed juice, antioxidant activity.

EFFECT OF FREEZING ON PHYSICO-CHEMICAL, ANTIOXIDANT, AND SENSORY PROPERTIES OF HONEYDEW HONEY

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ABSTRACT

Freezing food slows down the physico-chemical and biochemical reactions in food. In honey, freezing is primarily used to delay or halt crystallization, reduce viscosity, and preserve nutritional components. However, low temperatures may influence the physico-chemical, antioxidant, and sensory properties of honey.

This study compares the properties of honeydew honey before and after freezing treatment. The analysis included the evaluation of physico-chemical parameters such as moisture content, water activity, pH value, acidity, hydroxymethylfurfural (HMF) content, diastase activity, sugar content, ash content, and electrical conductivity. Antioxidant properties were assessed by determining total phenolic and flavonoid content, as well as FRAP, ABTS, and DPPH assays, along with HPLC analysis. Sensory evaluation encompassed assessments of color, consistency and texture, odor, taste, and aroma.

The obtained results indicated a decrease in water activity and pH value after freezing, accompanied by an increase in acidity. HMF content and diastase activity exhibited only minor changes compared to the control sample. Additionally, an increase in total flavonoid content and higher FRAP and DPPH values were observed. HPLC analysis revealed elevated levels of catechin and malvidin in the treated sample. Sensory evaluation showed no significant differences in the taste and aroma of honeydew honey following the freezing treatment.

Keywords: honeydew honey, freezing treatment, antioxidant activita, sensory properties.

SENSORY EVALUATION OF COMMERCIAL FISH PÂTÉS AS A BASIS FOR THE DEVELOPMENT OF AN INNOVATIVE FISH SPREAD

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ABSTRACT

The aim of this study was to conduct a sensory analysis of commercial fish pâtés available on the Serbian market to identify their "strengths and weaknesses" in the context of developing a new fish spread. A total of 11 samples, made from both marine and freshwater fish, were evaluated under controlled conditions following ISO standards (SRPS EN ISO 8589:2015) by a ten-member expert panel (ISO 8586:2023). Using seven-point numerical scales (SRPS ISO 4121:2013), various parameters were assessed, including appearance (color uniformity, lightness, red color intensity, surface homogeneity), texture (hardness, spreadability, adhesiveness, graininess), and sensory characteristics such as aroma and taste.

Sensory evaluation revealed notable differences among the examined samples. Marine fish pâtés, primarily made of tuna, hake, and salmon, dominated the market and exhibited a more distinct characteristic aroma and aroma. In contrast, freshwater fish pâtés, such as those made of trout, displayed greater textural uniformity, contributing to a smoother and more cohesive consistency. Based on the results of sensory evaluation, the highest-rated samples were selected for instrumental measurements of color and texture parameters. Color measurements were performed using a portable colorimeter (CR-400, Konica Minolta, Tokyo, Japan), while texture analysis was carried out with a Texture Analyzer TA.XT Plus (Stable Micro Systems, England). These findings provide

valuable insights for optimizing formulation and technological parameters in the development of an innovative fish spread, particularly by exploring the potential of underutilized fish species such as freshwater bream (*Abramis brama*), roach (*Rutilus rutilus*), species from the *Mugilidae* family (mullets), and lumpfish (*Cyclopterus lumpus*), which have been identified as key low-trophic species within the HEU project IMPRESS.

Keywords: fish pâtés, sensory analysis, product development, marine fish, freshwater fish.

Acknowledgments: This study is supported by project IMPRESS that has received funding from the European Union's Horizon Europe programme (GA No. 101084437).

CIRCULAR ECONOMY: IMMOBILIZATION OF *LACTOBACILLUS ACIDOPHILUS* ON FLAXSEED CAKE

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ABSTRACT

Lactobacillus acidophilus has been increasingly studied as a probiotic for allergy treatment. For probiotics to deliver their beneficial effects, they need to be present in adequate numbers, which is often achieved by immobilizing them within protective matrices. A flaxseed cake is rich in fibers, proteins, and bioactive components which makes it a potential good carrier for probiotics.

Flaxseed cake, obtained from the cold-pressed oils industry, was grounded, sieved to a diameter of less than 600µm, sterilized, and diluted in distilled water at 10 % (w/v). After *L. acidophilus* inoculation, one sample was fermented, incubated at 4 °C for 1 h, frozen, and freeze-dried, while the other was subjected to every step but fermentation. The lyophilized probiotic powder was examined for probiotic viability and antioxidant capacity.

The probiotic culture showed a high survival rate in both samples. The fermentation decreased probiotic viability during the lyophilization procedure by 13 % but significantly increased the antioxidant activity of probiotic powder. The results indicate that flaxseed cake is a good probiotic carrier.

Keywords: probiotics, freeze-dry, immobilization, flaxseed residue, antioxidant.

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IMPACT OF FLAXSEED CAKE HYDROLYSIS ON ANTIOXIDANT CAPACITY

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ABSTRACT

Cold pressing of flaxseed produces high-quality oil along with a nutritionally rich by-product—flaxseed cake. While the cold-pressing process is valued for its minimal processing and preservation of oil quality, it is also characterized by low resource utilization efficiency and significant by-product generation. Specifically, the production of 1 kg of flaxseed oil results in approximately 2 kg of residual cake. Given its high protein content (approximately 35–40%), flaxseed cake holds considerable potential as a source of bioactive peptides and other value-added compounds

In this study, flaxseed cake obtained from cold pressing was milled and sieved to a particle size below 0.6 mm. Its chemical composition (protein, oil, fiber) was analyzed. Controlled enzymatic hydrolysis was performed with Trypsin for 2 h. An E/S ratio was 5 %, and the temperature used for hydrolysis was 37 °C. The antioxidant capacity of the non-hydrolyzed sample and hydrolysate was determined.

Protein content was 37 %, oil was about 20 %, and fiber was approximately 40 %. The results showed a degree of hydrolysis of about 5% and a significant increase in antioxidant activity. The hydrolysate had about two times higher antioxidant potential compared to the non-hydrolyzed sample.

Keywords: hydrolysis, protein, Trypsin flaxseed residue, antioxidant.

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IMPACT OF TREHALOSE-BASED CRYOPROTECTANT ON IMMOBILIZATION AND RELEASE OF *LACTOBACILLUS PLANTARUM* OBTAINED FOR WOUND DRESSING

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ABSTRACT

Lactobacillus plantarum has been increasingly studied and applied in the context of wound healing and wound dressings, thanks to its antimicrobial, anti-inflammatory, and biofilm disruption properties. In some approaches, lyophilized (freeze-dried) *L. plantarum* is applied as a powder or mixed with a carrier to facilitate topical delivery.

Lactobacillus plantarum was diluted in 10 % trehalose and a mixture of 5 % trehalose and skim milk. The mixtures were aseptically added on top of AC pads, frozen at −80 °C, and freeze-dried for 5 h. Immobilized probiotics on AC pads were incubated in normal saline at 37 °C for 24 h. Immobilization efficiency after lyophilization and the release of probiotics from the pad after 10 and 180 minutes, as well as after 24 hours were determined.

The combination of trehalose and skim milk showed significantly better results, maintaining almost 80 % viability after 24 h, Trehalose alone preserved almost half as many probiotics compared to trehalose with milk. Since the controlled release of probiotics is essential for their antimicrobial effectiveness in wound dressings, it can be concluded that the AC pad containing probiotics protected with both trehalose and skim milk is a more effective option than the probiotics protected with trehalose alone.

Keywords: *Lactobacillus plantarum*, freeze-dry, immobilization, AC pad, milk.

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FUNCTIONALIZED COMPOSITES BASED ON POLYVINYL ALCOHOL AND ACTIVATED CHARCOAL FOR ADVANCED WOUND APPLICATION

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ABSTRACT

Chronic wounds remain a pressing healthcare challenge, often complicated by microbial colonization and persistent inflammation. To address the growing need for multifunctional wound dressings, this study explores polyvinyl alcohol (PVA) hydrogels combined with activated charcoal (AC), and further functionalized with either silver ions (SI) or povidone-iodine (PI). The aim was to combine moisture retention, antimicrobial efficacy, malodor control, and structural stability in a single material. PVA–AC hydrogels were synthesized through a freezing-thawing method and subsequently loaded with antimicrobial agents via immersion in either 100 or 1000 ppm water solutions. Characterization revealed successful incorporation of both SI and PI onto AC, although only silver-functionalized hydrogels demonstrated significant antimicrobial activity against clinical isolate of *Klebsiella pneumoniae*, showing a 3–4-fold reduction in bacterial count. PI-functionalized samples, in contrast, failed to release detectable iodine into the simulated wound fluid, likely due to strong adsorption onto AC. Swelling tests showed moderate fluid uptake, with slightly lower values in AC-containing samples. These findings suggest that PVA–AC–SI hydrogels hold

promise as effective antimicrobial dressings, while the modular nature of the developed material supports future adaptation with other therapeutic agents.

Keywords: multifunctional wound dressing, antimicrobial activity, silver ions, povidone-iodine.

Acknowledgments

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SODIUM CHLORIDE SOLUTION TEST OF TI_6AL_4V IMPLANT SPECIMENS MANUFACTURED BY ADDITIVE TECHNOLOGY

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ABSTRACT

Additive technology is a valuable process for medical implant manufacturing. The most common metallic material in this area is the Ti_6Al_4V alloy. The research aimed to learn the implant material behaviour in saltwater environments. During the sodium chloride test, mate-rial quantity and quality loss need to be evaluated. The corrosion resistance tests were performed with a 3% concentration of NaCl solution at 36°C, with a duration of 4, 8, 12, and 16 days. The weight loss quality is determined by the test sample weight measuring before and after the tests. The NaCl solution was also tested to characterize the most relevant quality element, which was retrieved from the implant material during the test. The quality of the lost element is determined by metal ion concentration determination by an inductively coupled plasma–optical emission spectroscope (ICP). Based on the experimental results, it can be declared that the weight loss increased as a function of time, and the measurable element was the aluminium in the NaCl solution. The chemical component of aluminium can cause many diseases and health problems. It should be stated that the additive Ti_6Al_4V implant material without surface treatment is not recommended.

Keywords: corrosion, additive manufacturing, Ti6Al4V, ICP test, implant.

UTILIZATION OF INDUSTRIAL CO_2 IN EOR METHODS FOR ENHANCED OIL RECOVERY

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ABSTRACT

A significant portion of oil remains trapped in reservoirs after primary and secondary recovery, creating the need for advanced enhanced oil recovery (EOR) techniques. One of the more efficient and environmentally friendly methods is the use of industrial CO_2 in the enhanced oil recovery process (CO_2-EOR). This paper provides an overview of the mechanisms through which CO_2 interacts with oil reservoirs, including viscosity reduction, improved mobility, and the achievement of miscibility, all of which promote the displacement of residual oil from the porous medium. The potential for CO_2 sequestration is also considered, making this method compatible with the principles of sustainable energy production and greenhouse gas emission reduction. Based on available experimental and simulation data from relevant literature, the positive effects of CO_2 injection are highlighted: oil recovery factor increases of up to 15%, and viscosity reductions of up to 80% compared to conventional methods. Despite technical and economic challenges, CO_2-EOR presents a promising opportunity to extend the productive life of oil reservoirs and reduce greenhouse gas emissions.

Keywords: CO_2-EOR, industrial CO_2, enhanced recovery, CO_2 sequestration, sustainable exploitation.

INDUSTRIAL HEMP AS A SUSTAINABLE ENERGY SOURCE: TECHNO-ECONOMIC AND ENVIRONMENTAL INSIGHTS

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ABSTRACT

Industrial hemp (*Cannabis sativa*) holds significant promise as a sustainable biofuel feedstock due to its high biomass yield, adaptability, and minimal environmental footprint. Its rapid growth, resilience to pests, ability to thrive on marginal lands without competing with food crops, along with high oil and lignocellulosic content, makes it ideal for integrated biorefinery approaches. Advances in cultivation, oil extraction, and conversion technologies have enabled the production of biodiesel, bioethanol, biogas, and biochar from various plant parts and residues. Hemp-based biorefineries can integrate biodiesel from seeds and bioethanol from lignocellulosic residues, achieving energy yields up to 100 GJ/ha. Life cycle assessment (LCA) studies consistently show that hemp-based biofuels reduce greenhouse gas (GHG) emissions, energy consumption, and environmental burdens, with high energy efficiency, especially through anaerobic digestion and incineration. The integration of biofuel production with high-value co-products in a circular economy framework further improves environmental and economic performance. Despite limited global cultivation due to regulatory constraints, hemp offers a scalable, climate-resilient solution for decarbonizing

the energy sector. Technological innovation and comprehensive environmental assessments are key to unlocking hemp's full potential in low-carbon energy systems.

Keywords: Industrial hemp (*Cannabis sativa*), biofuel, life cycle assessment, biorefinery approach, environmental sustainability.

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COMPARATIVE ANALYSIS OF CONVENTIONAL AND ADVANCED METHODS FOR INDUSTRIAL HEMP OIL EXTRACTION

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ABSTRACT

Industrial hemp (*Cannabis sativa*) is primarily cultivated for its versatile raw materials, including fibers from stems and oil from seeds, which hold significant value across various industrial applications. The extraction of industrial hemp oil (IHO) has garnered growing interest due to its nutritional and industrial value; however, comprehensive comparisons of different IHO extraction methods, regarding relative efficiencies and oil quality, remain scarce. The extraction method, whether conventional (mechanical pressing, solvent extraction) or advanced (ultrasound-assisted, microwave-assisted, high-pressure-assisted, and supercritical CO_2 extractions), plays a crucial role in determining the IHO yield and quality. Advanced solvent-based techniques generally offer higher extraction efficiencies and significantly reduce duration. Microwave-assisted extraction achieved an IHO yield of 53.8% for 30 min, surpassing ultrasound-assisted (46.8%) and screw pressing (41.1%). Though Soxhlet extraction provides high yields (up to 37.9%), extended duration (up to 24 h) makes it less practical for industrial use. Supercritical CO_2 methods showed lower efficiency, but provided high-quality oil. The use of pressurized *n*-propane provides superior quality oil

with slightly lower yields and reduced operational costs. Overall, advanced methods demonstrate promise for efficient, high-quality IHO extraction, but optimal selection depends on balancing yield, time, cost, and oil quality parameters.

Keywords: Industrial hemp (*Cannabis sativa*), extraction methods, industrial hemp oil yield, fatty acid composition.

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PERFORMANCE AND EMISSION CHARACTERISTICS OF BIODIESEL DERIVED FROM INDUSTRIAL HEMP OIL

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ABSTARCT

Biodiesel produced from industrial hemp oil (IHO) represents a promising carbon-neutral alternative to fossil diesel, aligning with global efforts to reduce greenhouse gas emissions. Industrial hemp's exceptional carbon sequestration potential enhances its sustainability as a biodiesel feedstock. The primary method for biodiesel synthesis is base-catalyzed transesterification using methanol. Emerging strategies such as two-step acid–base catalysis address high free fatty acid (FFA) content, yet advanced techniques like enzymatic catalysis, sub/supercritical methanolysis, and innovative methods involving ultrasound, microwaves, or ionic liquids remain largely unexplored. The physicochemical characteristics of IHO-based biodiesel (IHOBB) significantly influence engine performance and emissions. The brake thermal efficiency (BTE) decreases gradually as the proportion of biodiesel in the blend increases. While blends such as B5 to B20 show BTE and fuel consumption comparable to diesel, higher blends increase brake-specific fuel and energy consumption. Emission analysis reveals that IHOBB generally reduces CO and unburned hydrocarbons due to its oxygenated nature, but may raise NOx emissions and exhaust gas temperature. Viscosity-induced issues, such as elevated smoke opacity at higher blends, pose

challenges for fuel atomization and combustion. Nonetheless, IHOBB blends can be successfully used in compression ignition engines without modifications.

Keywords: Industrial hemp (*Cannabis sativa*), biodiesel, blends, fuel properties, exhaust gas emissions.

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This work was supported by the Republic of Serbia - Ministry of Science, Technological Development and Innovation (Programs for financing scientific research: 451-03-18/2025-03/200155 assigned to the Faculty of Technical Sciences, Kosova Mitrovica, 451-03-137/2025-03/200116 assigned to the Faculty of Agriculture, Belgrade; 451-03-137/2025-03/200133 assigned to the Faculty of Technology, Leskovac; 451-03-66/2024-03/200032 assigned to the Institute of Field and Vegetable Crops, Novi Sad), Innovation Centre, Faculty of Technology and Metallurgy (451-03-136/2025-03/200287), and the Serbian Academy of Sciences and Arts (SASA), Branch of SASA in Niš (Project F-78).

MINERAL CHARACTERIZATION OF COLD-PRESSED FODDER RADISH SEED PRODUCTS: OIL, PRESS CAKE, AND DEFATTED MEAL

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ABSTRACT

Oilseed radish (*Raphanus sativus* var. *oleiformis*) is recognized for its oil-rich seeds, yielding valuable by-products such as oil, press cake, and defatted meal. This study employed Inductively Coupled Plasma Optical Emission Spectrometry (ICP-OES) to analyze the mineral composition of cold-pressed radish seed products, including the unprocessed cake and the product of the extraction with *n*-hexane. A total of 26 macro- and microelements were assessed. Results highlighted the mineral profiles, demonstrating that the defatted meal exhibited enriched mineral concentrations compared to the unprocessed cake, emphasizing its potential as a nutritious animal feed. The extracted oil, conversely, showed lower mineral content but contained essential elements such as P, Ca, and K, with negligible levels of toxic metals such as Pb and Cd. These findings underscore the nutritional and technological significance of fodder radish seed products for animal feed and agro-industrial applications.

Keywords: radish oil, seed cake, mineral composition, ICP-OES analysis.

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INFLUENCE OF CATALYSTS ON THE COSOLVENT-ASSISTED METHANOLYSIS OF WASTE POLYETHYLENE TEREPHTHALATE

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ABSTRACT

Polyethylene terephthalate (PET) is the fourth most produced polymer worldwide, however, its recycling rate remains below 30% in most countries. Among various PET recycling methods, chemical depolymerization offers significant potential for closed-loop recycling, enabling the recovery of monomeric or dimeric constituents and the production of new PET with properties comparable to the original material. In this study, waste PET strips were subjected to cosolvent-assisted methanolysis using various catalysts. The aim was to investigate the influence of selected catalysts (KOH, NaOH, K_2CO_3, and CaO) on the depolymerization efficiency of PET in the presence of tetrahydrofuran as a cosolvent. The experiments were conducted in a stirred batch reactor under the following reaction conditions: temperature 70 ºC, a methanol-to-PET molar ratio of 50:1, a tetrahydrofuran-to-PET molar ratio of 50:1, and catalyst-to-PET molar ratio of 0.5:1. The highest PET conversion (97%) was achieved using KOH as a catalyst within 30 min. A similar conversion (96.8%) was obtained with NaOH under the same reaction conditions, whereas the use of K_2CO_3 and CaO resulted in no PET conversion, even after 6 and 12 h, respectively. Based on the results, KOH and NaOH were identified as effective catalysts for the cosolvent-assisted methanolysis of waste PET.

Keywords: alkaline catalysts, methanolysis polyethylene terephthalate, tetrahydrofuran.

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ENHANCING BIODIESEL PRODUCTION FROM RADISH SEED OIL USING TRIETHANOLAMINE–PROPYLENE GLYCOL DEEP EUTECTIC SOLVENT

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ABSTRACT

Biodiesel production is often limited by high feedstock costs, which can account for 70-95% of total production costs. Radish (*Raphanus sativus* L.) seed oil (RSO), which yields 40% and contains high erucic acid levels, could be a promising non-edible alternative. This study investigates biodiesel production from RSO via methanolysis in the presence of uncalcined CaO as a catalyst and the deep eutectic solvent triethanolamine:propylene glycol (TEOA:PEG) (molar ratio of 1:2) as a cosolvent. The transesterification of RSO was performed at 60 °C under atmospheric pressure, with continuous stirring (500 min^{-1}), employing a methanol-to-RSO molar ratio of 12:1, 10 wt.% uncalcined CaO, and 6 wt.% TEOA:PEG (based on the weight of RSO). The control reaction was performed under identical conditions without the cosolvent. The presence of TEOA:PEG significantly enhanced the process, achieving a maximum FAME content of 99±0.3% within 10 min, whereas the control reaction reached a FAME content of 97±0.07% after 60 min. These findings indicated the positive effect of TEOA:PEG as a cosolvent on the FAME content and reaction rate. Utilizing RSO as a feedstock and TEOA:PEG as a cosolvent presents a cost-effective and efficient approach to biodiesel production.

Keywords: biodiesel, deep eutectic solvent, methanolysis, triethanolamine, radish.

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TAILORING VALPROATE-BASED IONIC LIQUIDS FOR NEUROPHARMACEUTICAL APPLICATIONS: HYDRATION BEHAVIOR AND THERMOPHYSICAL INSIGHT

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ABSTRACT

Valproic acid is a well-established antiepileptic drug, but its formulation in conventional systems often encounters solubility, bioavailability, and stability limitations. Two pharmaceutically active ionic liquids (API-ILs) based on valproic acid were synthesized using ethanolamine and choline as cationic components to address these challenges. These cations were selected not only for their biocompatibility but also due to their neuroactive roles, as structural constituents of neuronal membranes, and their ability to cross the blood-brain barrier. The aim of this study is to develop novel API-ILs with potential synergistic pharmacological effects and favorable aqueous interaction profiles.

Fourier-transform infrared spectroscopy (FTIR) and nuclear magnetic resonance (NMR) spectroscopy structurally characterized the synthesized ionic liquids. Their interaction with water was investigated through experimental determination of density, sound velocity, and viscosity in the temperature range of T = 283.15 K to 323.15 K, at concentrations up to 0.5 mol·kg^{-1}. Based on the experimental data, apparent molar volumes and limiting apparent molar expansibilities were calculated, providing insight into solute–solvent interactions and hydration structure. In addition, Jones–Dole viscosity B coefficients were determined to evaluate solute-induced structuring or disruption of the water network.

The results indicate clear differences in hydration behavior and structuring tendencies between the protic (ethanolammonium-based) and aprotic (cholinium-based) ionic liquids, particularly in their temperature dependence and concentration trends. These findings emphasize the importance of targeted physicochemical profiling in developing functionalized ionic liquids for biomedical applications, particularly for central nervous system drug delivery.

Keywords: Valproic acid, Ionic liquids, Hydration, Neuroactive cations, Thermodynamics.

DESIGN OF BIOCOMPATIBLE TOPICAL FORMULATIONS BASED ON PHARMACEUTICALLY ACTIVE IONIC LIQUIDS AND NATURAL DEEP EUTECTIC SOLVENTS

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ABSTRACT

The synthesis and application of pharmaceutically active ionic liquids (API-ILs) represent an innovative strategy for overcoming challenges related to poor aqueous solubility, polymorphism, and low bioavailability of conventional drug formulations. In this study, we investigated the solvation behavior and thermophysical properties of the API-IL benzocainium ibuprofenate ([Ben][Ibu]), a compound composed entirely of active pharmaceutical ingredients, in two types of natural deep eutectic solvents (NADESs): menthol:decanoic acid and menthol:lauric acid, both in a 2:1 molar ratio. These hydrophobic NADESs were selected for their potential to enhance solubility and facilitate transdermal delivery.

The ionic liquid was synthesized and characterized by IR, NMR, and DSC, revealing a melting point around 60 °C. Poor water solubility of [Ben][Ibu] (0.0006 mol·dm^{-3}) was significantly improved in both NADESs, reaching over 0.4 mol·dm^{-3}. Systematic studies of density, viscosity, and speed of sound were performed in the temperature range of T = 293.15–318.15 K. Thermodynamic parameters, such as apparent molar volume and isentropic compressibility at infinite dilution, were determined to assess solute-solvent interactions and structural organization within the mixtures.

Results indicate that the solvent composition significantly affects ion–ion and ion–solvent interactions, with menthol-rich systems showing enhanced structuring and reduced solvation ability. In contrast, decanoic acid-rich systems facilitate better solvation and reduce ion pairing. The menthol:lauric acid system demonstrated lower apparent molar volume values, implying more compact solvation shells due to steric and hydrogen-bonding effects. These findings underscore the potential of combining API-ILs with NADESs to design customizable, biocompatible formulations for localized drug delivery with improved physicochemical stability and reduced systemic absorption risks.

Keywords: API-ILs, NADES, Solubility, Topical delivery, Thermodynamics.

PHYSICO-CHEMICAL INVESTIGATION OF IONIC ADDITIVES FOR ENHANCED LITHIUM-ION BATTERY PERFORMANCE

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ABSTRACT

The development of high-energy density, safe, affordable, and environmentally friendly energy storage devices is crucial for the energy transition. Lithium-ion batteries (LIBs) currently dominate the global energy storage market, but their safety, cost, and environmental impact are significant concerns. The highly flammable and toxic state-of-the-art electrolytes used in LIBs are a major concern, as they can pose a risk to both people and the environment. Electrolyte additives, though typically used in small concentrations, have a disproportionate impact on battery performance by influencing interfacial chemistry, thermal stability, electrochemical stability, and overall battery lifespan. Traditional additive such as vinylene carbonate (VC) has long been employed to enhance the formation of stable solid electrolyte interphases (SEI) and cathode electrolyte interphases (CEI). However, the growing complexity of modern LIB chemistries, including high-voltage cathodes and silicon-based anodes, has necessitated the development of next-generation additives capable of meeting more demanding electrochemical environments.

This paper provides an in-depth discussion of newly explored electrolyte additives, focusing particularly on innovative molecular designs that introduce enhanced functionality and stability. Among these, zwitterionic additives have attracted significant attention due to their unique dipolar structures confer high polarity and intrinsic charge neutrality. These properties allow zwitterions to

effectively modulate solvation structures, stabilize lithium-ion transport pathways, and suppress undesirable side reactions at electrode interfaces. Recent studies have demonstrated their potential to improve high-voltage stability, reduce gas evolution, and extend battery cycle life, making them promising candidates for advanced LIB systems.

This work aims to highlight structure–function relationships and guide future additive design strategies through a comparative analysis of additive performance. The discussion concludes with a perspective on integrating multifunctional additives into commercial electrolyte formulations and the remaining challenges in translating laboratory-scale advancements into scalable, cost-effective solutions. Overall, this review underscores the critical role of novel electrolyte additives in the continued evolution of lithium-ion battery technology toward safer, higher-performing, and more durable energy storage systems.

Keywords: Lithium-ion batteries, electrolyte, zwitterion additives, physico-chemical characterization.

Acknowledgments: This research was supported by the Science Fund of the Republic of Serbia, GRANT No 11036, *The new ionic additives for safer and durable electrolytes in lithium-ion batteries* - SafeLi.

INFLUENCE OF SELECT BIOLOGICALLY ACTIVE CO-SOLUTES ON METFORMIN HYDRATION PROPERTIES

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ABSTRACT

Metformin is the primary drug used for treatment of type 2 diabetes mellitus due to its ideal combination of effectiveness, safety and price. As with all pharmacologically active compounds, understanding its behavior in a water medium is of great value, especially how the presence of a third component affects this behavior. Due to a large number of potential molecules that can be present in the body in parallel with metformin, this work selected four as a "vertical slice" to represent several types of molecule. The third components that were analyzed were glutamine, as the most abundant amino acid in the body, sodium salicylate as a representative of another pharmacologically active compound, nicotine and caffeine were also selected as representatives of psychoactive compounds often taken recreationally. To analyze the effects of these substances on metformin hydration: density, sound velocity and viscosity measurements were performed.

The results show significant differences in metformin hydration depending on the third component of the system. The differences include hydration numbers, taste and structure making/breaking. This highlights that extensive and targeted analysis of hydration properties is key to understand and predict the behavior of a pharmacologically active substance such as metformin.

Keywords: metformin, water, density, viscosity, sound velocity.

Acknowledgements: The authors are grateful for the financial support of Provincial Secretariat for Higher Education and Scientific Research, grant number: 142-451-2545/2021-01 and the Ministry of Science, Technological Development and Innovation of the Republic of Serbia and Doctoral Stipend for Andrija Vukov No. 451-418/2024-03/3324.

ROLE OF METHYL SALICYLATE ON THE SOLUBILITY AND AGGREGATION BEHAVIOR OF CAFFEINE: THERMODYNAMIC AND MOLECULAR SIMULATIONS

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ABSTRACT

Caffeine, the most prevalent psychoactive substance, is classified within the xanthine alkaloids. This compound is an active ingredient in various consumables, including coffee, black and green tea, soft drinks, and energy beverages. Caffeine exhibits relatively low solubility in water (approximately 16 $mg \cdot mL^{-1}$ at room temperature), which presents significant challenges, particularly for products consumed or stored at lower temperatures, such as certain beverages, as well as for an array of supplements, pharmaceuticals, and applications within the cosmetic industry. The limited solubility of caffeine in water is attributed to the self-association and aggregation of its molecules through hydrophobic interactions. Our research aims to ascertain caffeine's solubility and the structural organization of its molecules in solvents that are appropriate for extensive utilization across the aforementioned industries. One solvent that fulfills both criteria is methyl salicylate. Typically recognized as a fragrance and flavoring agent in mouthwashes at low concentrations, methyl salicylate is utilized in higher concentrations as a topical analgesic for musculoskeletal pain.

This research integrates experimental (solubility, volumetric, and viscosimetric) analyses with computational simulations to explore the aggregation behaviour of caffeine in methyl salicylate. The results noted in volumetric and viscosimetric measurements indicate that caffeine self-aggregation does not happen in the presence of methyl salicylate. Molecules of methyl salicylate form

a clathrate-like structure around the one caffeine molecule. According to the molecular dynamic simulations, interactions between caffeine and methyl salicylate molecules occur through hydroxyl groups of methyl salicylate and carbonyl caffeine groups. Based on the results obtained, it is concluded that caffeine has a zwitterionic structure in the methyl salicylate solution.

The results demonstrate that methyl salicylate enhances caffeine solubility and inhibits its self-association. These findings provide a foundational framework for developing topical and transdermal caffeine formulations in the pharmaceutical and cosmetic industries.

Keywords: Caffeine, methyl salicylate, MD simulations, solubility, thermodynamic.

Acknowledgements: The acknowledgement for the support of the Cost Action CA18202 " NECTAR - the Network for Equilibria and Chemical Thermodynamics Advanced Research", and the Secretariat for Higher Education and Scientific Research of the Autonomous Province of Vojvodina, Serbia (Grant No. 142-451-2545/2021-01/2).

PREPARATION AND LONG-TERM STABILIZATION OF POLYSACCHARIDE NANOFIBERS

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ABSTRACT

As an increasingly implemented technique for nanofabrication, electrospinning has appeared as versatile and cost effective for producing nanofibers with controlled morphology and uniform diameters. Unique continuous nanofibrous structure with fascinating features obtained by electrospinning technique make them attractive for applications in the area of foog packaging, filtration, controlled drug delivery, tissue engineering, wound dressing, and other biomedical applications. High porosity and specific surface to volume ratio of interconnected nanofibers provide great adhesive abilities and structural similarities with extracellular matrix. Pullulan is an extracellular and microbial polysaccharide generated by the activity of fungus *Aerobasidium pullulans*. Owing to its linear structure composed of α-(1→6)-linked maltotriose units, it is regarded as edible, biocompatible and material obtained from renewable resources. Pullulan is water-soluble and nanofibers can be easily fabricated from water solutions, but also their structure can be damaged by contanct with water or in hydrated conditions, reducing its mechanical strength and limiting its practical applications as structural materials. Therefore, fine chemical modifications of the resulting nanofibers are necessary to improve the degradation resistance and mechanical properties for their successful potential applications. Pullulan nanofibers were fabricated from water systems via electrospinning technique and stabilized by in-situ chemical crosslinking using trisodium trimetaphosphate (SMP) (5 and 10 wt.% per polymer weight) under

alkaline conditions. Fourier transform infrared spectroscopy (FTIR), differential scanning calorimetry (DSC), scanning electron microscopy (SEM) and water solubility tests were performed to evaluate chemical structure, thermal stability, morphology and diameter of nanomats. Taken together, the result show significant improvement in water resistance and superiority of polysaccharide nanomaterials.

Keywords: electrospinning, bimedical engineering, biopolymers.

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SYNERGISTIC PROPERTY ENHANCEMENT IN BIODEGRADABLE POLYMER BLENDS: TAILORING POLYHYDROXYALKANOATE PERFORMANCE

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ABSTRACT

The increasing environmental burden of persistent synthetic plastics necessitates the development of sustainable alternatives. Polyhydroxyalkanoates (PHAs) represent a promising class of biodegradable polyesters derived from renewable resources. However, their inherent brittleness and limited processing window often restrict their wider applicability. This study investigates the impact of blending PHA with another biodegradable polymer, poly(butylene adipate-co-terephthalate) (PBAT), across a range of composition ratios (70/30, 50/50, 30/70, PHA/PBAT w/w). Blend films were prepared via solution casting and characterized for their thermal, mechanical, and morphological properties using Differential Scanning Calorimetry (DSC), Thermogravimetric Analysis (TGA), Universal Testing Machine, Scanning Electron Microscopy (SEM). The results demonstrate a significant influence of the blend ratio on the resulting material characteristics. Specifically, the incorporation of PBAT at 50% led to a notable increase in elongation at break improving its toughness and flexibility, compared to neat PHA, while maintaining acceptable tensile strength and thermal stability. Morphological analysis revealed varying degrees of miscibility between the phases, co-continuous morphology where both phases are interpenetrating networks influencing the overall blend performance. This research highlights the potential of strategically tailoring PHA-based blends through compositional

control to overcome their limitations and expand their utility in diverse sustainable applications.

Keywords: Polyhydroxyalkanoate (PHA), Biodegradable Polymer Blend, Sustainable Materials.

Acknowledgements: This research was funded by the Provincial Secretariat for Higher Education and Scientific Research, Autonomous Province of Vojvodina, Republic of Serbia Grants: No. 451-03-136/2025-03/200134.

INTERACTIONS OF HUMAN SERUM ALBUMIN WITH A PALLADIUM(II) COMPLEX CONTAINING A THIOAMIDE MOIETY: DETAILED EXPERIMENTAL AND MOLECULAR DOCKING STUDIES

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ABSTRACT

Thioamides and their derivatives are an interesting group of compounds because of their structural variations and also because of the combination of hard and soft donor atoms (S and N) that potentially allow coordination – in a variety of binding modes – to a wide range of metal centers, and also because of their biological significance.

In our previous studies, we have synthesized a palladium(II) complex with a thioamide-type ligand of the formula $[PdL_2Cl_2]$ (L= ethyl 4-[1-amino-2-cyano-3-(methylamino)-3-thioxo-1-propen-1-yl]-1-piperazine-1-carboxylate), whose ability to interact with DNA was investigated fluorometrically. In this work, research was continued in the direction of studying the interactions of the thioamide ligand and its palladium(II) complex with human serum albumin (HSA) in the presence of site-specific markers: warfarin (site I, subdomain IIA), ibuprofen (site II, subdomain IIIA) or methyl orange (site III, subdomain IB), to determine the binding affinity, binding strength and the location of binding site. The results obtained showed that ligand and complex bind moderately to the HSA via the site III (subdomain IB), and that the quenching mechanism is static.

Keywords: palladium(II), thioamide, HSA interaction, competitive binding studies, docking simulation .

BETA-DIKETO ESTERS IN REMEDIATION PROCESS OF SEWAGE SLUDGE

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ABSTRACT

The Claisen condensation reaction between diethyl oxalate and methyl ketone (2-Acetyl Thiophene) was performed to obtain sodium salts of biologically important beta-diketo ester. The antimicrobial activity was tested *in vitro* to further investigate the antimicrobial potential of the compound for future use in sludge treatment. Microbiological research was conducted in two directions. The first direction is the examination of whether and in what concentrations the substance has an antimicrobial effect, that is, the assessment of whether the substance will disturb the natural microflora in water or soil. The antimicrobial action of the substance was tested using the microdilution method, using a certain number of microorganisms isolated from nature (isolates from heavy metal pollution sites) and standard strains (ATCC).

After that, the treated sludge was used and mixed with fertile soil in different ratios to determine the most suitable ratio for mixing the treated sludge with the soil. As a control, we used soil that contained untreated sludge. Crops of plants were planted on such soil. The tested substance had a certain degree of influence on microorganisms, but the degree of influence was significantly lower than the positive control (antibiotic). The results show that in the waste sludge there are almost no bacteria, or the number is extremely low. After a certain vegetation period, it is observed that the total number of bacteria and coliforms is the lowest on the substrate (fertilizer), control, and that it is the highest on KKM50 (half of the substrate and half of sewage sludge tested with the substance). The results

also showed that the compound has a favorable effect on the maintenance of the microbiological community in the soil compared to the control.

Keywords: beta-diketo esters, antimicrobial effects, remediation process, sludge treatment, environmental protection.

INNOVATIVE APPROACH TO NEUTRALIZING OF POLLUTANTS IN ASBESTOS TAILINGS USING B–DIKETONATE

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ABSTRACT

The subject of this study is the application of an innovative approach to neutralize pollutants from asbestos sampled in asbestos tailings in Kotraža (Republic of Serbia). The potential application of beta-diketonates at different concentrations (10, 30, 50, 100, 200 mg/L) as a means of neutralizing pollutants in asbestos tailings was tested using bioassay methods (sandwich method) on the model organism red clover (Trifolium pratense L.). The results showed that the synthesized β-diketonate exhibited selective effects depending on the concentration applied and the substrate to which it was applied. On agarose medium and plant growth substrate, lower concentrations of β-diketonate showed a positive effect on the growth of T. pratense roots. On a commercial plant substrate as substrate, β-diketonate at concentrations of 30 mg/L reduced inhibition and stimulated root growth of the tested species compared to untreated substrate, while on asbestos substrate at the same concentration it did not significantly reduce the inhibitory effect on root growth. The results of the study indicate the potential of β-diketonates to neutralize the toxic effect of pollutants in the tested substrate, especially at low concentrations, and indicate the possibility of their application in sustainable soil remediation and environmental pollution control.

Keywords: asbestos, pollutants, β-diketonate, neutralization.

BIOLOGICAL TEST METHODS – MODEL FOR ASSESSING THE NEUTRALIZATION OF SEWAGE SLUDGE POLLUTANTS USING B–DIKETONATE

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ABSTRACT

The subject of this study is the application of an innovative approach to the neutralization of pollutants from sewage sludge taken from the Cvetojevac wastewater treatment plant in Kragujevac (Republic of Serbia). The aim of the research was to investigate the possibility of using β-diketonate as a means of neutralizing pollutants from sewage sludge using a modified bioassay method (sandwich method). Red clover (Trifolium pratense L.) was used as a model organism to test seed germination in sludge treated with synthesized β-diketonate at varying concentrations (10, 30, 50, 100, 200 mg/L). The results indicate that β-diketonate application significantly affected the germination rate and root growth of T. pratense. The synthesized β-diketonate demonstrates potential for pollutant neutralization in sewage sludge and could be applicable in horticulture, agriculture, and environmental remediation.

Keywords: sewage sludge, pollutants, bioassay, β-diketonate, neutralization.

EFFECT OF GAMMA RADIATION ON THE STRUCTURAL AND MECHANICAL PROPERTIES OF IPP-LDPE POLYMER BLENDS

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ABSTRACT

This study investigates the impact of gamma radiation on the thermal and mechanical properties of isotactic polypropylene (iPP) and low-density polyethylene (LDPE) blends, aiming to assess the changes that occur during sterilization or material modification processes. Blends with different iPP/LDPE ratios were exposed to gamma radiation doses of 25 kGy and 50 kGy. Thermogravimetric analysis (TG) and differential thermal analysis (DTA) revealed changes in thermal stability, which depend on both the radiation dose and the blend composition. Mechanical testing showed that gamma radiation can induce crosslinking as well as macromolecular degradation, resulting in either a reduction or an increase in tensile strength and elongation at break, depending on the conditions. Although multiple radiation doses can negatively affect mechanical properties, certain conditions can improve specific properties. The results suggest that gamma radiation can be a useful tool for modifying recycled polymer materials, but precise optimization of doses is required to avoid degradation. This research contributes to a better understanding of the behavior of iPP-LDPE blends under radiation and opens up possibilities for their functional application in packaging and medical materials.

Keywords: Gamma radiation, iPP, LDPE, thermal stability, mechanical properties.

CHITOSAN AS A FORMALDEHYDE SCAVENGER AND DYE SORBENT

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ABSTRACT

This study aims to investigate the effect of chitosan on the formaldehyde (FA) content in in-situ synthesized modified urea-formaldehyde (UF) resin, as well as the removal efficiency (R%) of Acid Red 183 (AR183) dye at various initial concentrations (100, 150, 200, 250, and 300 mg/dm³). The percentage of free and released FA was determined using the sulfite method. The content of free FA in the chitosan-modified UF resin is 0.06%, compared to 0.84% in the unmodified UF resin. After acid hydrolysis, the chitosan-modified UF resin exhibits a higher amount of released FA (2.52%) than the unmodified resin (1.74%).

The results indicate that R% remains relatively constant with increasing initial concentrations of AR183 dye, showing effective decolorization in all cases. For chitosan, R% slightly decreases from 99.01% to 98.25% as the dye concentration increases. At a concentration of 300 mg/dm³, R% increases with contact time, rising from 45.72% at 10 minutes to 98.25% at 150 minutes, when equilibrium is reached. Chitosan effectively removes free FA from the cross-linked modified UF resin and successfully adsorbs AR183 dye across various concentrations.

Keywords: Chitosan, formaldehyde, Acid red 183, adsorption, scavenger.

ELECTROCHEMICAL EVALUATION OF VO_X THIN FILMS FOR ENERGY STORAGE

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ABSTRACT

The growing demand for compact, flexible, and transparent energy storage systems is driving the exploration of advanced electrode materials for next-generation devices. Transition metal oxides have shown promising performance for these applications. Among them, vanadium oxide (VO_x) is a particularly interesting candidate due to its ability to exhibit multiple oxidation states and form non-stoichiometric compounds. In this study, VO_x thin films were deposited on transparent ITO-coated glass using DC reactive sputtering under varied oxygen pressures, without substrate heating. The resulting electrodes were characterized by SEM and UV-Vis spectroscopy, revealing homogeneous, non-porous films with a thickness of approximately 100 nm. The transparency and electronic properties of the films were found to depend on the deposition conditions. Electrochemical performance was evaluated in 1 M Na_2SO_4. Cyclic voltammetry revealed a high volumetric capacitance of 143 F/cm³ at a scan rate of 50 mV/s, while galvanostatic charge-discharge measurements showed good cycling stability at a current density of 1 mA/cm². These results demonstrate the potential of sputtering as a scalable deposition method for producing homogeneous thin films with tunable properties. The electrochemical performance of the prepared electrodes highlights their suitability for application in supercapacitors.

Keywords: vanadium oxide, thin films, supercapacitors.

MINIMIZING PLATINUM GROUP METAL CONTENT IN CATALYSTS FOR THE HYDROGEN EVOLUTION REACTION

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ABSTRACT

Platinum group metals (PGMs) exhibit the highest catalytic activity for the hydrogen evolution reaction (HER), but their rarity and cost hinder large scale adoption of hydrogen-based energy technologies. A promising strategy to address this challenge involves minimizing PGM usage by depositing them as nanoclusters on conductive carbon substrates. This study explores the electrodeposition of Pt, Pd, Ir, Rh, and Au as nanoscale clusters on glassy carbon (GC), graphene, and graphene nanoplatelets to enhance HER efficiency while significantly reducing metal loading. Controlled electrodeposition enabled uniform dispersion of nanoclusters, maximizing the surface area to mass ratio and catalytic exposure. Combining two, or more, of deposited metals can result in synergetic effect boosting their overall activity. Electrochemical testing demonstrated that these PGM-carbon composites achieved HER activity comparable to commercial Pt/C catalysts and bulk metal electrodes. The nanostructured catalysts also exhibited good stability under operational conditions. These findings highlight that strategic nanostructuring of PGMs on tailored carbon supports can reduce precious metal usage by over 90% without sacrificing performance, paving the way toward scalable, cost effective, and sustainable hydrogen production.

Keywords: Hydrogen evolution reaction, Electrodeposition, Platinum group metals, Nanoclusters, Carbon substrates.

XPS CHARACTERIZATION OF VO_X THIN FILMS OBTAINED BY SPUTTER DEPOSITION

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ABSTRACT

Vanadium oxide (VO_x) thin films exhibit versatile electrical and optical properties, making them attractive for applications in electrochromic devices, sensors, photocatalysis and electrocatalysis. In this study, VO_x thin films were deposited via DC reactive sputtering under varying oxygen partial pressures to tune their stoichiometry and chemical states. X-ray photoelectron spectroscopy (XPS) was employed to analyze the surface composition, oxidation states, and chemical environment of vanadium and oxygen species. The results for V 2p spectra revealed the presence of mixed oxidation states, primarily V^{5+} and V^{4+}, with the V^{5+}/V^{4+} ratio strongly dependent on the O_2 partial pressure used during deposition. The O 1s spectra indicated contributions from both lattice oxygen and adsorbed surface species. These findings highlight the sensitivity of VO_x film stoichiometry to sputtering parameters and demonstrate the utility of XPS in evaluating thin film composition and electronic structure. Tailoring the oxidation state distribution offers a pathway to optimizing VO_x thin films for target applications.

Keywords: Vanadium Oxide (VO_x), X-ray Photoelectron Spectroscopy (XPS), Thin Films, Sputter deposition.

THIN-FILM SUSTAINABLE TECHNOLOGIES: THE POTENTIAL OF VANADIUM OXIDES

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ABSTRACT

Vanadium oxides (VO_x) represent a diverse family of transition metal oxides with rich structural and electronic properties, making them promising candidates for a wide range of applications in sustainable technologies. Their ability to exhibit multiple oxidation states and reversible redox behavior enables their use in electrochemical systems such as supercapacitors, lithium-ion batteries, and electrochromic devices. Simultaneously, VO_x compounds possess tunable optical and semiconductor properties that make them attractive for photochemical applications, including photocatalytic degradation of pollutants and solar-driven water splitting. This mini review explores the multifunctional nature of VO_x materials, with a focus on their integration into thin films and nanostructures that enhance performance and enable scalable use. Emphasis is placed on recent advances in deposition techniques, structure–property relationships, and the dual electrochemical and photochemical potential of VO_x-based systems. By showcasing their adaptability and relevance to clean energy and environmental technologies, this review positions vanadium oxides as key materials for future innovation in green and smart devices.

Keywords: vanadium oxides electrochemistry photochemistry.

ADVANCES IN THE PERFORMANCE AND COMPATIBILITY OF INKJET PRINTING MATERIALS

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ABSTRACT

Inkjet printing has evolved into significant technology across a wide range of applications, mainly in the field of graphics, textiles and electronics. The performance of this technology is highly dependent on the complex interaction between inks and substrates, and their physical and chemical properties. This paper presents the recent advancements in inkjet printing material properties, focusing on their influence on printing quality and application areas. The study evaluates printing inks combined with a variety of structural substrates, highlighting the role of surface chemistry and energy distribution in ink adhesion and drying behavior. Enhancements in image details and color reproduction can be achieved by selecting suitable substrates and surface treatment methods and optimizing ink formulations. Recent innovations such as nanoparticle-based inks, functional coatings, and bio-based substrates are also explored for their potential to enhance performance while meeting sustainability goals. The findings provide insights into optimizing material selection for specific printing demands and highlight current trends in sustainable and high-performance inkjet printing technologies.

Keywords: inkjet printing, materials, inks, substrates, sustainability.

ARTIFICAL INTELLIGENCE SUPPORTED APPLICATION FOR EXPLOSIVE CLADDING PROCESS SPECIFICATION

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ABSTRACT

Explosive cladding is becoming increasingly widespread in the field of metalworking technologies. The advantage of this technology is that it cannot be combined with other welding technologies, and dissimilar metals can be joined by cohesion joint. The wide range of materials and the different properties of metallic materials (modulus of elasticity, tensile strength, hardness, ductility, etc.) are the reasons for the difficulty of determining the welding process specification. In addition, many explosives (with blast velocities below the speed of sound) are suitable for creating the appropriate bond strength. AI is a good tool for several applications and process parameter calculations. The innovative application supported by AI can help the welding engineer in the explosive welding process parameter determinations. For the welding process, the engineer chooses the suitable metal and explosive materials. AI, on the base of the explosive material parameters and the metallic materials' mechanical properties, calculate the explosive welding setup parameters. In this article, the algorithm of the application and the theoretical and practical elements of the technological design are presented in detail. The developed application facilitates the technological design of the otherwise complex blast welding process.

Keywords: welding, AI, application, explosive cladding, algorithm.

SURFACE MODIFICATION TECHNIQUES FOR DENTAL IMPLANTS

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ABSTRACT

Surface finishing of dental materials significantly influence their functional properties, biological compatibility, and long-term clinical performance. Given the diversity of materials used—including ceramics, metals, polymers, and bioactive composites—each material type necessitates a tailored approach to surface layer modification. This review focuses on the classification and analysis of primary surface finishing methodologies applied to dental materials. Mechanical techniques aimed at increasing micro-roughness are described alongside chemical methods targeting surface property alteration. Physical processes such as plasma activation and laser texturing are also examined. Attention is dedicated to treatments enhancing surface bioactivity, including the deposition of bioactive coatings and chemical surface functionalization. The study emphasizes the correlation between applied surface modification techniques, resultant changes in surface topography, and biological responses within the oral environment. Moreover, the necessity of customizing technological approaches based on specific clinical requirements is underscored. The insights gained provide guidance for the optimal selection of surface finishing according to material type and intended clinical application.

Keywords: surface finishing, modification, techniques, dental implant.

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PSYHOLOGY
PSIHOLOGIJA

TALENT MANAGEMENT IN FOOTBALL

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ABSTRACT

In Hungary, organizations involved in youth football development have undergone a major transformation in recent decades, both professionally, organizationally and financially. In parallel with the development of the sport, youth academies are also becoming increasingly formalized, which requires the development of an appropriate organizational framework. To implement the National Strategy for Sport adopted by the Hungarian Government in 2007, it was necessary to set up football academies to ensure that the social and economic objectives of youth development could be achieved. The State has channelled significant resources into the development of team sports, including football, to help achieve the objectives of youth education. The introduction of a supporting tax system and the development of a staterecognized academy system have created new opportunities for youth sports organizations. However, the organizational framework previously in place was no longer able to take sufficient advantage of these development opportunities. Youth training organizations not only seek to achieve social benefits but also generate additional income over and above subsidies by selling or transferring young athletes to their parent clubs, thus ensuring the sustainability and efficiency of their operations. In my research, I will look at the activities these organizations undertake to achieve their objectives and the key areas within talent management that can help to transfer both sporting and social values. In my research, I explored the knowledge

of educators, coaches and player selection of those working in youth development organizations, and I also explored that despite organized selection processes in football, many children are lost or drop out during training. The work on the field not only helps to transfer football achievements but also other human and social values. In my research, I examined the organizations separately in terms of their training classification, which allowed me to identify their individual characteristics and compare different types of organizations.

Keywords: youth sport, youth football, development, talent management.

THE RELATIONSHIP BETWEEN RIGIDITY, PERFECTIONISM AND MENTAL HEALTH

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ABSTRACT

Rigidity is one of the oldest psychological constructs to which, today, in the literature, traits such as egocentrism, authoritarianism, obsessiveness, inflexibility, and similar are associated. From the psychiatry's point of view, a rigid person is not a sick person, but a normal, healthy person with a special personality trait. The aim of this study was to determine whether rigidity as a personality trait is statistically significantly associated with perfectionism and the general state of mental health, measured through the parameters of stress, anxiety, and depression levels. The sample consisted of 212 respondents, of whom 110 were female and 102 were male. The following measuring instruments were used: Structured questionnaire for sociodemographic data (constructed for the needs of this study), Brexin's rigidity scale, Burns' perfectionism scale, Mental Health Inventory (MHI-5), Depression, Anxiety, and Stress Scale (DASS).

The research results did not reveal a significant connection between rigidity and perfectionism and different aspects of mental health, which is not in accordance with the presented theoretical assumptions and previous researches. However, the obtained results showed that there is a difference between the examined concepts in relation to gender, whereby men show a significantly higher level of rigidity (p=.01) and perfectionism (p=.05) compared to women. Statistically significant differences were found between the level of rigidity and the variable "age" (p=.05): older respondents in the sample are more rigid in their behavior compared to younger respondents. Also, the research showed that respondents from the suburbs, as a place of residence, produce a higher level of

depression and stress compared to respondents from the countryside and the city, while no statistically significant differences were found in relation to the variable "stress".

Keywords: rigidity, perfectionism, mental health.

THE VALUES AND ATTITUDES AS DRIVERS OF ORGANIC FOOD PURCHASE

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ABSTRACT

Values are one of the fundamental concepts that explain the human behavior, both individually and socially (Slijepčević & Matanović, 2015). Attitudes and values can greatly influence and guide our decisions and behavior. The aim of this research was to determine how attitudes and values about organic food can influence the decision to purchase it. Basis for this research was The Schwartz Theory of Basic Values and The Theory of Planned Behavior. In the first part, the questionnaire comprises 20 variables (Krystallis et al., 2008). It is divided into the three sections: the list of 17 Portrait Value Questionnaire (PVQ), organic food shopping behavior, and list of nine organic food-related consumer beliefs. For the second part of this research the questionnaire is used to determine attitude, subjective norm, perceived behavioral control, perceived barriers, self-efficacy, past behavior and intention (Chan et al., 2016). The resreach involved 352 respondents, of whom 232 were women and 120 were men. The results showed a large number of statistically significant correlations between the variables used. The most significant correlation is related to the decision to buy organic food, which is less likely for respondents with higher scores on the Benevolence, Universalism, Self-direction and Security subscales.

Keywords: organic food, values, attitudes, the Schwartz theory.

RECREATIONAL SPORT AND PERSONALITY DEVELOPMENT

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ABSTRACT

The link between physical and mental health is now widely recognised and acknowledged. A large body of research has confirmed the prominent role of physical activity and regular sport in the development of various aspects of personality, in particular its contribution to increased goal orientation and perseverance, healthy self-esteem, the ability to manage stress and reduce anxiety (Meyer et al., 2020; Bartha, 2018). Recreational sport is an excellent tool for preventing the development of a number of health problems. The main aim of my research was to explore the effects of regular physical activity on different aspects of their personality as experienced by recreational athletes. My aim was to assess whether there is a difference in the impact of sport on personality and mental health depending on the sport, the location and the company. I used a questionnaire survey, which was completed by 314 people. My results reflect the fact that, although many people are aware of the role of sport in health, they do not consciously use it as a tool for developing different aspects of their personality or as an effective coping strategy against stress. Sport has a positive impact on personality and mental health, but there are forms of sport that are highly supportive of mental well-being through the development of characteristics such as confidence, selfesteem and stress tolerance. The effects of competitive sport on personality have been the subject of numerous studies, but my results specifically reflect the positive effects of regular sporting activity among recreational athletes.

Keywords: recreational sport, mental health, personality development, physical activity.

CONNECTION OF PERCEIVED SOCIAL SUPPORT WITH THE SCHOOL ACHIEVEMENT OF HIGH SCHOOL STUDENTS

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ABSTRACT

Great demands have been constantly made before students by contemporary education, expecting them not only to acquire academic knowledge, but also the development of various social and emotional competencies that contribute to their school success. Numerous studies indicate that factors such as motivation, work habits and intellectual abilities are not the only predictors of school achievement, but that the social support that students perceive from various sources – parents, peers and teachers – also plays a significant role. Some researches show that students who receive greater social support perform better in school, have more developed strategies for coping with academic challenges, and express a higher level of motivation for learning (e.g. Tayfur & Sevim, 2016; Mackinnon, 2012; Jiahui, et al., 2023; Saeed et al., 2023; Ahmed et al., 2008). Although there is a significant number of studies researching this topic, the consistency of the results varies. The goal of this paper was to determine whether there is a connection between the perceived social support by parents, teachers and peers, as well as the overall perceived social support and school achievement of high school students of Tuzla Canton. 384 respondents (50,8% female and 49,2% male respondents), students of four high schools from Tuzla Canton area, participated in the research. Data on the variables of the survey were collected through a questionnaire of sociodemographic data, designed specifically for the purposes of this research and the Perceived Social Support Scale (Dubow, Ullman, 1989), which is used to

assess the support of parents, teachers and peers. Despite expectations that the perceived social support by parents, teachers and peers will have a significant connection with the school achievement of high school students, the hypotheses were not confirmed by the results of the research. The obtained correlations were low and did not indicate a significant connection of the independent variables with the dependent variable. When it comes to high school age, these findings suggest that future researches should consider additional variables that may affect the relationship between the social support and the school achievement in a mediator or moderator way, including individual differences in learning, motivation and school system characteristics.

Keywords: perceived social support, school achievement.

THE IMPORTANCE OF THE RELATIONS BETWEEN FAMILY AND SCHOOL (PEDAGOGUE/PSYCHOLOGIST)

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ABSTRACT

The relationship between family and school is always a current topic. The cooperation between family and school implies a traditional spirit. Cooperation in the educational process previously referred primarily to the most basic relations between parents and the school. On the other hand, the partnership of the school (educator, pedagogue/psychologist) and parents (family) is particularly important and it is on the path of harmonizing educational influences that are the product of direct communication between the school (educator, pedagogue/psychologist) and parents (family) during various direct contacts of the two educational environments. Both educational environments carry obligations and responsibilities. From the school climate, the partnership includes (apart from educators and pedagogues/psychologists) the school management, and other members of the collaborative team (if any): social workers and librarians. The main goal of this research is to check whether there is a statistically significant difference in the perception of parents of elementary school students in the Central Bosnia Canton about the importance of cooperation between parents and the school (school pedagogue/psychologist) with regard to gender, age, level of education of parents and place of residence. A total of 700 respondents from the Central Bosnia Canton took part in the survey.

Keywords: family, school, cooperation, partnership.

THE VIRTUAL WORLD: ILLUSION OR SAFE HAVEN FOR CHILDREN AND ADOLESCENTS

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ABSTRACT

This paper explores the experiences of children and adolescents regarding safety and violence in the virtual world, based on data collected through focus groups involving 110 participants aged 6 to 18. Participants describe their daily use of digital technologies, highlighting issues such as disregard for privacy, exposure to violent content, visiting pornographic websites, and sexting. Particularly concerning is the normalization of violence in video games and the imitation of destructive behavior by influencers, indicating a weak development of critical thinking towards digital content. Children often report feeling safe in virtual environments, while at the same time admitting to sharing personal information, accessing inappropriate content, and consuming violence as entertainment. The results suggest that the virtual world is increasingly becoming a space without clear boundaries, where risks are masked by interactivity and amusement. The study points to an urgent need for systemic education on digital safety and the implementation of clear guidelines for internet use among children and adolescents.

Keywords: children, adolescents, safety, screens, violence.

VIRTUAL ROLE MODELS: POSITIVE OR NEGATIVE INFLUENCES ON THE IDENTITY FORMATION OF CHILDREN AND ADOLESCENTS?

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ABSTRACT

This paper explores the types of role models that children and adolescents form in the digital world and their influence on identity development. Through focus groups involving 110 participants aged 6 to 18, the study analyzed the figures most commonly followed by the participants, including athletes, musicians, and influencers. Special attention was given to the motivations behind following these role models, such as a sense of belonging, identification with a certain lifestyle, humor, or the informational value of the content. The paper also investigates the topics of sexualization and objectification on social media, where a noticeable trend of emphasizing physical appearance—especially among girls—can contribute to the formation of distorted self-image and perceptions of others. The results show that while children are often aware that virtual role models do not represent real life, they still assign them significant importance and form emotional attachments. The study emphasizes the need to strengthen media literacy and to develop a critical attitude toward the content that shapes young people's identities in the digital environment.

Keywords: role models, children, adolescents, social media, sexualization.

EDUCATION
OBRAZOVANJE

TRANSFORMING STUDENT AUTONOMY IN CHANGING EDUCATIONAL CONTEXTS: LEARNING MATERIAL CHOICES FROM THE PANDEMIC ONWARD

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ABSTRACT

During the Covid-19 pandemic, the transition to online learning led to a **significant** increase in students' autonomy in selecting and using educational materials. **A survey involving 832 higher education students collected data on their preferences regarding types of learning materials, their perceived usefulness, and various aspects of their learning experiences during the pandemic.** The analysis also examined the influence of **factors such as** study modality (traditional, online, and hybrid), gender and year of study. The findings revealed clear patterns in students' independent selection and evaluation of educational resources, **indicating an increased capacity for self-directed learning during crises.** Students reported that, despite altered **working conditions**, they regularly attended classes, had **suitable** working conditions, and recognized the **significant** potential of distance learning. Nevertheless, despite recognizing the benefits of distance learning, approximately 50% of students would still prefer not to adopt it as the sole mode of instruction. In the current context of socio-political challenges frequently disrupting traditional teaching processes, the continuity of learning habits is a relevant question. This paper aims to present the pandemic-era learning experience as a foundation and potential direction for developing future **teaching** models emphasizing on student autonomy and flexible use of educational materials.

Keywords: student autonomy, distance learning, learning materials, higher education.

TEACHING GRAMMAR THROUGH ORAL STORYTELLING

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ABSTRACT

When language skills is considered, grammar remains one of the most challenging skills to develop and students often struggle to construct correct sentences despite having a wide vocabulary. One possible reason is the insufficient focus on grammar instruction. This study aimed to teach grammar through oral storytelling, taking advantage of magical nature of stories. This case study was conducted during the first semester of the 2021–2022 academic year, the study involved 58 ninth-grade students from a science high school in Elazığ. Class 9A was assigned as the control group, receiving traditional grammar instruction, while 9B was the experimental group, taught using oral storytelling. A pre-test was administered to both groups to determine the grammar levels of the students. before the research. Over four weeks, stories were told monthly, supported by pre- while and post-story activities. After the intervention, post-test was applied, and group interviews were conducted to explore student experiences. Quantitative data from the tests were analyzed using SPSS, and qualitative data were derived from interviews. The results showed a significant improvement in the experimental group's grammar skills. In conclusion, the storytelling technique positively impacted grammar learning and can enhance academic success in English language education.

Keywords: English Language Education, Grammar Teaching, Storytelling Techniques.

MATHEMATICS FOR FUTURE ENGINEERS: STUDENT ATTITUDES, LEARNING STRATEGIES, AND THE ROLE OF TECHNOLOGY

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ABSTRACT

In engineering education, mathematics plays a key role not only in developing basic numerical competence but also in facilitating the understanding of advanced concepts and the development of critical reasoning. As technological innovation accelerates, particularly with the rise of artificial intelligence and data-driven systems, mathematics becomes increasingly important in engineering education, providing students with the skills needed to engage with complex problems and advanced reasoning. This study examines engineering students' attitudes toward mathematics, their learning approaches, and the role of information technology in the learning process. A questionnaire-based survey was conducted among 269 engineering students from the University of Belgrade and the University of Novi Sad. The results indicate that engineering students generally hold positive attitudes toward mathematics. They tend to prioritize solving tasks over understanding theoretical content, and peer interaction emerges as an important learning resource. The study also explores differences in attitudes based on gender, previously completed courses, and year of study. Findings of this study underscore the importance of aligning mathematics instruction with students' perspectives and learning preferences. The study recommends strengthening theoretical learning through interactive, technology-supported environments that foster deeper mathematical engagement and critical thinking in engineering education.

Keywords: Engineering students, attitudes toward mathematics, engineering education, learning approaches, technology-supported learning.

PARENTS' PERCEPTION OF THE ROLE OF PRESCHOOL TEACHERS, PRESCHOOL INSTITUTIONS, AND THE IMPORTANCE OF PHYSICAL EDUCATION

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ABSTRACT

This paper aims to demonstrate that improving collaboration between preschool teachers and parents requires systematic training of teachers, both during their education and through continuous professional practice. The research has shown that the kindergarten plays a crucial role in initiating and encouraging cooperation with parents, which contributes to their more active involvement in the educational process and the enhancement of children's physical education. The analyzed data indicate a strong connection between the family and children's physical activity, with parents playing a vital role in fostering healthy habits from an early age. The research was conducted on a sample of parents of younger preschool children in Banja Luka, varying in age, social status, and educational background. The survey method and theoretical analysis were used, while statistical data processing included simple frequency methods, cross-tabulation, and the Chi-square test. The results showed that parents hold a highly positive attitude towards the quality of preschool teachers' work, while also expressing a strong need for improving material conditions in preschool institutions. Furthermore, significant differences were identified in the perspectives of parents and teachers regarding material-technical working conditions and physical education, highlighting the necessity of improving these aspects of preschool education.

Keywords: perception, preschool teachers, preschool institutions, physical education.

DEVELOPMENT OF MOTOR SKILLS IN PRESCHOOL CHILDREN UNDER THE INFLUENCE OF SPORTS ACTIVITIES

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ABSTRACT

Preschool institutions play a key role in laying the foundation for the overall development of a child, including physical, emotional, cognitive, and social aspects. Through various educational programs, special attention is given to physical activities that support the development of motor skills and the adoption of healthy lifestyle habits. Planned sports activities not only contribute to better physical fitness but also promote socialization, the development of discipline, and the creation of a positive self-image. The aim of this research was to analyze the frequency, type, and intensity of sports activities in preschool children during their stay in kindergarten, with a special focus on their motor skills. The research was conducted in a preschool institution in Mostar, where preschool educators were surveyed. Using a structured questionnaire, data were collected about the organization and implementation of sports activities and their impact on the development of children aged 3 to 5 years.

Keywords: development, motor skills, sports activities, preschool children.

OPTIMIZING TEACHING STRATEGIES IN LARGE GROUPS THROUGH MULTIPLICATIVE MCDM METHOD

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ABSTRACT

Delivering lectures in large student groups at higher education institutions, particularly at technical faculties, presents considerable pedagogical and organizational challenges. Individualized attention is significantly limited, making it difficult for instructors to adequately address the diverse learning needs of all students. Progressing too quickly may confuse students with insufficient background knowledge, while moving too slowly may demotivate advanced learners. Moreover, large class sizes reduce opportunities for interaction through questions, discussions, and active student participation.

This paper examines these challenges in the context of the Faculty of Technical Sciences Čačak, University of Kragujevac, where general education courses are delivered to large, multi-program groups, while professional courses in the later years are conducted in small, focused groups. The study presents a structured approach to evaluating the quality of the teaching process using the multiplicative MCDM method introduced by M. Žižović et al. (2016). A set of qualitative and quantitative criteria, including class size, has been defined and weighted based on expert assessments and student feedback. The results provide valuable insights into the effectiveness of current teaching practices and highlight specific areas for improvement, particularly in high-enrollment courses.

Keywords: Multi-criteria analysis, higher education, instructional strategies, large groups.

THE CONCEPT AND SIGNIFICANCE OF ERGONOMICS IN HIGHER EDUCATION WITH A FOCUS ON MECHANICAL ENGINEERING

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ABSTRACT

Ergonomics constitutes an integral part of engineering design, specifically in the development of technical systems where human physical and cognitive characteristics are systematically considered. Higher education in mechanical engineering requires the structured integration of ergonomic principles into curricula, not only from a theoretical perspective but also in terms of their practical applicability in engineering practice. This paper aims to analyse the current role of ergonomics within university-level mechanical engineering education and to emphasize the necessity of aligning academic instruction with real-world industrial requirements. The implementation of ergonomic approaches in industrial settings contributes to the reduction of workload, enhancement of occupational safety, and optimization of productivity. Through the analysis of academic curricula, scientific literature, and professional standards, key areas of ergonomics education are identified, with a focus on the needs of contemporary mechanical engineering practice. The evaluation also includes the assessment of digital tools, simulation technologies, and hands-on projects that enable students to apply acquired knowledge to solve specific engineering problems. Furthermore, the paper discusses opportunities for interdisciplinary integration

with fields such as manufacturing engineering, technical equipment design, and automation. The conclusion presents proposals for the adaptation of educational content and instructional methods, aiming to increase the practical relevance and effectiveness of ergonomics education in mechanical engineering programs.

Keywords: ergonomics, mechanical engineering, analysis, higher education.

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MATHEMATICS
MATEMATIKA

ON SOLVING HAMILTON'S GENERAL QUADRATIC EQUATION

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ABSTRACT

Based on *Hamilton*'s method of solving the quadratic equation (couple equation), defined over the field of couple numbers, as he calls them, in this paper the method of solving the general Hamilton quadratic equation is reduced to solving of the matrix quadratic equation, which is defined over the field of bireal matrices, which correspond to bireal numbers. As the matrix equation is decomposed into a system of nonlinear algebraic equations (SNAE), the solutions of the matrix equation are also the solutions of the SNAE, such that the solutions of the matrix quadratic equation implicitly determine the symmetric matrices S of the null space of the SNAE. In the second part of the paper, the matrix method for solving the SNAE, which is obtained via decomposition of *Hamilton*'s quadratic equation

$$(a_{11},a_{21})(x,0)^2 - (a_{12},a_{22})(0,y)^2 + 2(b_2,-b_1)(x,0)(0,y) +$$
$$+ (c_{11},c_{21})(x,0) + (c_{22},-c_{12})(0,y) + (d_1,d_2) = (0,0).$$

Keywords: bireal numbers, couple equation, matrix quadratic equation.

FRECHET DERIVATIVES OF EXPONENTIAL AND LOGARITHMIC FUNCTIONS IN BANACH ALGEBRAS

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ABSTRACT

Some problems in stochastic analysis, such as the construction of coefficients of some stochastic differential equations, require further development in the study of the higher-order Fréchet derivatives of elementary functions. Here, the explicit formulae for the arbitrary order Fréchet derivatives of the exponential and logarithmic functions in unital Banach algebras (complex or real) are presented in integral forms. Computations are obtained on Bochner integrals for Banach-algebra-valued functions with respect to the standard Lebesgue measure, via the Dominated convergence theorem and mathematical induction principles, among other techniques. Examples are presented and, as an application, these results in approximation schemes of solutions to stochastic functional differential equations are shown.

Keywords: exponential and logarithmic functions, real Banach algebras, higher-order Frechet derivatives, real functional calculus, stochastic differential equations.

A TAYLOR APPROXIMATION FOR A CLASS OF NEUTRAL SDE WITH CONSTANT DELAY

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ABSTRACT

Some social and natural phenomena, such as those from economics, physics, chemistry, medicine and epidemiology, can be described by neutral stochastic differential equations (NSDEs). Most of them do not have explicit solutions, and these equations are of interest for an approximation via Taylor expansions of their coefficients. Various integral, martingale and probability inequalities were used, as well as known inequalities from mathematical analysis, to go with some standard and non-standard methods, which include application of the Ito formula. The existence and uniqueness of the newly formed NSDE are shown under certain assumptions, and the closeness between solutions of this and the initial equation is estimated in the L^p and almost sure sense. When orders of the expansions are higher, so is the closeness between the solutions. Examples are constructed in order to show that the NSDEs which satisfy our assumptions do exist.

Keywords: neutral stochastic differential equations with constant delay, Taylor approximation, polynomial condition, L^p convergence, almost sure convergence.

APPLICATION OF TIME-CHANGE LÉVY NOISES ON REFLECTED BACKWARD STOCHASTIC DIFFERENTIAL EQUATIONS

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ABSTRACT

We study reflected backward stochastic differential equations with a left/lower barrier (RBSDEs with lower barrier) for time-changed Lévy noises when the time-change is independent of the Lévy process. Existence and uniqueness of the solution of RBSDE with left barrier under natural filtration F and under enlarged filtration G, which contains additional information with respect to the time-change process, are proved. Further, the comparison principle for this equation is obtained.

Keywords: time-changed Lévy noises, backward stochastic differential equations.

SIRS MODEL FOR COMPUTER VIRUSES PROPAGATION

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ABSTRACT

In this presentation stochastic SIRS model which describes the propagation of two independent computer viruses will be proposed. Randomness in the model is introduced by perturbing transmission rates via Brownian motion and Poisson jump. For this model, it is theoretically proven that its solution is unique, global and positive. Furthermore, the conditions under which viruses become extinct from a population are derived. Also, conditions for stochastic strong persistence in the mean of viruses will be obtained. In the end, numerical simulations will be presented in order to illustrate theoretical results using the Euler-Maruyama method.

Keywords: Computer viruses, stochastic SIRS model.

MATRIX FACTORIZATIONS WITH PRESCRIBED RANGES AND NULL SPACES

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ABSTRACT

Matrix factorization or matrix decomposition is the representation of a matrix in

the form of a product of two or more matrices. There are countless ways to represent a matrix in such a form, and certain ”good” factorizations, with significant applications, are obtained by imposing some special properties on the factors. These special properties depend on the particular needs arising from the purposes for which these factorizations are used. For instance, in factorizations intended for solving large linear systems, such as LU-factorization, Cholesky factorization, or QR-factorization, one of the factors (the one on the right) is required to be an upper triangular matrix. Other applications, such as dimensionality reduction, require decomposition of the matrix into a product of two matrices of the smallest possible dimensions. That is the basic idea of full rank factorization, and singular value decompositions (SVD) can be used for the same purpose.

Here we deal with matrix factorizations where the factors are subject to restrictions regarding their ranges and null spaces. More precisely, we show that for an arbitrary matrix D with entries in a field, and an arbitrary idempotent matrix E of the same rank as D (with entries in the same field), there exists a factorization D = UV such that the matrix U has the same range as D and the same null space as E, while the matrix V has the same null space as D and the same range as E. Such a factorization is called an idempotent-aided factorization

of D carried by E. We will see that it is crucial for such factorizations to be carried by idempotent matrices (also known as projections). We also show that idempotent-aided factorizations of matrices are direct generalizations of full rank factorizations, which are obtained when the idempotent matrix E is taken to be an identity matrix of the same rank as the matrix D being factorized. As with the full rank factorizations, the idempotent-aided factorization of the matrix D is not unique, but if we fix any of the factors, then we show that the other factor is uniquely determined. It is important to note that the semigroup-theoretical version of idempotent-aided factorization has been recently introduced in [5], and that the fundamental results regarding those factorizations, proved in [6] for regular elements of a semigroup, also hold for matrices. The main purpose of this work is to provide three efficient algorithms for determining idempotent-aided factorizations of matrices over a field, as well as the fourth one that determines the so-called canonical idempotent-aided factorization. We also apply those algorithms in the construction of algorithms for testing the existence and computing group inverses and (B,C)-inverses of matrices over a field.

Keywords: Factorization, matrix, matrix inverse.

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ENHANCING FUZZY AUTOMATA DETERMINIZATION THROUGH PARAMETRIC T-NORM

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ABSTRACT

This study investigates the utilization of the specific type of T-norm, called parametric Tnorm, in the process of determinization of fuzzy automata. Fuzzy automata play a vital role in areas such as speech recognition, natural language processing, and the modeling of systems with inherent uncertainties. However, their determinization presents a significant challenge, as not every fuzzy automaton has an equivalent deterministic counterpart. To address this issue, we propose applying the parametric T-norm, which facilitates the conversion of fuzzy automata into a deterministic form while maintaining their essential properties. Our research outlines the theoretical foundation and algorithmic strategy for implementing this approach, supported by experimental findings that illustrate its effectiveness and practical viability. Although our method ensures termination and provides a determinization algorithm, it comes with the drawback that the resulting automaton does not recognize precisely the same fuzzy language as the original. Nevertheless, the difference is confined to words with very low acceptance degrees in the initial automaton. We anticipate that this work will offer fresh perspectives on the determinization of fuzzy automata and foster further progress in this domain.

Keywords: fuzzy automata, fuzzy determinisation, approximate determinisation.

APPROXIMATING LANGUAGE EQUIVALENCE: COMPUTATION OF E-WEAK BISIMULATIONS FOR FUZZY AUTOMATA

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ABSTRACT

Weak bisimulations are essential tools for analyzing fuzzy automata (FAs), particularly in preserving language equivalence and enabling state minimization. However, their practical use is limited due to the infinite systems of fuzzy relation inequalities involved, especially in the context of $(\vee, \cdot)$-FAs. To overcome these chellenges, we introduce ε-weak bisimulations, a relaxed form of weak bisimulation parameterized by a threshold $\varepsilon > 0$. This approach transforms the infinite system into a finite one, enabling tractable computation while allowing a controlled deviation in acceptance degrees bounded by the threshold ε. We developed an efficient algorithm for computing ε-weak bisimulations, applicable to both single automata and pairs of FAs. We analyze its computational complexity and discuss practical aspects of its implementation. Our results offer a scalable and effective alternative to classical weak bisimulations, broadening their applicability to a wider class of fuzzy automata. This work provides both a theoretical foundation and a practical framework for approximate equivalence checking in fuzzy systems.

Keywords: fuzzy automata, bisimulations, weak bisimulations, approximate bisimulations.

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APPROXIMATE REGULAR RELATIONS OF FUZZY SOCIAL NETWORKS

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ABSTRACT

Researchers have developed various methods to simplify complex fuzzy social networks, helping to manage the vast amount of data they contain. One well-known approach involves the use of regular and structural fuzzy relations to reduce these networks. However, because of the very strict conditions that these relations must meet, they can very rarely be used in reducing the number of states of fuzzy networks. In this study, we introduce a method for reducing the states of a fuzzy network using approximate regular fuzzy relations. Specifically, we classify the network elements based on their approximate regular fuzzy equivalence to a certain predefined degree. In this work, we study fuzzy social networks over the Hayting algebras. Due to its local finiteness property, the Heyting algebra provides the possibility of computing the greatest approximate regular fuzzy relations in a finite number of steps. By leveraging these specialized fuzzy relations, we demonstrate that it is possible to simplify a fuzzy social network in scenarios where earlier algorithms were unable to perform such reductions. Our findings suggest that the blockmodel generated through reduction using approximate regular fuzzy preorder maintains the structural integrity of the original network.

Keywords: Social network, fuzzy network, fuzzy relations, reduction of network.

OTHER TOPICS
OSTALE TEME

THE ROLE OF OFFICE OF THE HIGH REPRESENTATIVE IN POST-DAYTON BOSNIA AND HERZEGOVINA (1997-2009)

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ABSTRACT

Annex X of Dayton Peace Agreement defines the competences of the OHR. After the first post-war elections held in 1996, international actors saw that the political elites had no interest in establishing institutions at the level of Bosnia and Herzegovina, which were necessary for the functioning of the state. In December 1997, a conference was held in Bonn where the competences of the High Representative were expanded.

The main research question in this paper is: What is the role of OHR in the process of building institutions in Bosnia and Herzegovina. We will use the comparative method in order to compare the dynamics of the use of Bonn powers in different periods, as well as the role of the High Representative in political processes.In addition to the comparative method, we will also use the descriptive method and content analysis in order to unify and better interpret the previous analyzes and works dealing with this topic.

The relevance of the topic stems from the fact that this year marks the 30th anniversary of the Dayton Peace Agreement, and Bosnia and Herzegovina is in the biggest post-Dayton crisis.

Keywords: Dayton Peace Agreement, Office of the High Representative, Bosnia and Herzegovina, state-building.

GRAPES AND WINE IN FOLKLORE TRADITION

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ABSTRACT

I this paper I present an overview of the role of wine and grapes in what we call the traditional folk tradition, highlighting some of its features and elements. Rites, beliefs and religious images have been associated with agricultural activity for thousands of years, while folklore and ethnography have applied the term "agrarian cult" to them. Grape and wine culture is no exception to this either.

It is a well-known fact that, in the wine-producing cultures of the ancient Mediterranean region the cult of wine was as important as in the Jewish and early Christian traditions. European culture and Christian civilization would be unimaginable without grapes and wine. In Christian Europe, which grew out of its ancient cultural and sacral roots, these customs lived on and took on new forms. Oftentimes, they have even been complemented to survive as modern-day practices. In my presentation, I will therefore talk about some of the folklore elements that have been preserved in the traditional culture and religiosity of the peoples of Central Europe in and around the Carpathian Basin right up to the 20th and 21st centuries to continue to be alive still today.

Keywords: cult, rites, folklore, viticulture.

THE LANDSCAPE OF CONTEMPORARY ARCHITECTURE IN THE REPUBLIC OF SRPSKA, 1997–2023

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ABSTRACT

Understanding the development of contemporary architecture requires observation within a specific territory, time frame, and social context. In conditions marked by a lack of architectural culture and systematic documentation, this process becomes a challenge that calls for a dedicated research effort. This paper presents the landscape of contemporary architecture in the Republic of Srpska from 1997 to 2023, based on research conducted for the exhibition *25 Years of (the School of) Architecture in the Republic of Srpska*. Through the analysis of everyday architectural experiences, spatial perception shaped by movement through the territory, and a curatorial approach, this paper explores the complexity involved in researching and evaluating architectural production. It identifies and critically presents the most significant examples, highlighting their typological diversity, territorial distribution, and temporal dynamics, as a reflection of a society in post-transitional transformation. The research findings aim to contribute to the improvement of architectural education and the enhancement of spatial culture in the local, regional, and broader context.

Keywords: Contemporary Architecture, Architectural Landscape, Republic of Srpska, Architectural Education, Cultural Context.

IMPLEMENTATION OF A PASSIVE RC LOW-PASS FILTER FOR EMBEDDED IOT SYSTEMS WITH OPEN-SOURCE SIMULATION SUPPORT

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ABSTRACT

In this study, we explore the design, simulation, and deployment of a passive RC low-pass filter, specifically targeting its integration within Internet of Things (IoT) applications. We employed a symbolic computing environment to theoretically model the filter's frequency response, which involved analytically deriving the transfer function and numerically optimizing it against existing data. Experimental verification was conducted using a virtual prototyping platform, where the filter was incorporated into a microcontroller-based setup for capturing analog signals. The real-time monitoring of filtered outputs validated the filter's capacity to effectively diminish high-frequency noise before the conversion to digital signals. As a practical demonstration, the filter was implemented within a simulated IoT node, showcasing its utility in enhancing signal integrity for sensor-based, low-power applications. This study highlights the ongoing importance of analog filtering techniques in enhancing data accuracy in contemporary IoT systems.

Keywords: RC low-pass filter, Internet of Things, numerical optimization.

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SIMULATION OF ULTRAFAST FREE ELECTRON DYNAMICS IN SKIN-LIKE TISSUE MEDIA UNDER SHORT-PULSE LASER EXCITATION

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ABSTRACT

In this study, we investigate the ultrafast dynamics of free electrons in skin-like tissue media, stimulated by laser pulses ranging from 50 femtoseconds to 5 picoseconds. Our analysis employs a comprehensive model based on rate equations to simulate how electron densities evolve over time depending on the laser's pulse duration, fluence, and wavelength. This model integrates various physical processes such as photoionization, avalanche ionization, movement and interaction of carriers (diffusion and recombination), and energy uptake from states below the energy gap and defects. One key output of our simulations is the time-dependent change in reflectivity, $\Delta R(t)$, which provides deep insights into the temporary optical properties of tissue equivalents as they respond to electronic excitation. Our findings delineate clear thresholds for generating free carriers, illustrate how localized energy states contribute to thermal ionization, and elucidate the effects of laser wavelength and pulse duration on the tissue's immediate optical response. This modeling approach is valuable for dissecting interactions between lasers and tissues, offering potential benefits for targeted heat therapy (selective photothermolysis), advanced ultrafast imaging techniques, and other laser-driven medical applications.

Keywords: free electron dynamics, skin-like tissue media.

Acknowledgements. Authors would like to acknowledge the support received from the Science Fund of the Republic of Serbia, #GRANT 6821, Atoms and (bio)molecules-dynamics and collisional processes on short time scale - ATMOLCOL. Our appreciation also goes to the Serbian Ministry of Education, Science and Technological Development (Agreement No. 451-03-66/2024-03/ 200122). H. Delibasic Markovic would also like to express gratitude to COST Actions CA21159 - "Understanding interaction of light with biological surfaces: possibility for new electronic materials and devices" for their support and CA22148 - "An international network for Non-linear Extreme Ultraviolet to hard X-ray techniques (NEXT)".

NONDESTRUCTIVE OPTICAL ACCESS TO CIRCADIAN RHYTHMS IN WATER-GROWN AND EPIPHYTIC PLANTS

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ABSTRACT

This study applies a nondestructive optical method (NOM) to monitor circadian oscillations in leaf transmittance across two ecologically contrasting plant species: air-grown *Tillandsia sp.* and submerged *Echinodorus sp.* Continuous measurements over seven days revealed different temporal transmission patterns, reflecting species-specific metabolic rhythms and environmental adaptation.

The NOM signal from Tillandsia exhibited a sharp, sawtooth-like oscillatory pattern, consistent with its CAM-based metabolism and epiphytic lifestyle. In contrast, the *Echinodorus* signal was smoother and more attenuated, likely influenced by underwater light distortion and C_3 metabolic characteristics.

To quantify signal dynamics, a damped sinusoidal model was fitted to the data, allowing the extraction of key parameters such as amplitude, phase, and damping rate. Although both models produced high coefficients of determination ($R^2_{adj} > 0.82$), minor deviations in submerged signals highlight the need for refractive corrections in aquatic environments.

Overall, the results confirm that NOM captures physiologically meaningful oscillations in real time and can distinguish plant species based on their transmission signatures, offering potential for classification and stress diagnostics using data-driven approaches.

Keywords: Circadian rhythm, Nondestructive optical method, Aquatic plants, Epiphytic plants, Signal modelling.

DESIGNING THE BRIEF: PRINCIPLES FOR SHAPING THE ARCHITECTURAL DESIGN CURRICULUM FOR HOUSING

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ABSTRACT

Learning to design architectural spaces intended for everyday inhabitance – houses, apartments, apartment buildings – represents one of the most important steps in the education process of an architecture student. Such a step, appropriately, demands a carefully prepared practical curriculum, and within it, an architectural brief created and curated through a valid set of parameters.

This paper aims to present and further examine the principles used in creating appropriate architectural briefs for housing design studio courses at the University of Banja Luka, Faculty of Architecture, Civil Engineering and Geodesy.

Methodology of the research is comprised of juxtaposition and cross-referencing of several key influences:

- understanding of the overall students' learning trajectory, both as intended by a school curriculum, al well as observed through educational practice.
- understanding of the local and international context of housing (including the valuable collective housing heritage of Yugoslavia)
- accumulating body of educational experience acquired over the years through different types of briefs and through specific response of students to those briefs (through design proposals).

Results and further analysis dictate specific sets (clusters) of brief design: contextual range (natural to suburban to urban), topographic range (flat vs. sloped), scale (housing ensembles vs. individual houses), scope of intervention (green-field or interpolation) and type of intervention (collective vs. atomized).

Keywords: housing, architectural brief, housing heritage, architectural education.

METHODS FOR TEACHING THE ARCHITECTURAL DESIGN: A CASE STUDY IN AN OFFICE SPACE CURRICULUM

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ABSTRACT

The paper examines approaches and procedures for teaching the subjects of architectural design to the undergraduate students of architecture. The text draws from the established body of research in relevant fields of architectural education, but is nevertheless firmly rooted in educational practice of design studios at the University of Banja Luka, Faculty of Architecture, Civil Engineering and Geodesy. The specific design area is that of an office/administrative spaces, accompanied by an auxiliary programme of exhibitions, conference, hospitality and logistics.

Methodology of the paper is devised around both the analysis of the longer-spanning influence vectors, as well as by the sampling of the specific students' proposals and student-mentor collaborations.

Results point towards a two-pronged system of a design-teaching environment:

One, besides and beyond the fixed parameters of the official curriculum, the process needs to be informed by a range of influence vectors, such as:

- the current assessment of students' design abilities;
- the scope and the type of previous studios' theme subjects;
- limited number of opportunities (studios throughout the undergraduate studies) and a vast area of design competences to be covered;
- the need for a year-to-year variety, as a vehicle of general educational improvement.

Two, the process is further structured through oscillating use of analogue and digital tools, definitive problem-solving within student-mentor collaboration, as well as through periodical (and final) live presentations.

Keywords: architectural design, architectural education, administrative programmes, live architectural models.

SPATIAL-TEMPORAL ANALYSIS OF HELICOPTER AVAILABILITY FOR WILDFIRE SUPPRESSION IN THE TERRITORY OF REPUBLIC OF SRPSKA

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ABSTRACT

The effectiveness of aerial interventions in wildfire suppression largely depends on the spatial distribution of operational capacities, response time, and logistical support on the ground. This study focuses on the territory of Republic of Srpska and analyzes the temporal accessibility of firefighting helicopters, considering flight performance, preparation time, and safe access to water sources. Using Geographic Information System (GIS) tools, temporal coverage zones were generated based on known helicopter base locations and technical characteristics. Additionally, the ground logistics of deploying mobile water reservoirs was examined through network analysis of the road infrastructure, aiming to model the actual time required to initiate an effective aerial intervention. By integrating aerial and ground response components, a comprehensive spatio-temporal model of resource accessibility was developed. The results can support strategic planning, optimization of firefighting resource allocation, and identification of areas with extended wildfire response times across the territory of Republic of Srpska.

Keywords: wildfire, GIS analysis, helicopter interventions, response time.