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SESSION 1: BIOLOGICAL AND ENVIRONMENTAL TECHNOLOGY

POTENTIAL APPLICATIONS OF DIELECTRIC MEASUREMENTS IN BIOMASS UTILIZATION PROCESSES

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ABSTRACT

Utilization of biomass by biological processes (enzymatic hydrolysis and fermentation of lignocellulosic biomass, anaerobic digestion) and other conversion methods (such as, thermochemical conversion) needs appropriate process control. In biological utilization of biomass, fast and non-destructive methods are needed to detect the physicochemical changes and the optimal end-point of the process. With the development of sensor technology dielectric measurements can answer for these challenges.

In our research, the dielectric behaviour (dielectric constant and loss factor) was investigated by a Speag DAK 3.5 open-ended coaxial line dielectric probe connected to ZVL-3 vector network analyser (VNA, Rohde&Schwarz) during enzymatic saccharification of plant derived biomass; ethanolic fermentation of preliminary hydrolysed lignocellulosic biomass (corn cob residue); and disintegration of primary wastewater sludge before anaerobic digestion in the frequency range of 200-2400 MHz. Cellulose hydrolysis, sugar conversion/ethanol production, and organic matter degradation was also monitored by routine analytical methods (photometric reducing sugar assay; refractometric ethanol determination; photometric chemical oxygen demand measurement).

Experimental data indicates that the degradation of organic matters of cellulosic biomass and wastewater sludge can be monitored with high precision by the dielectric constant at the frequency range of 200-900 MHz. Nevertheless, dielectric loss factor determined in the frequency range of 300-500 MHz was the most sensitive and appropriate dielectric parameter to monitor and predict the sugar/ethanol conversion yield. Our results verified the accuracy of open-ended coaxial dielectric probe for biomass contented suspensions and fermentation broth; and the applicability of dielectric measurements for detection of biomass degradation processes.

Keywords: dielectric parameters, biodegradation, enzymatic hydrolysis, biomass, process monitoring

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A PRELIMINARY SURVEY OF HEAVY ELEMENTS IN INDOOR DUST COLLECTED FROM DIFFERENT SERBIAN MICROENVIRONMENTS

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ABSTRACT

The quality of the indoor microenvironment is a concern for environmental health because people spend up to 90% of their time indoors such as in homes, workplaces, and schools. Indoor dust contains various pollutants, including heavy elements, which adversely affect human health, and the concentration of the studied elements in the settled dust has been shown to be higher than those found in outdoor dust. Studies examining indoor settled dust are limited, especially in developing countries such as Serbia, and knowledge of the occurrence, potential sources, and risks of such regions are rare. Thus, this study was conducted to determine the occurrence and levels of heavy elements (Pb, Cd, Cu, Cr, and Ni) in indoor dust collected in 45 Serbian households, offering the first insight into the current pollution status of the investigated Serbian indoor microenvironments. Geo-accumulation (I_{geo}), pollution (PI), integrated pollution (IPI) and pollution load (PLI) indexes were used to determine the heavy elements contamination and USEPA models were employed to assess non-carcinogenic and carcinogenic risks for the Serbian population. In all analyzed indoor dust samples, Cu was detected with the highest mean concentration (39 mg/kg) followed by Pb (11 mg/kg), Cr (9.1 mg/kg), Cd (2.8 mg/kg) and Ni (2.5 mg/kg). Average concentrations of Cu, Cr and Cd found in indoor dust samples were 4.4, 3.5, and 4.4 times higher, respectively, than the soil background values, which may be used as a reference in the absence of the relevant criteria for assessing the permissible and tolerable levels of heavy metals in indoor dust. The results showed that the current state of indoor dust ranged from unpolluted to polluted, depending on the analyzed elements and the applied index. The health risk assessment model revealed negligible non-cancerous risk for Serbian children and adults, because estimated hazard index values (1.30E-01 and 1.40E-02, respectively) were considerably below the safe limit (<1). Total carcinogenic risk (TCR) estimated via ingestion, inhalation and dermal exposure for Serbian children was 5.58E-04, exceeding the tolerable risk (>1.00E-4), while TCR assessed for Serbian adult population (8.18E-05) was in the range of the acceptable/tolerable values (from 1.00E-6 to 1.00E-4). To the best of our knowledge, occurence of these heavy metals are reported for the first time in the indoor dust of Serbian households.

Acknowledgements: This work was supported by Ministry of Education, Science and Technological Development of Republic of Serbia (451-03-9/2021-14/200134).

DETERMINATION OF MINIMUM INHIBITORY CONCENTRATIONS OF SEVERAL PLANTS EXTRACTS AGAINST DIFFERENT BACTERIAL PATHOGENS

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ABSTRACT

In the context of COVID-19, the use of face masks has been recommended as a preventive measure against the spread of SARS-CoV-2. Despite their health benefits, usage of single-use masks represents a threat to the environment as they are manufactured from long-lasting plastic materials. Reusable fabric masks are an alternative to reduce the risk of pollution and the amount of plastic wastage. The application of antimicrobial agents in the tissues used to produce masks would be an additional hurdle on the prevention of other respiratory infections and secondary bacterial infections that occur from touching contaminated masks. In this context, impregnation of the fabrics with plant extracts is an atractive approach since they are potentially safe and free of adverse side effects and powerful antimicrobials. In a preliminary study, the objective was evaluated sixteen plant extracts to select the most efficient against 55 pathogenic microorganisms. Initially the plants extracts were tested at 50%, however, the minimum inhibitory concentration (MIC) was only determined for extracts that demonstrated antimicrobial activity. MICs of each extract was determined by broth microdilution in 96-wells microtiter plates (tested concentrations between 50.00 and 0.78% V/V) against different pathogenic bacteria. According to the results obtained, it was possible to selecte two plant extracts, both extracted with 1:1 ethanol:water, as the more effective against most of the pathogens tested, with MICs between 50.00 and 1.56%. It is important to highlight that Gram-positive bacteria were eliminated more easily than Gram-negative bacteria. Although being a preliminary work and more tests are needed, the two plant extracts could be good candidates to be impregnated into tissues in order to eliminate pathogens and avoid health problems associated with them.

INFLUENCE OF PRETREATMENT ON THE PRODUCTION OF HIGHLY PURIFIED XYLOOLIGOSACCHARIDES FROM WHEAT CHAFF

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ABSTRACT

Xylooligosaccharides (XOS) are oligomeric sugars with different health benefits. It was demonstrated that XOS are resistant to gastric digestion and reduce the risk of cancer. Some of the unique properties of XOS include high stability in different pH and temperature ranges. All of that makes xylooligomers an ideal food ingredient. However, lignocellulosic biomass is a carbohydrate-lignin complex, and the production of XOS from such material is not that simple. XOS production from lignocellulose is carried out in a two-stage combining physical. The aim of this study was to produce XOS from wheat chaff, which represents underutilized agricultural waste material. The influence of different pretreatment procedures followed by hydrolysis of pretreated material by xylanase on XOS production yield and purity was studied. Wheat chaff was subjected to ultrasound, hydrothermal or hydrothermal-alkali pretreatment. Hydrothermal-alkali pretreatment combined with enzymatic hydrolysis produced the highest amount of reducing sugars - 107 and 170 mg/g by xylanase doses, 1.5 and 3U/g, respectively. However, sugar profile analysis by RP-HPLC showed the lowest level of XOS in this case. Hydrothermal pretreatment and subsequent hydrolysis by xylanase produced the highest amount of sugar monomers and resulted in the lowest xylooligosaccharides purity of 66%. The highest achieved purity of hydrolysates was obtained by combining ultrasound treatment with enzymatic hydrolysis. In addition, this procedure resulted in more than six times lower weight loss of xylooligosaccharides in the liquid stream than the other two applied treatments. Results indicated the production of xylooligosaccharides from wheat chaff subjected to ultrasound-xylanase treatment represented an efficient green procedure with the lowest content of impurities in comparison to other studied procedures.

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SEPARATION OF OIL IN WATER EMULSION WITH TiO_2 AND DIFFERENT TiO_2/(f)CNT COMPOSITE MODIFIED MICROFILTER MEMBRANES

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ABSTRACT

In the present study, PVDF microfilter membranes were modified with TiO_2 and 9 different CNT containing TiO_2/CNT nanocomposites – in which CNTs differ in their lengths, diameters and surface properties – and were used for the membrane separation of 100 ppm crude oil emulsion. The effects of the modified membranes on the achievable fluxes, filtration resistances and purification efficiencies were investigated and were compared with the neat PVDF membrane. By the usage of TiO_2 nanomaterial significant flux enhancement, lower filtration resistances and better purification efficiencies could be achieved compared to the neat PVDF membrane. The utilization of several TiO_2/CNT composite materials as surface modifiers was also beneficial to the filtration properties, but these coatings were not more advantageous – during the presently applied experimental conditions – than the simple TiO_2 coating. But the correlation between the different properties of CNTs and their effects on the membrane surface and filtration properties has been partially discovered. The functionalization of CNT was able to increase the surface hydrophilicity of TiO_2/CNT nanocomposite membranes.

Keywords: crude oil, emulsion, membrane separation, titanium dioxide, carbon nanotube, functionalized carbon nanotubes

Acknowledgments: The research was funded by the Hungarian National Research, Development and Innovation Office—NKFIH under the „Development and application of nanoparticle modified membranes for the efficient treatment of oil-contaminated waters" project (NKFI_FK_20_135202).

APPLICATION OF MgCuAl-LAYERED DOUBLE HYDROXIDE-BASED ADSORBENTS FOR THE ORGANIC DYE REMOVAL

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ABSTRACT

Layered double hydroxides (LDHs) are most commonly classified as stacked hydroxide layers with charge-balancing anions in the interlayer. The properties of these materials can be tailored by the variation of numerous synthesis methods and parameters. Additionally, thermal treatment of LDHs causes the collapse of the layered structure and the formation of non-stoichiometric metastable mixed oxides with suitable textural, structural, specific acid-base and redox properties. Considering the on-going problems occurring from numerous industries that generate and release organic dyes into the environment leading to severe health and environmental hazards, rapid and efficient approach for the dye removal from water is of great interest in this field of research. The motivation for this study was to investigate the adsorption properties of MgCuAl-LDHs and their derived mixed oxides related to adsorption of Methyl Orange (MO). For material characterisation (synthesized MgCuAl-LDH and MgCuAl-C mixed oxides), structural (XRD), and textural (low temperature nitrogen adsorption) were conducted. The MgCuAl-LDH synthesized materials were dried at 100°C, whereas MgCuAl-C mixed oxides were calcined at 500°C. Experiments were carried out in an open cylindrical pyrex reaction vessel containing 100 ml of solution (C_{MO}=20 mg/L) and 50mg of powdered materials. In order to eliminate the solar light influence, the adsorption experiments on MO removal were conducted in the dark. The MO removal efficiency was determined from the MO concentrations that were measured at defined time intervals using UV-VIS spectrophotometery at 463.9 nm. The results showed that both samples (MgCuAl-LDH and MgCuAl-C) had very promising adsorption properties, considering that after only 30 min, the MO removal efficiency for MgCuAl-LDH reached 80% and for MgCuAl-LDH up to 93.5%. Higher adsorptive capacity detected for the calcined sample (complete decolourisation of MO solution) could be explained by the more favourable textural properties since after thermal treatment the surface area increases.

This study showed that MgCuAl-layered double hydroxide-based adsorbents possess unique properties and could be considered to be promising materials for further research and application in the field of environmental protection, regarding the removal of organic dyes from water solutions.

Key words: adsorption, layered double hydroxides, organic polutants, enviromental protection

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ADVANCED PROCESSES IN WASTEWATER SLUDGE TREATMENT

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ABSTRACT

The amount of wastewater sludge is increasing annually, and since it presents potential environmental and health-related risks, an appropriate treatment and stabilization process is needed. In our present work we investigated the effects of microwave irradiation on the biogas yield gained by the anaerobic digestion of standalone meat industry wastewater sludge (MIWS) on the one hand, and on the other hand, its effects on the co-fermentation of MIWS and lignocellulosic plant waste. We also supplemented our research with monitoring methods, namely dielectric and rheological measurements, to see whether these techniques are capable of tracking the fermentation processes. The anaerobic digestion of sludge and the co-fermentation of sludge – plant waste mixtures were carried out in laboratory anaerobic fermenters, and the biogas yield was measured via respirometric method.

Our results revealed that in terms of total biogas yield the microwave irradiation can enhance the fermentation process of both standalone wastewater sludge and sludge–plant waste mixtures, however in case of the latter, the pre-treatment arrangement plays a key role in the process - the highest biogas yield could be achieved when the sludge–plant waste mixture was exposed to microwave irradiation simultaneously before the co-fermentation. It was also proved that dielectric and rheological measurements are capable of monitoring the fermentation processes; a strong correlation was found between the accumulating biogas yield and the dielectric constant, as well as the absolute viscosity of the fermentation material.

THE POSSIBILITIES OF MEMBRANE SEPARATION INTENSIFICATION BY 3D PRINTING

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ABSTRACT

The dairy industry uses a large volume of water to produce different, various products, and generates wastewater, which has to be treated efficiently before releasing it into the water bodies. Membrane technology, such as ultrafiltration or nanofiltration, has been often considered as a promising method for dairy wastewater purification as part of a complex cleaning system due to their high energy efficiency and small footprint. However, the membranes are often susceptible to fouling, and contaminants can accumulate on the membrane surface, resulting in different problems, such as permeate flux decline. One of the effective approaches to mitigate the fouling is to improve the hydrodynamic flow conditions using commercially available spacers in the feed channel or membrane module. Compared to simple plastic spacers, the application of 3D printed spacers can result in significant improvements of the overall filtration efficiency due to their characteristics. Since the significant development of three-dimensional (3D) printing proceeded significantly cheaper and unimaginably fine and detailed 3D printed elements that can be integrated easily into membrane filter modules.

In this study, the possibilities of the intensification of different membrane separation processes using 3D printing promoters have been reviewed based on literature survey. Especially, the advantages of the 3D printed elements integrated into membrane module were summarized. Some laboratory experiments were carried out with different polylactic acid (PLA) 3D printed element configuration in batch, classical cell and in a continuous operation, cross-flow membrane module using polyethersulfone ultrafiltration membranes and model dairy wastewater. The implication of this research is that the 3D printed promoters have shown great promise in terms of flux enhancement and fouling reduction. However, the factors to be considered in promoter fabrication by 3D printing technique are important, and should be researched more details in the near future.

Key words: membrane fouling, 3D printed elements, spacers, ultrafiltration

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USE OF STATISTICAL ANALYSIS FOR FABRICATION OF PVDF/PVP/TiO_2 MEMBRANES TO TREAT OIL-IN-WATER EMULSION

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ABSTRACT

Highly effective treatment of oily wastewater is becoming an urgent necessity due to its harmful effect on the environment. Membrane filtration can be used to remove finely dispersed, emulsified, and dissolved oil. Polymeric membranes are usually fabricated with phase-inversion method and can be modified to generate membranes with defined characteristics; for this, different polymers and additives are often used, such as photocatalytic nanoparticles, which became an interesting approach since they can decompose the organic matter on the membrane, reducing the fouling and increasing the flux. The use of statistical analysis is important for membrane fabrication since it shows how different variables affect the formation and performance of membranes simultaneously.

In this study, the effects of different contents (0.0, 0.5, 1.0, and 1.5%) of polyvinylpyrrolidone (PVP) and titanium dioxide (TiO_2) on polyvinylidene fluoride (PVDF) membranes were investigated, generating response surfaces that show how the additives affect the pure water flux, flux, and rejection rate of an oil-in-water emulsion (100 mg L^{-1}), flux recovery ratio after cleaning, and decomposition rate of methyl orange.

TiO_2 had a significant effect on the photocatalytic activity of the membranes ($p=0.00196$) and every TiO_2-membranes decolorized more than 95% of dye in the studied interval; 1.5% of TiO_2 did not show the greatest decomposition, therefore, the optimum content of nanoparticle is within 0.5 and 1.0%. TiO_2 and PVP did not significantly affect the filtration performance of the membranes ($p>0.05$). However, higher contents of PVP reduced oil rejection rates ($p=0.000521$), but min. 90% was observed in all cases. PVP had a positive effect on the flux recovery ratio as well ($p=0.000143$). Therefore, the chosen content of PVP was 1.0%. The presented data show details of how PVP and TiO_2 affect the membrane fabrication and performance and can be used for better understanding for the membrane filtration enhancement.

Keywords: membrane filtration, photocatalytic membrane, TiO_2 nanoparticles, statistical analysis

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AMMONIA REMOVAL FROM AQUEOUS SOLUTION IN PRESENCE OF ORGANIC COMPOUNDS USING MODIFIED BIOCHAR FROM BANANA LEAVES

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ABSTRACT

The scientific community has currently determined nine limits beyond which we cannot put pressure on terrestrial systems without putting their balance at risk and guarantee life on the planet, one of the nine boundaries humanity must respect to keep the planet habitable is biogeochemical flow of nitrogen and phosphorus; unfortunately, the data suggests that we cross the risk threshold at this limit due to the huge amount of fertilizers produced based on fossil fuels used in agriculture. Additionally, and without a doubt, we are facing the great challenge of the unbridled rate of water pollution. In order to face environmental challenges by implementing sustainable strategies like circular economy, the present work seeks to improve water quality by removing nutrients from it with the help of biochar obtained from agricultural waste, later using the recovered nutrients for the production of more environment-friendly fertilizers. The study involves adsorption experiments at different pH and initial concentrations of ammonium and the effect on the percentage of ammonium adsorbed in the presence of different organic compounds such as albumin bovine serum, acetic acid, lactose and humic acid as part of aqueous solutions. The ammonium concentration was measured in the UV-vis spectrophotometer and the results obtained show that biochar is an excellent material to recover nutrients and has excellent properties to be used as fertilizer later, however the presence of organic compounds limits the adsorption of ammonium in more than 30% of the removal percentage if the action of biochar is taken into account in solutions with the presence of ammonium only.

Keywords: ammonium removal, water treatment, biochar, adsorption.

Acknowledgement: The authors thank the support of the 2017-2.3.7-TÉT-IN-2017-00016 project.

HYDROTHERMAL CARBONIZATION OF WASTE WOOD BIOMASS: CHARACTERIZATION OF ANTIOXIDANT AND SAFETY ASPECT OF THE LIQUID PRODUCT

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ABSTRACT

Hydrothermal carbonization (HTC) is a thermochemical process that enables valorization of waste biomass. Under relatively mild conditions (200-400°C and 4-25 MPa), HTC converts biomass material into a carbonaceous solid product (hydrochar), liquid phase and a small quantity of gases as primary products of reaction. The liquid (aqueoues) phase is rich in organic compounds (polyphenols, flavonoides, etc.) and it could be use as a source of valuable biochemicals. In contrast, discharge of this water without its prior processing is hazardous for aquatic ecosystems due to high organic load. This study explores the antioxidant potential of liquid phases formed during HTC of wood-waste biomass under different conditions: temperature (200-300°C), autogenous pressure (1.5-8.7 MPa) and reaction time (30-165 min). At the same time, the contents of 16 EPA priority polycyclic aromatic hydrocarbons (PAHs) in the same liquid samples were determined in order to investigate influence of the reaction conditions.

The total polyphenol content and antioxidant activity of produced liquid phases were determined by standard spectrometric methods. The PAHs content was analysed by gas chromatography–mass spectrometry (GC/MS) after the liquid-liquid extraction with dichloromethane and solid-phase (silica gel) extraction clean-up. The liquid HTC samples (2 mg/ml of dry extract in methanol) have high polyphenols content (0.396-0,836 g Gallic acid/L) and showed a high antiradical potential (61-87% against DPPH free radical). The 2- to 4-ring PAHs dominated, generaly in the following order of decreasing contents: naphthalene (111-164 μg/kg) > phenanthrene > fluoranthene ~ pyrene. The total 16 EPA PAHs concentration was in the range 50.5-374 μg/kg, with higher concentrations obtained at increased reaction temperature and duration. Naphthalene (low molecular 2-ring PAH with the highest water solubility among the 16 EPA PAHs) was found only in samples from the HTC tests conducted at temperatures above 200 °C and during the longest reaction time of 165 min. High molecular PAHs (with 5 and more rings in the molecular structure) were not detected and it might be hypothesized that this is the result of mild reaction temperature and/or the condensation of these higher PAHs onto the surface of hydrochar particles during the HTC reactor cooling.

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CHARACTERIZATION OF BIO-MAGNETIC NANOPARTICLES SYNTHETIZED IN THE PRESENCE OF WATER PLANT EXTRACTS

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ABSTRACT

In this work, the synthesis of bio-magnetic (Fe_3O_4) nanoparticles (MNPs) was performed by co-precipitation method in the presence of water extracts of the *Sumbucus ebulus* L. leafs; and its characterization was performed. The characterization of bio-MNPs was performed by using Scanning electron microscopy (SEM), X-ray diffraction (XRD) and Fourier transform infrared spectroscopy (FTIR) techniques. The results are compared with MNPs synthetized at the same reaction conditions in the absence of plant extract. According to the SEM analysis, visible stains can be observed on the surface of the bio-MNPs, which originate from the remains of the plant extract. The XRD pattern of bio-MNPs shows that characteristic peaks matched well with the magnetite phase that can be indexed to the face-centered cubic crystalline structure. However, the broad peaks as well as the small intensity of the peaks indicate the low crystallinity of the product. On FTIR spectra, it can be noticed that biosynthesis has improved the functionalization of MNPs due to the presence of a large number of functional groups on its surface compared to native one. A wide peak was observed at 3402 cm^{-1} which is attributed to the -OH stretching vibrations in water, -COOH group and polyphenols. Peaks between 2900 cm^{-1} and 2800 cm^{-1} are representative bands of C-H stretching vibrations of $-CH_3$ and $-CH_2$ groups. Peak observed at about 1700 cm^{-1} attributed to the carbonyl symmetric vibration. Peak at 1078 cm^{-1} is attributed to asymmetric stretching vibration of -C=O, which is an indication of the presence of –COOH groups. It can be concluded that the valuable biomaterial has been synthesized, and its possible applications will be further examined. Depending on the volume and quality of the plant extract, the size of the particles can be affected, as well as their biological properties; so their functionality can be significantly improved.

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MECHANICAL PRETREATMENT OF WASTED PRINTED CIRCUIT BOARDS (WPCBS) IN AN INDUSTRIAL MECHANICAL TREATMENT LINE

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ABSTRACT

Nowadays, more than 3 Mt of waste printed circuit boards (WPCBs) is produced annually. This large amount is potentially a big environmental problem, but also a great economic potential through recycling and "urban mining". Copper, gold, silver and palladium can account for up to 80% total material value of waste PCBs. The current PCB recycling treatments, relying on pyrometallurgy, hydrometallurgy, or electrochemical processes, retrieve approximately 99% of metals, precious as well as bulk, from the metal fraction. An assessment is that barely 10 to 15% of e-waste is recycled in Serbia, and this mainly refers to mechanical recycling, because officially there is no adequate recycling of e-waste in Serbia. This work is aimed to show results of mechanical pretreatment of WPCBs in an industrial mechanical treatment line in Serbia.

A mix of WPCBs from mobile phones (10%), old laptop (10%) and desktop personal computers (80%) were used for the experiments. The input WPCBs were processed through a mechanical treatment line of a WEEE treatment plant operating in Serbia that mainly enables the separation of recyclable metals from plastic fractions. A sample of 100 kg of WPCBs was shredded by a ball mill to get homogenized samples. Additional grinding by a knife mill was done after this first mechanical pretreatment in order to reduce particle sizes to less than 8 mm. Thereafter, the material was separated of ferrous metals (iron, steel, nickel, etc.) by using a magnetic separator. The dust formed in the process was collected by cyclones, and bag air filters. Separation of non-magnetic fraction obtained in the first stage of mechanical pretreatment was performed with a two stage electrostatic metal/plastic separator. In the first stage three fractions were obtained: conductive (A1), non-conductive (C1) and a mix (B1). Since the mixed fraction (B1) was abundant of 33% (w/w), another separation step of that fraction was performed. Consequently, three new fractions labeled A2, B2 and C2 were obtained. Obtained fractions were further characterized in terms of size distribution. Chemical composition was determined from XRF analysis done by a JEOL JSX-1000S Fluorescence Spectrometer X-ray analyser.

Metals such as Cu (65.40%), Sn (67.55%), Pb (57.11%) and Ba (79.30%) were predominantly distributed in B1 fraction. Aluminum (67.65) was mainly concentrated in A1 fraction and Br (74.50%), Ca (83.59%) and Fe (70.67%) were concentrated in C1 fraction. Silicon was almost equally distributed between B1 and C1 fractions, while Zn is almost equally distributed between A1 and B1 fractions. After the second separation stage, in A2 conductive fraction was found Cu (47.2% of the quantity found in B1), Sn (74%) and Pb (42.2%). In contrast, Zn (59.57%) and Fe (65.71%) were concentrated in C2 fraction while Ba (54.71%) is distributed in B2 fraction. Bromine is predominantly distributed in the B2 fraction. Silicon is predominantly distributed in the C2 fraction.

THE POSSIBILITY OF FLAXSEED OIL CAKE UTILIZATION FOR NEW COMPOSITE FILM PRODUCTION

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ABSTRACT

Biopolymer based packaging materials have been widely researched for food packaging application, because they are eco-friendly and functionally similar to synthetic polymers. Different sources for biopolymer materials productions are known, but food and agriculture by-products attract great attention, because they lag behind in great amount and regarding their chemical composition, they are considered as underused. Oil industry by-products are suitable for biopolymer films production, because they are rich in proteins, carbohydrates and fibers, which are necessary to obtain the biofilm with good mechanical and barrier properties. Since the pumpkin oil cake (PuOC) based films have good mechanical properties, it is unknown weather flaxseed oil cake (FlOC) could be also used as a suitable source for biopolymer film production. The possibility of linseed oil cake utilization for new composite film production was evaluated. In this regard, PuOC and FlOC were mixed in a ratio 1:1 (Fig.1), 1:3 (Fig.2) and 3:1 (Fig.3). All the film synthesized are examined on mechanical properties (thickness, elongation at break and tensile strength), because they are of great importance due to the potential application for packaged product integrity and its preservation. It has been shown that FlOC films can be synthesized as a component in composite film or as a separate layer, what is an important direction for further investigation.

Keywords: biopolymers, pumpkin oil cake, flaxseed oil cake, mechanical properties.

APPLICATION OF UV/VIS SPECTROSCOPY FOR ASSESSMENT OF IoBioFluid STABILITY

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ABSTRACT

Iobionanofluids are a dispersion of ionic fluids as a based fluid and biomass nanoparticles. Ionic fluids consider as new green fluids which characteristics can improve the performance of IoBioFluids. This is a new class of nanofluids as a sustainable alternative to IoNanoFluids. In this work two different ionic based fluids were used ammonium formate and [HMIM] [NTf 2]. Bionanoparticles were generated by two step methods. In the first step bionano particles were produced. In the second step IoBioFluid was prepared. Bionano particles were produced from sunflower stalk biomass after hydrothermal carbonization process. Dispersion of nanoparticles and ionic fluid was created by treatment with ultrasound probe and bath. One of the disadventages of nonofluids is limited stability. Stabilty of dispersion depend on nautre of base fluid, nanoparticels, peparation method, applied surfactants etc. Stability can be acess by observation or some optical method. For this purpose UV/VIS UniSPEC 2 spectrophotometer was used. Absorbance value used as a stability indicator. Measurment were conducted walvelenght range 200 – 800 nm. Samples of two different IoBioFluids were scaned every day for 10 days. Dispersion of nanoparicels and ammonium formats showed better stability. UV/VIS spectroscopy can be used as a fast method for evaluation of nanofluid stability.

Key words: IoBioFluids, spectroscopy, satility

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EFFECTS OF TIO_2 CONCENTRATIONS ON ULTRAFILTRATION PVDF/TIO_2 MEMBRANE FOR DAIRY WASTEWATER TREATMENT

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ABSTRACT

Nowadays nanomaterial is becoming an important component in membrane separation and purification technology. They play a great role in improving membrane hydrophilicity and offering photo-catalytic benefits. Examining the optimum concentration loadings of the nanomaterial is very important to exploit the maximum benefits in modified membrane application. In this study, pristine polyvinylidene fluoride (PVDF) and modified membranes with various TiO_2loadings are fabricated by phase in version and reported their performance. The hydrophilicity of the modified membrane was proven by contact angle measurements. The contact angles of the PVDF membrane at various TiO_2 loadings (0, 1, 1.5, 2, and 2.5%) were exhibited a decreasing trend from 78.1º at 0 to 66.72º at 2.5%. With increasing TiO_2loadingsthe filtration resistance and the flux were showing a decreasing and increasing trend respectively. All fabricated modified membranes exhibited better antifouling with lower irreversible foaling as compared to pristine PVDF. The rejection performance of all modified membranes for BSA and COD were comparable with pristine PVDF membrane (98.88% BSA and 99.83% COD). Regeneration of the fouled modified membranes by UV irradiation was possible. However 3 hours UV exposure is not enough to achieve the original flux which requires further investigation. The extents of flux restoration of all modified membranes were small and almost the same which means the effect of TiO_2 concentration on flux recovery was negligible.

Keywords: polyvinylidene fluoride, titanium oxide, photo-catalytic membrane, regeneration

Acknowledgement: The authors thank the support of the 2017-2.3.7-TÉT-IN-2017-00016 project.

CHARACTERIZATION OF SILK FIBROIN SOLUTIONS

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ABSTRACT

Silk fibroin has attracted more and more attention due to its high mechanical properties, great biocompatibility with living tissues, low biodegradability and minimal inflammatory reaction. It can be isolated from silk fibers, which are produced by cultivated *Bombyx mori* silkworm. Silk fibers mainly consist of two proteins, sericin and fibroin. Depending on the cocoons strain, the fibroin content is 66.5–73.5 wt. % and the sericin content is 26.5–33.5 wt. %. The silk fibroin fibers consist of two proteins: a light chain and heavy chain which are linked by a single disulfide bond and these proteins are coated with sericin. The isoelectric point of fibroin varies in the range pH 3.6–5.2, depending on the solution preparation conditions. Native fibroin can be solubilized and regenerated in aqueous solution, then further processed into sponges, films, hydrogels and nanoscale electrospun non–woven mats. Also, due to the amphiphilic character and surface activity, silk fibroin can produce physically stable oil/water emulsions. The aim of this paper was preparation of aqueous fibroin solution and its characterization. An aqueous solution of silk fibroin was prepared from silkworm cocoons, which were previously treated to remove sericin. Fibroin was dissolved in 9.3M LiBr and then dialyzed against water. The isoelectric point of fibroin was determined by measuring the zeta–potential and turbidity of silk fibroin solution at different pH values. Intrinsic viscosity of the prepared solution was determined with glass capillary viscometer in the temperature range from 10 to 70°C. In addition, according to the flow times of the solution, the fibroin solution was found to be stable for up to three weeks if stored in the refrigerator. Surface tension of the fibroin solutions with different fibroin concentrations was also determined.

Keywords: silk fibroin, silk proteins, isoelectric point, surface tension, viscosity.

INFLUENCE OF SYNTHESIS ON COMPOSITE/LAMINATED STARCH-GELATINE BASED BIOPOLYMER FILM PROPERTIES

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ABSTRACT

Biopolymer films have an increasing share and influence in the packaging materials sector, certainly due to a number of advantages: availability, cheapness, easy processing, degradability, etc. On the other hand, numerous methods have been developed to optimize their unfavorable properties (weaker mechanical characteristics, hydrophilicity, etc.). This paper examines the influence of the method of synthesis of biopolymer films on their properties. The selected substrate are starch-gelatin films. A starch-gelatin film was synthesized in a ratio 1:1 as an example of a composite film (label C). The second sample was obtained by lamination of gelatin film on starch film (label L). Plain starch film was used as a control sample (label 0). On the all three groups of samples, mechanical (thickness, tensile strength and elongation at break), structural (Fourier transform infrared spectroscopy) and physico-chemical (moisture content, swelling, solubility) properties of importance for the application of packaging materials were tested. All the obtained biopolymer films were transparent and easy to handle. Fourier transform infrared (FTIR) spectroscopy identified all characteristic groups and bonds formed in composite and laminated films. The results showed a significant contribution of gelatin in the developed biopolymer films compared to the control sample. Gelatin incorporation in both forms, as a component in composite film or as a separate layer, improved mechanical properties (tensile strength and elongation at break increased) and water solubility. Slight differences were observed between composite and laminated films because the effect of the method of added gelatin is minimal compared to the sample without the addition of gelatin.

Keywords: biopolymer films, starch, gelatin, synthesis, properties

DAIRY WASTEWATER ULTRAFILTRATION USING 3D PRINTED SPACERS IN A VSEP MODULE

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ABSTRACT

The basis of our research project is the detailed investigation of ultrafiltrations for membrane separation processes by testing a crossflow membrane filtration device capable of modul vibration. Our goal is to map the ultrafiltration parameters of a dairy wastewater model with an average load, using a 3D printed spacer that can be placed in the module. The design and printing of the 3D printed elements to be examined was also part of our work. We examined the change in filtration parameters with the use of the spacer, primarily with respect to changes in fluxes, retention values, and resistance values. For our research, we used a laboratory-scale (L-mode) vibrating membrane separation, VSEP (Vibratory Shear Enhanced Processing) equipment. For our laboratory ultrafiltration experiments, 50 kDa cut off polyethersulfone (PES) membrane with a 500 cm^2 filter surface was tested. For 3D printing, we used a composite polylactic acid (PLA) philatelic, the shape and arrangement of which were designed to improve the filtration indices, and then we compared and improved it accordingly during their tests. Based on the studies, we chose the most obvious layout and shape for more comprehensive measurements. Based on our results it can be concluded that the application of spacer and vibration of the module showed positive results, and we were looking for a way to explore the effectiveness of their joint application.

Keywords: membrane filtration, 3D printed spacer, dairy wastewater, ultrafiltration

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MODELLING OF FOULING IN AN ULTRAFILTRATION CELL USING DIFFERENT SPACERS

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ABSTRACT

The dairy industry generates the large volume of wastewater due to large water consumption, originated from washing and cleaning operations during the technology, which has to be treated effectively. Membrane filtration processes (such as ultrafiltration, UF or nanofiltration, NF) seem to be promising methods for the treatment of dairy industrial wastewater, which has several advantages compared with other conventional methods. Unavoidably, membrane fouling always hinders the membrane performance. The characterization of membrane fouling mechanisms and the reduction of the fouling tendency are highly important research topics.

In this work, two mathematical models were used to investigate the fouling and flux decline mechanism. The resistance-in-series model was used to identify the place (membrane surface or internal pore) of fouling. In this model membrane resistance, total resistance, irreversible resistance and reversible resistance were determined. According to the modified Hermia model, there are four main fouling mechanisms: complete blocking, standard blocking, intermediate blocking and cake layer formation.

In this study polyethersulfone (PES) UF membranes with molecular weight cut-off (MWCO) of 10 kDa and 150 kDa were tested. The UF experiments were carried out at model dairy wastewater with different stirring velocities (100, 200, 300 and 400 rpm) and six different polyacid (PLA) 3D printed element/spacer configurations. By fitting the experimental data into four models, fouling mechanism which was prevailing can be identified. The main fouling mechanism can be confirmed according data. Larger R^2 values indicated better fitting models.

Keywords: fouling, modelling, spacers, ultrafiltration, 3D printed elements

Acknowledgements: The authors are thankful for the financial support of the János Bolyai Research Sholarship of the Hungarian Academy of Sciences (BO/00576/20/4) and the New National Excellence Program of the Ministry of Human Capacities (UNKP-21-5-SZTE-550)

ENVIRONMENTALLY SAFE BIOMATERIALS FOR 3D PRINTING

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ABSTRACT

Three-dimensional (3D) printing is a wide-ranging technique that can create complex structures and 3D objects for different purposes. This technique is also called additive manufacturing (AM), because it enables rapid prototyping, where according to digital view, model is formed by depositing material layer by layer. Different materials can be applied in this process, but not all of them are perspective and suitable in terms of protecting the environment. Biodegradable materials are better for the environment and can be used to replace non-biodegradable materials for this purpose. In the process of printing, biomaterials are being coverted into the ink so that they can be used to print complex geometric structures. Mixtures of biopolymers with different properties are mostly used, thus forming ink of the desired characteristics. Before mixing the polymers, they need to be modified by appropriate processes in order to form the ink of desired characteristics. In this regard, mechanical, structural and rheological properties of printable biopolymeric-based materials and inks and are discussed. The aim of this paper is to represent the current achievement it the field of 3D printing with an emphasis on environmentally safe biomaterials that can be used to produce well-defined 3D models with great preciseness.

Keywords: 3D printing, additive manufacturing, environmentally safe materials, biopolymers.

TIO_2/CNT COMPOSITE MODIFIED MEMBRANES FOR ADVANCED MEMBRANE SEPARATION OF OIL-IN-WATER EMULSION

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ABSTRACT

Oily wastewaters are produced all over the world by several activities, which contain several toxic and carcinogenic components, and mean serious risk both on the natural environment and human health. Beyond environmental protection reasons, economic concerns also lead the industries to use advanced wastewater treatment methods which ensure higher purification efficiency. The augmentation of conventional techniques is expected to be compulsory in the near future Membrane filtration has several advantages, like high purification efficiency, no chemical addition, and easy integration, but oily contaminants quickly form a hydrophobic layer which reduces the water flux, decreases the membrane lifespan and increases the energy consumption which leads high operational costs.

In the present study titanium dioxide (TiO_2) and carbon nanotube (CNT) were used for the modification of PVDF membranes to reduce the membrane fouling via the inhibition of oil droplet adhesion on the membrane surface. Titanium dioxide (TiO_2) coating can increase the membrane hydrophilicity, while carbon nanotube (CNT) can be used to reduce the significant electron/hole recombination of TiO_2 during the photocatalytic cleaning of the fouled membrane.

In the present study, the beneficial concentration of the used carbon nanotubes in TiO_2/CNT nanocomposites was investigated (in an interval of 1-10 w/w%) to achieve advantageous filtration properties. Within the studied range, TiO_2/CNT nanocomposite containing 2 w/w% of CNT – which was physically immobilized onto the membrane surface – was the most beneficial. That composition increased the flux and reduced the filtration resistance with the highest efficiency, and it also proved to be beneficial in terms of purification efficiency during the filtration of 100 mg/L^{-1} oil-in-water emulsions (prepared from natural crude oil). It has also been shown that the advantageous properties of the nanocomposite-modified membrane surface are enhanced by increasing the transmembrane pressure.

Keywords: crude oil, emulsion, membrane separation, titanium dioxide, carbon nanotube

Acknowledgments: The research was funded by the Hungarian National Research, Development and Innovation Office—NKFIH under the „Development and application of nanoparticle modified membranes for the efficient treatment of oil-contaminated waters" project (NKFI_FK_20_135202). The authors are also grateful for the partial support of the 2017-2.3.7-TÉT-IN-2017-00016 project.

HEALTH RISKS ASSOCIATED WITH PAHs IN INDOOR DUST COLLECTED FROM HOUSEHOLDS IN VOJVODINA PROVINCE

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ABSTRACT

Dust is increasingly attracting public attention, as a complex matrix that is used to assess human exposure to various contaminants, both in indoor and outdoor environments. Knowledge about the adverse effects caused by various pollutants on human health is crucial. Thus, the main aim of this research was to perform a preliminary survey of PAHs present in indoor dust samples (n=47) collected from households located in the northern Serbian province of Vojvodina. The PAHs occurrence and profiles of indoor dust was investigated, along with their potential sources and carcinogenic risk. Total concentrations of 16 EPA priority PAHs in the dust samples ranged from 140 to 8265 μg/kg. In all analyzed dust samples, 4-ring PAHs dominated, representing 40-53% of total PAHs, followed by 3-ring PAHs (29-40%). Vehicle emissions and wood combustion were the major sources of PAHs in the Serbian indoor microenvironments, based on diagnostic ratios, principal component analysis (PCA), and positive matrix factorization (PMF). The incremental lifetime cancer risks (ILCRs) of exposure to PAHs found in indoor dust was 3.88E-04 for children and 3.73E-04 for adults, exceeding the US EPA safe limit of 1.00E-6. The highest exposure of the Serbian population to PAHs present in indoor dust was through dermal contact and accidental ingestion. Total cancer risks estimated for 85% of the studied locations exceeded 1.00E-4, indicating that places, where the Serbian populations spend the most of their lifetime, contained PAHs in concentrations that can affect human health.

Acknowledgements: This work was supported by Ministry of Education, Science and Technological Development of Republic of Serbia (451-03-9/2021-14/200134).

SESSION 2: TECHNICAL

DESIGN OF WASTE HEAT RECOVERY SYSTEMS FOR A CHOCOLATE FACTORY

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ABSTRACT

Nowadays, the protection of the environment and, indirectly, the increase of energy efficiency is an extremely important topic. One way of increasing energy efficiency is the utilization of waste heat.

In our article, we present a cooling system designed for a newly built chocolate factory, which in addition to performing the cooling task required by the customer and fulfilling the technological requirements, uses the waste heat and utilizes it in other areas.

We present the building of the chocolate factory. We determined the magnitude of winter heat loss and summer heat load.

In the next step, we reviewed the production technology used in the plant: we mapped the equipment used during production and their heat load, examined their cooling possibilities, and in which area of the factory the waste heat should be utilized.

We determined the cooling needs of the pulp mill, the ball mill and the tempering equipment and designed the method of their cooling.

We describe the current heating and hot water production system and – based on the above information – have planned the waste heat utilizing.

Based on the plans, we selected the appropriate equipment that can perform the desired tasks and prepared the technical documents for the planned system.

Keywords: cooling, heating, waste heat recovery, energy efficiency, chocolate production

INVESTIGATION OF MOTORCYCLE MODIFICATIONS BY POWER AND TORQUE MEASUREMENT

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ABSTRACT

Increasing, measuring and evaluating the performance of motorcycles is a technical field in which the goal is to constantly look for new challenges and solutions. Many parts are available commercially for the conversion and modification of motorcycles. These modifications include air filter and carburetor replacement, selection of optimally sized jets, cylinder head and electronics modifications. These changes individually affect the operating characteristics of the engine. In the absence of proper settings, their effects can be unfavorable. The combined effect of each modification should also be examined. The tool of our tests is a dinamometer, with which it is possible to record the power and torque characteristic curve of an internal combustion engine at full load. In our article we describe the effect of each modification and the characteristic curves obtained as a result of the measurements.

Keywords: modifications of internal combustion engines, characteristic curves of internal combustion engines, power measurement, torque measurement, dinamometer

SOFT ROBOTICS: STATE OF ART AND OUTLOOK

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ABSTRACT

Widely used robot systems have a rigid base structure that limits the interaction with their environment. Due to the inflexible attachment points, conventional robotic structures can only manipulate objects with their special gripping system. It can be difficult for these systems to grasp objects with different shapes, handle complex surfaces or navigating in a heavily crowded environment. Many of the species observed in nature, like octopuses are able to perform complex sequences of movements using their soft-structured limbs, witch are made up entirely of muscle and connective tissue. Researchers have been inspired to design and build robots based on these soft biological systems. Thanks to the soft structure and high degree of freedom, these soft robots can be used for tasks that would be extremely difficult to perform with traditional robot manipulators. This article discusses the capabilities and usability of soft robots, reviews the state of the art, and outlines the challenges in designing, modeling, manufacturing, and controlling.

Keywords: soft robotics, soft actuators, bio-inspired robots, pneu-net, flexible robots

INFLUENCE OF CRACK LENGTH IN AIRCRAFT CYLINDER HEAD ON EFFECTIVE STRESS VALUE AROUND CRACK TIP

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ABSTRACT

The appearance of cracks in the cylinder head of aircraft piston engines is a common occurrence in practice. Determining the stress state of the cylinder head with a crack is of great importance and enables the assessment of the integrity of the same. In this paper a structural analysis of the cylinder assembly without crack I and with cracks of different lengths is performed. Values of the effective stress of the cylinder assembly at room I and at an elevated temperature corresponding to the operating temperature of the cylinder assembly were obtained. The influence of the crack length in the cylinder head on the value of the effective stress in the vicinity of the crack tip is presented. Research has shown that with crack growth above 3 mm the slope of the effective stress growth line increases with maximum values of effective stress occurring around the cracks tip.

Key words: crack, cylinder head, thermomechanical load, effective stress

NEURAL NETWORKS IN ECONOMIC DATA ANALYSIS

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ABSTRACT

Neural Network based Machine Learning algorithms are the most developing branch of Artificial Intelligence and programming today. These Neural Networks frequently used in data analysis, face detection, classification, pattern detections etc. The aim of this project was to develop a simple but flexible NN system with graphical interface, which could demonstrate the power of this method mostly in real economical and financial databases. The Python and Linux based application has several setup possibilities and was tested in various databases with success, and capable to introduce into the economics education. With the program the user will able to fit the NN to the actual database, and can find the relationships or mistakes with ease. The application use the black-propagation algorithm, and works with CSV data recently. The output can be seen graphically, but the final setup of the NN results can be saved for future utilization as well. The system is suitable for teaching and learning due tu its easy fine tuning and quick setup.

NEW NUMERICAL PROCEDURE FOR DETERMINATION OF ELASTIC CURVE OF STATICALLY DETERMINATE AND INDETERMINATE BEAMS WITH VARIABLE CROSS SECTIONS

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ABSTRACT

In this lecture a new numerical procedure is developed for calculating the inclination angle and deflection as initial conditions of the end points of statically determinate and indeterminate beams. The method is based on the topology comparison of simple (hinge-roller combination) supported beam and a resemblant cantilever beam. Assuming that the support reactions of the beam are active forces, the virtual displacements at the points of the reaction forces are calculated. Based on these values the inclination angle is calculated. Several examples are considered and the suggested in this lecture, while the procedure is applied for various types of structures and loadings. The results, obtained by the suggested numerical procedure, are compared with analytical ones, and they are in good agreement.

Keywords: elastic curve, beams of variable cross section, initial guess for slope and deflection

STRUCTUAL AND MORPHOLOGICAL STUDIES OF LACTIC ACID BASED BIODEGRADABLE MODIFIED POLYMER PACKAGING MATERIALS

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ABSTRACT

During our research, we modified biodegradable PLA samples with acetic anhydride at room temperature. The modified, as well as the untreated samples were being interacted with different food products. Some of our samples were prepared via the mechanical pressing of PLA granules. Since the surface of the samples had not become homogeneous during this aforementioned process, we used prefabricated PLA covers later on. Vibration spectroscopy is capable of analyzing the chemical composition of different substances and is a widely used method in quality control, hence the structural changes in the polymer samples were monitored with Raman-spectroscopy. The material composition analysis has been complemented by atomic force microscopy (AFM), during which we obtained morphological information about the surface of the samples in a 10^{-9} m spatial resolution. Since AFM is suitable for the measurement of elasticity, we gained knowledge about the mechanical nature of the investigated samples as well.

Keywords: PLA,Vibration spectroscopy, Food products

DESIGNING AN EXCEL VBA FUNCTION TO RECOGNIZE MORE IMPORTANT IRRATIONAL NUMBERS

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ABSTRACT

In our work, we typically perform calculations on a calculator or computer, which show the result as a decimal fraction if it is not an integer. However, it would be much easier to interpret the result if a value could be expressed in integers using some operations, such as the root subtraction operation. Using the Microsoft Excel spreadsheet, we have the opportunity to do so with our algorithm developed during our research, which recognizes the most important irrational numbers and displays them in text form together with the character of the operation sign. For example, the text form "5√3/2" is given for 4.330127019. It is also useful to display irrational numbers with integers because only an infinite number of decimal places in a decimal fraction could show the exact value, which is obviously not possible. So we get a shorter, more interpretable and accurate form of the number. In addition to the results that can be written as square roots, our algorithm can display irrational numbers that can be expressed as the number Pi using the π character, but it can show all rational numbers as the quotient of two integers that are relative primes. The programming was implemented with the Visual Basic for Applications feature of Excel, so we created a function that can be used in the usual way in Excel.

Keywords: irrational number, Excel VBA, programming, function, root recognition

INVESTIGATIONS AND TESTING OF LITHIUM-ION CELLS

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ABSTRACT

In our wider and narrower environment, due to the significant developments in the automotive industry, increasing attention is trending towards electric powered vehicles.
At the same time, sales for electric-powered cars is increasing which causes favorable environmental effects in the city. However, it sets out new challenges to promote its decent operation.
Li-ion batteries dominate the rechargeable battery market, but their safety is a major issue that has aroused public concern and attracted the attention of researchers.
If a Li-ion battery is short-circuited or exposed to high temperature, exothermic reactions can be triggered, resulting in a self-enhanced increasing-temperature loop known as “thermal runaway.”
We used Panasonic18650 energy cells, because they are produced with a maximum capacity to provide long run-times.
We installed a DIGATRON BE 300-600 type battery emulator, so we can measure data from 300 cells at the same time using this charger and tester device.
Our investigation is a part of an innovation programme under a grant agreement (EFOP-3.6.1-16-2016-00014) that has ran for four years, which is to reveal opportunities for Li-ion batteries and their testings.

Keywords: electric charging, Li-ion batteries; testing of cells.

MINIMIZING THE RISK AND TRANSPORTATION COST OF ETHANOL TRANSPORTATION

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ABSTRACT

This paper presents the circumstances regarding the transportation of high purity ethanol. The main topic in the paper is how this flammable product can be transported by tank trucks. The paper focuses on a real life logistic problem. ADR and road regulations are presented throughout a personal example in order to determine, which is the optimal tank volume for high purity ethanol transportation. It is not just a logistics problem, has environmental impacts as well.

Key words: logistics, ethanol transport, environmental protection, cost efficiency, ADR

Acknowledgements: -

CREATING THE CONCEPTUAL AND LOGICAL MODEL OF A JOURNAL DATABASE

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ABSTRACT

This article describes the process of creating the conceptual and logical model of a journal database. Since 2006, 482 publications from Hungarian and foreign authors have been published in the Journal of Contemporary Social and Economic Processes. To efficiently extract the information from the articles published so far, the idea of creating a database has emerged. To create a database, it is highly recommended to design a high-level conceptual model and convert that into a logical data model. The benefit of the thoughtful design is that it shows the structure of the database in an easily comprehensible form. It also facilitates the dialogue between the user and the programmer, and it may give new ideas concerning the database as well. This design serves as a plan or description that does not need to be changed depending on the selected database management system. The entity-relationship model is a fast and efficient way to create the conceptual model and it can be easily converted to a relational database model, which is a logical model. Both have entities, attributes, and relationships to describe a database. The entity-relationship model uses diagrams containing shapes (rectangles, ovals, diamonds, etc.) Its downside is that there is no computer database system capable of understanding this type of description. The relational model uses tables (and describes their structures and relations), and because of its simplicity and robustness, most database management systems use this model. The first (initial) version of the entity-relationship model of the journal database had one entity type and 25 attributes, no relationship. This was modified based on the information to be obtained from the stored data, and the final version contained three entity types, 39 attributes, and three relationships. This final conceptual model was converted to a logical model, the relational model, based on conversion rules. The result was ten tables to store entity data with 22 different fields (columns) and another three tables to ensure the relationships between the entity sets. The developed model can be created in a relational database manager and is suitable for serving information needs related to the journal.

Keywords: database planning, entity-relationship model, relational model

PLASTIC WASTE TREATMENT BY PYROLYSIS

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ABSTRACT

The increase in the global plastic production resulted serious environmental problems including the accumulation of plastic waste. Various treatments of the waste like recycling or energetic utilization are able to lower the environmental pollution, however a significant amount of the used plastic is still landfilled. Pyrolysis can be an effective method to decrease the environmental impact of plastic waste generation. In this study, the thermal degradation of high- and low-density polyethylene, polypropylene, and polystyrene was investigated. These plastics results in valuable hydrocarbon oils containing mainly paraffins, olefins and aromatics. Experiments were performed in a laboratory scale batch reactor using the individual plastics and two mixtures (with and without PS). The oils produced were separated into gasoline and diesel fractions (210 and 350 °C cuts). The gasoline fractions were further analysed by GC-MS. The results showed that the concentration of olefins in the pyrolysis oils significantly exceeds the maximum amount stated in the EN-228 European gasoline standard. The olefin concentration of pyrolysis oils can be lowered by hydrotreatment, thus an additional catalytic hydrogenation experiment was carried out by utilizing the gasoline fraction of the mixture not containing PS.

Another valuable product of the process is the pyrolysis gas. An average gas yield of ~20 wt% could be achieved, which is heavily influenced by the ratio of plastics utilized. The composition analysis of the pyrolysis gas showed a significant amount of ethane, ethene, propane and propene, which enhances the heating value. The combustion of this gas may be able to cover the energy requirements of the process.

Key words: plastic waste, pyrolysis, energy, fuel

MODERN TRENDS IN THE CHOICE OF VERTICAL PACKERS CONCEPT

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ABSTRACT

The strong competition in the global market, which is becoming more open, leads to the fact that packer manufacturers must diversify their production program. Companies that previously had only few products are now forced to constantly release new, or the same products in new packaging. Such requirements for packer manufactures mean that they must ensure the flexibility of machines, so that they can work with more sizes, and sometimes with more different forms of packaging. A very important item is the quick change of format, which in the case of vertical packers means the replacement of the forming set, as well as the quick adjustment of parameters that need to be executed by software. The main trends in choosing a packer concept are reducing the level of mechanical complexity, increasing the complexity of the control system and providing electronic synchronization of the packer subsystem. The paper provides guidelines for the selection of concepts of individual subsystems of vertical packers, which would, in addition to meeting the required operating parameters, provide the necessary flexibility.

Keywords: vertical packers, modern trends, flexibility

THE SAFETY OF COLLABORATIVE ROBOTICS - A REVIEW

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ABSTRACT

There is a growing demand for humans and machines to collaborate. Many examples can be found of this in our daily lives; simple devices in our household or semi-automatic machines in factories where some level of collaboration has been realized. The field of robotics also has a chance to make workplaces safer, more collaborative, and more productive for the operators. One of these forms of this collaboration is, when a human and a robot are able to work together without any physical barriers. The aim of this review is to collect the available and applicable technology in the field of collaborative robotics safety based on "Collaborative robots - ISO/TS 15066:2016" standard. The safety aspects of collaboration by comparing the implications of standards with the direction in which researches are conducted in science. In this review the requirements are compared starting from the risk assessment through the theoretical methods to the implemented case studies. Finally, the paper provides insights to the possible directions in field of human machine collaboration.

Keywords: robot safety, human–robot collaboration, cobot safety, cobot review, standard

EVALUATION OF GEAR PITTING SEVERITY BY USING VARIOUS CONDITION MONITORING INDICATORS

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ABSTRACT

Fault detection techniques based on vibration measurement are implemented to identify in an early stage failures appearing in gear transmissions. Condition monitoring indicators (CMI), like: Root Mean Square (RMS), Kurtosis, Crest Factor, FMO, FM4, M6, NB4, Energy ratio, NA4 or Energy operator, are used to estimate the level of gear faults such as pitting, cracks, spalling, scuffing or scoring. However, in is multitude of indicators, the question that arises is: which CMI is the most sensitive in estimating the severity of defects? Thus, this paper presents an extensive comparison between the before mentioned indicators computed from vibration signals collected on four pinions with different pitting grades, created by artificial means. The pinions where incorporated in a single helical gearbox and the tests were performed on an open-energy test rig at three different imput speeds. This comparative study assesses the receptivity of different condition monitoring indicators towards gear pitting failure.

Keywords: condition monitoring indicators, fault diagnosis, gear pitting

KINETIC AND DYNAMIC INVESTIGATION OF A NOVEL INERTIAL PROPULSION DRIVE

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ABSTRACT

Today there is a great deal of controversy over the operation of inertial propulsion drives (IPD), as they challenge the laws of Newtonian mechanics. Starting with the last decades of the previous century, many devices that use the centrifugal force to generate linear propulsion were patented. Regrettably, whether we are talking about the initial, or the most recent attempts, only a few of these systems passed the patent stage and were involved for practical applications. The aim of this paper is to present an IPD, developed by the authors, which uses for generating linear motion the kinetic energy of several masses, placed in the articulation points of the links of a chain drive. The masses placed equidistantly along the half-length of the chain perform a complex movement, consisting of the specific displacement of the chain elements and a rotation around an axis which is parallel to the line which joins the centers of the chain wheels. After deducting the equations of the geometric coordinates of the masses, the total propulsion force was computed. The obtained results are supporting the ability of the IPD to generate propulsive force and linear motion.

Keywords: dynamics, inertial force, kinematic, propulsion drive

JUSTIFICATION ANALYSIS OF THE APPLICATION OF CYLINDRICAL ROLLER BEARINGS WITHIN THE UNIVERSAL MOTOR HELICAL GEAR REDUCERS

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ABSTRACT

Within the universal motor helical gear reducer, single row deep groove ball bearings are usually used, but for larger driver dimensions and heavily loaded shafts, spherical roller bearings are used. In order to achieve the maximum load capacity of the gearbox, within the same axis height, relatively large single-row ball bearings are necessary. In some cases, due to dimensions constraints, they can not be installed in the gearbox, so many manufacturers, in certain cases, use somewhat smaller and more expensive single-row cylindrical roller bearings. Though these bearings are not specifically designed to transmit axial forces, they can bear axial loads. The idea of this paper is to point out this problem and the benefits that come from the use of cylindrical roller bearings.

Keywords: helical gear reducers, roller bearings

THE SINGLE-STAGE GASIFICATION OF MAGNETITE HEAVY SUSPENSION SEPARATED COAL SAMPLES FROM HUNGARIAN BROWN COAL

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ABSTRACT

On one hand, it cannot be denied that the electricity generation has been highly depended on fossil fuels, like coal and it will be at least until the half of this century. But on the other hand,the use of traditional technologies in coal power generation will lead to even higher emission levels. Clean coal technology (CCT) could be one of the solutions. Currently, gasification of coal is considered the centre of CCTs.

In this study, there were two coal samples from the magnetite heavy suspension separated process used in the single stage fixed bed gasification within the non-moving of material. Thesetwo samples were marked as A1 and A2 sample, with the specific densities of □1.8 g/cm^3 and

□1.6 g/cm^3, respectively and diameters from 1 to 20 mm. The main purpose of the experimentswas to consider the effects of temperature and steam flow rate during the coal gasification fromboth, the energetic and chemical utilisation point of views.

As the temperature increased, the char yields decreased, and the gas yields increased at all examined steam flow rate. At each gasification temperature, the higher steam flow rate resultedin the lower char yields and higher gas yields. With higher temperature and steam flow rate, theexperiments within A1 sample performed a better char yield and higher volume of produced syngas. In the case of A1 sample, the lowest char yield was 23.78 %wt at 900 °C gasification temperature and 10 g/min steam flow rate. While the ash content of A1 sample was 19.05 %wtin the proximate analysis. As the temperature increased from 700 to 900 °C, the total composition of H_2, CO_2, and CH_4 showed a decreasing trend in both samples. While CO concentration increased with the increasing gasification temperature. When steam flow rate increased from 5 to 10 g/min, the H_2 and CO_2 concentration increased in case of both samples. While that of CO and CH_4 showed a decreasing trend at all temperatures.

Regarding to the effect of samples in gasification performance, the A1 sample showed a betterpromising starting material for gasification than the A2 sample in term of carbon conversion and cold gas efficiency, especially at 900 °C of gasification temperature. In the case of A2 sample, the carbon conversion efficiency was 41.98 % at 5 g/min and 42.28 % at 10 g/min of steam flow rate. While that was 36.01 % and 50.12%, respectively, for A1 sample. The highestcold gas efficiency was at 61.97 % for A1 sample at 900 °C of and 10 g/min of steam flow rate.From the results of experiment, it can be concluded that the steam gasification is a promising solution for the better efficiency of low rank coal utilisation. In addition, the proper selection of operation parameters will help to increase the overall efficiency in both the energetic and chemical utilisation point of views.

Key words: Low rank coal, brown coal, clean coal technology, steam coal gasification. Acknowledgements:

DIELECTRIC PARAMETERS OF SOILS AS FUNCTION OF FREQUENCY

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ABSTRACT

Engineering applications may include such investigations, which play important role in the innovative agriculture. Investigations have to be carried out to isolate the effects of specific characteristics through laboratory and field experiments. The most important soil characteristics are moisture content, salinity, organic matter content, bulk density, texture and structure. Of course, these parameters can be measured using conventional techniques, too. One relatively recent innovation in soil investigations is utilising electromagnetic methods (electromagnetic waves) to measure soil parameters. Dielectric characteristics of soils can be evaluated from both an agricultural and a technical perspective. Undoubtedly, the most significant and easiest to isolate is soil moisture. Dielectric test method can be potentially utilised in agricultural researches. Furthermore, technical education, research, development and innovation provide opportunities for resilience and reinvention.

This paper presents how the dielectric parameters of soils characterize and describe the properties of soils, evaluate the effects of soil properties on microwave complex dielectric constants and contains a dielectric model. Relationships between the dielectric parameters and moisture are the basis for the microwave sensing of soil moisture. Open-circuit coaxial transmission-line method was used to determine the electromagnetic (dielectric) parameters of different soil types (different texture and moisture) as function of frequency. The measurements were carried out in the microwave frequency range between 200 and 2400 MHz. Measurements were made with DAK 3.5 dielectric measuring system.

Dielectric measurements were help to evaluate the dependence of the dielectric constant. The results show the relationship between soils physical parameters and their electrical properties (dielectric parameters). The effects of dry density or degree of compaction on the dielectric constant of different soil types (ranging from sand to bentonitic clay) must be experimentally investigated and evaluated. There are significant variations for the real part and large variations for the imaginary part of dielectric constant among soils in the test frequencies ranging from 200 to 2400 MHz. The real part of the dielectric constant for high-moisture cases correlate energy store of electric field and the imaginary part for all soils correlate the extent of electrical energy converted to heat and characterize moisture conditions. The new models can be used for soils with similar characteristics.

Soil characterisation, soil fundamental parameters such as water content and density are usually required to be measured and monitored continuously to ensure successful agricultural activity. A review of the results of this paper shows an alternative way of measuring soil water content and density in agricultural discipline. The effects of dry density on the soil dielectric constant depend on the soil type. In addition, microwave measurements should be supplemented and supported by experimental observations and agricultural field work. These results can be used as a database for future in agricultural investigations and interdisciplinary researches.

In addition to technological impact assessments, ecological impact assessments should not be neglected in the course of engineering activities.

Keywords: soil, microwave, dielectric parameters, innovation

BEST PRACTICE COMPUTATIONAL APPROACH FOR KINSHIP ANALYSIS OF LOW COVERAGE/ANCIENT DNA SAMPLES

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ABSTRACT

Current state of art kinship analysis is capable to infer relatedness up to the 5-6th degree from deeply sequenced DNA if the proper reference population is known. Low coverage, partially genotyped, degraded archaic (or forensic) DNA and often unavailable or unknown reference population poses additional challenges. Accordingly up to now kinship analysis from low coverage archaic sequences is mainly possible up to the second degree with large uncertainties.We performed extensive simulations to assess the main factors of bias. Accordingly, here we offer a best practice guideline to overcome the difficulties associated with aDNA kinship analysis. We validated our proposed methodology on experimental modern and archaic data with widely different genome coverages using samples with known family relations and known or unknown population structure as well. With a proposed practical workflow we provide the necessary additional tools to calculate the corrected kinship coefficient using the widely used genome data formats. Our methodology allows to reliably identify relatedness up to the 4-5th degree from variable/low coverage archaic (or badly degraded forensic) WGS genome data.
Emil Nyerki was supported by the ÚNKP-21-3-SZTE-67 New National Excellence Program of the Ministry for Innovation and Technology, from the source of the National Research, Development and Innovation Fund.

Keywords: bioinformatics, archaeogenetics, simulations

LOCALIZATION METHODS FOR MOBILE ROBOTS

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ABSTRACT

Localization aims to provide the best estimate of the robot pose. It is a crucial algorithm in every robotics application, since its output directly determines the inputs of the robot to be controlled in its configuration space. In real world of engineering the robot dynamics related measurements are subject to both uncertainties and disturbances. These error sources yield unreliable inferences of the robot state, which inherently result in wrong consensus about the appropriate control strategy to be applied. This outcome may drive the system out of stability and damage both the physical system and its environment. The localization algorithm captures the uncertainties with probabilistic approaches. Namely, the measurement processes are modelled along with their unreliability, moreover, the synergy of multiple information sources is formulated with the aim to calculate the most probable estimate of the robot pose. In essence, this algorithm is composed of two main parts, i.e., first the dynamics of the system is derived, and the corresponding uncertainties are initially predicted, next the additional sensor information is incorporated in the algorithm to refine the posterior estimate. This approach provides the state-of-the-art solution for the derivation of mobile robot poses in real applications.

Keywords: mobile robot, pose estimation, state estimation, bayes state estimation framework, localization

TYPES AND APPLICATION OF INFILL IN FDM PRINTING: REVIEW

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ABSTRACT

3D printing is technology that today has various application in production, through mechanical industry, medicine, civil engineering, food production, etc. Through 3D printing the fabrication of complex geometrical parts using various materials had been made possible.

Fused deposition modeling (FDM) is widely used 3D printing technology. It has found its place from manufacturing consumers products through industrial parts. FDM also has been popular because of low price of commercially used printers and plastic materials such as PLA or ABS. In 3D printing process there are many elements that have great influence on finished product, such as part orientation, used material, support, infill, etc. Part infill have impact on overall part functionality, printing process and material consumption. In this paper it will be discussed the infill types, printing parameters of infill and their functional role in part production for FDM 3D printing.

Key words: 3D printing, FDM, infill

THE IMPORTANCE OF SOLAR RESOURCE USAGE IN INTERNET OF THINGS (IoT)

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ABSTRACT

The need to encourage the use of renewable resources exists in all developed countries. This enables the saving of non-renewable resources, security and independence in energy supply, preservation of the environment, increasing the competitiveness of the economy as well as socially responsible business. Modern living conditions imply the increasing application of ICT technologies in all spheres of life. The application of sensor stations within smart technologies such as smart cities, smart agriculture, etc. implies the installation of sensor stations in places without infrastructure, which is why batteries with limited capacity are mainly used to power them. This problem can be overcome by using photovoltaic cells to transform solar energy into electricity, which would ensure their energy independence, which would allow their even greater application. In this paper, a study of the possibility of supplying sensor stations with electricity using PV cells was conducted.

The research is conducted through the project »Creating laboratory conditions for research, development and education in the field of the use of solar resources in the Internet of Things«, at the Technical Faculty »Mihajlo Pupin« Zrenjanin, financed by Provincial Secretariat for Higher Education and Scientific Research, Republic of Serbia, Autonomous Province of Vojvodina, Project number 142-451-2684/2021-01/02.

Key words: solar energy, IKT technologie, sensor stations

A NEW APPROACH FOR IMPERFECT BOUNDARY CONDITIONS OF THE DYNAMIC BEHAVIOUR

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ABSTRACT

Real beams have non-ideal boundary conditions and it is necessary to use new models to determine the real modal parameters. Models that use ideal conditions do not fully reflect reality and can lead to unsatisfactory description of the dynamic behaviour. The hinged – hinged boundary conditions, which is in the focus of the paper, are not analyzed as a single beam, but as a continuous beam with three spans, free at the ends. The continuous beam with three spans is analyzed for cases in which the intermediate supports can occupy any position along the length of the beam, by an analytical solution of the problem, with the example of cases when the intermediate supports are located very close at the free ends of the continuous beam, thus simulating the real case for an hinged beam at both ends; the situation in which the intermediate supports are very close to one of the ends of the beam, thus simulating the real case of the clamped beam, with an imperfect clamped end; and the situation in which the intermediate supports are very close located anywhere on the beam length, thus simulating the ipotetic case with a continuous beam free at the ends and fix on the hinged supports. The analytic results are compared with numerical results by using finite elements method.

EXPERIMENTAL INVESTIGATION OF SYNGAS PRODUCTION FROM STEAM GASIFICATION OF REFUSE DERIVED FUEL

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ABSTRACT

Even these days large quantities of wastes – including municipal solid wastes (MSW) – still end up on landfills, which poses a serious threat to human health and to the environment as well. Energy recovery has an important role in a sustainable waste management system because this is the only way to prevent landfilling of non-recyclable wastes. Using Refuse Derived Fuel (RDF) instead of MSW has several advantages during the energy recovery process, as it has higher energy density. The focus of this work is the pyrolysis and steam gasification of RDF, with an emphasize on the characterization of the solid and gas products. The experiments were performed in a two-stage laboratory system. At the first stage approximately 20-25 g "fluff" RDF was placed inside the reactor tube, where the pyrolysis occurred at 600 °C. In the second stage the products of the pyrolysis were gasified by steam at 900 °C. The composition of the generated gases was analysed by gas chromatography and based on the results lower heating value and H_2/CO ratio were calculated. Elemental analysis of the feedstock material and the products was also performed.

Keywords: syngas, RDF, gasification

MODELING OF STATIC BEHAVIOR OF FOUR POINT CONTACT BALL BEARING

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ABSTRACT

Within this paper is described an analytical model for the analysis of quasistatic load distribution in four contact ball bearings. The quasistatic model was developed on the basis of the static model, applying Hertz's theory of contact and John-Harris's load distribution on ball. In this paper, the model is extended by introducing parametars such as positiv/negativ clearancs into static equilibrium equations. Behavior analysis of the four point contact ball bearing (FKL LSQFR 308) was performed for different operating conditions. Within certain analyzes, the analysis of the influence of conceptual parameters (positiv/negativ clearancs) on the operational characteristics of bearings was performed. The change in external load also varied. Verification of the static behavior of the ball bearing LSQFR 308 was performed by comparing the results obtained by quasistatic modeling and the results obtained using the finite element method.

Keywords: bearing, clearance, load, mathematical model, four point contact

DEVELOPING FATIGUE TEST MACHINE FOR COMPOSITE MATERIALS

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ABSTRACT

This paper's goal is to introduce the third step of the EFOP-3.6.1-16-2016-00014. project on the Faculty of Engineering, University of Szeged. In this period the production technology of composite material was chosen and a fatigue test machine was developed and tested. The paper shortly describes the composite materials and summarizes the theory of fatigue than it presents the process of the development with several prototypes of fatigue test machine, some of which were manufactured and tested. Initially a shaker played the key role in the first two conceptions and finally a crank mechanism became as the best solution. The main solved problems during the development were selection of bearings and solving the partly dynamic balancing of the moving parts.

Keywords: plastic composites, fatigue test machine, dynamic balancing

VIBRATION DAMPING WITH COUPLED MASSES IN PARALLEL

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ABSTRACT

The author is going to introduce his latest result in vibration reduction research with "wallpaper"-like metastructure. At the beginning the dynamic adsorbers and the acoustic metamaterials are briefly presented then translational model of the "wallpaper"-like metastructure is shown. The motion equations of the mathematical model are written and solved by rotating vectors. The bent cantilever model with elastic support method is presented. The damping ability of the system is shown during a simulation of a 3D solid body model.

Keywords: "wall-paper"-like metastructure, acoustic metamaterial, rotating vectors, elastic support

COMPARATIVE TESTING AND ANALYSIS OF PLASTIC COMPOSITES

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ABSTRACT

Polymers are being used in increasing amounts in everyday and technical life, and their markets have started to grow again after the economic crisis at the beginning of the decade. Besides unreinforced polymers, composites are getting more popular due to their relatively high density coupled with their low strength. The growing demand–affect**s** not only–cross-linked matrix composites, but also thermoplastic composites, as from these materials with relatively little energy large quantities of various three-dimensional products can be produced by injection molding, the manufacturing accuracy of which can be better adjusted due to fiber content. Fiber-reinforced polymer composites are gaining ground in many industrial segments due to their extremely favorable mass-specific mechanical properties. In our research, we examined plastic composite specimens made with FDM 3D printing technology, the aim of which is to determine their mechanical and physical properties, and the obtained results could serve as a basis for their use in technical practice. The existing ABS as well as PLA based specimens were subjected to static, tensile strength and dynamic impact test methods on Galdabini Quasar equipment. Both the tensile test and the Charpy impact bending test were performed according to ISO 527 standards for plastic composites. A comparison was made between the measurement results of the ABS and PLA specimens, which show that there is no significant difference in the strength characteristics of the two materials under static stress, however**,** ~~but~~ in contrast to dynamic testing, ABS has twice the load-bearing capacity as PLA.

Key words: dynamic testing, 3D printing technology, tensile test, impact test

WHAT A HASTY, ALMOST HYSTERICAL CHANGE IN VEHICLE DRIVE TECHNOLOGY CAN BRING TO SUSTAINABILITY?

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ABSTRACT

I have a feeling that humanity is not learning from the past. Without clear, genuine, scientifically proven evidence, they are forcing technical changes of a nature and magnitude that have more of a risk than a possible solution. In my dissertation, I will try to point out the logically questionable or harmful elements in the field of e-cars and renewable energies. I will recall the past and development of e-cars and then present a comparison with traditional cars with my own source data, not with the results and conclusions of the popular trend. I present one side of the material and economic implications of the related infrastructural change. All of this, of course, affects most of the resources for sustainability, which of course also raises issues of human, economic, renewable energy and environmental impact.

My aim is to arouse scientific thinking, arouse doubt and stimulate meaningful debate with numerical and logical examples. It would be good if the truth were born in a debate.

Keywords: BEV, energy and economic footprint, sustainability, climate change

ENRICHMENT OF RARE EARTH ELEMENTS FROM CONTAMINATED BIOMASS PRIOR TO EXTRACTION

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ABSTRACT

Under the context of reserve depletion, recovering rare earth elements (REEs) from secondary resources is essential which assists to strengthen the circular economy. Contaminated biomass growing from brownfield lands is a potential material for REE recovery. However, prior to the extraction stage, polluted plants need to be lessened to a manageable volume. In this study, contaminated biomass gathered from an abandoned mining area was combusted in a pilot scale boiler, while solid residuals from different positions in the burning system were collected and analyzed. Higher REE concentration in the ash samples compared to that in the woody biomass indicates the efficiency of the combustion process from the metal enrichment point of view. The significant metal level in the solid remains is an advantage for the following step of extraction to reclaim REEs. It was concluded, that the concentration of REEs in bottom ash is greater than in the other solid residuals. That indicates the low volatility of rare earth metal compounds during incineration.

Keywords: rare earth metals, contaminated biomass, combustion, recovery

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DETECTION OF TRANSVERSE CRACKS IN PRISMATIC CANTILEVER BEAMS AFFECTED BY WEAK CLAMPING USING A MACHINE LEARNING METHOD

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ABSTRACT

Because our infrastructure is aging and approaching the end of its intended functioning time, the detection of damage or loosening of joints is a topic of high importance in structural health monitoring. The most desired way to assess the health of engineering structures during operation is to use non-destructive vibration-based methods that can offer a global evaluation of the structures integrity. A comparison of using different modal data for training feedforward backpropagation neural networks for detecting transverse damages in beam-like structures that can also be affected by imperfect boundary conditions is presented in the current paper. The different RFS, RFS_{min}, and DLC training datasets are generated by applying an analytical method, previously developed by our research team, that uses a known relation, based on the modal curvature, severity estimation of the transverse crack, and the estimated severity for the weak clamping. The obtained dataset values are employed for training three feedforward backpropagation neural networks that will be used for locating transverse cracks in cantilever beams and also detect if the structure is affected by weak clamping. The output from the three ANN models are compared by plotting the calculated error for each case.

Keywords: damage detection, machine learning, natural frequency, structural health monitoring, weak clamping

EVALUATING THE SEVERITY OF TRANSVERSE CRACKS IN BEAM-LIKE STRUCTURES BY USING AN LOSS ENERGY METHOD

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ABSTRACT

Over functioning time, structures can be affected by multiple types of damages caused by fatigue, improper production methods or due to exceeding loads. The current paper describes a method for evaluating the severity of transverse cracks that are present in beam-like structures based on changes in the natural frequencies. Because the presence of a damage has a negative impact on the energy that a beam can store in the affected section, it is possible to find the influence of the crack on any other position along the beam, considering the stored normalized energy in that location. The technique is based on a mathematical relationship that provides the exact solution to the frequency changes of the bending vibration modes, taking into account two terms. The first term is related to the tensile energy stored in the beam, and the second term considers the increase of flexibility due to cracks, for this reason, damage assessment is performed in two stages; first, the location of the crack is found and then an assessment of its severity is performed. In this study, the aim is to test the developed method for estimating the severity of transverse cracks for different sections and lengths of beams.

Keywords: damage detection, transverse crack, deflection, structural health monitoring, stiffness reduction

LABORATORY FACILITY FOR RESEARCH OF FORCED CONVECTION OF IOBIOFLUIDS

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ABSTRACT

The subject of the research was laboratory facility for research of forced convection of iobiofluids (ionic biofluids). Iobiofluids are a new class of dispersions obtained by suspending particles produced from agricultural biomass in ionic liquids as base fluids. Iobiofluids could be in the future sustainable alternative to ionanofluids (ionic nanofluids). With their enhanced thermal properties iobiofluids could be used as new heat transfer fluid in heat exchangers. In the frame of the research was done setting up and testing of developed and constructed laboratory facility for research of forced convection of iobiofluids. The aim of the research was confirmation of laboratory facility parameters. Within the research was conducted the first phase of the facility parameters confirmation by using distilled water. The results were measured after stabilization of parameters at laboratory facility. The laboratory facility parameters were successfully confirmed for laminar flow regime. The experimental results were verified by comparison with results calculated from the well known Darcy-Weisbach and Shah's equations. In the second phase confirmation of the laboratory facility parameters will be done by using certain iobiofluids.

Keywords: iobiofluids, ionanofluid, agricultural biomass, forced convection

This paper is the result of research within the project "Research and development of ionic bio fluids – RIDIBF" which is implemented within the Program for excellent projects of young researchers – PROMIS funded by the Science Fund of the Republic of Serbia.

SESSION 3: FOOD TECHNOLOGY

USE OF WHEY PROTEINS IN FOOD PACKAGING

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ABSTRACT

Packaging in food technology is commonly used materials to protect the foods against environmental conditions such as growing of microorganisms, water vapor and oxygen barrier. In general, packaging materials in food industry are plastic-based, complex, difficult to degrade in the nature and multi-layered types that can cause environmental pollution. Recently, to overcome these increasing environmental pollution problems, various attempts have been applied. Nowadays, one of these attempts is the using of edible films and coatings as food packaging material. The commonly used materials are vegetable and animal-based proteins, starch, cellulose derivatives, chitosan/chitin as edible films and coatings. On the other hand, proteins offer a wider spectrum than those polysaccharides and lipids. Among various proteins, whey proteins are the most attractive substances due to their film-forming abilities and mechanical properties such as transparency, odorless, tasteless and good gas barrier. Moreover, films and coatings obtained from whey proteins improve the functional properties of foods. They reduce the occurence of some reactions such as lipid oxidation. However, the important disadvantage is related with their poor moisture barrier properties. In order to improve these poor properties of whey proteins various modifications to the film properties can be made by physical, chemical or biochemical processes by means of casting and/or curing process. In this article, the formulation of edible films and coatings obtained from whey proteins, their properties in previous studies were discussed. It was also given an overview of current developments in the use of whey proteins as food packaging materials.

Keywords: whey proteins, food packaging, edible films, coatings

GENETICALLY MODIFIED FOODS IN BALKAN COUNTRIES- WHO ACCEPTS THEM?

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ABSTRACT

The introduction of new technologies and innovations in the food industries has transformed the efficiency of food products systems. One of the most evident innovation examples of food technology is Genetically Modified Food (GMF). Several studies have evaluated positive effects related to GMF applications, mainly linked to economic effects, environmental impact from the changes in the use of insecticides and herbicides and their contribution to the greenhouse reduction emissions. Both consumers and farmers receive benefits are reported. However, despite the promising scientific consensus about the no inherent risk for human health and the environment of GM technology, a widespread feeling of dislike concerning GMF persist. The disapproval is more evident to developed countries than to developing ones. In this framework, the presents research aims to analyse consumers' attitudes in Albania and Kosovo toward GMF. To capture the most influential factors in the attitudes of Balkan consumers concerning the GMF SPART (Subjective norms, perceived benefits, Attitudes, Risk and Trust) model is applied. The results show that respondents can be classified into three main groups regarding their attitudes and intentions towards GMF. The first group does not have a defined opinion (40%) to GMF, the second reveals a clear opposition to GMF (32%), and finally, the third group is considered GMF supporters (28%). Youngers consumers and big households show positive attitudes toward GMF. Consumers that reveal low trust in institutions show a negative attitude toward GMF in both countries.

Keywords: Genetically Modified Food , consumer acceptance, Balkan Countries, food product development, SPART model

ENZYMATIC ENGINEERING OF MICROBIAL LIPASES AND PHOSPHOLIPASES AND THEIR USE BIOCATALYSTS FOR FOOD APPLICATIONS

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ABSTRACT

Background and aim: Currently, chemicals from different industries pose serious problems for human health and the environment. Biotechnology has enabled these sectors to develop new or better products and be more environmentally friendly. Microorganisms, play a fundamental role in the functioning of natural ecosystems through to a considerable number of active molecules. Among these, lipolytic enzymes, biocatalysts of a protein nature having catalytic properties. They constitute a biological alternative to chemical agents traditionally used in industries, oil mills and vegetable oil refineries.

Methods: During this work we were interested in the production, purification and biochemical characterization of a lipase and phospholipase of bacterial origin as well as the evaluation of their potential in some biotechnological applications.

Results: A thermostable phosphatidylcholine-specific phospholipase C encoding gene from *Bacillus thuringiensis* strain IL14 (PC-PLC$_{Bt}$) and *Serratia* sp. strain W3 lipase (rSmL) were expressed in *E. coli* and purified to homogeneity. The biochemical and interfacial kinetic for the native and recombinant enzymes was studied. Interestingly, both PC-PLC$_{Bt}$ forms were found to be able to hydrolyze negatively charged phosphatidylglycerol film with a more pronounced rate of hydrolysis for the native form. The ability of both PC-PLC$_{Bt}$ forms to hydrolyze the PG remains exclusive compared to all known *Bacillus* PLCs. Using olive oil emulsion as substrate, the specific activity of the rSmL was 3530 U/mg, twelve times higher than that of native SmL. The results proved that SmL exhibited a high penetration power and was found to be able to hydrolyze the ester bond at *sn*-1 and *sn*-3 positions with a clear regio-preference toward the *sn*-3.

Conclusion: The construction of overproducing strains of lipase and phospholipase enzymatic activities, as well as the optimization of the conditions of production, stabilization and formulation of these enzymatic preparations and making available to vegetable oil refineries an enzymatic cocktail (of phospholipases and lipases) fairly stable under unconventional conditions of temperature, pH, or in the presence of organic solvents and detergents, which can be partially or completely substituted for conventional methods of degumming and the modification of lipids.

Keywords: PLC, lipase, thermostability, substrate specificity, refined vegetable oils, oil degumming

THE NUTRITIVE COMPOSITION OF SUGAR BEET LEAF

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ABSTRACT

Sugar beet is mainly used for the production of white sugar. Despite the fact that its leaves are left on fields or could be used as animal feed, people look at them as agricultural waste, ignoring its possibility in industrial production. Compared to this, in opposition to other vegetable leaves, because of the great amount, it could be used for some industrial purposes. The sugar beet leaf has a high protein content that could have a great use in food industry as protein and essential amino acid source. Because of this, the sugar beet leaf composition determination was the main aim of this research.

During the extraction of organic matters, we primarily focused on the nutritious composition of the sugar beet leaves (sugars, cellulose, proteins, fats and oils), and their quantity was also determined. The process of the isolation was preformed according to the methods of the Association of Analytical Chemists under laboratory conditions. In our experiment, we wanted to determine the yield of the substances we extracted, because this information decides which materials could be profitably utilized in different industries. In our experiment, we found that sugar beet has a high fibre (31.58%), sugar (28.89%) and protein (31.33%) content, so these materials could be used the most efficiently for industrial production.

Keywords: *sugar beet leaf, composition determination, industrial use*

MONITORING FRUIT OPTICAL PARAMETERS USING LASER LIGHT BACKSCATTERING IMAGING TECHNIQUE DURING DRYING

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ABSTRACT

The moisture content of fruits is one of the most important quality parameters that requires monitoring during the drying process, because it directly affects the storability and market potential. Thus, the main objective of the presented work was to evaluate the laser light backscattering imaging (LLBI) technique for monitoring the moisture content of banana fruit during drying. In a nondestructive manner, laser diodes with wavelengths of 532 nm, 635 nm, 780 nm, 808 nm, 850 nm, and 1064 nm were used to investigate the optical properties of the banana. Scattering images have been taken before and after the samples were exposed to hot air drying of 60 °C. Experiment was repeated 4 times. The grey level intensity and the size of the backscattering area were extracted from the images. The scattering profiles were characterized by the Gaussian- Lorentzian cross product (GL) distribution function with five parameters and absorption, reduced scattering, and effective attenuation coefficient from Farrell's diffusion theory models. Both models are based on radial intensity profiles. The wavelengths of 780, 808, and 850 nm achieved good fit with $R2 > 0.993$ for Gaussian-Lorentzian cross product (GL) model and $R2 > 0.951$ for Farrell's diffusion model. The maximum value of scattering and the minimum value of absorption and effective attenuation coefficients have been observed at 532 nm, with $R2 > 0.997$ for both models. In contrast, higher absorption and effective attenuation and lower scattering coefficient values were obtained at wavelengths of 635 nm and 1065 nm with $R2 < 0.98$ for both models. Significant change was observed for all optical properties of the tissue in response to drying ($p < 0.05$). This is the result of the degradation of pigments, cellular structures, and moisture content. The moisture content of bananas was successfully monitored in a non-destructive way using LLBI technique during the drying process.

Keywords: Laser backscattering Imaging, Drying, Optical properties

DNA BARCODING ANALYSIS OF MICROBIAL COMMUNITY in Olive Orchards : *Olea europaea* L. Bacterial and fungal diversity in Tunisia

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ABSTRACT

Olive production is the main agricultural activity in Tunisia. In this study, we investigated the microbial diversity isolated from soil and one of the major olive tree pests, namely the Olive psyllid, Euphyllura olivina Costa (Homoptera: Psyllidae). We aimed to explore the scarcely known microbiota in Tunisian olive orchards is the first step for elucidating the microbial interactions that meddle the biological control. A total of 215 bacterial and fungal strains were randomly isolated from eight different biotopes situated in Sfax (Tunisia) with different management practices. 16S rRNA and ITS gene sequencing were used to identify the microbial community increasing the board view. The different olive cultivars depicted distinct communities and exhibited dissimilar amounts of bacteria and fungi with distinct ecological functions that coud be considered promising resources in biological control.

Keywords: Biological control, Microbial diversity, Bacteria, Fungi, Olea europaea

OPTIMIZATION OF TIME-TEMPERATURE COMBINATION DURING DRYING TO RETAIN THE PUNGENCY CHARACTERISTICS OF Zingiber officinale Roscoe (VARIETY: SIDDHA) CULTIVATED IN SRI LANKA

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ABSTRACT

Ginger (*Zingiber officinalis Roscoe*) is a perennial plant whose underground rhizomes are used widely as a spice and flavoring agent. The maturity, temperature and time used for drying and the storage conditions of the rhizomes can affect their functional properties, especially the pungency. Freshly harvested ginger rhizomes (local variety Siddha) obtained from a commercial cultivation in Sri Lanka were subjected to hot air drying and selected physicochemical properties of the dried rhizomes were evaluated in this study. Response surface methodology (RSM) was applied to determine the optimal conditions for dehydration.The independent variables were time (7 hours-23 hours) and temperature (40^0C-60^0C) and nine treatments were assigned based on central composite design (CCD), containing one center point and four axial points. The quality of dried ginger was evaluated by determining the moisture content (AOAC, 1999), L*, a*,b* color values (Konica Minolta CR- 400 colorimeter), and total phenolic content (Folin–Ciocalteu assay) of each dried sample. A ranking test was conducted initially with 15 panelists for identifying the most suitable maturity level of the rhizomes based on perceived pungency of ginger samples. Ginger rhizomes harvested at a maturity stage of 12 months from sprouting was identified to have more pungent taste and aroma by the panelists and this sample was selected for further exprements.

The initial average moisture content of the ginger rhizomes was ~84% [wet basis (WB)]. The final average moisture content (MC) showed significant differences ($p<0.05$) between ginger rhizomes dried at different time-temperatures combinations. The highest moisture content was observed at 3.6 hr,50^0C drying conditions (MC:63.04%WB), and the lowest moisture content was observed at 23 hr, 60^0C drying conditions (MC:3.63%WB). Therefore, the desired final MC (10% WB) for long term storage can be obtained under 50^0C/18hr drying conditions. According to the colour analysis of the dried rhozomes, highest yellowness value and lowest redness values were observed at 7hr, 40^0C. The optimization results indicated that the best responses within the range studied were reached when the drying time was 23.34 hr, and the drying temperature was 54.43^0C, based on the observed maximum total phenolic content (4.76 mg GAE/ml). The results of this study will help to idenitfy the most suitable time-temperature combination for drying siddha ginger for commercial applications in the food and beverage industry.

Keywords: ginger, hot air drying, moisture content, optimization, response surface methodology

DETERMINATION OF GLUTEN IN THREE MAIN METHODS IN DIFFERENT WHEAT CULTIVARS

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ABSTRACT

Wheat flour is an important material for the production of various types of bakery products such as bread, pasta, cookies, etc. Compared to other cereals, wheat flour has some rheological properties due to gluten, a network formed when wheat flour and water are mixed that other cereals are lack.

The main proteins responsible for the gluten network are found in wheat and are part of the group of prolamin and glutenin. Depending on the quality of the gluten, the rheological properties of the dough are determined. A large quantity and quality of gluten mean that the dough is very easy to process from a technological point of view, it has viscosity and elasticity properties and the ability to bind gas and water. They are a very important factor in each stage of the production flow chart of bakery products.

There are different methods for determining gluten and this study aims to determine the amount of gluten in some of them.

We considered about 100 wheat samples varieties and performed the determination of gluten with the traditional washing method referring to the AACC 38.10.1, the glutomatic method approved by the AACC, method 38.12.01 and with near-infrared using a NIR system 5000 with monochromatic scanning.

The data obtained in the determination of gluten by the different methods showed that the gluten content was between 20 and 39%, which is a very satisfactory value for the quality of wheat. In a few samples, the gluten content was more than 40%.

Comparing the values of the three methods, the glutomatic method gave values almost identical to the near-infrared method with r=0.05%. If we refer to the time of the method takes to be realized, the washing method takes too much time in compare with the other methods which is not very suitable in the food technology.

According to this study we think that the glutomatic method and the NIR method should be used in industry in order to determine the quantity of the wet gluten.

Keywords: wheat flour, gluten, wet method, Glutomatic, NIR.

DIFFERENCES IN *IN VITRO* ANTIBACTERIAL ACTIVITY OF *Dracocephalum moldavica* L. ESSENTIAL OIL AND HYDROLATE

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ABSTRACT

Large-scale steam distillation under industrial conditions has been applied for extraction of essential oil from Moldavian Dragonhead (*Dracocephalum moldavica* L.) plants, while hydrolate was obtained as a by-product. Therefore, samples were tested in view of antimicrobial activity against pathogenic bacteria (*Escherichia coli*, *Pseudomonas aeruginosa*, *Salmonella* Typhimurium, *Bacillus cereus*, *Staphylococcus aureus*, and *Listeria monocytogenes*). *In vitro* evaluation of antimicrobial activity was done by the disk diffusion method as well as the method for determination of minimal inhibitory concentration (MIC). According to the obtained results, tested samples have an antimicrobial effect against almost all tested bacteria, but on different levels. A significant antimicrobial effect of *D. moldavica* essential oil against all other mentioned bacteria was demonstrated, while the same effect for hydrolate was on a lower level. Briefly, tested oil was inhibitory against *E. coli*, *S. aureus*, *L, monocytogenes*, and *S*. Typhimurium, but did not show antimicrobial effect against *B. cereus* and *P. aeruginosa*. The antimicrobial effect of hydrolate was absent against *B. cereus*, *P. aeruginosa*, and *S*. Typhimurium. It could be noted that essential oil showed good antibacterial activity, with low MIC values (≤3.125 μg/mL). In the contrast, a higher MICs (3.125-12.5 μg/mL) of hydrolate were noted. Antibacterial performance of *D. moldavica* essential oil and hydrolate may contribute to their use in reducing foodborne pathogens and extending the shelf life of food products or as a potential natural and green replacement of synthetic antibiotics and preservatives in food and cosmetics industries.

Keywords: Moldavian dragonhead; antimicrobial testing; steam distillation;

ANTIMICROBIAL ACTIVITY OF *Pimpinella anisum* L. ESSENTIAL OILS FROM DIFFERENT GEOGRAPHICAL ORIGIN

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ABSTRACT

Pimpinella anisum L., commonly known as anise, is one of the oldest species from the *Apiaceae* family used by people, being firstly cultivated in Egypt and then in Greece, Rome and the Middle East. Even today, *Pimpinella anisum* fruits, seeds and essential oils are globally used in the food and beverage industry. Also, it is well-known that besides other characteristics, geographical origin of essential oils may have important influence on their biological activity.

Considering the above, the objective of this work was to evaluate the antimicrobial potential of anise essential oils originating from Serbia and Russia over nine referent cultures of microorganisms. The preliminary screening of antimicrobial activity was performed by disk diffusion method. According to the obtained preliminary results, it can be concluded that the both tested oils showed high antimicrobial activity against *B. cereus* ATCC 11778, *S. aureus* ATCC 25923, *E. coli* ATCC 25922, *A. brasiliensis* ATCC 16404 and also against *C. albicans* ATCC 10231 in the case of Serbian essential oil. Moderate activity of the essential oils were confirmed against *S.* Typhimurium ATCC 13311, while no activity was observed against *L. monocytogenes* ATCC 35152, *P. aeruginosa* ATCC 27853 and *S. cerevisiae* ATCC 9763. In almost all cases of positive antimicrobial activity against the selected microorganisms, the essential oil from Serbia expressed from slightly to considerable better results than the Russian essential oil. Furthermore, the minimal inhibitory concentration of the both essential oils was determined for all selected microorganisms. Based on the obtained results, the lowest minimal inhibitory concentration of 0.78 % was noticed for Serbian essential oil in the case of two gram-positive bacteria *B. cereus* and *S. aureus*. On the other hand, the highest minimal inhibitory concentration of above 100% was determined for microorganisms that were resistant to these oils according to the disk-diffusion method. In accordance with the gained results, it can be clearly pointed out that the tested oils, especially essential oil from Serbia, could be possibly used as a promising antimicrobial agent for protection against different microbial strains or as preservative in many products.

Keywords: essential oils, antimicrobial activity, Pimpinella anisum

DEVELOPMENT OF HIGH-FIBER, READY-TO-BAKE FLOUR MIXTURES

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ABSTRACT

Nowadays, consumers are paying more and more attention to healthy eating, and unfortunately, insulin resistance and type 2 diabetes are affecting many people. They are paying more attention to the consumption of fiber-rich foods. In my thesis, we developed high-fiber ready-to-bake flour mixture blends using purple wheat flour (white and wholemeal). For fiber fortification, inulin, chia seed flour and psyllium husk flour were used. After determining the main nutritional parameters of the raw materials, 4 series of experiments were carried out to prepare bread rolls and to test the finished products. The correct mixing ratio of the enriching agents were tested, and the final flour mixtures were tested. At the end of our research, three blends (white purple wheat flour + 4% inulin + 2% psyllium husk flour; wholemeal purple wheat flour + white purple wheat flour + 4% inulin + 4% chia seed flour; wholemeal purple wheat flour + 4% inulin + 4% chia seed flour) were developed and their nutritional data, their material norm and a SWOT analysis were performed.

Keywords: purple wheat, flour mixtures, bread roll, inulin, chia seed flour

CHARACTERISTICS AND PROPERTIES OF PECTIN FIBER FROM BUTTERNUT SQUASH (*CUCURBITA MOSCHATA*) OBTAINED BY GREEN PROTOCOL

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ABSTRACT

Conventionally, pectin is isolated from plant material by means of acidic extraction. The ever-growing demand for 'green' products and technologies has pushed researchers to explore alternative methods of extraction. Different enzymes could be used as environmental-friendly agents for selective hydrolysis of other cell wall polysaccharides in order to release pectin. Not only that enzymatic extraction can influence pectin yield, but it can also deliver pectic fibers with different characteristics and properties than their acid extracted counterparts. As the market demand for pectic substances continually expands, new pectin sources need to be recognized and better utilized. Therefore, butternut squash (*Cucurbita moschata*) pulp could be used as an unconventional source of pectin rich fiber.

The aim of this study was to investigate the effect of enzymatic extraction procedure on yield and characteristics of pectin fiber from butternut squash pulp and compare it with the one extracted by acid. Commercial cellulase and xylanase were the cell wall degrading enzymes applied. The yields of enzymatic and acidic extraction were both approximately 60 mg/g_{DW}, while the content of galacturonic acid was 2.5-fold higher in enzymatically extracted pectin fiber. HPSEC profiles of extracted fibers were different, with enzymatically obtained pectin fiber exhibiting greater fraction with higher molecular weights than the acid extracted one. Viscosity of solution of pectin fiber extracted with the aid of enzymes was considerably lower than that of acid extracted fiber while its water solubility was significantly improved. Results of this study revealed significant influence of enzymes involvement in extraction procedure on characteristics and properties of pectin molecule from butternut squash. Furthermore, the green protocol produced pectin fiber with some of the more favorable characteristics for their advanced application in food matrices.

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FUNCTIONAL AND BIOLOGICAL PROPERTIES OF ISOLATED CHICKPEA (CICER ARIETINUM L.) SEED PROTEIN

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ABSTRACT

Proteins are essential functional components of various food products and thus determine sensory, textural and nutritive properties of food. Usage of proteins in food industry greatly depends of its functional properties such as solubility, water and oil retention capacity, gelation, emulsifying and foaming properties. Studying the functionality of food proteins is crucial with the purpose that they may be completely understood and used effectively in food products. Chickpea (*Cicer arietinum* L.) is one of the most consumed legumes around the world and an excellent source of protein. Chickpea proteins have received huge attention during recent years owing to their high biological and nutritive values and better functional properties than oilseed proteins. Furthermore, various bioactive properties of chickpea proteins have been reported, primarily antioxidant activity because these proteins possess capacity to scavenge free radicals by different mechanisms. The aim of this work was to isolate albumin, globulin and glutelin protein fractions from chickpea seeds by sequential extractions. Additionally, some functional characteristics and biological properties of isolated fractions were determined as factors which have important role in behave of this protein in food systems.

Sequential extraction of protein fractions with different solvents - water, NaCl and NaOH solutions was conducted and albumin, globulin and glutelin fractions, respectively, were obtained. In evaluation of functional properties, emulsifying and foaming, water and oil holding capacities of isolated fractions were analyzed. Obtained results showed that highest emulsifying and foaming properties were determined for glutelin fraction. This fraction exhibited 20% higher emulsifying activity compared to albumin and 70% higher than globulin. Moreover, water and oil holding capacities were significantly different among fractions, while glutelin fraction showed the highest results (2.74 g/g and 5.29 g/g, respectively). In addition, protein fractions showed variations in antioxidant activities, with albumin fraction showing superior ABTS radical scavenging activity compared to other two fractions. Results revealed that all assayed functional and biological properties of chickpea protein fractions were suitable for their application in food industry.

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EFFECT OF PROTEASE TREATMENT ON ANTIOXIDANT ACTIVITY OF CHICKPEA GLOBULIN AND ITS POTENTIAL USAGE IN PROTEIN NANOPARTICLES PREPARATION

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ABSTRACT

Proteins are large, complex molecules that play many crucial roles in the food industry. In recent time huge attention is given to plant proteins due to their ability to potentially complement or replace proteins from animal origin in various food applications. Chickpea presents important source of consumable proteins with fascinating functional and nutritive properties. Furthermore, chickpea proteins have potential to scavenge free radicals and endow beneficial effect on human health. Enzymatic protein hydrolysis represents a cleavage of molecules into lower molecular weight peptides and probably some free amino acids. The degree of hydrolysis (DH) has considerable effects on the size and the amino acid composition of peptides. Thus biological activity of peptides formed during this process could be improved due to exposure of antioxidant amino acids that are usually buried within protein core. Beside enhancement of protein biological properties, enzymatic hydrolysis can be efficient tool for the fabrication of advanced protein nanoparticles for the application in many food systems.

Focus of this work was on the isolation of chickpea globulin and on the application of enzymatic hydrolysis to produce modified protein with different degrees of hydrolysis. Additionally, antioxidant activity of prepared hydrolysates was determined and compared to native unmodified protein. Possibility of forming nanoparticles from native and enzymatically hydrolyzed protein was assayed as well.

Enzymatic hydrolysis of isolated chickpea globulin was carried out using protease Neutrase (Novozymes) with varying time of hydrolysis (15, 30, 60 min) and concentration of enzyme. Degree of hydrolysis in prepared hydrolysates varied from 16 to 55%. Depending on DH, differences in antioxidant activity were determined. Results showed that prepared hydrolysates had significant enhancement of ABTS radical scavenging from 2 and 3 fold compared to native globulin without enzymatic treatment. It was shown that degree of hydrolysis affected process of preparation and characteristics of protein nanoparticles.

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RuBisCO FROM SPINACH: THE INFLUENCE OF ISOLATION PROTOCOL ON PROTEIN RECOVERY, PURITY AND FUNCTIONAL PROPERTIES

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ABSTRACT

In the era of fast growing world population one of the global chalenges is to provide enough food. Also, the need for novel food types for special categories of consumers is in raise. These are the reasons for a constant search for protein sources that would provide lower-cost and healthier alternatives than those derived from traditional ones (wheat, soya, meat), without compromising product quality and safety. One of the possible sources of protein for sustainable food and feed production could be green leaves. Proteins in them comprise two fractions - the white and the green, with the former one containing mainly ribulose-1,5-bisfosfat-caroboxylase/oxygenase (RuBisCO) known as the most abundant protein in the world.

The aim of this study was to establish a protocol for efficient and low-cost isolation of RuBisCO that would yield protein with valuable functional properties. Spinach used as raw material was pressed to prepare green juice. Contaminat proteins from green fraction were removed by thermal denaturation, after what two protocols for concentration and partial purification were conducted. One included salting out and dialysis, and the other isolectric precipitation. Collected protein samples were freeze dried and analyzed for purity by SDS-PAGE and by reducing sugars assay. Results showed that applied protocol affected both protein recovery and purity. Some functional properties of protein samples relevant for their food application such as solubility, water and oil holding capacity were determined. It was revealed that protein samples exhibited favourable functional properties that would enable their advantageous incorporation into food matrix.

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INFLUENCE OF SUNFLOWER SEED CHARACTERISTICS ON PRESSING PARAMETERS USING A GLOBAL SENSITIVITY ANALYSIS

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ABSTRACT

Mechanical extraction is one of the oldest oil extraction methods. The advantages of mechanical extraction of oil in relation to chemical are better oil quality and greater possibility of using pressing cake compared to meal containing traces of solvent. Critical parameters in the cold pressed oil production are the raw (pressing) material characteristics (type, hull content, oil and moisture content), feeding the press with pressing material, temperature, expeller screws speed rotation, nozzles diameter, pre-treatment of pressing material. Since sunflower oil belongs to the group of the most represented edible vegetable oils in the world, as in Serbia, this paper aims to investigate the newest sunflower hybrids. The aim of this study was to examine the influence of sunflower seed characteristics on pressing capacity, oil yield and pressing parameters using global sensitivity analysis. The mentioned analysis was preceded by the application of artificial neural networks, which was used to predict the capacity, oil yield and pressing parameters based on the obtained characteristics of the seed. It was determined that the oil and seed yield had the greatest positive impact on the seeds oil content (24.43 and 26.85%, respectively), as well as the mass of pressing materials (10.04 and 11.64%). The biggest negative impact on these two output parameters had the cake oil content (-16.65 and -14.31%). The obtained result indicates that the seeds mass has a decisive influence on the seeds flow through the press, and confectionary sunflower hybrids with a significantly higher 1000 seeds mass, compared to oily hybrids, had a significantly lower seed flow. Also, the global sensitivity analysis confirmed that sunflower seeds with higher dimensions and seeds mass reached higher oil temperature during pressing.

Keywords: sunflower, seeds characteristics, pressing parameters, oil

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DIFFERENCES DETERMINATION BETWEEN SEED CHARACTERISTICS OF NEW SUNFLOWER HYBRID USING HIERARCHICAL CLUSTER ANALYSIS

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ABSTRACT

Sunflower breeders aims to create highly productive hybrids with increased protein content for human and poultry consumption, to create highly productive hybrids with high oil content, hybrids tolerant to dominant diseases and pests, highly productive hybrids with altered oil quality, highly productive hybrids resistant to certain herbicide groups, etc. In this paper, the characterization of the latest sunflower oily hybrids grown on the territory of Serbia and Argentina and the latest confectionery sunflower hybrids grown in Serbia are performed. Seed characterization included examination of seed moisture and oil content, seed dimensions (length, width, thickness), geometric characteristics (equivalent diameter, surface area, seed volume, sphericity), gravimetric characteristics (true density, bulk density, porosity), general characteristics (hull content, thousand seeds mass), firmness and color characteristics. Hierarchical cluster analysis (HCA) was applied to the obtained results in order to determine the differences between the samples. Obtained dendrogram shows two clusters a and b, clear grouping of samples into confectionary and oily hybrids. Within cluster b, two subclusters are observed. Subcluster I includes oil hybrids grown in Argentina while subcluster II includes oil hybrids grown in Serbia. Observing the groups obtained by HCA it was noticed that the greatest similarity was found among oil hybrids grown in Serbia, while the greatest difference was found among confectionery hybrids. Diversity among oily hybrids grown in Serbia obtained by HCA, expressed as the Manhattan distance value, ranged from 3.2 to 9.6. Confectionery hybrids mutually differed significantly, Manhattan distance values ranged from 6.2 to 22.6.

Keywords: sunflower, oily hybrids, confectionery hybrids, hierarchical cluster analysis

Acknowledgement: This research is financed by Ministry of Education, Science and Technology Development of the Republic of Serbia, Project Number 451-03-9/2021-14/200134.

MICROSTRUCTURAL, BARRIER AND ANTIMICROBIAL PROPERTIES OF CITRUS PECTIN-BASED EDIBLE FILMS

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ABSTRACT

The main role of food packaging is to protect food products from outside influences (chemical, physical and biological) and preserve their nutritional properties. Petroleum-based polymers and plastics that are most commonly used for this purpose due to their toxicity and their non-biodegradability need to be replaced. Over the last decade, biopolymer-based packaging originating from naturally renewable resources, such as polysaccharides, proteins and lipids has become the focus of food preservation technology. Pectin is an easily accessible polysaccharide that is non-toxic, biodegradable and edible. Due to its gelation capacity it is considered as good matrix for edible film production with application in food packaging. The incorporation of different additives (plasticizers, emulsifiers or cross-linking agents) and active compounds in pectin films could give them good barrier, antimicrobial, nutritional and antioxidant properties.

The present study aims to develop pectin edible films based on citrus peel pectin and oregano essential oil. The oregano essential oil was added to two final concentrations (0.05 and 0.1%). Polyethylene glycol 400 was used as a plasticizer and Tween® 80 was added as a surfactant. Analyses were focused on characterization of emulsions from which films were casted and physical properties including thickness, water vapor permeability and microstructure of dried films. The antimicrobial properties against different Gram-positive and Gram-negative bacteria were also studied. Results showed that prepared emulsions exhibited good stability, while films had excellent barrier properties accompanied with antimicrobial activity.

MASS TRANSFER RATE AND OSMOTIC TREATMENT EFFICIENCY OF PEACHES

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ABSTRACT

The highest quality peaches *[Prunus persica* (L.) Batsch] are cultivated in areas with sunny summers, therefore the territory of the Autonomous Province of Vojvodina is a favorable region for their production. Peaches are usually consumed fresh, canned, or dried and represent a great source of important nutrients, including fiber, vitamins, and antioxidants. Osmotic dehydration is a well-known preservation method that relies on mild temperatures and low energy requirements. The Faculty of Technology Novi Sad research has introduced sugar beet molasses as an efficient osmotic solution for drying various food samples of animal and plant origin. In this experiment, peach samples were osmotically treated in sugar beet molasses solutions (60, 70 and 80% w/w), under atmospheric pressure, at different temperature regimes (20, 35 and 50°C) for 1, 3 and 5h. The goal was to investigate the impact of different osmotic solution concentrations, temperatures, and immersion time on the mass transfer rate and the efficiency of osmotic treatment. To follow the mass transfer change throughout the treatment, loss-RWL, rate of solid gain - RSG, weight reduction WR, rate of weight reduction - RWR, and dehydration efficiency index - DEI, were calculated based on previously determined the most significant process variables (moisture content, change in weight, and change in dry matter). To describe the structure of the research data that would offer a better perception of connections among diverse peach samples, PCA Principal Component Analysis (PCA) was applied. The results have shown that the mass transfer rate during osmotic treatment of peach samples in sugar beet molasses was the most intensive at the beginning of the process, at the highest solution concertation and the highest temperature. In accordance with the results, diffusion occurred most rapidly during the first 3 hours of the process; therefore, processing time can be reduced.

Keywords: osmotic dehydration, mass transfer rate, sugar beet molasses, peaches

COMPARATIVE ANALYSIS OF COLOUR AND SENSORY PARAMETERS OF KONZUM BISCUITS MADE FROM HIGH FIBER FLOUR USING SWEETENER

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ABSTRACT

We investigated that how change the surface color and sensory parameters of „konzum" biscuits if they were made using high fiber flour and sweetener. „Konzum" biscuits were baked using various high-fiber flours and sweeteners. The 5 different types of flour (BL 55, whole wheat flour, graham flour, spelt flour and reduced carbohydrate flour) and 3 different sweeteners (xylitol, erythrite and mixture of cyklamate and saccharin) were used. The CIELab colour characteristics of biscuits surface were measured using Hunter Miniscan colorimeter. The sensory classification was based on texture, taste and smell. In the evaluation, we compared the sensory score and surface color of the biscuits made according to the factory recipe and the biscuits made with different flour and sweeteners. The sensory score of the control biscuit baked according to the factory recipe was the highest, the total score of the biscuits baked with different flours and sweeteners was 2-4 units lower. The best sensory ratings were achieved by biscuits baked with a mixture of cyclamate and saccharin, including those made from graham flour or whole wheat flour. Biscuits baked with xylitol received the worst sensory rating. The color difference value calculated between the color characteristics of the control biscuits and the biscuits made using different flours and sweeteners was the smallest in the case of biscuits baked with a mixture of cyclamate and saccharin. The color difference was 3,32 in the case of graham flour and was less than 3 units perceptible to the eye for other flours.

Keywords: biscuit, sweetener, colour, sensory parameters

COMPARATIVE ANALYSIS OF BEEF, BUFFALO AND BISON MEAT

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ABSTRACT

Nowadays, the consumption of bison meat is becoming more widespread worldwide. For the industry, this could lead to the emergence of a new market sector in the future. It is important to examine the extent to which the quality of its meat differs from that of the usual cattle or buffalo returning to the public consciousness.

Our measurements were performed on the loin of bison, buffalo, and cattle, including Angus cattle. Using the following test methods, we concluded the following conclusions:

• When comparing consumer prices per 100 grams of meats, it can be observed that the most expensive was bison meat and the cheapest was buffalo meat. The price difference was almost double. Although in our case the bison meat was further expensive, it was only available in portions and vacuum-packed.

• During instrumental color measurement: there was a large color stimulus difference between beef–buffalo meat and beef–bison meat. There was also a well noticeable difference between buffalo and bison meat.

• In instrumental hardness measurement: bison meat proved to be the hardest, approximately quintuply harder than beef, which proved to be the softest, and twice as hard as buffalo meat.

• During the cooking probe: the loss of buffalo meat proved to be the largest, followed by bison meat and beef meat, although the difference was negligible in the latter two, only 0.27%.

• In the roasting probe, the biggest loss was in roasting bison meat, followed by beef and buffalo meat.

• During the pressing probe, the highest loss was observed for beef meat (it was also significant for bison and buffalo meat).

• During the instrumental analytical analysis, we observed that the highest energy and fat content became the beef meat, in addition, the protein content was the most favorable. Bison meat had the lowest values.

• During the sensory evaluation, the most outstanding results were obtained from the bison meat, which received the most favorable evaluation in all respects, so based on the overall impression. The buffalo meat received good reviews in color and aroma, but it was too hard, and the taste was less than that of beef meat.

During our research, we concluded that bison meat may become a very popular product in Hungary in the future. There is a clear place for the consumption of both buffalo meat and bison meat in a health-conscious diet based on the measured results.

Keywords: beef meat, buffalo meat, bison meat, comparative analysis

OSMOTIC DEHYDRATION OF WILD GARLIC IN SUCROSE-SALT SOLUTION

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ABSTRACT

Due to its nutritional and nutraceutical qualities, wild garlic (*Allium ursinum* L.) has graet potential for use in the food and pharmaceutical industries. The limitation is availability of this plant only during the early spring season and tendency to perishable immediately after harvest. Some method of drying or pretreatment is necessary to improve sustainability of wild garlic for further use in aforementioned industries. Osmotic dehydration (OD) is verified as an effective pretreatment to reduce the water content in raw material with minimal negative effect on nutritive and sensorial quality of the obtained osmodehydrated product.

In this study, osmotic dehydration of wild garlic leaves in aqueous solution of sucrose and salt, at three temperatures (20, 35 and 50 °C) and diverse immersion times (1, 2.5 and 4h) was analyzed. The effect of temperature and immersion time on the dry matter conent, water loss and solid gain was evaluated using response surface methodology (RSM) and analysis of variance (ANOVA). Also, fundamental chemical composition was determined by *SRPS ISO* methods, and mineral content was determined using AAS method, in samples before and after OD. The results show that during the process of OD dry matter content of wild garlic increases from 7.91±1,08% to 51.51±1,34%. Maximum achieved values for water loss (0.6189±0.0146 g/g i.s.) and solid gain (0.2417±0.0146 g/g i.s.) indicate a good dehydration level. The amount of analyzed chemical and mineral components in osmodehydrated samples, except Na, was slightly reduced compare to the fresh wild garlic leaves.

Keywords: osmotic dehydration, wild garlic, osmotic solution, water loss, chemical composition

CHEESE RIPENING PROCESS MONITORED BY DIELECTRIC PARAMETERS

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ABSTRACT

Efficiency and economy of cheese manufacturing is determined by cheese ripening. Therefore, monitoring of cheese ripening and estimation of the end point of the process has high relevance and contributes to achieve high quality product. There are known several methods to characterize the physicochemical changes during ripening, such as texture profile analysis (TPA), colour measurements, soluble protein determination and sensory analysis. Dielectric measurements as fast and non-destructive method can be applied for monitoring of enzymatic processes, chemical reactions and textural modification of food, but, there are very few experiences related to application in dairy technology. Therefore, the aim of our research was to investigate the applicability of dielectric measurements for monitoring cheese ripening process. For the experiments Trappist cheese and Bácskai kneaded cheese samples were used. During the ripening period CIE LAB colour coordinates (measured by Minolta CR300), hardness and the adhesive force (TPA parameters by Brookfield CT3 analyser), and soluble nitrogen fraction were determined. Dielectric constant (□') was measured by Speag DAK 3.5 probe connected to vector network analyser (Rohde&Schwarz ZVL-3) in the frequency range of 200-2400 MHz. Our results show, that the dielectric constant has a good linear correlation with TPA parameters and colour coordinates (□' show decreasing tendency for Trappist cheese, and increasing tendency for Bácskai cheese versus time) in the first 14 days of the ripening period.

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Keywords: cheese ripening, dielectric parameters, texture profile analysis, colour measurement

DEVELOPMENT OF METHOD FOR MEASURING OF PARTICLE SIZE BY CHOCOLATES AND COMPOUND COATINGS

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ABSTRACT

Objective measurement of quality features is the one of the most important task in all industrial segments, including the food industry. The first step is always the development of methods that will serve as a basis for further improvements. Both, for chocolate and compount coating, particle size is crucial, this research has been focused on this area.

The laser diffraction is one of the possible way, which the authors have chosen. A Malvern Mastersizer 2000 instrument was used for the experiments.

The aim was to develop an efficient and relatively cheap method to determine the size of cocoa particles.

The liquid was a special mixture of edible oil and petroleum ether (Benzinum medicinale, Ph. Hg. VIII.). A ratio of 3:1 was found to be optimal.

The test results showed that the clear solution and the samples were well separable. The method proved to be well reproducible within the set parameters.

MICROBIOLOGY OF WATER KEFIR BASED ON LEMON AND PEPPERMINT: POTENTIAL PROBIOTIC PROPERTIES

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ABSTRACT

Water or sugary kefir is an alternative non-dairy kefir beverage fermented by a symbiotic culture of bacteria, primarily lactic acid bacteria and yeast, which are designated as primary microbial members of so-called water kefir grains. Unlike conventional milk-based kefir products, the starting medium for obtaining water kefir is mainly an aqueous sugar solution. Its nutritional and sensory properties could be significantly improved by the addition of different fresh or dried fruits. In addition, aromatic and health-promoting plants or their extracts combined with diverse varieties of dried fruits could represent an excellent combination, since the nutritional quality and sensory acceptability of kefir beverages by consumers has been remaining a principal challenge. Further, due to its specific composition of the present aforementioned microbial species, water kefir could have a positive effect on achieving the general well-being of the human body. Since literature data often characterize water kefir as a product with functional probiotic benefits, many authors have extensively studied the potential ability to change the gut microbiota composition and activity. Namely, according to the recommendation of the World Health Organization (WHO) and the Food and Agriculture Organization (FAO), kefir should contain a minimum of 10^7 CFU/ml microorganisms, and the final product should contain at least 10^4 CFU/ml of yeast. As part of this research, water kefir samples based on sugar water solution with the addition of dried lemon slices and fresh peppermint leaves or its evaporated alcoholic extracts were examined after 72 h of spontaneous fermentation to determine the total number of lactic acid bacteria and yeast (CFU/ml). A sample based on aqueous sugar solution without the addition of any other ingredients was designated as a control sample and the total number of lactic acid bacteria and yeast in this kind of ready-to-drink water kefir was approximately 10^6 and 10^4 CFU/ml, respectively. In the case of the other two samples with the addition of lemon and peppermint, an increase in the number of microorganisms was observed, so the measured number of lactic acid bacteria was around 10^7, while the counted value of yeast was approximately 10^6 CFU/ml. By previously mentioned recommendations of WHO and FAO in terms of accomplishing the potential probiotic properties, it could be concluded that all tested samples of water kefir achieved the minimum required number of living microorganisms at the end of the fermentation process.

Keywords: water kefir, fermentation, microorganisms, probiotic properties

THE STABILIZATION OF WINE TO TARTARS

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ABSTRACT

The stabilization of tartar is one of the most important technological processes of good quality wine production and can have an impact on everyday wine consumption. The laboratory research that forms the backbone of the dissertation examines the stabilizing effect of various additives on tartar. The research was done in the laboratory of the Faculty of Technology for wine testing. The survey was performed on a sample of white wine and by measuring the electrical conductivity of seven additives (Senso Ü, Claristar, CMC, MetaGum, TannivnMulti, Zenith, StabivinSP). The method of its research is based on measuring the difference in electrical conductivity that can be measured between the given materials, in the case of different quantities under the same conditions, during the examination of the same wine. By knowing the differences, we can draw conclusions about the stability of the wine to tartar, the quality of the given added substances and the amount needed to obtain the desired test results, which is standard practice for assessing the quality of wine as food- The aim of the research is therefore to find out the conductivity properties of these additives in order to determine which are the most suitable for achieving the stability of wine and the various substances that are not only stabilizing factors for tartars, but, in some cases, clarifiers. Based on this research, it can be concluded that in this case, a mannoprotein-based stabilizer extracted from the yeast *Saccharomyces cerevisiae* called Claristar showed the most desirable results.

Keywords: wine, tertar, tartar stabilization, wine clarifiers

POSSIBILITIES OF USING NATURAL DYES IN THE PRODUCTION OF BREADED PRODUCTS

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ABSTRACT

Recent trends have led to an increase in interest in modern food in recent years. Although in Hungary it is rare to find various colored breadcrumbs, it is even more widespread abroad. We made a trial production with various natural dyes extracted from vegetables, where we tried to achieve the usual golden brown color in the case of crumbs. We measured color coordinates and performed consumer sensory evaluation. Based on our results, it can be said that bread crumbs made with saffron and paprika are very popular among consumers. Although saffron is very expensive, it is also an extremely good colorant in small quantities. Furthermore, when added to paprika, it has a less intense flavor and is available as a sought-after color accepted by consumers. Based on our results, the use of plant extracts also holds many possibilities. Consumers are open to innovation and would be willing to try a breaded product of a special color that has not yet been produced on the market.

APPLICATION OF PULSED ELECTRIC FIELD AS A PRETREATMENT FOR THE MICROWAVE-ASSISTED EXTRACTION OF TURMERIC (*Curcuma longa*) BIOACTIVE COMPONENTS

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ABSTRACT

Introduction: *Turmeric (Curcuma longa*) is a perennial herb, known to be one of the oldest spices that have been used in Western and Southern parts of India for thousands of years. In addition to extensive use as a flavoring agent, turmeric also has a major part in traditional medicine (Verma et al., 2018). This prominent place in traditional medicine is deserved due to its large number of pharmacological activities. Modern medicine states that turmeric possesses anti-inflammatory, antidiabetic, antioxidative, antibacterial, hepatoprotective, neuroprotective, cardioprotective, and anticancer activities (Krup et al., 2013; Labban L., 2014). Considering the vast pharmacological properties of turmeric rhizome, enhancing the current methods of extraction is of high importance. For obtaining turmeric extracts, microwave-assisted extraction (MAE) was applied. In order to improve the efficiency of extraction and quality of obtained extracts, pulsed electric field (PEF) pretreatment of the turmeric material was conducted. Obtained extracts were investigated in terms of total phenols and antioxidant activity.

Materials and methods: PEF was applied with field strength 2 kV/cm (PEF 1) and 4 kV/cm (PEF 2), while specific energy input was 14 kJ/kg. After the pretreatment, MAE was applied using 50 and 70% ethanol/water mixture as a solvent and irradiation power 400 and 800 W. Additionally, MAE extraction of the non-pretreated control sample was conducted to determine the efficiency of the applied pretreatments. In the obtained extracts, the content of total phenols was determined, as well as the antioxidant activity using DPPH and ABTS assays.

Results: The content of total phenols was in the range from 250.05 to 448.86 mg GAE/g DE. It was determined that PEF significantly improved the phenolic content compared to the control sample. Moreover, the highest activity was recorded when the PEF 1 pretreatment was applied, at the MAE conditions of 400 W and 70% EtOH. The extract obtained under the same MAE conditions also exhibited the highest antioxidant activity according to the DPPH test (IC_{50} value 0.0055 mg/mL). However, the ABTS test showed that the control sample had the highest antioxidant activity (0.00268 mg/mL). Also, both PEF pretreatments enhanced the extraction yield.

Conclusion: The application of PEF improved the extraction efficiency and content of antioxidant components in the extracts of turmeric rhizome. PEF 1 pretreatment proved to be the more efficient pretreatment for improving the quality of turmeric extracts.

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Keywords: Curcuma longa; antioxidant; extraction; microwave; pulsed electric field

DETERMINATION OF CAFFEINE AND PHOSPHORIC ACID IN SOFT AND ENERGY DRINKS IN KOSOVO MARKET

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ABSTRACT

Soft and energy drinks are subject of addition of different preservatives responsible for the taste and appearance. Caffeine and phosphoric acid are the two most used additives for the production of soft and energy drinks. In the present study, the presence of caffeine was detected by ultraviolet spectrophotometer while phosphoric acid was determined by potentiometric titration method. For this purpose 41 samples of non-alcoholic beverages were analysed which includes soft and energy drinks. About 32 samples were in accordance with the EFSA recommendation for caffeine criteria in soft and energy drinks. Meanwhile, nine samples which were energy drinks contained higher caffeine levels than 150 mg/L and where not declared as "high in caffeine". On the other hand, 36 from 41 samples were within the regulated criteria for phosphoric acid which is 700 mg/L. Soft and drinks are part of the daily diets of different type of people especially children. Therefore, the monitoring of the concentrations of these additives is important to compare with the current standard regulations.

Keywords: soft drinks, energy drinks, caffeine, phosphoric acid, additives.

EDUCATION IN THE TIME OF THE PANDEMIC, THE ROLE OF THE USE OF TECHNOLOGY IN TEACHING

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ABSTRACT

Pre-university and university in Albania has gone through many challenges during the pandemic time of covid-19. We live in a time when education is undergoing many fast changes, in which technology is playing the key role in where sources have founded a wide field of action to go in.

Teaching underwent changes in both structure and content, leaving marks at us, especially at students, teachers and all the actors that have been part of this process. Teaching shifted by the auditor conditions in the premises of the house in which this thing give the teachers the pleasure to work with professionalism and desire.

Based on our theme the importance of the role of technology and creative didactic work of the teachers in educational institutions.

Methodological aspects of this work: Monitoring and research. The descriptive analysis is both even quantitative even qualitative. It is quantitativ because our search is extended in 20 pre university schools in Tirana using surveys and questionnaires. Those databases ore based on the on this formulary with graphics and tables on %. We arerelyon the literature of the Ministry of Education and Sports in the curriculum and on the education strategy used by universities and pre universities.

All the results are product of all collected data from students and the teachers.Meanwhile students are 1900/1035 which where involved in search ,1035 were girls and 200 teachers. Resualts are showing that 80 #of teachers showed that this situation found the unprepared and put them in front of a big challenge. 5% of the are well known with TIK on teaching .30% of the them own the technology in teaching GOOD ,30 % of them are good enough and 25 % are not enough .

Programs that the students are following mostly even for lessons even for chatting or playing are good in technology where GOOGLE takes 60 % GOOD , 30% GOOD ENOUGH and 10% ENOUGH .

In conclusion of all this we are seeing that teachers' qualifications should be the focus of attention of both the educational authorities and the university auditors in teaching . To achieve an integrated and good system of skills knowledgewe needed to see the challenges and the war between the digital age and free market economy and obviously the realization of digital competence for both teachers and students in this case.

Keywords: technology, technical and strategy, knowledge, teaching, education process, teaching game etc.

ISOLATION OF YEASTS AND ACETIC ACID BACTERIA FROM KOMBUCHA BEVERAGE DURING FERMENTATION

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ABSTRACT

Kombucha is a beverage which has been traditionally obtained from a fermentation of sweetened black and green tea leaves, which results in a product with a slightly acid, sweet flavor and high sensory acceptance. The beverage posses antimicrobial, antioxidant, antidiabetic and anticancer benefits. The fermentation of tea is the product of a symbiosis of acetic acid bacteria and yeasts installed in a cellulose film as well as in beverage. Community of microorganisms varies in great stance based on the geographical origin and also over time between batch fermentations of the same producer. The variability in the kombucha microbial community demonstrates how complex is the process of this fermented beverage. So, it is important to establish standard process conditions and a stable set of microorganisms throughout fermentations which will result in beverage stable characteristics and facilitate the process transition to the industrial level.

Considering the above, the objective of this work was to isolate different strains of yeasts and acetic acid bacteria during kombucha fermentation. The process lasted eight days, when the beverage achieved optimal consuming acidity, about 3,5g/L. On the start of fermentation, on the third, fifth and eighth day, samples were taken to determine total count of yeasts and acetic acid bacteria. Based on macromorphological and microscopic characteristics of colonies on appropriate nutrient media, from each examined day of fermentation, potentially different colonies were selected. It has been observed that there were six potentially different strains of yeast and three strains of acetic acid bacteria. In order to notice further differences between acetic acid bacteria, tests of cellulose formation and acetic acid degradation were performed, which showed that at least two of the three strains are different. As for yeasts, sporulation test, urea hydrolysis, temperature effect on growth and glucose fermentation were done. Results showed that at least four different yeast strains were present in fermentation broth. The next step in the research is the identification of isolated species and identify the best mixture of microorganisms result in kombucha beverage showing stable characteristics.

Keywords: kombucha, yeasts, acetic acid bacteria

RHEOLOGICAL PROPERTIES OF WHITE CHOCOLATE WITH RESISTANT STARCH

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ABSTRACT

White chocolate is confectionery product produced of sugar, cocoa butter, milk solids, lecithin and vanillin where the particles of sugar and milk solids are covered by fatty phase, mainly consisted of cocoa butter. White chocolate must include whole milk powder and cocoa butter in its composition, and, unlike dark and milk chocolate, it does not contain dark cocoa solids. Therefore, white chocolate lacks of valuable components such as polyphenols, minerals, and dietary fiber. Thus, the functionality of white chocolate is very low compared to dark and milk chocolate.

Dietary fibers certainly represent some of the possible functional components and among them resistant starch as a special type of dietary fiber with functional proper-ties. In the present study, 5%, 10%, and 15% of white chocolate was substituted with resistant starch in order to improve the nutritional value of enriched white chocolate. Rheological measurements were performed first since they predict interactions of components within the system and behavior during chocolate processing. Resistant starch addition increased water and dietary fiber content and also reduced volume mean diameter of white chocolate samples that further influenced their rheological properties. The addition of resistant starch caused the reduction of white chocolate fat phase consisted of cocoa butter and milk fat and thus increased Casson viscosity of white chocolate mass in accordance with the added amount. Also, the addition of all amounts of resistant starch to white chocolate increased the values of Casson yield stress that relates to energy required to initiate chocolate flow. However, RS did not impair the color and sensory characteristics of enriched white chocolates.

Keywords: white chocolate, resistant starch, dietary fiber, viscosity, yield stress

Keywords: mass, chocolate, particle size, particle size distribution, Malver Mastersizer, quality, food technology

COMPARISON OF LARGE AND SMALL-SCALE SEMI-HARD CHEESES

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ABSTRACT

Industrial cheese making technology led to a significant increase in productivity and production. Furthermore, it has also helped the standardization cheeses, considering the composition, food safety status etc., but large-scale cheeses differ in some respects from small-scale cheeses. We investigate the composition, colour and texture of small-scale semi-hard, fatty Trappista cheese during six weeks ripening and we compared to industrial cheese with the same maturation time (6 weeks at 15°C). FoodScan Lab 2 (Foss) for composition, Minolta CR-300 for colour measuring and Brookfield CT3 instruments for texture properties were used and we performed sensory evaluations too. Considering the composition, there were two notable differences as lower relative fat content required in the "fatty" category (44.1 g/100g vs minimum limit of 45g/100g) and slightly high NaCl content (2.29g/100g) of small-scale cheese. Required texture properties of it was reached after three weeks ripening including the formation of required holes are very important in case of round holes cheeses and based on the sensory properties, small-scale cheese was sufficiently ripe. It is also supported by the results of the colour and texture tests. The comparison of industrial and small-scale cheese has yielded partly unexpected results. The holes in industrial cheese were abnormal and did not meet the requirements unlike the perfect small-scale cheese. Abnormal holes may be caused by technical and not microbiological problems, but this properties is extremely important for customers, and because it may also indicate the growth of coliform bacteria. Significant differences were explored in Hardness (2052,1 mN vs 2955,9 mN), Chewiness (3,893 mJ vs 5,678 mJ) and Gumminess (1545 mN vs 2154,8 mN) between industrial and small-scale cheese probably caused higher total solids and lower fat content of small scale cheese. There was no difference in Brightness (L*) and large-scale cheese had significantly but slightly better colour, mainly yellow coordinate (b*, 24,26 vs 24,10) probably due to the use of colorant. Expert judges preferred small-scale cheese (18,7 points vs 17,1 points from max 20) due to the better texture, smell and taste. This investigation points excellent cheeses could be made both in small and large scale but industrial manufacturers with modern technology also need to pay more attention to the perfect structure of semi-hard cheeses.

SESSION 4: FOOD SCIENCE

MECHANICAL IMPEDANCE OF FOOD MATERIALS

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ABSTRACT

The mechanical properties of food materials are very important quality characteristics for the whole food chain from the harvesting and postharvest treatment to processing or consumption. Among other measurement methods, the dynamic methods (acoustic response, impact and/or wave-propagation measurements) offer advantageous possibilities due to their speed and non-destructive nature. However, the applicability and the information provided by these methods are limited. Complex description of all components of a mechanical system (mass, stiffness, damping) can be given by the mechanical impedance approach: Z = F/v, where 'F' is the force, applied to the system and 'v' is the velocity of the measurement probe. These properties have spectral behavior. Similarly to the analysis of an electronic circuit or a continuous control system, the behavior can be described by differential equations and the solution is given by the transfer-function, applying Fourier-transformation. This way, applying sine-wave forces or displacements on the system, it can be investigated in frequency-domain (instead of time-domain).

To test the approach experimentally, model-materials (gelatin half-spheres of increasing hardness due to increasing concentration) were used. In our experiments a shaker (K2004E01 Smartshaker, The Modal Shop, USA) was used to generate the sinusoidal excitation of the sample and a PCB Piezotronics 288D01 Impedance-Head measured the input and output signal of the mechanical system. A RULA RL-C21 instrument was applied to control the shaker and for conditioning and processing of the sensor signals. The frequency-dependent signals of the impedance head are the a(f) acceleration and F(f) force parameters. Due to the sine-wave excitation, derived parameters, as the v(f) velocity and x(f) displacement can be simply calculated from the measured acceleration signal. In order to get almost directly the mechanical impedance spectra, linearly increasing acceleration was generated by the controlling instrument in the desired frequency range, resulting in constant velocity. This way, the F(f) spectra have the same shape, as the desired Z(f) impedance spectra, but M(f) = 1/ Z(f) mobility and the FRF(f) = x(f)/F(f) frequency-response function can be determined as well for comparison with literature data.

For the model-materials, the theoretical impedance-functions were fitted to the measured spectra in Excel by Solver. The fitted parameters were compared to the characteristics, determined by traditional methods (SMS penetrometer). The good fitting results and the agreement between the parameters are convincing about the applicability of the approach. Further investigations were started about the methodological properties, the optimal setup and the applicability of the method on more complex samples (real foods).

EFFECT OF PAN FRYING CONDITIONS ON THE FORMATION OF 3-MCPD AND GLYCIDYL ESTERS IN DIFFERENT VEGETABLE OILS

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ABSTRACT

3-monochloropropane-1,2-diol esters (3-MCPD-E) and glycidyl esters (G-E) are undesirable heat-induced contaminants. Vegetable oils may contain these contaminants since they undergo a refining process that is performed at elevated temperatures. Vegetable oils are mainly used for frying purposes and the safety of the oils is a major concern for both consumers and the industry. The purpose of the current work, was to evaluate the effect of frying time (5, 10 and 15 minutes) and temperature (160°C, 180°C and 200°C) on 3-MCPD esters and glycidyl esters of vegetable oils during pan-frying. For this purpose three refined oils (sunflower, hazelnut, corn), olive oil and margarine were used for frying trials performed with potatoes. The frying oils were analyzed in terms of 3-MCPD and glycidyl ester contents, according to DGF C VI 18 (10). The method is based on alkaline transesterification and performed with gas chromatography-mass spectrometry instrument. Results have shown that, the 3-MCPD-E contents of sunflower, corn, hazelnut and margarine samples ranged in 0.18-0.20, 0.42-0.64, 0.18-0.20 and 1.50-1.79 mg/kg respectively. The G-E contents of the same oils varied in 0.10-0.12, 0.02-0.10, 0.08-0.14 and 0.56-0.73 mg/kg, in the same order. The margarine samples had higher content of 3-MCPD-E and G-E than other frying oils, whereas no contaminant formation was detected for virgin olive oil. All oils' glycidyl ester levels were within the limit of 1 mg/kg established by international regulations. Frying conditions did not have clear and certain formation pattern for 3-MCPD and glycidyl esters in different oils.

Keywords: 3-MCPD esters, glycidyl esters, pan frying, temperature, time

THE HEALTH EFFECTS OF ASTAXANTHIN AS A FOOD INGREDIENT

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ABSTRACT

Astaxanthin is detected in a variety of living organisms, most of which are found in the seas; in varying concentrations in single-celled microalgae, plankton, krill, salmon, trout and crustaceans, including crayfish and shrimp as sea food. It gives the latter their reddish color also found in some fungi. Astaxanthin has both lipophilic and hydrophilic properties. Its red color is due to the conjugated double bonds in the center of the compound. The conjugated double bond it possesses donates electrons and reacts with free radicals, turning them into more stable products. In this way, it acts as a powerful antioxidant by ending the free radical chain reaction. The antioxidant activity of astaxanthin was determined to be 10 times higher than zeaxanthin, lutein, cantaxanthin, β-carotene and 100 times higher than α-tocopherol; oxidant-scavenging effect is 800 times higher than coenzyme Q10 and 550 times than vitamin E. It inhibits lipid peroxidation. Its anti-inflammatory, antidiabetic, protection against cardiovascular diseases, anticancer, immune system regulatory effects are monitored in different experimental researches. The following results were obtained with some experimental studies using astaxanthin: In diabetic rats treated with astaxanthin, it was determined that astaxanthin reduced hyperglycemia and decreased lipid peroxidation caused by inflammatory proteins COX-2, iNOS, MCP-1, NF-β and ROS. Astaxanthin administration has been shown to protect the heart muscle in experimental cardiac ischemia-reperfusion injury. In the model of lung injury with cecal ligation and perforation, application of astaxanthin was found to alleviate oxidative/nitrative stress, reduce inflammation levels in lung tissues and pulmonary apoptosis. It was also determined that this treatment significantly reduced the mortality rate in mice. In an experimental myocardial infarction study in Sprague-Dawley rats, three different doses of astaxanthin administered in four days resulted in significant improvements. Astaxanthin has a positive chemotherapy effect in melanoma with lung metastases in vivo. It has been proven for the first time that an antioxidant in nanoparticle application improves lung metastatic melanoma. As a result, astaxanthin, which is a natural food product, is important as a component that can be used for treatment in pathological processes with its structural and functional properties and can show protective properties before various pathologies.

Keywords: Astaxanthin, anti-inflammatory, antioxidant, oxidative stress, sea food

THE HEALTH EFFECTS OF BETA GLUCANS AS FOOD INGREDIENTS

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ABSTRACT

Beta glucans are relatively affordable byproducts with proven health benefits. They are mainly isolated from the cell walls of yeast, fungi and cereals, and their content is highly dependent on environmental conditions. Among the cereals, the beta glucan content per 100 g dry weight of barley and oats was reported to be 20 and 8 g, respectively. The use of beta glucans is permitted as potent immunological modulators in many countries, including the United States, Canada, Finland, Sweden, China, Japan, and Korea. Beta glucans exert their effects as free radical scavengers and by supporting the antioxidant system. However, they are powerful immunostimulators with known positive effects on the immune system. The dose range of beta glucan has been specified as 40-3000 mg per day by the American Food and Drug Administration in the General Safe for Use category, and it has been accepted as 2-6 mg/kg of body weight. As a result of some clinical and experimental studies investigating the effects of beta glucan on health, the following results were obtained: The effects of beta glucans on abscess formation and mortality in experimental intra-abdominal sepsis were investigated and their protective effects were reported. In another study, it was determined that beta glucans significantly reduced the expression of pro-inflammatory cytokines and systemic inflammation in rats with septic peritonitis. There are experimental studies showing that beta glucans are effective in increasing resistance against bacterial and parasitic infections. In a clinical study on Corona virus, it was determined that purified beta glucans (lentinan) reduced the bacterial load in arterial blood and bronchoalveolar lavage, and alleviated inflammation by reducing the number of leukocytes in the lung. It was determined that the effects of renal ischemia and ulcerative colitis were significantly improved in rats given beta glucan. As a result, considering that beta glucans do not have a known negative effect as a food ingredient, it is recommended to be used for protective purposes.

Keywords: Anti-inflammatory, antioxidant, beta glucan, immunomodulation, oxidative stress

ANTIBACTERIAL EFFECT OF EDIBLE COATINGS WITH ESSENTIAL OIL

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ABSTRACT

Food preservation technologies are a continuously renewed area because of industrial and customer needs, social transformation and environmentally friendly processing and climate change. The shelf life of perishable food products must be extended with different technologies, for example using green methods like the edible coating (EC). EC is made from different biopolymers (chitosan, alginate, gelatin, agar), the effect can increase with using plant extracts. In this study, the effect of chitosan EC, chitosan EC+thyme essential oil (EO); effect of alginate EC, alginate EC+thyme EO was examined on fresh chicken breast having artificial contamination with E. coli; E. faecalis, that the EC can extend the shelf life. The organoleptic quality of baked treated chicken breast was established also. Based on the result both EC can decrease the cell number (with 1-3 log CFU/g) on treated chicken breast and this antimicrobial effect was enhanced with thyme essential oil (3.2 µl/ml concentration). There was significant differences ($p<0.05$) between the two edible coatings. Alginate had better preservation effect, than chitosan. However, the thyme EO could increase the antimicrobial activity of chitosan in higher values, than the effect of alginate EC. In this experiment, the E. faecalis was more sensitive to treatment than the E. coli. In conclusion, the edible coating can be used as an alternative preservation technique and these combined with essential oils can extend the shelf life of chicken breast fillet.

Keywords: chicken breast, edible coating, preservation, thyme essential oil

POLYPHENOLS EXTRA VIRGIN OLIVE OIL IMPROVES MINERAL PROFILE DISORDERS AND HEMATOLOGICAL PARAMETERS IN ACRYLAMIDE INTOXICATED RATS

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ABSTRACT

Our study investigated the protective efficacy of polyphenols extra virgin olive oil against acrylamide induced disorders in blood hematological parameters and mineral profiles in rats.
Animals were divided into four groups of six each: group 1, serving as controls, received distilled water; group 2 received acrylamide (40 mg/kg body weight) by gavage; group 3 received both acrylamide and polyphenols olive oil (1 ml) by gavage; group 4 received only polyphenols (1 ml) by gavage for 3 weeks.
Acrylamide treated group showed significant differences in several hematological parameters including red and white blood cells 'count, hemoglobin concentration, hematocrit value and platelets' counts. Moreover, there are changes in plasma levels of some trace elements such as iron, calcium, magnesium and Phosphorus.
Co-administration of polyphenols olive oil to treated rats restored changes in blood hematological and mineral profiles to near normal values due to their potent antioxidant power.

*Keywords: Acrylamide, rats, polyphenols olive oil, hematological and mineral profile*s.

FOOD SAFETY ISSUES REL ATED TO THE PRESENCE OF MICRO AND NANOPLASTICS IN FOOD

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ABSTRACT

The presence of micro and nanoplastics in the environment has been the subject of numerous scientific articles, focusing in particular on the impact on marine and terrestrial environment. Recently, this topic has started to be treated in terms of food safety and human health, leading to the development of branches of science such as nanotoxicology, which has approached in vitro and in vivo studies to elucidate the impact of such particles.

The aim of this study is to reveal the food safety issues that derived from the presence of microplastics and nanoplastics in both marine and terrestrial ecosystems, which, due to their size, have the ability to enter into the food chain. Therefore it is necessary to pay special attention, especially from the specialists in the field of food safety in order to limit as much as possible the presence of these particles along the food chain.

Key words: *microplastics, nanoplastics, food safety hazards, human health risks*

THE PROTECTIVE EFFECTS OF DIETARY POLYPHENOLS ON ALZHEIMER'S DISEASE

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ABSTRACT

Alzheimer's disease (AD) is a progressive irreversible neurodegenerative disease in the hippocampus and cortex regions of the brain and is the most common cause of dementia in the elderly population. Although it is known that there are 40 million cases worldwide today, it is thought that this number will exceed up to 100 million by 2050. The disease is characterized by symptoms of memory loss, difficulty in speaking, decision making, learning, problem solving, and impaired perception of time and orientation. In its pathogenesis, the accumulation of amyloid beta (Aβ) senile plaques in the extracellular synaptic spaces of the neurocortex, especially in the temporal and parietal lobes of the brain, the formation of intracellular hyperphosphorylated tau protein deposition and neurofibrillary tangles (NFY) are important and triggered neurodegeneration mainly affects cognitive behavior and memory.

The most accepted hypothesis in recent years and supported by various studies is the "amyloid hypothesis". It is accepted that this hypothesis is triggered by Aβ peptides resulting from cleavage of APP by β-secretase, and the toxicity of these peptides plays an important role in disease progression.

Phenolic compounds are organic compounds containing a benzene ring to which one or more hydroxyl groups are attached. It has been reported in the literature that polyphenols are highly effective on cognitive functions. Studies have shown that regular consumption of polyphenols reduces the risk of developing neurodegenerative diseases. Studies have reported that polyphenols inhibit Aβ production and accumulation processes by interacting with different forms of amyloid structure. Various studies have proven that numerous polyphenols such as epigallocatechin 3-gallate, punicalagin, curcumin, resveratrol, rutin, quercetin, caffeic acid, tannic acid, ferulic acid, rosmarinic acid, ellagic acid etc. prevented or decelerated AD progression with different mechanisms. In this study, polyphenols and their therapeutic properties against AD will be discussed extensively.

Keywords: Alzheimer's Disease, Amyloid Beta, Neurodegeneration, Polyphenols, Antioxidants

TOTAL DIETARY FIBER AND MINERAL CONTENT IN SOME SELECTED MUSHROOM VARIETIES GROWN IN SRI LANKA

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ABSTRACT

Mushrooms are edible fungi rich in nutrients and bioactive compounds. Although there is a large number of mushroom species grown around the world only a few species have been identified as potential sources of nutrients. Mushrooms species used in this study are commercially grown in Sri Lanka and not studied for their nutritional properties. Thus, this study investigated the total dietary fiber content, major elements (Ca, Mg, K), and trace elements (Fe, Zn, Cu, Mn, and Na) in four mushroom varieties; Button (Agaricus bisporus), Oyster (Pleurotus ostreatus), MK-white (Calocybe sp.), and Ganoderma (Ganoderma lucidum). Total Dietary Fiber and mineral content were determined by the dietary fiber kit (AOAC 985.29 (2009) and the Inductively coupled plasma/optical emission spectroscopy (ICP/OES) method, respectively. Results of this study showed that all four studied mushrooms species are a good source of micronutrients and Ganoderma lucidum showed a significantly higher micronutrient content compared to all other three species. The trace minerals Zn, Fe, Cu, Mn, and Na were in the range of 418.56-8853 mg/kg dry weight (dw), 31.34- 148.27 mg/kg dw, 131.67-647.14 mg/kg dw, 34.41-99.60 mg/kg dw, 91.02-576.61 mg/kg dw, respectively. The total dietary fiber content in the mushroom species was in the range of 32.59-75.33% w/w dry weight (dw), and the highest content was observed for Ganoderma Lucidum (75.33±0.83 %w/w, dw) and lowest for Agaricus Bisporus (32.59±0.02% w/w, dw). Major elements of Ca, Mg, and K were in the range of 6.138 -35.28 g/kg dw, 9.59 -11.34 g/kg dw, and 6.12 -25.11g/kg dw sequently. Findings show that mushrooms are rich not only in fiber but also in micronutrients and are a good source for non-communicable diseases and micronutrient deficiencies.

Keywords: Dietary Fiber, Mushroom, Mineral, Nutrient, Varieties

PHYSICOCHEMICAL ANALYSIS OF OVEN DRIED RAW TAMARIND (TAMARINDUS INDICA) POWDER TO PRODUCE VALUE-ADDED PRODUCTS

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ABSTRACT

Tamarind (Tamarindus indica L.) is a versatile fruit used for culinary and medicinal purposes. It is considered a seasonal underutilized species in Sri Lanka and its post-harvest losses are high. Drying is a suitable alternative method for the reduce its post-harvest losses and can be used to produce value-added products. The present study was aimed to investigate the effective drying temperature to produce raw tamarind powder by oven drying method. In here matured raw tamarind was subjected to four different drying temperatures as 50^0C, 60^0C, 70^0C, and 80^0C to produce tamarind powder and physicochemical properties; moisture content, pH, total soluble solid content, powder properties, rehydration properties, colour and particle size of these powder samples were evaluated. According to the results, the final moisture content was reduced from 9.11±0.30% (50^0C) to 6.42±0.42% (80^0C). With the increase of temperature (50^-80^0C), pH (2.25±0.02-2.43±0.02) was increased and the acidity (17.38±0.47-22.81±1.09%) and total soluble solid contents (38.23±0.47-43.27±0.05^{0}Brix) were decreased. Powder recovery (41.64±1.84-43.08±0.97%), bulk density (359.85±3.37-71.34±14.97kgm^{-3}), tapped density (403.49 ±4.19-733.24±16.06kgm^{-3}), true density (1313.17±10.04-1358.25±74.88kgm^{-3}) and rehydration properties; solubility (61.13±0.96-73.67±1.96%), flowability (medium to free-flowing), wettability (0.26±0.03-0.49±0.03sec.) and sinkability (0.7±0.06-10.21± 0.44sec.) were changed significantly ($p<0.05$) with the increase of temperature. Porosity (47.8±0.02-72.48±0.21%), hygroscopicity (22.78±0.44-25.86±0.31%) and degree of caking (89.98±0.04-97.41±0.91%) were high in low temperatures respectively. According to chroma values desirable characteristics were shown in sample dried at 70^0C (L*= 27.10±0.173; a* = 17.26±0.89; b*= 28.78±0.45). Particle size was not changed significantly with the drying temperature. X-ray diffractogram revealed the amorphous nature of the dried powder. Powder samples exhibit type IV adsorption isotherm which shows a swellable hydrophilic character. Considering all the evaluated physicochemical characteristics, 70^0C temperature is the most effective temperature to produce raw tamarind powder by oven drying method.

Keywords: Oven drying, Physiochemical properties, Raw powder, Tamarind; Tamarindus indica L., Temperature

RICE AND MILK MAINTAIN THE IONIC HOMEOSTASIS

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ABSTRACT

Background: Nearly ten thousand varieties of the twenty known rice varieties is known today, of which we produce several types of Oryza sativa var. japonica in Europe. In 2011, coloured red and blue varieties were breeding in Hungary and allowed in domestic cultivation, which is recommended for consumption in medical diets for many diseases. These breaded varieties are slightly rounded, higher oil containing and harder than Oryza sativa var. indica. The production and consumption of rice has been going on nearly 14 thousand years which, due to the beneficial content of rice, we eat as the first child's food, the daily food of millions and we consume against the elderly diseases. Aim: In terms of its content, rice is complete compared to other cereals with a wide variety of vitamins, all essential amino acids, and comparable to raw milk values for all types of essential lipids and minerals. Vitamins and elements of raw brown rice were compared to raw milk. Discussion: In rice dishes is unbinding the macro- and micro elements from fibers to retain or restore ionic homeostasis e.g. in chronic diseases such as cancer processes, cardiovascular, kidney, sensorineural and nervous system diseases. In addition, they ensure the beneficial effects of microbiota in the intestinal tract, normal blood sugar levels, the function of immune and nervous system. The purpose of breeding „Medical rice" is to restore the injured function of ion and energy balance of the body in serious diseases, preventing fatal outcomes, especially consumption of organic rice.

Keywords: Rice, Milk, ionic homeostasis, Medical rice

A REVIEW: NEURODEGENERATIVE DISEASES AND DIET

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ABSTRACT

Neurodegenerative disorders and dementia are on the rise, with an incidence of over 17 million people worldwide. Neurodegenerative diseases such as Alzheimer's disease (AD), Parkinson's disease (PD), Huntington's disease (HD) and amyotrophic lateral sclerosis (ALS) are major threats to human society as the aging population grows. All the neurodegenerative diseases are characterized by neuronal loss progressively in the brain, causing cognitive impairment and motoneuron disability. Even though multifactorial interactions are conspicuous, diet plays an important role in the pathogenesis and evolution of neurodegenerative diseases. Previous studies have proven that the Mediterranean diet (MeDi), supplementation of antioxidants and some vitamins bring various benefits on memory and cognition impairment. While nutritional support and calorie-controlled diets have a protective effect against cognitive decline, an increasing number of data demonstrate the utility of ketogenic diets in neurodegenerative diseases that is recognized as an effective treatment for pharmacoresistant epilepsy. The collected data shows that malnutrition and low body mass index (BMI) are associated with higher development of dementia and death. Malnutrition also activates gut-microbiota-brain axis dysfunction, which exacerbates the neurogenerative process. Insulin activity is a common factor contributing to brain health. In this review, the effect of diet on some selected neurodegenerative diseases will be discussed.

Keywords: Neurodegenerative Diseases, Mediterranean Diet, Ketogenic Diet, Nutrition, Antioxidants

QUALITY OF RUGOVA CHEESE PRODUCED IN TRADITIONAL AND INDUSTRIAL CONDITIONS

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ABSTRACT

Rugova cheese is an endogenous product in the Republic of Kosovo, which originates from the region of Peja, where it is traditionally produced from the unpasteurized milk of cows, sheep and goats. There are little scientific data on cheese's physicochemical and sensory characteristics produced under traditional and industrial conditions. In the experimental stage of this paper, the entire cheese production process was followed in traditional and industrially produced cheese. This research determined physicochemical characteristics such as dry matter, proteins, fats, titratable acidity, pH and sensory attributes such as colour, taste, aroma, consistency and appearance. These parameters were determined from traditional and industrial cheeses from the Rugova region with an altitude of about 997.14 meters. These cheeses were analyzed on the first day, the 30th day and the 60th day of storage. Significantly highest protein, fat and pH values of the cheeses were determined in traditional (6.12%) cheeses during 30 days of ripening. Also, the instrumental colour assessment showed the lowest L values significantly in traditional cheeses at all stages of ripening. There was a strong negative correlation between salt in dry matter and the pH of the cheese. In conclusion, traditional cheese has a higher nutritional value than industrial cheese but not enough standardized protocol for the ripening process that affects sensory attributes. This technical information is of great interest for this cheese's eventual unification and geographical protection.

Keywords: traditional cheese, standardization, instrumental colour, sensory attributes

RESPONSE OF TWO TOMATO CULTIVARS TO TRICHODERMA SPP. ASSESSED BY NON-DESTRUCTIVE MEASUREMENTS

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ABSTRACT

Biofertilizers have great potential to improve crop yields through environmentally save mechanisms. Fungi of the genus Trichoderma, as potential components of biofertilizers, have a positive effect on plant growth and inhibit the growth of pathogenic microorganisms through several antagonistic mechanisms. In this study, commercially available tomato genotypes (Narvik and Gruzanski zlatni) and strains of two Trichoderma species (T. afroharzianum SZMC 25231 and T. rodmanii SZMC 25217) were selected to examine the effects of Trichoderma spp. on morpho-physiological parameters of tomato plants grown under organic production system. The experiment was conducted in a randomized block design under greenhouse conditions. In total, 15 plants of two tomato cultivars per treatment were transplanted in soil: NC – control Narvik, GZC – control Gruzanski zlatni, NT1 – T. afroharzianum; NT2 – T. rodmanii; GZT1 – T. afroharzianum; GZT2 - T. rodmanii. The suspensions of Trichoderma isolates were applied in the root zone of tomato plants in the phase of four established leaves. Measurements of relative chlorophyll (Chl), flavonol (Flav) and anthocyanin (Ant) content were performed in vivo on fully developed leaves of the tomato plants using Dualex optical sensor (Force-A, Orsay, France). NBI (Nitrogen Balance Index) was calculated as Chl/Flav ratio. Plant height was measured as a plant growth parameter. Measurements were performed once per week during 35 days of plant growth (5 weeks) and conducted in 10 replications on 10 plants per treatment.

Compared to the control, significant increase of Chl and Flav content was observed on genotype GZ after treatment with both Trichoderma species in the 3rd and 4th week, which resulted in decreased value of the NBI. Also, for the same genotype, Trichoderma positively affected plant height. On the other hand, combination of Trichoderma and genotype Narvik hasn't showed stimulative effect on examined morpho-physiological parameters. These results indicated genotype-species dependence of tomato-Trichoderma interaction.

The obtained results indicate that non-destructive measurements with Dualex sensor could serve as starting point to better understand plant responses to Trichoderma presence.

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BASIL ESSENTIAL OIL (OCIMUM BASILICUM): IN VITRO ANTIFUNGAL PROPERTIES AND ANTIOXIDANT ACTIVITY

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ABSTRACT

The purpose of the present study was to evaluate the antioxidant and in vitro antifungal properties of commercial Basil (Ocimum basilicum) essential oil (BEO). The antioxidant activity of BEO was estimated by DPPH free radical scavenging ability. The antifungal activity of the EO was tested against three pathogenic Penicillium (P.) spp. strains (P. expansum, P. citrinum, P. crustosum) using the disc diffusion method (concentrations: 12.5 $\mu L.L^{-1}$, 25 $\mu L.L^{-1}$, 50 $\mu L.L^{-1}$, and 100 $\mu L.L^{-1}$). From the results it is clearly evident that Ocimum basilicum EO showed a strong antioxidant activity with the value of inhibition to be 86.20 ±0.15%. The highest concentrations (100 $\mu L.L^{-1}$) of BEO exhibited the strongest antifungal activity manifested by the highest diameters (5.33 ±0.58 mm, 4.33 ±0.58 mm, 3.33 ±0.58 mm) of inhibition zones against all three fungi strains (P. crustosum, P. citrinum and P. expansum; respectively). These findings show that the BEO represents a good source of biologically active substances that could have potential applications in the food and pharmaceutical industries.

Keywords: Ocimum basilicum, essential oil, disc diffusion method, Penicillium spp., DPPH assay

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ANTIBACTERIAL AND ANTIBIOFILM EFFECT OF WINTERGREEN AND IMMORTELLE ESSENTIAL OILS AGAINST STAPHYLOCOCCUS AUREUS

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ABSTRACT

Biofilms are highly-structured communities of cells that produce an extracellular matrix and adhere to abiotic or biological surfaces, therefore they can contaminate foods as well. Staphylococcus aureus is a common bacterium with biofilm-producing character. Foods that are not cooked after handling, such as sliced meats, puddings, pastries, and sandwiches, are especially risky if are contaminated with S. aureus [1]. The essential oils (EOs) and their components are becoming increasingly popular as anti-biofilm agents. Gaultheria procumbens L. (wintergreen) and Helichrysum italicum Roth. (immortelle) are aromatic medicinal plants. They are traditionally used as choleretic, diuretic and expectorant and in bacterial infections [2, 3]. These EOs have antibacterial effect, but their anti-biofilm activity has not been proved yet.

GC-MS analysis revealed that the main compound of wintergreen EO was methyl salicylate and the main component of immortelle EO is neryl acetate.

The MIC [Minimum Inhibitory Concentration] was determined with broth macrodilution test (wintergreen: 0.40 mg/mL; immortelle: 0.07 mg/mL) against S. aureus. The bacterial biofilm was created in 96-well microtiter plates. After incubation, the Tween80 solution of the EOs was added to the biofilm in MIC/2 concentration (wintergreen: 0.2 mg/mL, immortelle: 0.03 mg/mL). After a second incubation, the adherent cells were fixed with methanol and stained with 0.1% crystal violet, and dissolved in 33% acetic acid. The absorbance was measured at 595 nm with plate reader.

Our results showed that the wintergreen and immortelle oils have anti-biofilm activity against S. aureus, because the EOs reduced the biomass of the bacterial biofilm. It is important to highlight that the immortelle EO was more effective (inhibitory rate: 69.5%) than the wintergreen oil (inhibitory rate: 58.9%), compared to the control (untreated bacterial biofilm).

In this study, the anti-biofilm effect of wintergreen and immortelle were investigated against S. aureus. We conclude that the biofilm formation of S. aureus was more sensitive to immortelle EO. After toxicological experiment, the application of this oil against food-borne pathogens in food industry might be supposed.

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CYTOTOXIC ACTIVITY OF JUNIPERUS COMMUNIS ESSENTIAL OIL FROM DIFFERENT GEOGRAPHICAL ORIGIN

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ABSTRACT

Essential oils from a broad spectrum of plant species have been shown to have antimicrobial, antioxidant, cytotoxic and/or antitumoral activity. Juniperus communis has been extensively used in traditional medicine in Serbia.

Juniperus communis L. (common juniper) is wide-spreading conifer, with small purple-black berries, used particularly in flavours, perfumes and pharmaceutical compounds (for example, for their diuretic, hypoglycaemic, anti-inflammatory, antibacterial and antifungal properties) and in the aromatisation of alcoholic beverage like beer and gin. Extracts and essential oil (EO) are used in cosmetics and food industry, and it is recognized by the European Pharmacopoeia as pharmaceutical raw material.

Juniper berries contain between 0.2–3.42% of essential oil. It is composed largely of monoterpenes such as, α-pinene, β-pinene, myrcene, sabinene and limonene, sesquiterpenes, aldehydes, alcohols and other oxygenated compounds. The composition of common juniper EO has been widely investigated and has been shown to be affected by the age and geographical origin of the plant, as well as ripeness of the berries. Thus, this study is based on determining the chemical profile and antiproliferative activity of juniper essential oil from Serbia and the Russian Federation.

The antiproliferative activity of the juniper berry essential oil, originated from Serbia and Russian Federation, was evaluated in vitro against three different humans cancer cell lines: the human cervix adenocarcinoma HeLa cells, the human lung adenocarcinoma A549 cells, the human colon adenocarcinoma LS-174 cells and normal fibroblast MRC-5 cells. Evaluation of cytotoxicity revealed that both Serbian and Russian juniper oil possess a cytotoxic potential against HeLa cells line. The MTT assay determined that cytotoxicity against A549 and LS-174 cells were the same, low, for both EOs.

Therefore, juniper oil can be considered with a beneficial effect on survival, immune regulation, and quality of life.

APPLICATION OF HANDHELD NEAR INFRARED SPECTROMETER FOR THE CHARACTERIZATION AND VIABILITY PREDICTION OF COMMERCIAL PROBIOTIC SUPPLEMENT

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ABSTRACT

The growing evidences of health claims related to the consumption of probitics have lead to the rise of probiotic based products in the market. However, one of the major concerns in the development of such products is the sustainability of viable cells at time of consumption and their stability against conditioning factors. Recently, researchers have explored the potential of near infrared spectroscopy method (NIRS) as a rapid technique to ensure that consumers receive the adequate dose of probiotics at the time of consumption. The aim of our study was to evaluate the applicability of the handheld near infrared spectrometer combined with chemometrics to characterize and predict the viability of commercial probiotic suplement subjected to concentration and temperature conditioning factors. According to the product label recommendations, three different concentrations (2g/125 ml, 2.5 g/125ml and 3g/125ml) were considered . Water heated at 60°C or 90 °C was added to probiotic powder and the obtained samples were left to cool down until reaching room temperature. Control samples prepared at 25 °C were also measured. The samples were analysed using handheld spectrometer in transmittance mode and chemometrics based analysis was performed on the obtained spectra. Principal component analysis based linear discriminant analysis (PCA-LDA) classification models, according to temperature and concentration levels, showed high accuracies. Average recognition and prediction abilities of 90% and 74.39%, respectively were found for the classification of the different concentration levels. Meanwhile, according to temperature level both the recognition and prediction accuracies were 100%. Moreover, PLSR showed a high ability of accurately predicting the viable counts (log CFU/g) of probiotic samples. Our study showed that handheld near infrared spectrophotometer have proven to be an effective and rapid tool which when coupled with chemometrics is able to predict the viability of probiotics strains under different conditions. Overall, NIRS showed good potentials for the characterization of probiotic food supplements that could be explored for quality control purposes.

Keywords: probiotics; NIRS, chemometrics; PCA-LDA; PLSR; food supplements; heat treatment

EVALUATION OF THE EFFECTIVENESS OF A QUATERNARY AMMONIUM-BASED COATING IN PREVENTING SALMONELLA CROSS-CONTAMINATION

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ABSTRACT

Kitchens are environments with many bacteria, most harmless, but pathogens such as *Salmonella* spp. have also been found. These pathogens are worrying due to their accumulation in places such as refrigerators, dishwashers, cutting boards and countertops, and can be transmitted to foods, causing food poisoning. As a result, thousands of foodborne illness cases are reported every year. Thus, the objective of the present work was to determine the antimicrobial activity of a quaternary ammonium-based coating spray applied to different surfaces and, then, to evaluate its ability to prevent possible cross-contamination.

The antimicrobial activity of the coating against *Salmonella* isolates was evaluated on stainless steel, acrylic, marble and silicone surfaces, using the method recommended by ISO 22196:2011. Significant differences ($p<0.05$) were found between treated and untreated surfaces, demonstrating the effectiveness of the coating in inhibiting these pathogens. Next, it was evaluated the ability of the coating to prevent cross-contamination between a surface contaminated with a portion of food and a portion of uncontaminated food. In this case, when incorporated into a matrix and placed on a particular coated surface, the pathogen was not inhibited and contaminated the food, which was later placed in contact with the contaminated surface. Furthermore, this cross-contamination occurred irrespective of the contact time of the food (10 seconds or 2 hours) and the surface material tested. In conclusion, it was verified that although the tested coating showed good antimicrobial activity, it was not able to reduce the transfer of *Salmonella* from the surfaces to the food, since the food matrix protected the bacteria from its action. Further tests are required, such as evaluating the effectiveness of the coating against other pathogens and using other matrices with a more significant number of samples. It would also be interesting to test the coating in combination with other antimicrobial compounds to assess the possible increase in its effectiveness in preventing or reducing cross-contamination.

EVALUATION OF THE ANTIMICROBIAL ACTIVITY OF DIFFERENT NATURAL EXTRACTS USED TO MARINATE A MEAT MATRIX ARTIFICIALLY CONTAMINATED WITH FOODBORNE PATHOGENS

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ABSTRACT

The use of natural extracts to inhibit foodborne pathogens has been an increasingly explored and debated topic. In addition to their antimicrobial capabilities, they also provide health benefits and allow the reduction of artificial additives in the food industry. In this context, this work aimed to test the antimicrobial activity of three natural extracts against three food industry target pathogens, using each extract solution to marinate an artificially contaminated meat matrix.

In culture medium, Rosemary (64 mg/mL) and Shiitake (250 mg/mL) extracts showed high antimicrobial capacity against the tested pathogens, with respective reductions of 3.77±0.32 and 3.81±0.32 log cycles for *Escherichia coli*, 3.97±0.98 and 3.54±0.67 log cycles for *Listeria monocytogenes*, 3.64±0.32 and 3.57±0.17 log cycles for *Salmonella* spp., and 4.02±0.82 and 4.44±0.08 log cycles for *Campylobacter* spp. In addition, Oleuropein extract (250 mg/mL) inhibited all pathogens to values below the detection limit of the enumeration technique (<1.3 log CFU/mL). After marinating a meat matrix contaminated with each pathogen individually, it was possible to observe that only significant reductions of *Campylobacter* spp. occurred in the meat marinated with the Oleuropein ($p=0.071$) and Shiitake ($p=0.033$) solution.

Despite being promising, the studied extracts did not significantly reduce the tested pathogens since they were protected by the meat matrix. Future studies of the synergy between the studied extracts, as well as their incorporation into different food matrices, would be interesting and lead to new beneficial discoveries for the entire food industry.

ASSESSMENT OF THE SITUATION OF MANAGED POLLINATORS (APIS MELLIFERA SPP.), THREATS, DRIVERS OF CHANGE IN BALKAN COUNTRIES

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ABSTRACT

Pollination and pollinators have multiple economic, environmental and socio-cultural values recognized worldwide. Recently, bees have been affected by various pathogens and diseases, and the annual losses of the colonies have been considerable. Our aim in conducting this study is to determine the extent of bee losses and identify the main threatening factors for pollinators. The methodological approach is based on field observations and a structured online questionnaire targeting beekeepers. The questionnaire is structured in four sections: first, demographic characteristics are collected, the second section encompasses the condition of bee families, factors that have led to the loss of these managed pollinators are included in the third section and in the final are asked the possible solutions. The beekeepers who completed this questionnaire were with bee-stabilized parks, distributed in a wide geographical area that includes different districts of Albania, Kosovo, Macedonia and Greece. The results showed losses in 56.2% of the parks included in this study, losses which ranged from 10-60%. The analysis of the results categorized into three groups the main factors that may have caused these losses by negatively affecting productivity and bee health: The first group of threats include pathogens and predators, where *Varroa destructor* and *Nosema Ceranae* were a high threat in 50-60% of parks. The second group of threats includes environmental factors, where it is worth noting that climate change, beekeeping chemicals (antibiotics) and pesticides posed a high threat in 50-70% of parks. The third group of threats includes beekeeping practices where the import of foreign queens (breeds) in Albania, failure to perform all technical services on-time and failure to provide services at the appropriate level posed a high threat in 50% of parks. Additional studies are needed to understand the impact of each of the factors mentioned earlier on honey production and lost income generated in rural households.

Key words: pollinators, honey bees, losses, threatening factors

HYDRATION AND OIL BINDING PROPERTIES OF RAW AND GERMINATED ALFALFA SEEDS AND SPROUTS AS NOVEL GLUTEN-FREE INGREDIENTS

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ABSTRACT

Arising incidence of coeliac disease made both consumers' and food industry aware of the close link between diet and health far beyond the well-known role of food in satisfying hunger. The emerging requirements for healthy gluten-free foods providing necessary nutrients has steadily prompted the research and development towards exploration and introduction of novel gluten-free raw materials as an alternative to refined flours and starches. However, finding the right balance between nutritive value and technological functionality of such gluten-free raw materials creates many challenges nowadays especially in production of gluten-free bread that will match the properties of its wheat counterparts.

As one of the extensively cultivated forage legume alfalfa or lucerne (*Medicago sativa L.*), and its seeds possessing high nutritional value (rich in proteins, dietary fibres, essential polyunsaturated fatty acids, vitamins and associated total phenols) have immense potential as a gluten-free food resource. In application of novel gluten-free flours as baking ingredients, knowing the water absorption properties of flour represents one of the essential prerequisites for reaching the final product with desired overall quality. Additionally, differences in novel gluten-free flours effect on the final product quality can be predicted to some extent by assessing its hydration properties. In this regard, presented study aims to investigate and compare the hydration (water binding capacity, water holding capacity, and swelling) and oil binding properties of grounded raw alfalfa seeds, grounded germinated alfalfa seeds, and alfalfa sprouts powder.

The highest water holding capacity and swelling was recorded for alfalfa sprouts 6.48 g/g and 7.13 cm^3/g, respectively, whilst germinated alfalfa seeds had the highest water binding capacity (3.13 g/g). Oil binding capacity ranged from 0.90 to 1.41 g/g with the highest value reported for alfalfa sprouts followed by germinated and raw alfalfa seeds. The obtained results demonstrated that alfalfa sprouts, considering their hydration properties, can have a great impact on other gluten-free ingredients functionality, product yield and shelf stability, while in terms of oil binding can act as flavour retainer increasing the mouth feel of gluten-free bakery products. Additionally, germinated and raw alfalfa seeds also showed hydration and oil binding properties desirable for the gluten-free bread production. Further research should be conducted to establish the raw and germinated alfalfa seeds and sprouts influence on gluten-free bread technological, sensory and nutritional quality.

Keywords: Alfalfa; Germination; Hydration properties; Oil binding; Gluten-free

ANALYZING PERCEPTIONS ON QUALITY AND SAFETY OF FROZEN FOODS WITH BALKAN CONSUMERS: THE CASE OF ALBANIA AND KOSOVO

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ABSTRACT

Freezing technology is one of the most well-established long-term preservation techniques to produce high-quality, nutritious foods with prolonged shelf-life. Frozen food is a significant section of the global food market experiencing rapid growth that represents an alternative to small producers in developing countries to add value to their products in a competitive market. However, unfairly frozen foods are often considered less qualitative than fresh produce, although studies have shown that some frozen foods have higher nutritional values than fresh products. This study analyses two Balkan countries' consumer behaviour, perceptions, and attitudes towards frozen foods. Three hundred eighty questionnaires have been developed (182 from Kosovo and 198 from Albania). The results show that Kosovo consumers generally show a higher positive attitude toward frozen food than Albanian consumers. Albanian consumers prefer fresh food instead of frozen food due to food safety issues. The lack of trust in food safety institutions is expressed with concerns on the conditions of the frozen chain applied both on the imported or domestic frozen products.

Similarly, the findings show Albanian consumers will pay 40% more than the baseline price to get fresh products instead of frozen, while Kosovo consumers will pay 30%. Additional studies are needed to explore if the lack of trust in food safety institutions inhibits the successful development of frozen food in Albania and Kosovo. In both countries, the public policy should help the consumers have a deeper knowledge of the qualities of the frozen products and, on the other side, boost these activities to increase the farmers' incomes.

Key words: Frozen food, Quality, Safety, Consumer perception, Balkans

STUDYING THE PROPERTIES OF COFFEE DRINKS MADE FROM COFFEE FRACTIONS OF DIFFERENT PARTICLE SIZES

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ABSTRACT

Coffee is a widespread and popular drink, consumed in significant quantities around the world. The quality of coffee beverages is affected by a number of factors, including the temperature, pressure, flow time and particle size of the coffee grounds.

We have investigated the effects of coffee bean grind size on the physico-chemical and organoleptic properties of brews for two different types of coffee beans. Our research included, among others, the measurement of pH, colour intensity, caffeine content, dielectric properties and antioxidant activity.

The results showed the effects of the particle size on the different properties of the coffee drinks.

ROLE OF WATER IN CULTIVATION OF RICE AND WHEAT DETERMINES THE INGREDIENTS OF SEEDS

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ABSTRACT

Background: The production of rice started hundreds of centuries ago and nowadays we produce several types of cereals and rice, *Oryza sativa var japonica* in Europe. In Hungary, the rice grown from irrigation schemes established about 600 years ago and rice production restarted in high quality of ingredients from 2010. The internal values of seeds are dependent on the cultivation of ecological factor under dry or irrigated systems, of which water is a particularly important. Rice is grown under continuous irrigation with full water control in Europe. However, rice crop can suffer from drought or water shortage. The *Aim* is to investigate the reasons for this problem: (1) the farmers sow rice in excessive areas, when rice price is very high and profitable in the market. Thus, available irrigation water can' not be enough for rice crop, (2) low water accumulation in the dams or less water flowing in the rivers due to low rainfall. (3) Some diseases give damage to rice crop i.e. fungal, bacterial etc. The reasons for this infection are the heavy rainfall in May, July and autumn, excessive nitrogen application, also late planting, high seed density, and cold irrigation water. *Discussion:* Due to the high temperature difference between day and night in rice mature production area, the quick-soluble double-chain sugar in rice-scented rice is accumulated more, likely the elements, which are very beneficial to human health. All these factors together with water are important in cereals to the biochemical synthesis of the ingredients giving energy: carbohydrates, fat and amino acids.

Keywords: Rice, wheat, cultivation, water, ingredients

SESSION 5: AGRO-ECONOMY

TRANSITION TO CIRCULAR ECONOMY IN OIL-EXPORTING COUNTRIES: MAIN CHALLENGES AND THE WAYS TO RESPOND THEM

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ABSTRACT

Important points

- Countries are different. For some of them this transition is easier than for the others.
- Potential negative consequences of transition to circular economy paired with energy transition will affect not the OECs only.
- However, the overall trend towards the circular economy is clear.
- The shift to circular economy does not necessarily mean decreased revenues and lower living standards for oil-exporting countries.
- Proper adaptation strategies aimed at reducing potential negative consequences and the way forward are required for these countries.

Even though the importance of transition to circular economy cannot be overestimated, this topic has not been a focus of researchers studying oil-exporting countries (OECs). Transition to circular economy paired with energy transition have been and will be creating challenges for the OECs. The biggest challenge is certainly the expected decline of oil-export revenues caused by the decline of oil and gas consumption worldwide. The authors attempted to explore this topic and came to the conclusion that the shift to circular economy does not necessarily mean decreased revenues and lower living standards for these countries. They also attempted to suggest adaptation strategies aimed at reducing potential negative consequences and the way forward.

This topic is of serious economic, social and political significance because the consequences of transition to circular economy paired with energy transition will affect hundreds of millions of people living in the OECs. Apart from that, a significant flow of migrants from these countries to other parts of the world can be expected if the OECs under consideration will not adapt to the new reality properly.

THE IMPORTANCE OF CIRCULAR ECONOMY IN FOOD WASTE MANAGEMENT TOWARDS ACHIEVING THE UNITED NATIONS SUSTAINABLE DEVELOPMENT GOALS

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ABSTRACT

According to UNEP Food Waste Index Report 2021, around 931 million tons of food waste was generated in 2019 and nearly 570 million tons of this waste occurs at the household level. On the other hand, more than 800 million people suffer from hunger worldwide. Additionally, 8-10% of global greenhouse gas emissions are associated with food that is not consumed. In general, food waste generation has substantial negative impacts: environmentally, socially and economically. The circular economy is an economic model that aims to avoid waste and to preserve the value of resources (raw materials, energy and water) for as long as possible. The main purpose of this paper is to analyze and present interlinkages between food waste management, circular economy and SDGs, considering that food waste management is generally treated as an environmental challenge, but it has also notable gains for the economic and social objectives of sustainable development. The first part of the presented research examines the role of food waste management in the context of a circular economy transition. The second part of this research presents an analysis of each of the SDGs in the context of circular economy and food waste management. The results obtained showed that the strongest relationships and synergies between circular economy practices, food waste management and SDG targets lie within SDG 2 (Zero Hunger) and SDG 12 (Responsible consumption and production), which have high scores both for direct and for indirect contributions.

Keywords: circular economy, food waste management, sustainable development goals, zero hunger

DIVERSIFICATION PROCESSES OF RURAL ECONOMIES FROM THE PERSPECTIVE OF SMART VILLAGE CONCEPT

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ABSTRACT

The general concept of smart villages implies saving villages and their inhabitants, protecting cultural heritage and using local potentials to meet modern challenges. The aim of the paper was to present the challenges for implementation of smart village concept in Poland. Apart from the introduction the theoretical background of the smart village concept, we investigated this phenomenon based on the Mazowieckie region in Poland, which presents the highest population in the country and at the same time, the highest number of people engaged in agriculture. The Mazowieckie region (NUTS 2 without capital Warsaw region) can be characterized by 172,7 thousand of people employed in agriculture, forestry and fishing (2020) which makes its 5th one among European regions, after three Romanian and one Spanish. Although the scale of the involvement of labour resources in the primary sector is significant, the analysis of the employment structure allows for concluding that Mazowieckie region is the most advanced in the completion phase (the three-sector model of the economy), with the highest percentage of employees in services and relatively average values in terms of the percentage of employees in the other two sectors. Structural changes in the economy, including changes in the sectoral structure of employment, are a long-term process, they do not usually take place by leaps and bounds. The research results proves a slow but continuous decrease in the share of employment in agriculture in the Mazowieckie in favour of an increasing involvement of labour resources in industry and services. The largest outflow from agriculture took place in the areas furthest from the capital, because the starting level was also the highest there. The largest increase in the share in employment in other sectors took place relatively more often in areas located closer to Warsaw or well connected with it. To sum up the study proves diversification process of rural economies so important from the perspective of rural development trap, described in the state of the art as an important challenge for smart villages.

CUSTOMER ACQUISITION ACTIVITIES OF WEB STORES

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ABSTRACT

Based on the domestic and international market trends of the last decades, it can be stated that the number and turnover of web stores, internet commerce is growing dynamically from year to year. The aim of our research is to explore the effective, proven customer acquisition methods of modern web stores. As part of this, the subject of our literature research was to explore the popular advertising platforms for web stores and their basic marketing principles and their optimal structure based on them. In our professional research, on the one hand, we explored through structured interviews what methods and communication are considered effective by the three webshops competing and selling in the different markets based on their experiences. On the other hand, we examined the shopping habits and preferences of consumers in the form of a questionnaire. The information obtained in this way can be crucial in planning the marketing strategy for any existing or new web store. We have found that one of the most important attributes in acquiring customers is reliability. From the beginning, you should strive for positive customer reviews as well as regular value creation proficiency must be demonstrated through content production, with which the business can build a committed community.

Keywords: marketing communication, consumer habits, structured interview, questionnaire

CIRCULAR ECONOMY AS A CONCEPT OF SUSTAINABLE DEVELOPMENT – THE CASE OF NORTH MACEDONIA AND SERBIA

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ABSTRACT

The circular economy is the antithesis of the current, so-called linear model of the economy, which involves the uncontrolled exploitation of natural resources and the circular flow of materials from the factory through the users to the landfill. Unlike a linear economy that is based on the take-do-throw principle, a circular economy is based on the take-do-fix-reuse-recycle principle. The principle of the circular economy changes business models, habits, and ways of thinking, both of producers and consumers. Thus, the new eco-design of the product extends its lifespan through repair, renovation, and recycling. As recycling is a leading tool on the road to a circular economy, the need for a circular economy in the world is imperative. The purpose of this paper is to show that the circular economy is a driver for the sustainable development of North Macedonia and Serbia.

The paper is conceived in three parts. The first part of the paper analyzes the advantages of the circular economy on the example of the European Union. The second part of the paper analyzes the circular economy as a driver for sustainable development on the example of North Macedonia, while the third part covers the analyzed issues on the example of the Republic of Serbia. The methodology applied in the paper involves qualitative research techniques, such as analysis, comparative analysis, and synthesis. Based on the obtained results, we concluded the need to urgently establish a comprehensive model of circular economy and an appropriate legal framework in both countries following the example of successful practices from leading European countries.

Keywords: circular economy, sustainable development, North Macedonia, Serbia

REACTIONS OF SUPREME AUDIT INSTITUTIONS TO AUDIT GOVERNMENTAL RESPONSES TO TACKLE THE ECONOMIC CONSEQUENCES OF COVID-19 PANDEMIC

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ABSTRACT

The evaluation of public finance management responses related to crisis management and the emerging aspects of accountability are always an interesting and sensitive area. This article focuses on Supreme Audit Institutions (SAIs) and their special activities in connection with the economic effects and aftermath of COVID-19 pandemic. Methodologically, this research is a comparative analysis and synthesis, including the audit responses, mandates and reaction time of SAIs. I use the analytical framework of value creation processes to analyze the relevant activities of these external, independent audit institutions. At the same time, I also explore similarities with the previous financial and economic crisis, which started to escalate in 2008. Finally, based on the results, I formulate my own comments and suggestions.

Key words: Supreme Audit Institutions, audit, COVID-19, crisis, responses

CONSUMPTION HABITS OF ANTIOXIDANT-ENRICHED FOODS

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ABSTRACT

The study is about the antioxidant enriched foods. The currency of the topic is given by the drastic growth of civilization diseases, and thus the spread of health awareness. In my research, I studied the willingness of the participants to consume antioxidant-fortified foods using an online questionnaire survey. I also examined the possible influencing factors related to this.

The research shows that more than half of the respondents have started to consume antioxidant-enriched foods on their own initiative, typically bought in supermarkets and chain stores. The majority of consumers prefer vitamin C and micronutrients. Vitamin A, vitamin E and selenium are almost equally valued with presumably less awareness of their benefits. The biggest problems were high prices, lack of availability and lack of familiarity.

SOIL MANAGEMENT AND SUSTAINABLE APPROACHES FOR ACHIEVING THE EU GREEN DEAL

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ABSTRACT

Soil is a fragile, non-renewable resource essential for all life-sustaining processes on our planet, thus it needs to be carefully managed and safeguarded for future generations. Over 60% of soils in the EU are in unhealthy state mainly because of human activities (e.g., intensive land use, pollution, poor soil structure due to compaction, loss of biodiversity, loss of soil carbon, occurrence of erosion, consumption patterns and urbanisation) that are acerbated by climate change. Given that soils deliver public goods, restoring soil health is crucial for achieving the United Nations' Sustainable Development Goals (SDGs), together to the objectives of the EU Green Deal. The SDGs related to soil are: *2. Zero hunger; 3. Health; 6. Clean water and sanitation; 7. Energy use; 12. Sustainable consumption and production; 13. Climate action; 15. Life on land*, each of them being specified by targets and indicators intended to be applied worldwide. However, neither UN agreement on SDGs or the EU Green Deal do not address operational methods or approaches by which these targets can be reached.

Therefore, this paper aims to focus the attention of soil science and business community on developing successful sustainable soil management approaches which may be applied toward realizing the SDGs, rather than to only understand soil science. These approaches have to use the "soil health concept" in a holistic manner that proves to be advantageous over traditional soil quality assessments (focused only on soil fertility and agricultural production) because it envisages both nature and human driven objectives.

The paper reveals that progress in sustainable soil management relies upon the development of holistic indicators for soil health that need to be evaluated under site-specific conditions that account for the different processes of different geological, climatic, and societal conditions. Moreover, it was revealed an obvious need of an interdisciplinary research that may provide studies regarding the impacts of soil systems on the socioeconomic systems. Through this paper is offered an alternative approach to developing effective soil management, where soil scientists and stakeholders work jointly to use European funds for achieving the Green Deal objectives.

EFFECT OF COVID-19 LOCKDOWN ON DIETARY HABITS AND LIFESTYLE OF STUDENTS FROM NORTH MACEDONIA

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ABSTRACT

This investigation aimed to study the changes in dietary behaviours, physical activity, and psychological habits during the COVID -19 lockdown among students from North Macedonia. An online questionnaire was distributed using an institutional mailing list and social media, based on 89 items, including sociodemographic information, anthropometric and physical behaviours, eating habits, and psychological data. We examined a cross-sectional survey with a sample size of 603 students from the University of Tetova. An online questionnaire was administered for pre-pandemic and during the pandemic to examine students' dietary intake, physical activity, sedentary and psychological behaviour. Categorical data were reported as numbers and percentages. Multivariate logistic regression models were used to assess the association between various factors and physical activity and weight gain. All statistical analyses were conducted using SPSS 21.0 (SPSS Inc, Chicago, Illinois, USA). There were significant differences between males and females regarding **working before social isolation.** The female (75.9%) participants reported significant **changes of eating behaviour during social isolation (P<0.001).** The weight gained during the lockdown was positively associated with an (OR, 1.32, $p < 0.01$), bread during pandemic and consumption of rice, pasta, tortilla (OR, 1.72, $p < 0.001$; OR, 1.49, $p<0.05$, respectively), and no physical activity in school (OR, 0.64, $p < 0.01$) during the COVID-19 lockdown. The odds ratio for decreased physical activity during isolation were significantly correlated with changes in the frequency of ordering and lower physical activity in school before isolation. The dietary habits during COVID-19 lockdown could be helpful in the strategy of improving and highlighting the need for better promotion of the students' well-being.

Keywords: COVID-19, body weight, lockdown, ordering frequency, physical activity

PAYMENT HABITS WITH MOBILE APPLICATIONS FOR STUDENTS OF THE FACULTY OF ENGINEERS

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ABSTRACT

In the first semester of the 2021/2022 academic year, we conducted a questionnaire survey of 326 students among the full-time students of the Faculty of Engineering of the University of Szeged. The subject of the research was a survey of payment habits with mobile phone applications. 100% of respondents have a smartphone. 65% of them used a mobile app for their payments. 43% of respondents consider it a completely reliable method of payment and completely displace the form of payment in cash.

14% of respondents say they use this payment method several times a day, and 14% say they use it every day. 21% of respondents use it several times a week and 16% use it monthly, and 35% do not use it. 66.7% of respondents would recommend one mobile payment app to others. The main reason for this was speed, as it is faster than paying in cash. Other reasons were that they were convenient, reliable, simple, and that they carried their cell phone with them more often than their credit card.

Most use Simple Pay and Apple Pay. Simple Pay can be used on almost any operating system and any card can be attached to it so it is widely used. The Apple Pay and Wallet features were often included in the responses. They only work on IOS-based devices, they are not available anywhere else. Several even wrote Google Pay, Paypal and Revolut.

Keywords: questionnaire survey, mobile phone application, engineering students, payment habits