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Prof. Dr. István Bíró

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Prof. Dr. Zsuzsanna László

Prof. Dr. József Sárosi

Réka Dobozi

Ákos Ferenc Fazekas

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Bio- and Environmental Engineering

ENHANCING SUSTAINABILITY IN CARBON DIOXIDE HYDROGENATION THROUGH PROCESS INTENSIFICATION

Masoud Shirzadi Ahoudashti

Department of Applied and Environmental Chemistry, University of Szeged, Rerrich Béla tér 1, H-6720 Szeged, Hungary
e-mail: masoud.shirzadi.2022@gmail.com

ABSTRACT

Delves into the pivotal role of process intensification in advancing carbon dioxide (CO_2) hydrogenation, is a crucial aspect of sustainable energy conversion and solving environmental problems. We explore the optimization of reaction conditions, catalysts, reactors, and processes design to elevate the efficiency of CO_2-direct Fischer Tropsch processes. Through innovative technologies such as hybrid catalyst-adsorbent materials, dynamic operations, integrated with various processes design, we aim to achieve higher conversion rates and selectivity beyond equilibrium constrains. Our research emphasizes the integration of process intensification methods to address challenges and propel greener, more effective CO_2 hydrogenation strategies for the production of more valuable products.

Keywords: CO_2-direct Fischer Tropsch, Process intensification

REACTOR CHAMBER DESIGN EFFECT ON FLUE GAS CONVERSION

Owais Alaqtash[1], Andras Sapi[1], Ferenc Farkas[2]

[1]Department of Applied and Environmental Chemistry, University of Szeged, Rerrich Béla tér 1, H-6720 Szeged, Hungary
[2]Department of Mechanical Engineering, Faculty of Engineering, University of Szeged, Mars tér 7, H-6724 Szeged, Hungary
e-mail: owais_aqtash@hotmail.com

ABSTRACT

A series of measurements were held to determine the effect of reaction chamber design on flue-gas conversion, to which three different reaction chambers were manufactured and tested while loaded with 65 grams of 0.1wt% Pd over spherical Al_2O_3 Catalyst. The focus point of the experiment is to monitor the effect of reaction chamber design on the catalytic activity as well as its contribution to the change in flue-gas conversion and fuel consumption. The results showed a clear distinction of performance that was led by the design change, Reactors B and C decreased the fuel consumption by 20% at the higher power output operating conditions, moreover, the conversion of CO in Reactor B and C increased by 5-fold and 3-fold respectively also at the higher power output operating condition, NO conversion was increased as well particularly for Reactor C with 225% of increase. This indicates that the proposed framework can significantly enhance the desired field such as flue gas conversion, fuel consumption, or even controlling the flow and heat profile of reactors.

Keywords: catalytic converter, Finite Element Method, catalysis, surface chemistry

FLOW DYNAMICS ASSESSMENT WITH INTEGRATED 3D PRINTED TURBULENCE PROMOTERS TO MITIGATE MEMBRANE FOULING IN ULTRAFILTRATION MODULE

Aws N. Al-Tayawi[1,2], Hajnalka Csott[4], Nikolett Sz. Gulyás[1,5], József Richárd Lennert[6], Zsuzsanna Horváth Hovorka[3], Zsuzsanna László[4], Cecilia Hodúr[4], Szabolcs Kertész[4]

[1]Doctoral School of Environmental Sciences, University of Szeged, Rerrich Béla tér 1, H-6720 Szeged, Hungary
[2]Department of Environmental Technology, Faculty of Environmental Sciences, University of Mosul, Mosul 41002, Iraq
[3]Department of Mechanical Engineering, Faculty of Engineering, University of Szeged, Mars tér 7, H-6724 Szeged, Hungary
[4]Department of Biosystems Engineering, Faculty of Engineering, University of Szeged, Moszkvai krt. 9, H-6725 Szeged, Hungary
[5]Department of Food Engineering, Faculty of Engineering, University of Szeged, Moszkvai krt. 5-7, H-6725 Szeged, Hungary
[6]Department of Power Electronics and E-Drives, Audi Hungaria Faculty of Automotive Engineering, Széchenyi István University, H-9026 Győr, Hungary
e-mail: awsaltayawi@uomosul.edu.iq

ABSTRACT

Rapid population growth increased the consumption of water resources and augmented the amount of wastewater generated. Membrane fouling, a challenge in membrane technology of wastewater treatment, requires innovative solutions for improved efficiency. Addressing this issue is crucial for maintaining filtration efficiency, prolonging membrane lifespan, and reducing operational costs. The study assessed the integration of 3D printed turbulence promoters to improve the efficiency of the ultrafiltration module in treating dairy wastewater. It investigated transmembrane pressure (0.2 - 0.4 MPa), stirring speed (0, 200 & 400 rpm), and membrane cut-off values (10, 20 & 50 kDa), to optimize the ultrafiltration process. Through experiments conducted on lab-scale ultrafiltration equipment using dairy model effluent, the research identifies optimal conditions, including a 20 kDa membrane, 0.3 MPa pressure, and 400 rpm stirring speed. Four different designs of 3D printed turbulence promoters, made from various filament materials (PLA, TPU, Stainless steel, Resin), are tested to assess their impact on permeate fluxes, membrane retention, and total resistance. Results indicate that certain turbulence promoter designs, particularly 'PLA initial' and 'PLA mini', significantly enhance permeate flux and organic retention. Subsequent tests with different printing filaments reveal resin as the most effective material, notably improving both flux and total resistance.

Keywords: Dairy Wastewater, Turbulence Promoters, Ultrafiltration, Membrane Fouling Mitigation, 3D Printed Materials.

Acknowledgements: This study was financed by the Hungarian National Research, Development and Innovation Office, project NKFI-FK-142414.

POTENTIAL APPLICATIONS OF MONITORING METHODS BASED ON DIELECTRIC BEHAVIOUR IN WASTEWATER AND SLUDGE TREATMENT AND UTILIZATION PROCESSES

Sándor Beszédes[1], Zoltán Jákói[1], Balázs Lemmer[2], Cecilia Hodúr[1]

[1]Department of Biosystems Engineering, Faculty of Engineering, University of Szeged, Moszkvai krt. 9, H-6725 Szeged, Hungary
[2]Department of Food Engineering, Faculty of Engineering, University of Szeged, Moszkvai krt. 5-7, H-6725 Szeged, Hungary
e-mail: beszedes@mk.u-szeged.hu

ABSTRACT

In the treatment of wastewater and sludge, meeting the challenges of circular economy principles, there is nowadays an increasing emphasis on recovery as a complete material stream or on the recovery of selected components.

Dielectric parameters can be used to monitor changes in the composition, structure and biodegradability of wastewater and sludge, but there is just few experiences in this area. We have measured the dielectric constant and dielectric loss factor in the frequency range 200-2400 MHz (Speag DAK3.5 sensor) for municipal and industrial wastewater and sludge.

Our research results have demonstrated that organic matter removal (11-88% COD removal) can be monitored in two-stage (mechanical and biological) municipal wastewater treatment technology by the dielectric constant measurement. For meat industry wastewater the organic matter removal efficiency (in the range of 8-44%) when using Fenton reaction correlated with the dielectric loss tangent.

Furthermore, the disintegration degree, aerobic biodegradation index and biotransformation efficiency in anaerobic digestion process can be monitored by the dielectric constant and loss factor measured at the frequency range of 200-600 MHz.

Keywords: sludge, wastewater, dielectric parameters

Acknowledgements: The research is supported by Bolyai János Research Scholarship (BO/00161/21/4), NKFIH (OTKA FK 146344) and the New National Excellence Program (23-3-SZTE-246 and ÚNKP-23-5-SZTE-668).

HYSPLIT AND K-MEANS CLUSTERING APPLICATION FOR TRAJECTORY ANALYSIS TO DETERMINE SOURCE REGIONS OF SECONDARY INORGANIC AEROSOLS AT HUNGARY'S KECSKEMET BACKGROUND MONITORING STATION

Houria Bouzghiba[1], Ajdour A.[2], Kenza Khomsi[3], Gábor Géczi[4]

[1]Doctoral School of Environmental Sciences, Hungarian University of Agriculture and Life Sciences, Páter Károly utca 1, H-2100 Gödöllő, Hungary
[2]Laboratory of Materials, Signals, Systems and Physical Modelling, Physics Department, Faculty of Sciences, Ibn Zohr University, Agadir, Morocco
[3]General Directorate of Meteorology, Face Préfecture Hay Hassani, B.P. 8106 Casa-Oasis, Casablanca, Morocco
[4]Institute of Environmental Sciences, Department of Environmental Analysis and Environmental Technology, Hungarian University of Agriculture and Life Sciences, Páter Károly utca 1, H-2100 Gödöllő, Hungary
e-mail: Bouzghiba.Houria@phd.uni-mate.hu

ABSTRACT

In this research, we aimed to pinpoint the origins of secondary inorganic aerosols at the Kecskemet Background Monitoring Station, located in a farming region. By integrating the HYSPLIT model for trajectory analysis and K-means clustering with CAMS reanalysis data on nitrate and ammonium, we identified distinct source clusters. Notably, Cluster 3, accounting for 20% of the air masses, emerged as a significant source across various areas, followed by Cluster 5, which accounted for 12% of air masses in the region. Our study sheds light on the geographical sources of secondary inorganic aerosols in this agricultural area.

Keywords: Hysplit, Air quality, CAMS, k-means clustering, Aerosols

Acknowledgements: The research was supported by the project 'The feasibility of the circular economy during national defense activities' of 2021 Thematic Excellence Programme of the National Research, Development and Innovation Office under grant no.: TKP2021-NVA-22, led by the Centre for Circular Economy Analysis

EFFECT OF BALL-MILLING AND WATER MATRICES ON THE DEGRADATION OF TRIMETHOPRIM BY BIOCHAR-ACTIVATED PEROXYMONOSULFATE

Dinesh Chandola[1], Erik Sinkovics[1], Zsuzsanna László[2], Tünde Alapi[1]

[1]Department of Molecular and Analytical Chemistry, University of Szeged, Dóm tér 7, H-6720 Szeged, Hungary

[2]Department of Biosystem Engineering, Faculty of Engineering, University of Szeged, Moszkvai Blvd. 9, H-6725 Szeged, Hungary

e-mail: dinesh.chandola@chem.u-szeged.hu

ABSTRACT

Antibiotics play an important role in protecting human and animal health from microbial infections. One of the five most commonly used antibiotics in the world is trimethoprim (TMP) that has been detected in river water (up to 60 ng L^{-1}), surface water (25 µg L^{-1}), hospital wastewater (10 µg L^{-1}), and municipal wastewater (0.17–8.8 µg L^{-1}). TMP cannot be completely removed by conventional biological wastewater treatment techniques; hence; poses a risk to humans and the environment. Therefore, the removal of TMP requires a straightforward and efficient method. Advanced persulfate-based oxidation processes (PS-AOPs) are known for their strong oxidative degradation capacity due to the formation of various reactive species, such as HO•, $SO_4^{\bullet-}$ and $^1O_2$. In PS-AOP, carbon-based materials, such as biochars, are emerging catalysts for the activation of various oxidizing agents and the generation of radicals.

In this work, various biomasses (grass pallets (GP-BC), corn cobs (CC-BC), and poplar wood (PW-BC)) were used as raw materials for biochar preparation. The biomass was treated at 400, 500, 600, and 700 °C in an N_2 atmosphere. The particle size of the prepared biochar was decreased with ball milling. Raman and FT-IR spectroscopy performed the characterization of biochars, while the specific surface area was determined via N_2 adsorption. The effectiveness of biochars on peroxymonosulfate ion (HSO_5^-, PMS) as oxidizing agent was investigated in TRIM transformation. The effect of biochar dose, PMS concentration, and biologically treated domestic wastewater as a matrix on the degradation of TRIM was investigated. The potential of GP-BC to activate hydrogen peroxide (H_2O_2) and peroxydisulphate (PDS) was also studied. The effect of pyrolysis temperature on the activity of GP-BC was examined. The specific surface area of biochar and its adsorption capacity decreased with the increase in the pyrolysis temperature from 400 to 700 °C. Still, the efficiency of TRIM transformation increased due to the structural change and depended on biomass as raw material. The ball milling increased the specific surface area of biochar prepared at 700 °C, from 10 m^2/g to 228 m^2/g, 236 m^2/g, and 130 m^2/g for CC-BC, PW-BC, and GP-BC, respectively. As a result, the TRIM ($5{,}0\times10^{-5}$ M) adsorption was negligible before ball milling; however, it increased to 33%, 28%, and 29% for ball-milled CC-BC, PW-BC, and GB-BC, respectively. The adsorptive removal and degradation were achieved up to 78%, 71%, and 93% with a 2.0 mM PMS and 3000 mg/L biochar dose in 120 minutes without ball-milled CC-BC, PW-BC, and GP-BC respectively. The ball-milling highly enhanced the efficiency of PMS activation, and decreased the required

biochar (500 mg/L) and PMS dose (0.2 mM). The overall removal of 83%, 75% and 88% was achieved within 60 minutes for ball-milled CC-BC, PW-BC, and GP-BC respectively. The ball-milled GP-BC was less effective in activating PDS and H_2O_2, so only 17% and 14% TRIM removal were achieved even with the same dose of BC (500 mg/L) and oxidant (0.2 mM).
The effect of various radical scavengers proved that the HO•, $SO_4^{\bullet -}$ and $^1O_2$ plays an important role in the transformation of TRIM. The degradation of TRIM was significantly impeded in biologically treated waste water (BTWW) containing organic substances and inorganic components. The matrix components affect the adsorption of TRIM, and consequently hinder its reaction with reactive species on the surface of biochar. Moreover, organic substances and inorganic ions can behave as HO• and $SO_4^{\bullet -}$ scavengers. Humic acid and HCO_3^- significantly reduced the TRIM transformation efficiency, while the effect of Cl^- was moderate.
In conclusion, the process of ball-milling and temperature have significantly changed the adsorption and degradation properties of biochar. Biologically treated wastewater and inorganic ions, however, have the potential to reduce the overall removal efficiency. The adsorption properties and activity of biochar are greatly impacted by the type of biomass, and temperature of the pyrolysis. By further modifying GP-BC, increased activation of PMS, PDS, and H_2O_2 can be achieved, and the matrix effect can be partially eliminated or reduced.

Keywords: Biochar, trimethoprim, sulfate-based advanced oxidation process, water treatment

Acknowledgements: This work was sponsored by the National Research, Development, and Innovation Office-NKFI Fund OTKA, project number FK132742.

EFFECTS OF FOOT ORTHOSIS AND KINESIO TAPE ON SPATIOTEMPORAL AND KINETIC GAIT PARAMETERS DURING RUNNING IN INDIVIDUALS WITH FLATFOOT

Hairong Chen[1], Qiaolin Zhang[1], István Bíró[2]

[1]Doctoral School on Safety and Security Science, Óbuda University, Bécsi út 96/b, H-1034 Budapest, Hungary

[2]Department of Mechanical Engineering, Faculty of Engineering, University of Szeged, Mars tér 7, H-6724 Szeged, Hungary

e-mail: chenhairong233@163.com

ABSTRACT

Flatfoot is a common condition that influences gait and can cause discomfort for runners during recreational activities. Identifying the most effective treatment necessitates a comprehensive analysis of each therapy's impact on gait. Our research investigated this. Twenty female rearfoot strike runners with FPI of 6 or higher participated in the running tasks at 3.3±5% m/s on the Zebris Medical GmbH treadmill. Gait data were collected under three conditions: shoe (A), shoe with Foot Orthoses (B), and shoe with Kinesiology Tape (C). A one-way repeated measures ANOVA was employed to analyzed the gait parameters during the stance phase. Under conditions B and C, the foot rotation angle significantly decreased compared to condition A. Additionally, in condition B, it was significantly lower than in condition C. In both conditions B and C, the center of pressure (COP) offset significantly reduced compared to condition A. Under conditions B and C, the peak pressure of forefoot significantly increased, whereas it in the midfoot significantly decreased, relative to condition A. Foot Orthoses and Kinesiology Tape both effectively diminish peak midfoot pressure during running. Additionally, FOs surpass KT in enhancing foot stability throughout the run. These findings offer valuable insights for the prevention of running-related injuries.

Keywords: flatfoot, insole, gait, running, biomechanics

INVESTIGATION OF THE USE OF PERSULFATE SALTS IN ADVANCED OXIDATION PROCESSES USING TRIMETHOPRIM AS MODEL COMPOUND

Anett Covic, Gyöngyi Orosz, Tünde Alapi

Department of Molecular and Analytical Chemistry, University of Szeged, Dóm tér 7, H-6720 Szeged, Hungary

e-mail: covicanett@chem.u-szeged.hu

ABSTRACT

Traditional 3-stage wastewater treatment does not completely remove all organic matter, even non- or hardly-biodegradable substances. Among others, advanced oxidation processes can efficiently remove these pollutants via processes based on the application of various oxidizing agents and radical-based reactions. The low-pressure mercury vapor (LPM) lamps emitting 254 nm UV light have an excellent germicidal effect and are widely used in water treatment for disinfection. The combination of UV light with oxidizing agents, such as hydrogen peroxide (H_2O_2) and persulfate (PS) ions (peroxodisulfate ($S_2O_8^{2-}$, PDS) and peroxomonosulfate (HSO_5^-, PMS)) results in HO• and SO_4•$^-$ and initiate the transformation of organic substances. In the case of a PS-based process, a sulfate ion is formed; the limit of its concentration in drinking water is 250 mg L^{-1}, which must be considered when dosing. The LPM lamp covered with high-purity quartz envelope, have a small-intensity emission of 185 nm VUV light, which can be used for radical generation directly from water.

The efficiency of UV/H_2O_2, UV/PMS, and UV/PDS processes and UV/VUV photolysis were investigated and compared in eliminating trimethoprim (TRIM) from aqueous solutions. The model compound TRIM, is a non-biodegradable, widely used antibiotic for treating urinary, respiratory and gastrointestinal tract infections and frequently detected in wastewater and surface waters and resistant for the UV–initiated transformation.

Due to the UV photolysis of H_2O_2, PMS, and PDS HO•, HO• and SO_4•$^-$, and SO_4•$^-$ forms. Both HO• and SO_4•$^-$ react with TRIM ($k(HO•) = 8.66 \times 109\ M^{-1}\ s^{-1}$ and $k(SO_4•^-) = 3.88 \times 109\ M^{-1}\ s^{-1}$). The rate of TRIM decomposition and mineralization increased with increasing the concentration of oxidizing agent. The dissolved oxygen has no effect on the photolysis of H_2O_2 or PS, but enhanced the transformation and mineralization of TRIM due to the formation of organic peroxyl radicals (ROO•), which have an essential role in the mineralization of each organic substances. The relative contribution of various radicals to the transformation was investigated with radical scavenger methanol and terc-buthanol. The results proved the essential role of HO• for UV/VUV and UV/H_2O_2 processes and SO_4•$^-$ for UV/PDS processes. However, the HO• formation can not be excluded in the case of UV/PDS process via hydrolysis of SO_4•$^-$. The efficiency of UV/VUV photolysis can be reached or even exceeded with PMS and PDS dosage lower than 1,0 mM. However, the additive role of low-intensity VUV radiation is manifested in the presence of H_2O_2 and PS and caused the further increase of the efficiency.

The effect of the matrix was investigated using biologically treated domestic wastewater (BTWW) having high Cl^- (120 mg L^{-1}) and HCO_3^- (524 mg L^{-1}) content. The inorganic ions

can inhibit the transformation of the organic pollutant to a different extent due to their reactions with HO• and $SO_4^{\bullet -}$. The matrix effect depended on the quality of the oxidizing agent and the dominant radical. The PS-based processes were found to be more sensitive to the presence of inorganic ions and less effective for mineralization. The positive effect of VUV radiation was well-pronounced in the compensation of the negative matrix effect.

Keywords: Trimethoprim, Advanced Oxidation process, UV/VUV, UV/PDS, UV/PMS

Acknowledgements: This work was sponsored by the National Research, Development, and Innovation Office-NKFI Fund OTKA, project number FK132742.

ENHANCING AND MONITORING THE ANAEROBIC DIGESTION OF WASTEWATER SLUDGE

Viktória Csatordai[1], Zoltán Jákói[2], Balázs Lemmer[1], Sándor Beszédes[2]

[1]Department of Food Engineering, Faculty of Engineering, University of Szeged, Moszkvai krt. 5-7, H-6725 Szeged, Hungary
[2]Department of Biosystems Engineering, Faculty of Engineering, University of Szeged, Moszkvai krt. 9, H-6725 Szeged, Hungary
e-mail: csatordaiviktoria3@gmail.com

ABSTRACT

Nowadays, protecting our environment and researching renewable energy sources play an increasingly important role. Anaerobic fermentation can lower the organic content of the wastewater sludge while a renewable energy source – biogas – is produced at the same time. During our work we examined two monitoring techniques – the monitoring of dielectric properties and absolute viscosity – in order to determine if these techniques are suitable for identifying and monitoring the different phases of the anaerobic fermentation of the sewage sludge. Furthermore, microwave pre-treatment was used on the wastewater sludge to examine its effect on anaerobic digestion, and co-fermentation experiments were also carried out. Our experimental results show that the microwave irradiation can intensify the total biogas yield by 15%, and it can reduce the viscosity of the fermentation media by 13%. Moreover, it has been confirmed in case of the results of co-fermentation experiments that the optimal setting of the C/N ratio in sludge samples mixed with plant by-products could increase the amount of the maximum biogas yield. To summarise, dielectric and rheological measurements are capable of monitoring the anaerobic fermentation, because there is a correlation among dielectric parameters, biogas yield and absolute viscosity of the fermentation media. Changes in dielectric parameters and absolute viscosity show similar trends, which can be explained by the connection with biogas production.

Keywords: anaerobic fermentation, biogas, dielectric properties, viscosity, microwave irradiation

ASSESSMENT AND VALIDATION OF SHALLOW GROUNDWATER VULNERABILITY TO CONTAMINATION BASED ON FUZZY LOGIC AND DRASTIC METHOD FOR SUSTAINABLE GROUNDWATER MANAGEMENT, SOUTH-EAST HUNGARY.

Abdelouahed Fannakh, Károly Barta, Andrea Farsang†

Department of Geoinformatics, Physical and Environmental Geography, University of Sezged,
Egyetem str. 2-6, H-6722 Szeged, Hungary
e-mail: abdelouahed.fannakh@gmail.com

ABSTRACT

An evaluation of shallow groundwater vulnerability based on an origin-path-target approach, by integrating the DRASTIC model and the fuzzy logic tool, is presented. The outcomes represent the potential risk to pollution of the natural aquifer to leaching of contaminants from the land surface to shallow groundwater in South-Eastern Hungary, a region characterised by a flat and fertile plain, largely cultivated, and growing industrial activities. Accordingly, the seven DRASTIC factors, including shallow aquifer depth, recharge rate, aquifer media, soil media, topography, vadose zone impact and hydraulic conductivity, were created to examine the spatial distribution of groundwater vulnerability. The integration of the fuzzy logic tool with the DRASTIC model were used to deal with the uncertainty arising from the sparsity of data in the intrinsic vulnerability evaluation. The results showed that the vulnerability index is classified as "low", "moderate" and "high". The Fuzzy DRASTIC model delineates 49.23% of the groundwater basin highly vulnerable to water pollution. A positive linear correlation was also found, during validation of the final vulnerability map, between the vulnerability index and the nitrate concentration (NO_3^-) observed from 46 groundwater sampling wells, with NO_3^- concentrations ranging from 1 mg/l to 36 mg/l. The correlation coefficient R^2 (0.31) shows a moderately strong positive correlation between the nitrate concentrations available in the groundwater and the different vulnerability classes established. The Fuzzy DRASTIC model has proved to be a suitable approach for assessing the vulnerability of shallow aquifer to pollution in south-east Hungary. The outcome of this study will provide useful information to help policy-makers identify the main contributors to pollution as well as adopt effective management strategies to mitigate nitrate pollution in groundwater to avoid further pressure on this invaluable resource.

Keywords: Vulnerability assessment, Shallow groundwater, DRASTIC, Fuzzy Logic, Southeast Hungary

IMMOBILIZATION OF TIO_2 AND TIO_2/CNT NANOPARTICLES USING POLYDOPAMINE TO FABRICATE PHOTOCATALYTICALLY ACTIVE PVDF MEMBRANES FOR FILTRATION OF OIL EMULSIONS

Ákos Ferenc Fazekas, Zsuzsanna László, Gábor Veréb

Department of Biosystem Engineering, Faculty of Engineering, University of Szeged, Moszkvai Blvd. 9, H-6725 Szeged, Hungary
e-mail: fazekas@mk.u-szeged.hu

ABSTRACT

Membrane filtration is a potential method for purification of oily wastewater. It is chemical-free, easy to incorporate with other techniques, and simple to operate. Moreover, it is effective for removing micro- and nanosized oil droplets. In this study, we aimed to develop PVDF membrane surfaces with photocatalytic properties and favorable filtration properties via polydopamine based immobilization of photocatalytic nanomaterials. The efficiency of TiO_2 and TiO_2/CNT in the photocatalytic degradation of methyl orange dye was evaluated, and the several filtration parameters (fluxes, filtration resistances, flux recovery ratios, purification efficiencies) were examined for the treatment of oil-containing wastewater. Modifying the membranes with nanoparticles led to a substantial improvement in the flux recovery factor, resulting in a flux reduction rate of 79-83%. Additionally, the irreversible resistance decreased by approximately 60% for membranes coated with polydopamine and by approximately 70% for those containing nanoparticles compared to the unmodified membranes. In terms of photocatalytic measurements, the best photocatalytic degradation result (approximately 20%) for pure TiO_2 modified membranes was obtained.

Keywords: PVDF, membrane filtration, oil emulsion, TiO_2, CNT

Acknowledgements: 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).

ENHANCING MEMBRANE SEPARATION EFFICIENCY THROUGH THE UTILIZATION OF 3D-PRINTED TURBULENCE PROMOTERS DERIVED FROM RECYCLED PET BOTTLES, WITH INTEGRATION INTO FILTRATION MODULE

Gréta Gergely[1], Kevin Tóth[1], József Richárd Lennert[2], Szabolcs Kertész[1]

[1]Department of Biosystems Engineering, Faculty of Engineering, University of Szeged, Moszkvai krt. 9, H-6725 Szeged, Hungary
[2]Department of Power Electronics and E-Drives, Audi Hungaria Faculty of Automotive Engineering, Széchenyi István University, H-9026 Győr, Hungary
e-mail: kertesz@mk.u-szeged.hu

ABSTRACT

The food industry, by its nature, requires significant water consumption, especially the dairy industry, as one of the largest consumers and producers of wastewater. Additionally, the food industry is a primary contributor to the utilization of packaging materials, predominantly for polyethylene terephthalate (PET), which exhibits long-lasting degradation properties, thereby raising significant environmental problems. Given these considerations, it is recommended to accelerate efforts towards sustainable development, with innovative solutions for recycling packaging waste and modernizing wastewater treatment processes.

Through the integration of 3D-printed turbulence promoters within filtration cells, the filtration efficiencies can be enhanced solely through mechanical means, avoiding the need for chemical additives. In our research, we have observed that the integration of turbulence promoters into a low-pressure filtration cell, alongside reduced mixing speeds yielded comparable improvements in filtration efficiency to higher mixing speeds without turbulence promoters. Our scope was to research the effect of turbulence promoters printed from filament made from accumulated PET bottles on the filtration efficiency. By integrating these promoters into microfiltration and/or ultrafiltration modules, we aim not only to purify dairy wastewater, but also to selectively separate and concentrate valuable components present in other dairy by-products (e.g. whey, buttermilk).

Keywords: 3D-printed Turbulence Promoters, Dairy Wastewater Treatment, Low-pressure Membrane Separation, Ultrafiltration, Membrane Fouling Mitigation

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EFFECT OF 3D PRINTED TURBULENCE PROMOTER ON FOULING

Nikolett Sz. Gulyás[1], Cecilia Hodúr[2], Szabolcs Kertész[2]

[1]Institute of Environmental Science and Technology, University of Szeged, Tisza Lajos krt. 103, H-6725 Szeged, Hungary
[2]Department of Biosystems Engineering, Faculty of Engineering, University of Szeged, Moszkvai krt. 9, H-6725 Szeged, Hungary
e-mail: kertesz@mk.u-szeged.hu

ABSTRACT

In recent years, membrane processes have become important tools in water and wastewater treatment because they have several advantages over traditional separation systems. Membrane fouling is still a serious problem in microfiltration and ultrafiltration, limiting the potential of this technique. A promising alternative for improving the hydrodynamic conditions of membrane separation processes is the application of turbulence promoters. These devices reduce particle deposition by increasing shear stress on the membrane surface. While membrane fouling can be reduced by membrane modification, membrane cleaning and other methods, a better understanding of the fouling phenomenon itself is crucial to its mitigation.

In this study, we compared the ultrafiltration of model dairy wastewater without and with turbulence promoter. We used a 3D printed turbulence promoter, which was designed based on our previous work. The comparison included the examination of the reduction of fluxes at different pressure values (0.1, 0.2 and 0.3 MPa), different mixing speeds (100, 200, 300 and 400 rpm) and the different fouling models. With the resistance-in series model, the Hermia model and the Makardij model, we investigated how the membrane fouling changes with the use of the promoter.

Keywords: dairy wastewater, fouling models, turbulence promoter, ultrafiltration

Acknowledgements: This study was financed by the Hungarian National Research, Development and Innovation Office, project NKFI-FK-142414.

ENHANCING THE BIODEGRADABILITY OF MEAT INDUSTRY SLUDGE WITH METAL NANOPARTICLES COUPLED MICROWAVE IRRADIATION

Zoltán Péter Jákói, Cecilia Hodúr, Sándor Beszédes

Department of Biosystems Engineering, Faculty of Engineering, University of Szeged, Moszkvai krt. 9, H-6725 Szeged, Hungary
e-mail: jakoiz@mk.u-szeged.hu

ABSTRACT

Our study examined the impact of combining iron oxide nanoparticles with microwave pretreatment on the anaerobic digestibility and soluble chemical oxygen demand (SCOD) of meat industry sludge. We aimed to determine if microwave pretreatment could enhance biogas production by making organic compounds more biologically available. Findings reveal that this combination significantly enhances SCOD, biogas production rate, and total biogas volume without adversely affecting biomethane quality. Additionally, examining the dielectric properties of the sludge (dielectric constant and loss factor at 500 MHz) showed a strong correlation with SCOD changes ($r=0.9942$, $R^2>0.99$), presenting a new method for assessing pretreatment effectiveness.

Keywords: sludge utilization, biogas production, microwave pretreatment, magnetic nanoparticles

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IMPACT OF PYROLYSIS TEMPERATURE ON THE PHYSICAL AND CHEMICAL PROPERTIES OF BANANA LEAVES BIOCHAR. AMMONIUM ADSORPTION CASE STUDY

Fernanda Pantoja[1], Sándor Beszédes[2], Tamás Gyulavári[3], Erzsébet Illés[4], Gábor Kozma[3], Zsuzsanna László[2]

[1]Doctoral School of Environmental Sciences, University of Szeged, Rerrich Béla Sqr. 1, H-6720 Szeged, Hungary
[2]Department of Biosystems Engineering, Faculty of Engineering, University of Szeged, Moszkvai krt. 9, H-6725 Szeged, Hungary
[3]Department of Applied and Environmental Chemistry, Institute of Chemistry, University of Szeged, Rerrich Béla Sqr. 1, H-6720 Szeged, Hungary
[4]Department of Food Engineering, Faculty of Engineering, University of Szeged, Moszkvai krt. 5-7, H-6725 Szeged, Hungary
e-mail: fliceth@hotmail.com

ABSTRACT

Given the current importance of the use of biochar within water treatment, especially as an adsorption process, it is important to study the physical-chemical properties of biochar in order to predict to a certain extent the behaviour of the adsorbent in contact with the adsorbates. Biochar can be made at different temperatures. In this research work, the physical and chemical characteristics of three biochars made with the same raw material which is banana leaves, but at different pyrolysis temperatures were analyzed. The results demonstrated that the increase in temperature in the raw material has a high impact on the structure of the final biochar, as well as on the surface chemistry. Regarding the adsorbent properties in the ammonium case study, the pristine biochar made at 300 °C is the most efficient, achieving a capacity of 7 mg of ammonium for each gram of biochar used, while the pristine biochar prepared at 500 °C shows the less value of ammonium adsorption.

Keywords: biochar, pyrolysis temperature, adsorption, ammonium removal

PHYSICOCHEMICAL PROPERTIES OF MACROPOROUS SUGAR BEET PULP USED AS BIOSORBENT

Lidija Perović[1], Jelena Miljanić[1], Lato Pezo[2], Zita Šereš[3]

[1]Institute of Food Technology in Novi Sad, University of Novi Sad, Bulevar Cara Lazara 1, 21000 Novi Sad, Serbia

[2]Institute of General and Physical Chemistry, University of Belgrade, Studentski Trg 12-16, 11000 Belgrade, Serbia

[3]Faculty of Technology Novi Sad, University of Novi Sad, Bulevar Cara Lazara 1, 21000 Novi Sad, Serbia

e-mail: lidija.perovic@fins.uns.ac.rs

ABSTRACT

The biosorption potential of sugar beet pulp was investigated through removal of molassigenic (sodium, potassium and calcium) metal ions from alkalized sugar juice. In the preliminary study was obtained optimum pH, biosorbent dosage and temperature of alkalized juice. Experiments were done in closed-loop adsorption system with adsorption column. Characterization of the biosorbent includes CHNS analysis, Mercury intrusion porosimetry study, BET porosimetry and XRD analysis. Alkalized juice represents multicomponent system with various components (minearals and metals) dissolved inside. During removal of molassigenic metal ions the competition for the active places on the biosorbent are present and system of metal ions removal becomes more complex. When the biosorption equilibrium was achieved, dependence between metal ions at the surface of the biosorbent (qe) and concentration of metal ions in the alkalized juice (Ce) was examined. Ratio between Ce an qe was characterized by using adsorption isotherms. Laungmuir model describes the most reliable removal of sodium and potassium, whereas Freundlich model describes removal of calcium ions. The data depicted the revalorization of sugar beet pulp as a promising lignocellulosic eco-friendly and economic biosorbent for sodium, potassium and calcium sequestration.

Keywords: biosorption, sugar beet pulp, porosity, metal ions removal

Acknowledgements: This research is financed by the Ministry of Education, Science and Technological development of the Republic of Serbia (451-03-66/2024-03/200222).

INTENSIFICATION AND MONITORING OF ANAEROBIC FERMENTATION OF SEWAGE SLUDGE FROM THE MEAT INDUSTRY

Zsófia Gréta Sánta[1], Balázs Lemmer[2], Zoltán Péter Jákói[1]

[1]Department of Biosystems Engineering, Faculty of Engineering, University of Szeged, Moszkvai krt. 9, H-6725 Szeged, Hungary
[2]Department of Food Engineering, Faculty of Engineering, University of Szeged, Moszkvai krt. 5-7, H-6725 Szeged, Hungary
e-mail: zsofiasanta71@gmail.com

ABSTRACT

As the global economy is growing, the quantity of industrial wastewater is also increasing. Hence, research of modern wastewater and sewage sludge treatment technologies is necessary. One promising approach involves utilizing sewage sludge as feedstock for anaerobic fermentation to produce biogas, a renewable energy source. The food industry (especially the meat industry) is one of those industries that produce the most biodegradable effluents. Although sewage sludge from the meat industry is not optimal for biogas production, its properties can be improved with adequate pretreatments. Our goal was to investigate the effects of microwave irradiation in the presence of magnetite nanoparticles as pretreatment on the quantity of biogas produced via anaerobic digestion. During fermentation, we monitored the process by tracking the dielectric properties of the sludge samples. Results clearly demonstrate the positive effects of the chosen pretreatments on biogas production during fermentation. While the methane content of the produced biogas remained unaffected (as confirmed by gas chromatography), the microwave treatment in the presence of magnetite nanoparticles significantly increased gas production, without compromising quality.

Keywords: meat industry, sewege sludge, waste water, microwave treatment, dielectric properties

APPLICATION OF OXIDOREDUCTASES IMMOBILIZED ON BIOCHAR FOR EFFECTIVE REMOVAL OF CECS FROM WASTEWATER

Marija Šobić, Mirjana Petronijević, Sanja Panić, Nataša Đurišić-Mladenović

Department of Biotechnology, Faculty of Technology Novi Sad, University of Novi Sad, Bulevar cara Lazara 1, 21000 Novi Sad, Serbia
e-mail: sobicmarija@gmail.com

ABSTRACT

The global population growth has increased the demand for various products, leading to the presence of contaminants of emerging concern (CECs) in natural waters. The aim of this study is to present a comprehensive review of the latest literature dealing with the biocatalytic removal of CECs from water using immobilized enzyme-based approaches. Enzymes that have been proven to be effective in removing CECs from water are oxidoreductases, such as laccases. Immobilizing these enzymes on solid supports, such as biochar (BC), enhances their properties. Oxidoreductases immobilized on BC are effective in addressing water pollution caused by substances like phenolic compounds, pesticides, pharmaceuticals, and hormones. Laccases immobilized on BC derived from pine wood, pig manure, and almond shells can rapidly remove diclofenac (100% removal) [1]. Laccase immobilized on BC from fiber industry waste efficiently eliminates sulfamethoxazole and methylparaben [2]. In summary, using immobilized laccases onto BC is a promising and eco-friendly approach for wastewater treatment.

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Keywords: CECs, water, laccase, immobilization

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USE OF NANOFILTRATION MEMBRANE IN THE REMOVAL OF CARBOFURAN, ACETAMIPRIDE AND PROPICONAZOLE FROM WATERQ

Jelena Šurlan[1], Noemi Kiš[2], Nikola Maravić[1], Nataša Đurišić Mladenović[1], Biljana Pajin[1], Jelena Živančev[1], Zita Šereš[1]

[1]Faculty of Technology Novi Sad, University of Novi Sad, Bul. Cara Lazara 1, 21000 Novi Sad, Serbia

[2]„Europa“ Student Centre-Student Dormitory – bachelor's student, Faculty of Technology Novi Sad, University of Novi Sad, 21000 Novi Sad, Serbia

e-mail: noemikiss887@gmail.com

ABSTRACT

Persistency and excessive use of pesticides in the agricultural domain has raised an issue on the potential harmful effects of pesticides on the environment, including water sources. Due to the negative impact of pesticides on aquatic environment, their efficient removal from water is required. The aim of this study was to determine efficiency of a nanofiltration membrane in the removal of two insecticides (carbofuran and acetamiprid) and one fungicide (propiconazole). METCell dead end filtration unit was used in nanofiltration experiments, while a nitrogen gas cylinder was used for obtaining a 7 bar pressure. Commercially available polyamide membrane with molecular weight cut off (MWCO) 200 Da was used for the removal of selected pesticides. Molecular weights (MW) of propiconazole, acetamiprid and carbofuran are 342.22 Da, 222.67 Da and 221.25 Da, respectively. Amount of propiconazole in the permeate was below the limit of detection and, therefore, had the highest apparent rejection (100%). However, the rejections of acetamiprid and carbofuran were 81.19% and 94.90%, respectively. Lower rejections of acetamiprid and carbofuran compared to propiconazole could be due to the lower MW. Additional molecular descriptors could cause the differences in rejections of acetamiprid and carbofuran, since the differences in MW are not significant.

Keywords: Nanofiltration, pesticides, water treatment

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REMOVAL OF CARBAMAZEPINE FROM WATER BY POLYAMIDE NANOFILTRATION MEMBRANES IN A CROSS-FLOW SYSTEM

Jelena Šurlan[1], Zita Šereš[1], Nikola Maravić[1], Nataša Đurišić-Mladenović[1], Igor Antić[1], Carla Brazinha[2], João G. Crespo[2]

[1]Faculty of Technology Novi Sad, University of Novi Sad, Bul. cara Lazara 1, 21000 Novi Sad, Serbia
[2]LAQV-REQUIMTE, Department of Chemistry, NOVA School of Science and Technology, FCT NOVA, Universidade NOVA de Lisboa, Caparica 2829-516, Portugal
e-mail: jelena.surlan@uns.ac.rs

ABSTRACT

Presence of pharmaceuticals in various water sources is often reported, due to their partial removal by conventional water treatments, as well as their persistency in the environment. Carbamazepine (CBZ) is an antiepileptic drug that is frequently detected in wastewater. The aim of this study is to determine efficiencies of three commercially available polyamide membranes with different molecular weight cut offs (MWCO) in the removal of carbamazepine. Molecular weight (MW) of carbamazepine is 236.27 Da, while the MWCO of the selected membranes is 200 Da, 150-300 Da and 400 Da, according to the manufacturers. Nanofiltration experiments were conducted in METcell® cross-flow filtration unit (EVONIK, Germany), while high pressure nitrogen gas cylinder was used for obtaining the pressure in the unit. Rejections were calculated based on the amount detected in the permeate and retentate. Rejections of carbamazepine were 95.79%, 52.72% and 76.62% for membranes with MWCO 200 Da, 150-300 Da and 400 Da, respectively. The highest rejection of carbamazepine was observed for the membrane with the lowest MWCO (200 Da). Membranes with MWCO higher then MW of carbamazepine had significantly lower rejections, however, rejection with the membrane with MWCO 400 Da was higher compared to the membrane with MWCO 150-300 Da.

Keywords: nanofiltration, carbamazepine, pharmaceuticals, water treatment

Acknowledgements: Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or EU executive agency. Neither the European Union nor the granting authority can be held responsible for them. This study is conducted under the project TwiNSol-CECs that has received funding from Horizon Europe programme under grant agreement no.101059867.

DETECTABLE POTASSIUM REDUCTION IN VARIOUS WASTEWATER TREATMENT SYSTEMS

László Tutor[1], András Béres[2], András Barczi[3], Márk Kálmán Horváth[4], Gábor Géczi[4]

[1]Doctoral School of Environmental Science, Szent István Campus, Hungarian University of Agriculture and Life Science, H-2100 Gödöllő, Hungary
[2]University Laboratory Center, Szent István Campus, Hungarian University of Agriculture and Life Science, H-2100 Gödöllő, Hungary
[3]Department of Agricultural Economics and Policy, Institute of Agricultural and Food Economics, Szent István Campus, Hungarian University of Agriculture and Life Science, H-2100 Gödöllő, Hungary
[4]Department of Environmental Analysis and Technologies, Institute of Environmental Sciences, Szent István Campus, Hungarian University of Agriculture and Life Science, H-2100 Gödöllő, Hungary
e-mail: ifjtutor@gmail.com

ABSTRACT

Partially or semi-treated wastewater could be an alternative for continuous water and nutrient source for hydroculture-based plant production. To achieve proper yields, determining the macronutrient contents of the wastewater, such as Nitrogen (N), Phosphorus (P), and Potassium (K), is required. As regular N and P measurements are regular on a daily basis, in this study multiple sources for Potassium (K) content were tested only, determining the exact concentration, the daily concentration pattern, and separately monitored influent and effluent Potassium (K) levels.

Potassium (K) content was quantified by flame photometry. Results of this study demonstrates that vegetation coverage does not significantly change Potassium (K) consumption in Water Reclamation outside the vegetation period. The concentration of potassium (K) is decreasing during the wastewater treatment process and the number of biological steps is correlating with the consumption increase. The potassium (K) is presumably consumed by the organisms responsible for the treatment and is discharged with the excess sludge, as it cannot leave in either gaseous or dissolved form.

Adequate measurement of potassium (K) consumption in various biological processes and technological configurations is essential to understand the background of these occurrences.

Keywords: Potassium (K) content, wastewater treatments, hydroculture

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THE EFFECT OF PERSULFATE IONS ON THE HETEROGENEOUS PHOTOCATALYTIC EFFICIENCY OF ZINC OXIDE

Bence Veres, Benjámin Vas, Tünde Alapi

Department of Molecular and Analytical Chemistry, University of Szeged, Dóm tér 7, H-6720 Szeged, Hungary
e-mail: veres0629@gmail.com

ABSTRACT

The effective removal of non-biodegradable and biologically active trace pollutants is an urgent problem in water treatment. Application of advanced oxidation processes (AOP) offers a solution. One of the AOPs is heterogeneous photocatalysis, which is based on the excitation of a semiconductor. On the surface of the excited photocatalyst, the reactions of photogenerated charge carriers (holes (h+vb) and electrons (e-cb)) with adsorbed substances result in the formation of radicals that can initiate the transformation of organic materials. However, the combination of heterogeneous photocatalysis with oxidizing agents, such as persulfate ions (peroxymonosulfate (HSO_5^-, PMS) and peroxydisulfate ($S_2O_4^{2-}$, PDS)), can enhance the efficiency due to the formation of $SO_4^{\bullet-}$. The effect of PMS and PDS (i.e. ZnO/PMS, and ZnO/PDS processes) were investigated in the case of ZnO photocatalyst to remove organic substances from water. The suspensions were irradiated with LED light sources emitting 367 or 398 nm photons. To investigate the contribution of various radicals to the transformation, various substances, i.e. trimethoprim antibiotic (TRIM), hydroquinone (HQ), and nitrobenzene (NB) were selected as target substances.

In the first stage, the effect of ZnO, PMS/PDS dose, and photon flux were studied and optimized. PMS and PDS significantly increased the photocatalytic efficiency of ZnO, even in O_2-free suspensions, because of the excellent electron acceptor properties of PDS and PMS. The addition of various radical scavengers proved that $SO_4^{\bullet-}$ had a dominant role in the transformations, besides, the contribution of •OH and $^1O_2$ was also significant. The relative contribution of these reactive species depended on the organic target substance.

The biologically treated communal wastewater (BTWW) drastically decreased the photocatalytic efficiency. Organic and inorganic components can influence the surface properties of a photocatalyst and the processes taking place there. The competition between the organic substances and inorganic ions for adsorption sites and the photogenerated charge carriers is responsible for decreasing the efficiency. Moreover, matrix components, even inorganic ions, react with •OH and $SO_4^{\bullet-}$ and change the radical set. The individual effect of Cl^- and HCO_3^- was also examined and proved that mainly HCO_3^- was responsible for the lower efficiency because of the hindered transformation of PDS on the ZnO surface.

Keywords: zinc oxide, heterogeneous photocatalysis, persulfate

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MAXIMIZATION OF TIO_2 CONTENT OF PVDF MEMBRANES PRODUCED BY BLENDING AND BLENDING/SPRAY-COATING METHODS

Gábor Veréb[1], Kata Fejes[1], Ákos Ferenc Fazekas[1], Szabolcs Kertész[1], Sándor Beszédes[1], Zoltán Jákói[1], Gábor Kovács[3], Zsolt Pap[3], Tamás Gyulavári[3], Klára Hernádi[3,4], Cecilia Hodúr[1], Zsuzsanna László[1]

[1]Department of Biosystems Engineering, Faculty of Engineering, University of Szeged, Moszkvai Blvd. 9, HU-6725 Szeged, Hungary
[2]Department of Horticulture, Faculty of Technical and Human Sciences, Sapientia Hungarian University of Transylvania, 400112 Cluj-Napoca, Romania
[3]Department of Applied and Environmental Chemistry, Institute of Chemistry, University of Szeged, Rerrich Béla sqr. 1, H-6720 Szeged, Hungary
[4]Institute of Physical Metallurgy, Metal Forming and Nanotechnology, University of Miskolc, Miskolc-Egyetemváros, C/1 108, HU-3515 Miskolc, Hungary
e-mail: verebg@mk.u-szeged.hu

ABSTRACT

The most conventional techniques for the treatment of oily wastewaters are skimming, flotation and sand filtration, but for the efficient elimination of dissolved and emulsified oil advanced methods must be used, such as membrane filtration, but it is necessary to develop the membranes to minimize their fouling caused by the hydrophobic contaminants.

In the present study, PVDF membranes were modified with hydrophilic TiO_2 nanoparticles by using blending and blending/spray-coating methods. In the latter case, different TiO_2 suspensions (produced with either water, ethanol, or acetone) were sprayed onto the surface immediately after membrane casting, but before the phase inversion to increase the amount of the nanoparticles on the surfaces. The membranes were used to filter crude oil emulsions (c=100 mg/L; V = 250 mL).

A maximum of 32-41 m/m% TiO_2 could be immobilized with the blending method, by using 82-84% NMP solvent. Higher TiO_2 content results in an inhomogeneous suspension, leading to the formation of holes, which cannot be compensated by higher NMP (solvent) concentration (as it reduced the membrane stability). The modification of the PVDF membrane with simple blending method was also advantageous in terms of the flux (and the flux recovery), but the used blending/spray-coating modification was more beneficial.

Keywords: membrane filtration, oil emulsion, TiO_2, blending, spray-coating

Acknowledgements: 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).

RECENT APPLICATION OF XANTHAN IN REMOVAL OF WATER CONTAMINANTS

Ida Zahović, Jelena Dodić, Zorana Trivunović

Department of Biotechnology, Faculty of Technology Novi Sad, University of Novi Sad, Bulevar cara Lazara 1, 21000 Novi Sad, Serbia
e-mail: ida.zahovic@uns.ac.rs

ABSTRACT

The global production of polymers has been constantly increasing, from 2 million tons in 1950 to 400.3 million metric tons in 2022. Up to 40% of conventional petroleum-based polymers end up in landfills, leading to serious ecological problems. Owing to the negative environmental impact of petroleum-based polymers, biopolymers, which have a lower or no negative effect on the environment, have been intensively explored. Xanthan represents a nontoxic, biocompatible, and biodegradable biopolymer of microbial origin. It is generally produced by aerobic submerged batch cultivation of the bacterium *Xanthomonas campestris* ATCC 13951 on the medium containing glucose or sucrose under optimal conditions and findings of researchers worldwide indicate that xanthan can be successfully biosynthesized on media containing different waste streams, using various *Xanthomonas* strains. The most common application of xanthan is in the food industry as a stabilizer, thickener, and emulsifier because of its high viscosity at lower concentrations and excellent solubility in hot and cold water. The application of xanthan is not only limited to the food and other branches of industry, but also to medicine, biomedical engineering, agriculture, and wastewater treatment. Recent studies have confirmed the excellent photocatalytic activity and emulsifying capacity of xanthan biosynthesized on waste-based media, which offers promising potential for its application in the decontamination of environment. The purpose of this study was to discuss data from available scientific and professional literature regarding the novel perspectives and application of xanthan in the removal of emerging water contaminants.

Keywords: biopolymer, xanthan, environmental application, water contaminants removal

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UTILIZATION OF BIODIESEL INDUSTRY EFFLUENT FOR XANTHAN PRODUCTION IN LAB-SCALE BIOREACTOR

Ida Zahović, Jelena Dodić, Damjan Vučurović, Bojana Bajić, Siniša Dodić, Zorana Trivunović

Department of Biotechnology, Faculty of Technology Novi Sad, University of Novi Sad, Bulevar cara Lazara 1, 21000 Novi Sad, Serbia
e-mail: ida.zahovic@uns.ac.rs

ABSTRACT

Xanthan represents microbial polysaccharide with excellent rheological properties, non-toxic nature, biodegradability, and biocompatibility. This biopolymer is widely used in food, biomedical, pharmaceutical, petrochemical, chemical and textile industry. Xanthan production process is generally conducted by aerobic submerged cultivation of *Xanthomonas campestris* strains on the media with glucose or sucrose under optimal conditions. Previous research has confirmed that xanthan also can be successfully biosynthesized on media containing crude glycerol from biodiesel industry by different *Xanthomonas* species, exhibiting promising photocatalytic activity and emulsifying properties. The aim of this study was to examine the course of xanthan biosynthesis by the reference strain *X. campestris* ATCC 13951 in laboratory-scale bioreactor on medium containing crude glycerol from biodiesel production. The bioprocess was monitored by the analysis of cultivation medium samples in predetermined time intervals, and its success was estimated based on the xanthan concentration in the medium, separated biopolymer average molecular weight and degree of nutrients conversion. At the end of bioprocess, cultivation medium contained 12.34 g/L of xanthan with the average molecular weight of $3.04 \cdot 10^5$ g/mol. Within this study, the achieved degree of glycerol, total nitrogen and total phosphorous conversion were 69.40%, 53.27% and 38.96%, respectively.

Keywords: xanthan, laboratory bioreactor, biodiesel industry effluent, crude glycerol

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TBIOMECHANICAL ANALYSIS AND MODELING OF DIFFERENT TRACTION PATTERNS IN ADOLESCENT IDIOPATHIC SCOLIOSIS SUBJECTS

Qiaolin Zhang

Doctoral School on Safety and Security Science, Óbuda University, Bécsi út 96/b, H-1034 Budapest, Hungary
e-mail: zhangqiaolin123@gmail.com

ABSTRACT

Objective: Traction is a valuable treatment for Adolescent idiopathic scoliosis; however, assessing its biomechanical effects, particularly with new methods, presents challenges. This study aims to explore the biomechanics using finite element analysis, with the goal of enhancing safety and effectiveness.

Methods: Based on CT images, two different boundary and loads were applied to simulate two traction methods. The effects of these two traction methods on stress and deformation of lumbar vertebral bodies and intervertebral discs were compared.

Results: Under two traction methods, the stress was concentrated on the posterior side. Multi-point traction resulted in higher stress and deformation, and concentrated stress on the convex side as well. However, there is some stress concentration on the vertebral arch, which may lead to injury.

Conclusion: Compared to longitudinal traction, multi-point traction can better reduce stress on the vertebral bodies and intervertebral discs, focusing the pulling force on the concave side and achieving greater deformation. Multi-point traction might better suit specific patients needing more correction and pressure relief compared to longitudinal traction.

Keywords: Finite element, Adolescent idiopathic scoliosis, Lumbar stress, Traction methods, Multi-point traction

Session 2.

Economics, Marketing, Management and Logistics

THE ROLE OF STATISTICS IN SUPPLY CHAIN MANAGEMENT

Edmira Cakrani

Canadian Institute of Technology, Rruga Xhanfize Keko Nr. 12, Tirana, Albania
e-mail: edmira.cakrani@cit.edu.al

ABSTRACT

Supply Chain consists of a logistics system, which accompanies the production of products or services, from the provision of raw materials to the sale of the final product to consumers. Efficiency in supply chain management is of primary importance for organizations. Statistics is considered a necessary tool for achieving efficiency. It plays a key role in forecasting the demand, which leads to the reduction of inventory costs, efficient allocation of resources, disruptions avoidance, etc. The production process can be optimized through techniques such as Six Sigma. Likewise, statistical tests help quantify risk, while methods such as Monte Carlo simulation serve for its management. Statistics also contribute to distribution and logistics, providing insights from historical data. This leads to a reduction in transportation costs and faster distribution of products.

Keywords: Demand Forecasting, Risk Management, Production Optimization

RISK-TAKING FACTORS IN A DYNAMIC APPROACH

László Csorba

Department of Business Administration, Eszterházy Károly Catholic University, H-3300 Eger, Hungary
e-mail: csorba.laszlo@uni-eszterhazy.hu

ABSTRACT

Technological developments only emphasize the importance of Statistics for Supply Chain management. In each of its many processes, a very large amount of information is generated, the statistical analysis of which enables managers to make the best decisions for their organizations.

Keywords: Risk, risk taking, dynamic model, capability gap

WASTE MANAGEMENT PROBLEMS IN LAOS

József Gál[1], Duanhvilay Khonesavahn[2]

[1]Department of Engineering Management and Economics, Faculty of Engineering, University of Szeged, Mars tér 7, H-6724 Szeged, Hungary
[2]Faculty of Agriculture, University of Szeged, Andrássy út 15, H-6800 Hódmezővásárhely, Hungary
e-mail: galj@mk.u-szeged.hu

ABSTRACT

This logistics case review delves into Laos' various waste management problems highlighting different aspects of garbage collection and handling from an operational standpoint. However, this study involves an integrated approach taking into consideration both peer reviewed journal articles and results of primary research, as well as practical suggestions that are highly relevant to the country's social-economic context as well as environmental conditions. The findings of this research improve comprehension of the main threats facing Laos and suggest environmentally friendly approaches for mitigation of adverse consequences of inadequate waste management.

Keywords: Waste management, Logistics, Laos, Primary research, Sustainable solutions

ECONOMIC PERSPECTIVES OF ALPACA FARMING IN HUNGARY

Helga Kovács, Bernadett Edit Rotics, Krisztina Gémes-Matusek, Ágnes Süli

Faculty of Agriculture, University of Szeged, Andrássy út 15, H-6800 Hódmezővásárhely, Hungary
e-mail: kovacs.helga.02@szte.hu

ABSTRACT

The aim of the research is to investigate the situation of alpaca breeding in Hungary, the sales of alpaca wool and other attributes that ensure profitability. The alpaca farming and market situation was assessed by means of structured interviews completed by 15 alpaca breeders and farmers. A SWOT analysis was used to examine alpaca farming. One of the major strengths of alpaca farming is its ability to strengthen several economic sectors simultaneously through its multiple uses. The primary agricultural sector includes wool production and the sale of nutrient-rich manure. Wool production supports the textile and clothing division of the industrial, secondary, light industry sector. The impact of alpaca farming on the tertiary sector is also significant in terms of tourism, as it increases the tourist attractiveness of certain rural communities and areas due to its curiosity, thus providing employment opportunities for local residents and increasing the turnover of other tourist services.

Keywords: alpaca, wool, rural development, SWOT analysis, agriculture

ANALYSIS OF THE MARKETING AND SALES STRATEGY OF A SMALL HUNGARIAN PROSTHESIS MANUFACTURING COMPANY

Edina Lendvai, Marcell Kocsis

Department of Engineering Management and Economics, Faculty of Engineering, University of Szeged, Mars tér 7, H-6724 Szeged, Hungary
e-mail: lendvai@mk.u-szeged.hu

ABSTRACT

In our work, we studied the history of the development of prosthetics, the state of hip prosthesis surgeries in Hungary and Europe, but primarily the market position of a long-established domestic medical device manufacturing company. We analyzed the marketing and sales strategy through our own experiences and structured interviews, and ultimately attempt to objectively assess the current situation in the domestic market. We examined the advantages and disadvantages compared to mostly foreign multinational competitors and find out how a domestic small business can compete and survive against well-capitalized foreign competition.

Keywords: analysing, prosthesis, interview, small and medium-sized enterprises

CURRENT ISSUES OF THE APPLICABILITY OF ARTIFICIAL INTELLIGENCE IN RELATION WITH THE WORK OF SUPREME AUDIT INSTITUTIONS

Sándor Nagy

Department of Engineering Management and Economics, Faculty of Engineering, University of Szeged, Mars tér 7, H-6724 Szeged, Hungary
e-mail: nagys@mk.u-szeged.hu

ABSTRACT

The growing popularity of artificial intelligence raises the question of how this new technology can be used in the field of public auditing and during the operation of Supreme Audit Institutions (SAIs). The research summarizes and synthesizes the literature aspects, and points out possible areas of applicability, advantages, and their limitations. However, the use of artificial intelligence in this way is not only a technical and professional issue, but also affects areas of legitimacy and ethics. My aim is to present the potential areas of integration and reveal the most relevant challenges related.

Keywords: supreme audit institutions, artificial intelligence, public auditing

HE IMPORTANCE OF HONEY IN A HEALTHY NUTRITION

Ágota Panyor

Department of Engineering Management and Economics, Faculty of Engineering, University of Szeged, Mars tér 7, H-6724 Szeged, Hungary
e-mail: panyor@mk-u-szeged.hu

ABSTRACT

The beekeeping sector is an integral part of agriculture. Beekeeping plays an important role not only is terms of beekeeping benefits, but also in the maintenance and pollination. The honey produts have beneficial effects on the digestive system, the respiratory system and the circulatory system.

Driving forces of honey consumption are mainly the price, type, quality and appearance. The special quality of honey products has a unique effect on consumption habits.

Keywords: beekeeping sector, healthy diet, other beekeeping products, beneficial effects on the body

INVESTIGATING THE MEANING OF THE CONCEPT OF "CLEAN LABEL" AND EVALUATING ITS CONTENT THROUGH A CONSUMER SURVEY

Csilla Samu, Krisztián Kis

Department of Engineering Management and Economics, Faculty of Engineering, University of Szeged, Mars tér 7, H-6724 Szeged, Hungary
e-mail: kisk@mk.u-szeged.hu

ABSTRACT

One of the recent trends in the food industry today is the "clean label" trend, which generally refers to products that have a short ingredient list, are made from natural ingredients and do not contain synthetic substances or preservatives. In a broader sense, it can also be associated with concepts such as sustainably sourced raw materials, environmentally friendly production technology or degradable packaging materials. Customer demands are constantly changing, and food businesses need to keep pace with them to maintain their market advantage, remain competitive and profitable by increasing customer satisfaction. One way to do this is for food companies to produce products that fit into the "clean label" trend. Therefore, the objective of this research is to explore the concept of the clean label trend and to clarify the context in which it is associated, and in this context to find out the perceptions of customers on the customer values that are at the heart of the clean label concept. The results of the online survey show that the majority of respondents have not heard of the "clean label" trend. However, after being introduced to the concept, more than 90% of the respondents felt sympathetic to the concept. However, the importance of value for money should not be overlooked, as the survey also revealed that one of the most influential factors in food purchases is the price of the product. The results have been used to formulate recommendations that can be valuable for food businesses seeking to achieve sustained success. Our key recommendations are: transparency, functionality, environmental protection, simplicity, additive and preservative-free, naturalness and packaging.

Keywords: clean label, food, customer value, value proposition, consumer perception

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THE RELATIONSHIP BETWEEN SUPPLEMENTATION AND SPORT

Gréta Újvári[1], Brigitta Zsótér[2], Zoltán Veres[3]

[1]Doctoral School of Management Sciences and Business Administration, University of Pannonia, H-8200 Veszprém, Hungary
[2]Department of Engineering Management and Economics, Faculty of Engineering, University of Szeged, Mars tér 7, H-6724 Szeged, Hungary
[3]Department of Marketing, University of Pannonia, H-8200 Veszprém, Hungary
e-mail: ujvarigreti@gmail.com

ABSTRACT

Nowadays, the fitness industry has become a growing industry alongside the nutritional supplements industry within the food industry. We cannot ignore the fact that supplementation has become a truly growing market. Small and large companies are fighting for consumers. They offer products tailored to different training goals, whether sold online or offline. Companies are developing their marketing strategies by observing consumer preferences and habits. But do we need supplementation? Are the products on the market safe? What do we even mean by a food supplement? Is it a good idea to buy supplements that are in line with the latest trends? One thing is for sure, the big supplement manufacturers are profiting handsomely thanks to the increasing purchases. In this study we will show whether or not supplementation is really necessary for athletes and what determines whether it is.

Keywords: educational guide, sport nutrition, food supplement, consumption, performance enhancement, fitness industry, nutrition market

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REVERSE OSMOSIS FILTRATION OF HAWTHORN FRUIT EXTRACT (*CRATAEGUS MONOGYNA* JACQ.): OPTIMIZATION FOR BIOACTIVE COMPOUND CONCENTRATES, PERMEATE FLUX AND FOULING INDEX BY RESPONSE SURFACE METHODOLOGY

Areej Alsobh, Gyula Vatai, Szilvia Bánvölgyi

Department of Food Process Engineering, Institute of Food Science and Technology, Hungarian University of Agriculture and Life Sciences, H-1118 Budapest, Hungary
e-mail: areejalsobh@gmail.com

ABSTRACT

Reverse osmosis depends on several parameters, including the osmotic agent type, the membrane pore size, the concentration, the flow rate, the feed and osmotic agent temperature, and the applied pressure, which affect the permeate flux and the concentration of total soluble solids. In this study, the response surface methodology (RSM) was applied to evaluate the effects of reverse osmosis filtration parameters and optimize various conditions for different responses. Central composite design (CCD) was studied using two numeric factors (temperature 25-45 °C and TMP 20-40 bar) on three levels. The results showed that the highest amount of recovered TPC, TFC, and their Antioxidant activity by FRAP, DPPH, and ATBS are (1057.65±32.57 mg GAE/g_{dw}), (176.89±3.97 mg QUE/g_{dw}), (575.67±22.58 mg AAE/g_{dw}), (187.76%), and (667.98%) respectively, as well as the highest permeate flux (6.64±0.52 L/m^2·h) were found at (T= 35°C and TMP= 40 bar), while the lowest fouling index (27.71%) was found at (T= 45°C and TMP= 40 bar). Meanwhile, the calculated amounts of the respective values via the RSM model were TPC:1073.69 mg GAE/g_{dw}, TFC: 176.89 mg QUE/g_{dw}, FRAP:589.97 mg AAE/g_{dw}, DPPH:187.05%, ATBS:655.46%, permeate flux: 6.28 L/(m^2·h), fouling index: 29.77%.

Keywords: Reverse Osmosis, Response Surface Methodology (RSM), Central Composite Design (CCD), Permeate Flux, Fouling Index

Acknowledgements: This investigation has been carried out at "the Hungarian University of Agriculture and Life Sciences, and supported by The Tempus Public Foundation under the Stipendium Hungaricum Scholarship Program".

SEARCHING FOR PROBIOTICS IN TRADITIONAL MONGOLIAN FERMENTED MILK PRODUCT

Nominzul Altankhuyag, Réka Dobozi, Judit Krisch

Department of Food Engineering, Faculty of Engineering, University of Szeged, Moszkvai krt. 5-7, H-6725 Szeged, Hungary
e-mail: krisch@mk.u-szeged.hu

ABSTRACT

Food preservation through fermentation is an old process that, in addition to prolonging the shelf life of the fermented food, has historically provided a significant supply of nutrients and health-promoting ingredients in the human diet. Several indigenous fermented beverages have been used in Mongolia since ancient times and are still used for ceremonial purposes. The production of these beverages consists of milk and milk products produced by livestock animals, which are used as a substrate by microorganisms during spontaneous fermentation. Airag is one of Mongolia's traditional fermented milk products, which is made by fermenting horse (mare) milk. However, a literature review revealed a lack of research on probiotics in this product.Our aim was the identification and characterization of the potentially probiotic lactic acid bacteria (LAB) from two different types of Mongolian traditional fermented horse milk (Airag) from two different sellers in Tuv and Bulgan provinces. We isolated 27 different types of bacterial colony samples from airag. Identification was made by using culture and PCR-sequencing techniques and probiotic characteristics were investigated by gastrointestinal survival tests and biofilm formation capacity.

Keywords: Probiotics, Mongolian traditional fermented horse milk (Airag), Lactic Acid Bacteria (LAB), Probiotic potentials

NUMERICAL SIMULATION OF YOGURT VISCOSITY DURING FERMENTATION

Thong Le Ba, Tímea Kaszab, László Baranyai

Institute of Food Science and Technology, Hungarian University of Agriculture and Life Sciences, H-1118 Budapest, Hungary
e-mail: kenty9x@gmail.com

ABSTRACT

In this study, a numerical simulation approach is presented to model the viscosity of yogurt during fermentation, using MATLAB and its ODE45 solver. Fermentation is an important process that affects the rheological properties of yogurt, in which lactic acid bacteria plays a key role in changing the physical structure from liquid milk to a thick and viscous product. The simulation is based on a set of differential equations that describe the kinetics of bacterial growth, lactose fermentation, and acid production, which collectively affect yogurt viscosity. Using the ODE45 solver, a powerful tool for solving ordinary differential equations, the aim was to accurately predict the viscosity change in time during fermentation. This simulation provides valuable insights for optimizing fermentation parameters and achieve the desired yogurt texture and consistency. Additionally, results can contribute to the improvement of dairy product quality and production efficiency.

Keywords: Yogurt, viscosity, numerical

INVESTIGATION OF LOW TEMPERATURE HEAT TREATMENT (SOUS VIDE) OF WHITE BUTTON MUSHROOM (*AGARICUS BISPORUS*)

Judit Bajzát[1,2], Amanda Sándorné Szőke[3], András Misz[1,2], Dániel Kökény[1], Marianna Visnyei[3], József Rácz[3], Máté Vágvölgyi[4], Csaba Csutorás[1,5], Csaba Vágvölgyi[2]

[1]Új Champignons Ltd., Bartók B. str. 162, H-1224 Budapest, Hungary
[2]Department of Microbiology, Faculty of Science and Informatics, University of Szeged, Közép fasor 52, H-6726 Szeged, Hungary
[3]Magyar Gomba Kertész Ltd., 0173/7/A/1. Hrsz, H-3395 Demjén, Hungary
[4]Institute of Pharmacognosy, Faculty of Pharmacy, University of Szeged, Zrínyi u. 9, H-6720 Szeged, Hungary
[5]Institute of Chemistry and Physics, Eszterházy Károly Catholic University, Eszterházy Sqr. 1, H-3300 Eger, Hungary
e-mail: bajud98@gmail.com

ABSTRACT

Heat treatment of food at low temperature for extended durations is a well-established technology in food production. The essence of sous vide technology lies in the heat treatment of food within sealed, preferably vacuum-sealed, heat-resistant plastic bags at low temperatures over prolonged periods, sometimes ranging from 50 to 70 hours, significantly lower than traditional cooking temperatures. The sous vide method of preparing mushrooms is recognized for enhancing flavour and aroma profiles in ready meals. The effects of heat treatment on mushrooms have received limited attention in recent years. In our experiments, we investigated the impact of temperature and other conditions on the Maillard reaction products in both white button and exotic mushrooms. We examined alterations in protein, polysaccharide, and vitamin content, identifying primary products and bioactive components resulting from low-temperature transformations. During heat treatment, we observed the production of a concentrated aqueous extract, rich in aromas and bioactive components, in liquid form. Optimization of its quantity is achieved by modifying conditions. Additionally, we produced mushroom powders with elevated vitamin D content through UV irradiation of the high-protein solid material generated during the browning process.

Keywords: heat treatment, mushroom, technology

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CHEMICAL COMPOSITION AND ANTIOXIDANT ACTIVITY OF LAVANDER (*LAVANDULA ANGUSTIFOLIA*) ESSENTIAL OIL AND LIPOPHILIC EXTRACTS

Danica Božović[1], Sanja Milošević[1], Maja Živanović[1], Nemanja Teslić[2], Nevena Gladikostić[1], Zoran Zeković[1], Branimir Pavlić[1]

[1]Faculty of Technology, University of Novi Sad, Blvd. cara Lazara 1, 21000 Novi Sad, Serbia
[2]Institute of Food Technology, University of Novi Sad, Blvd. cara Lazara 1, 21000 Novi Sad, Serbia
e-mail: danica_bozovic@live.com

ABSTRACT

Lavender (*Lavandula angustifolia*) is a perennial herbaceous plant belonging to the *Lamiaceae* family and originates from the Mediterranean region. Lavender oil is well-known for its aromatic scent and is widely used in the cosmetic industry. In addition, it has anti-inflammatory, antimicrobial, and spasmolytic effects. The aim of this study was to determine the yield of lavender essential oil and obtained lipophilic extracts, antioxidant activity, and chemical composition. Lavender essential oil was isolated using hydrodistillation (HD) as a traditional method and microwave hydrodistillation (MWHD) as an innovative method of distillation. Unger's apparatus was used for both distillations, and the process lasted 2 hours. Soxhlet extraction (Sox) and supercritical fluid extraction (SFE) were used for isolating the lipophilic extracts. The chemical composition was determined using gas chromatography with mass spectrometry (GC-MS), while the antioxidant activity was tested in vitro by DPPH and ABTS assays. Physicochemical analyzes were used to determine the average diameter of particles and hygroscopic moisture of the examined plant species. Selected extraction and distillation techniques yield antioxidant-rich extracts and essential oils, which can be further used in the food, pharmaceutical and cosmetic industries.

Keywords: Hydrodistillation, microwave hydrodistillation, supercritical fluid extraction, Soxhlet extraction, antioxidant activity

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PRESENCE OF FOOD-BORNE AND TOXIGENIC MOLDS IN WHEAT AND CORN PRODUCTS

Sandra Bulut, Ružica Tomičić, Jelena Pejin, Milana Pribić, Jelena Živančev, Igor Antić, Sunčica Kocić-Tanackov

Faculty of Technology, University of Novi Sad, Bulevar cara Lazara 1, 21000 Novi Sad, Serbia
e-mail: suncicat@uns.ac.rs

ABSTRACT

In this work, the monitoring of molds in corn and wheat products from the market in Novi Sad, Serbia was examined. Different samples were analysed: white wheat flour, wheat semolina, and wheat, as well polenta and popcorn. The total number of molds was determined by the dilution method (white wheat flour, wheat semolina, and polenta) or by the direct plating method (popcorn, and wheat). The identification of molds was determined based on their macro- and micro-morphological characteristics using different keys for determination.

The lowest number of mould was observed in the wheat (1.09 CFU/g), while the highest number of molds was observed in polenta (230 CFU/g). Isolated mould genera from white wheat flour were: *Aspergillus*, *Cladopsorium*, *Moniliella*, and *Penicillium*. From wheat semolina were *Aspergillus* and *Eurotium*, while from wheat were: *Alternaria*, *Aspergillus*, *Fusarium*, *Penicillium*, and *Rhizopus*. In corn-based products isolated mould genera were from polenta: *Aspergillus*, *Acremonium*, *Eurotium*, *Fusarium*, *Penicillium*, and *Rhizopus*. While from popcorn were isolated *Aspergillus*, *Eurotium*, *Fusarium*, *Penicillium*, and *Rhizopus*. Potential aflatoxigenic mould *Aspergillus flavus* was isolated from all analaysed samples. Other potential toxigenic isolated molds were: *Aspergillus versicolor*, *Alternaria alternata*, *Fusarium equiseti*, *Fusarium sporotrichoides*, *Fusarium poae*, *Penicillium auratniogriseum*, and *Penicillium chrysogenum*.

Keywords: wheat, corn, molds, toxigenic molds

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DIELECTRIC MONITORING OF MICROWAVE EXTRACTION PROCESSES

Réka Dobozi[1], Zoltán Péter Jákói[2], Sándor Beszédes[2]

[1]Department of Food Engineering, Faculty of Engineering, University of Szeged, Moszkvai krt. 5-7, H-6725 Szeged, Hungary
[2]Department of Biosystems Engineering, Faculty of Engineering, University of Szeged, Moszkvai krt. 9, H-6725 Szeged, Hungary
e-mail: dobozireka@mk.u-szeged.hu

ABSTRACT

Our research investigated the dielectric traceability of microwave and ultrasound intensified extraction processes of plant by-products. For the experiments, we used plant by-products from beetroot, carrot and raspberry, which were extracted in 5% suspensions. The dielectric behaviour of the extracts was investigated in the frequency range 300-2400 MHz using an open-ended coaxial probe. For both the ultrasonic and microwave intensified procedures, the reported energy was 30, 45 and 60 kJ, respectively. Based on our research results, we found that the dielectric constant measured in the frequency range 700-900 MHz is closely related to the yield of total polyphenol and pectin regardless of the feedstock and treatment used, but the method has limitations due to the presence of components that affect the physical structure and the concentration of target components below the limit of detection.

Keywords: microwave, extraction, dielectric properties, dielectric measurements

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STATISTICAL INVESTIGATION OF THE CORRELATION BETWEEN THE INTAKE OF BISPHENOL A (BPA) FROM CARBONATED AND ENERGY DRINKS AND THE OCCURRENCE OF REPRODUCTIVE PROBLEMS IN 156 SUBJECTS

Namik Durmishi, Vlatko Tanevski, Nexhdet Shala, Gafur Xhabiri, Ismail Ferati, Xhezair Idrizi, Rejhana Luma

Faculty of Food Technology and Nutrition, University of Tetova, Str. Ilindenska bb., 1200 Tetovo, Republic of North Macedonia
e-mail: namik.durmishi@unite.edu.mk

ABSTRACT

Bisphenol A (BPA) is an organic substance that contains two phenolic functional groups and is widely used in the production of plastics. The main objective of this statistical study is to determine the correlation between the intake of BPA from carbonated and energy drinks and the occurrence of reproductive problems in the subjects who were included in this study. The study was conducted by the Faculty of Food, Technology, and Nutrition at the University of Tetovo and VT Diet Club - Bitola in the period from 01.05.2023 to 24.05.2023 through an online survey. The research was conducted on a representative sample of 156 respondents (147 women and 9 men) aged 15 to 69 years. X^2-test and relative numbers are used as statistical methods of work. Since the obtained result (X^2=0.68) is lower than the tabular value (X^2=3.841), we conclude that there is no association or connection between the intake of BPA through carbonated and energy drinks, and the occurrence of reproductive problems among the respondents (p> 0.05), that is, the working hypothesis is rejected and the ull hypothesis is accepted.

Keywords: BPA, drinks, fertility, plastic, reproductivity, problems

DEVELOPMENT OF SPREADABLE MEAT PRODUCT MADE FROM MANGALICA LIVER

Bálint Erdei, Tamás Kulcsár, József Mihalkó

Department of Food Engineering, Faculty of Engineering, University of Szeged, Moszkvai krt. 5-7, H-6725 Szeged, Hungary
e-mail: mihalko@mk.u-szeged.hu

ABSTRACT

Liver can serve as the basis of tasty treats in Hungarian cuisine. Its special taste is determined by the function of the organ, while its texture is determined by the blood content. Although these products are not so saleable due to the distinctive taste of the liver. The industry tried to eliminate this by developing different liver meat products, which are made using a small part of liver and a large part of meat.

During our research work, we attempted to develop a spreadable meat product made from mangalica liver. We tried to compare the new liver product we also made from additional raw materials - pork and beef liver - using a wide variety of instrumental and traditional methods - instrumental stock measurement and determination of stock characteristics, pH measurement, water activity measurement, determination of cooking loss, instrumental colour measurement. The samples were also included in a sensory assessment conducted with the participation of 20 people, so the opinions of the participants were considered when formulating the differences and similarities found between the individual samples. Using an online questionnaire, we tried to get an idea of the typical habits of domestic consumers for consumption and purchase of the product.

Keywords: liver, spreadable meat product, Mangalica, beef, pork

THE EXAMINATION OF APPLE SHELF LIFE FROM CONSUMER STORAGE PERSPECTIVE

Anna Farkas, Antal Veres, Péter Korzenszky

Department of Agricultural and Food Machinery, Institute of Technology, Hungarian University of Agriculture and Life Sciences, Páter Károly 1, H-2100 Gödöllő, Hungary
e-mail: farkasanna41@gmail.com

ABSTRACT

The storage and preservation of apples are essential for consumer satisfaction and the efficiency of the food industry. The aim of this research is to comprehensively examine how different storage conditions affect the physical and chemical properties of apples, as well as their shelf life, with particular attention to the differences between store and home storage.

In the experimental part of the research, Golden Delicious apples, commonly available in commercial markets, are stored in a refrigerated warehouse, simulating consumer behavior, at two different temperatures (5 °C and 10 °C). The planned duration of the study is 10 weeks, with weekly sampling. The parameters under investigation include physical properties such as mass, size, color, flesh firmness, as well as chemical properties such as sugar and acid content. During data collection and analysis, statistical methods will be used to identify relationships and correlations between different parameters to help consumers effectively preserve and evaluate the quality of apples.

The home storage of apples plays an important role in the economic cycle, as it contributes to reducing food waste and promoting more sustainable food consumption. If consumers can effectively store apples at home, less fruit will be wasted, thus reducing the amount of food waste.

Keywords: Golden Delicious apples, consumer storage, physical properties, shelf life

Acknowledgements: The research was supported by the project 'The feasibility of the circular economy during national defense activities' of 2021 Thematic Excellence Program of the National Research, Development and Innovation Office under grant no.: TKP2021-NVA-22, led by the Centre for Circular Economy Analysis.

CASCADE MEMBRANE SYSTEM FOR SELECTIVE SEPARATION OF FUNCTIONAL COMPOUNDS FROM DAIRY BY-PRODUCTS

Adrienn Fejős[1], Zsuzsanna László[1], Gábor Veréb[1], József Csanádi[2], Sándor Beszédes[1], Edina Lendvai[3], Anikó Birkásné Nagypál[1], Dorottya Csenki[1], Imre Ábrahám[4], Nóra Garabné Ábrahám[4], Andrea Süveges-Gruber[4], Cecilia Hodúr[1], Szabolcs Kertész[1]

[1]Department of Biosystems Engineering, Faculty of Engineering, University of Szeged, Moszkvai krt. 9, H-6725 Szeged, Hungary
[2]Department of Food Engineering, Faculty of Engineering, University of Szeged, Moszkvai krt. 5-7, H-6725 Szeged, Hungary
[3]Department of Engineering Management and Economics, Faculty of Engineering, University of Szeged, Mars tér 7, H-6724 Szeged, Hungary
[4]Unichem Chemical, Manufacturing and Trading Ltd., Kistelek H-6760, Hungary
e-mail: kertesz@mk.u-szeged.hu

ABSTRACT

The utilization of low-pressure membrane separation processes, such as microfiltration (MF) and ultrafiltration (UF) can be very effective in the selective separation of valuable components from various dairy by-products such as whey or buttermilk. Whey, abundant in lactose and soluble proteins like β-lactoglobulin, α-lactalbumin, and immunoglobulins, poses risks for individuals with milk protein allergies. Our scope is to selectively separate compounds in addition to lactose in order to obtain an immunoglobulin (Ig)-rich, casein- and β-lactoglobulin-free concentrate with minimal lactose content.

In our study, we employ a cascade membrane system comprising several sequential steps, including: Milk fat separation step with 0.1/0.2/0.5 µm pore sizes MF membranes. Protein-selective UF with 100-150 kDa cut-off membranes. Protein concentration with 10 kDa UF.

Our further plan is to cooperate with the industrial partner to test special cleaning agents with multiple compositions for cleaning fouled membranes, manufactured by them in compliance with the strict rules of green chemistry principles. Our goal is that maximize the membranes can be used in as many cycles as possible, so adhering to the principles of circular economy.

Keywords: Cascade MF/UF Membrane System, Selective Separation, Functional Compounds, Whey, Soluble Proteins

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SOIL MICROBIOTA'S IMPACT ON MAIZE GRAIN NUTRITION

Njomza Gashi[1,3], Péter Fauszt[1], Péter Dávid[1], Zsombor Szőke[1], Judit Remenyik[1], László Stündl[2], Melinda Paholcsek[1]

[1]Center for Complex Systems and Microbiome Innovations, Faculty of Agricultural and Food Sciences and Environmental Management, University of Debrecen, H-4032 Debrecen, Hungary
[2]Institute of Food Technology, Faculty of Agricultural and Food Sciences and Environmental Management, University of Debrecen, H-4032 Debrecen, Hungary
[3]Department of Food Technology with Biotechnology, Faculty of Agriculture and Veterinary, University of Prishtina "Hasan Prishtina", 10000 Pristina, Kosovo
e-mail: njomza.gashi@agr.unideb.hu

ABSTRACT

Enhancing the nutritional quality of crops stands as a critical endeavor for farmers globally, resonating with the imperative of providing nutritious food for growing populations. While traditional agricultural techniques such as tillage systems and fertilization strategies have long been employed to bolster plant health and productivity, the profound influence of soil microbiota on shaping crop nutritional profiles has often been overshadowed. In this study, we embark on an exploration of the intricate relationship between soil microbiota and the nutritional composition of maize grains. Maize was studied using chromatography and spectrophotometry to analyze carotenoids, proteins, and antioxidants. Also, soil microbial communities were examined through DNA extraction and 16S rRNA amplicon sequencing.

Results showed significant variations in maize grain nutrition based on soil microbial diversity. Correlation analyses highlighted connections between soil microbes and specific nutrients, revealing their influence on crop quality. This emphasizes the complexity of agricultural ecosystems, where soil microbes play a crucial role in crop nutrition. Understanding and preserving soil health and microbial diversity are essential. Holistic agricultural approaches, prioritizing soil stewardship, are advocated. This research contributes to sustainable agriculture by emphasizing the need to align human activities with natural ecosystem dynamics for nutritious crop production.

Keywords: maize, nutritional quality, soil microbiome, biodiversity, sustainable agriculture

NON-THERMAL PLASMA FOR IMPROVED FRACTIONATION OF LIGNOCELLULOSE BIOMASS – DIFFERENT STRATEGIES

Jovana Grbić[1], Mihajlo Bogdanović[2], Mihailo Mladenović[2], Dragana Mladenović[1], Saša Lazović[3], Aleksandra Djukić-Vuković[1]

[1]Innovation Centre of Faculty of Technology and Metallurgy, University of Belgrade, 11120 Belgrade, Serbia

[2]Department of Biochemical Engineering and Biotechnology, Faculty of Technology and Metallurgy, University of Belgrade, 11120 Belgrade, Serbia

[3]Institute of Physics Belgrade, University of Belgrade, Pregrevica 118, 11000 Belgrade, Serbia

e-mail: adjukic@tmf.bg.ac.rs

ABSTRACT

Agricultural waste is an emerging environmental pollutant, with a nearly five times higher volume than municipal solid waste. The aim is to develop treatments for fractionation of residues into more uniform streams suitable for biorefineries, by low energy, green treatments. Non-thermal plasma is technology which enables the continuous forming of reactive species through an electrical field at ambient conditions. Thanks to their high reactivity and low selectivity, they are important in combination with chemicals for the conversion of recalcitrant lignocellulose biomass. Ions deriving from acids, alkalis, or inorganic salts are accelerated due to a strong electrical field of cold plasma, and their collision with reactive species provides a synergistic effect. We combined CPT with an alkaline hydrogen peroxide solution and an acidic Fenton reagent for improved delignification and facilitated enzymatic hydrolysis of corn stalks. FTIR and Raman spectroscopy and SEM were used for analysis of chemical and morphological changes in the lignocellulose substrates. Treatments contributed to the improved enzymatic hydrolysis of biomass while enabling valorization of both oxidised lignin and carbohydrate fractions. Residual lignin-rich fractions could be important precursors, e.g. to produce pharmaceuticals and bio-based chemicals, for packaging or suitable for the removal of heavy metals.

Keywords: cold plasma, biomass, processing, biorefinery, agri-food residues

Acknowledgements: This work was supported by the Ministry of Science, Technological Development, and Innovation of the Republic of Serbia (Contract No. 451-03-47/2023-01/200287 and 451-03-47/2023-01/200135) and SparkGREEN project ANSO-CR-PP-2022-08 funded by Alliance of International Science Organizations (ANSO).

OLEOGEL CONTAINING BEESWAX AND MONOGLYCERIDES AS A POTENTIAL SUBSTITUTE FOR CONFECTIONERY PALM FATS

Szabolcs Homolya[1], Eszter Vozáry[2], Katalin Badak Kerti[1], Mohsen Mardani[1], Tímea Kaszab[2], Anikó Lambert Meretei[1]

[1]Department of Grain and Industrial Plant Processing, Institute of Food Science and Technology, Hungarian University of Agriculture and Life Sciences, H-1118 Budapest, Hungary
[2]Department of Food Measurement and Process Control, Institute of Food Science and Technology, Hungarian University of Agriculture and Life Sciences, H-1118 Budapest, Hungary
e-mail: szabolcs.homolya@gmail.com

ABSTRACT

In the confectionery industry large quantities of palm fat in the fillings of chocolate products are used. Based on today's nutritional science results, it is desirable to replace palm oil with healthier fats. Oleogels can provide a kind of solution for this replacement. In our work the rheological, textural and thermal properties of oleogels containing high oleic sunflower oil, beeswax and monoglycerides were determined. In the samples we examined, the gelator concentrations were: 20% beeswax, 15% beeswax and 5% monoglycerides, 10% beeswax and 10% monoglycerides, 5% beeswax and 15% monoglycerides, and 20% monoglycerides. Based on our results, the oleogel containing 15% beeswax and 5% monoglycerides can replace the Chocofill filling fat, which contains mainly palm fat, used in large quantities in sweets.

Keywords: beeswax, chocolate filling, monoglycerides, oleogel, palm oil

COMPARISON OF COLOR COORDINATES MEASURED WITH DIFFERENT DEVICES IN CASE OF GROUND SPICES

Zsuzsanna Horváth

Department of Mechanical Engineering, Faculty of Engineering, University of Szeged, Mars tér 7, H-6724 Szeged, Hungary
e-mail: horvatzs@mk.u-szeged.hu

ABSTRACT

The aim of our work was to investigate whether the repeatability and measurement accuracy of the Precise Color Reader color measuring device in the case of spice grinds differs significantly from the accuracy values experienced in the case of Minolta and HunterLab color measuring devices. We measured 20 spice samples in 3 series, with 8-15 repetitions for each sample. The measured values clearly showed that the three colorimeters provided different data, therefore we performed a correlation test between the obtained average color characteristics L*, a*, b*. The best repeatability values were obtained for the HunterLab color measuring device. In the case of the two tristimulus instruments, we did not observe a significant difference between the degree of repeatability. The regression analysis performed to compare the color coordinates measured with different devices showed that the value of the R^2 of the L* was higher in the case of the comparison of the HunterLab-Minolta and HunterLab-PCR color measuring devices 0.99, for the a* it ranged between 0.90 and 0.96, even for the b* it was between 0.98 and 0.93. The correlation between the values measured with the two tristimulus devices is even closer, the smallest value of the coefficient of determination was 0.963.

Keywords: spices, measurement of colour coordinates

POSSIBILITY OF USING NEW BIOPOLYMER/POLYETHYLENE BILAYER FILM FOR PACKING COFFEE

Nevena Hromiš, Senka Popović, Danijele Šuput, Marija Jokanović, Snežana Škaljac, Anita Milić

Faculty of Technology, University of Novi Sad, Bulevar Cara Lazara 1, 21000 Novi Sad, Serbia
e-mail: nevena.krkic@uns.ac.rs

ABSTRACT

EU Legislation in Progress shows strong orientation towards usage of packaging materials suitable for recycling. In the domain of polymers, this would mean monolayer materials primarily. In some areas of packaging, this can represent serious challenge. In the present research, two-layer material was developed and tested for coffee packaging. The new material was designed using two rather different layers: hydrophilic biopolymer layer based on wild flax *(Camellina Sativa)* oilseed cake and polyethylene, non-polar layer. Two layers can be separated based on their different nature and directed to waste streams to be recycled (polyethylene) and disposed/composed (biopolymer).

Using new material, pouches were formed, filled with 10g of black coffee (90% Arabica and 10% Robusta) and sealed. As a control, pouches were also made of PET/AL/PE, filled and sealed. After 30 and 60 days of storage, sensory analysis of coffee was performed. After 30 days of storage, sensory score of coffee packed in the new material was minimally lower comparing to control (no statistical difference), but after 60 days of storage, difference in sensory score was considerable. For shorter period, new material could be interesting solution, but with prolonged contact time, sensory attributes of coffee were influenced by sensory properties of the packaging material.

Keywords: biopolymer, wild flax, packaging, coffee

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FARMERS' DECISIONS IN THE SOUTHERN GREAT PLAIN REGION AS A RESULT OF THE 2022 DROUGHT

Júlia Hupuczi, Adrienn Weigert, Helga Kovács

Faculty of Agriculture, University of Szeged, Andrássy út 15, H-6800 Hódmezővásárhely, Hungary
e-mail: hupuczi.julia@szte.hu

ABSTRACT

In Hungary, drought is a feature of our changeable climate, while the increasing extremes of weather due to climate change are posing new challenges for agriculture. 2022 was a particularly difficult year for farmers, with very little rainfall in the first 8 months of the year and the hottest summer since 1901. Increasingly, record highs were recorded for heat, and the number of hot days increased. We had to face the fact that across the country there was a severe, and in places extreme, drought. The main objective of the research was to investigate the effects of the 2022 drought on farmers in the plains and Southern Great Plain region, which is heavily affected by climate change. The research method used was an online questionnaire completed by 50 farmers, mainly in the statistical region of the Southern Great Plain. As a result of the study, it can be said that the production losses were significant. For more than half of the farmers who received drought damage compensation, less than 25% of the compensation covered the costs of the crop losses and, in addition, due to the extreme weather conditions in the year under study, most farmers were open to new technologies and different cultivation methods. It is important to note that the climate is a natural resource that cannot be influenced, and adaptation to it should therefore be seen as a basic task.

Keywords: Southern Great Plain region, drought, extreme weather, agriculture

INSIGHTS INTO SAFFRON'S ANTI-INFLAMMATORY PROPERTIES; LAB STUDIES AND BEYOND

Dea Ismajli, Bence Pecsenye, Endre Mathe

Institute of Food Sciences and Nutrition, University of Debrecen, H-4032 Debrecen, Hungary
e-mail: dea.iii@outlook.com

ABSTRACT

Chronic diseases, often associated with inflammation pose significant health risks globally. Inflammation, whether acute, chronic, or subacute, profoundly influences the onset and progression of various illnesses, including cancer, obesity-related disorders, cardiovascular diseases, and depression. Our research aim is to investigate the complex mechanisms of inflammation through laboratory studies to learn more about the therapeutic effects of saffron (*Crocus sativus* L.) and its potential to counteract possible negative effects regarding inflammation, particularly in a diabetes like stress environment by initiating curing mechanisms on molecular and cellular level. Utilizing *Drosophila melanogaster* as a key animal model species, the research aims to estimate the viability and the development of the fly individuals.
This study begins with the preparation of saffron extract in Gemmotherapy Extracts (GTE) form. Subsequent analysis of the extract's phytonutrient profiles using UHPLC-ESI-MS enables precise identification and quantification of its diverse phytonutrients. Moreover, determination of total polyphenolic and flavonoid content provides insights into its phytochemical activity. We were estimating the saffron GTE associated physiological effects under normal, restrictive, and diabetic nutritive diet. Our experiments have revealed some interesting effects that will be presented.

Keywords: Crocus Sativus L., anti-inflammatory, therapeutic potential, phytonutrient profile, Drosophila melanogaster

KNOWLEDGE GRAPH TO BUILD A DATABASE ON HUMAN MILK MICROBIOTA

Raziyeh Jamalifard, József Baranyi

Doctoral School of Food and Nutrition, University of Debrecen, H-4032 Debrecen, Hungary
e-mail: raziyeh.jamalifard@agr.unideb.hu

ABSTRACT

For a long time, human milk was considered sterile, but recent studies have demonstrated that it is a rich source of microbes, that have the potential to influence a child's health in terms of growth and development. Human milk contains highly interactive microorganisms, whose temporal change can unveil the complex interplay between the mother, the milk, and the infant's health, affecting infant health and gut microbiome development.

A knowledge graph is a structured representation of knowledge that captures information about entities and the relationships between them. It is a way to organize and represent data in a format that is more easily understandable by both humans and machines.

This study will demonstrate how Computational and Data Science methods can be used to discover patterns and draw conclusions from existing, published data, in order to develop data-driven nutrition science.

Keywords: Data Science, Human Milk Microbiota, Graph knowledge

ANALYSIS AND FERMENTATION MONITORING OF WINES FROM CSONGRÁD WINE REGION

Blanka Juhász[1], Balázs Lemmer[1], Zoltán Jákói[2]

[1]Department of Food Engineering, Faculty of Engineering, University of Szeged, Moszkvai krt. 5-7, H-6725 Szeged, Hungary
[2]Department of Biosystems Engineering, Faculty of Engineering, University of Szeged, Moszkvai krt. 9, H-6725 Szeged, Hungary
e-mail: blankajuhasz1@gmail.com

ABSTRACT

Our research followed the fermentation of two types of grape wine using different analytical methods, which provided me information on how the sugar and alcohol concentration and acidity of the wine changed during fermentation. Among the methods of analysis, we focused on the dielectric parameters, in general the dielectric parameters, and on the possible correlation between the alcohol contents of the samples.

Overall, the results of our research showed that the dielectric constant increased steadily with the fermentation time, but there were differences in the dielectric behaviour of Blue Franc and Rhineland Riesling. The variation of alcohol content showed a trend well consistent with the classical fermentation processes of the wines, with which the results of the acidity analysis of the samples were well comparable.

Keywords: wine, dielectric, fermentation

UNVEILING HOUSEHOLD FOOD WASTE: SURVEY RESULTS FROM THE HOUSHOLDS FROM VOJVODINA REGION, SERBIA

Zsóka Kratofil, Maravić Nikola, Ivana Lončarević, Éva Đurović, Biljana Pajin, Dragana Šoronja Simović, Zita Šereš

Faculty of Technology Novi Sad, University of Novi Sad, Bulevar Cara Lazara 1, 21000 Novi Sad, Serbia
e-mail: kratofilzsoka@gmail.com

ABSTRACT

The prevention and proper management of household food waste is a collective challenge. Food waste is a multifaceted and complex problem that raises social and ethical concerns, but also deeply affects the environment. In this sense, addressing the problem is a priority that requires actions that target our entire food system. Around 88 million tonnes of food waste is generated in the EU every year and the associated costs are estimated at €143 billion. While an estimated 20% of all food produced is lost or wasted, 33 million people cannot afford to eat quality food every other day (according to Eurostat, 2018). FAO reported, that 1.3 billion food wastes are generated worldwide in a year. The purpose of this study was to examine the attitudes and behavior of families in Vojvodina region in Serbia regarding food waste and to estimate the monthly amount and economic value of discarded food waste in households, using a self-filling method. The questionnaire consisted of 19 questions, which were filled in by a total of 193 people. The average age of the applicants were between 18 and 40 years old. According to the results 80,9% of the respondents are concerned about food waste trying to avoid it if possible. 64,8% of respondents are from the countryside, and 35.6% of those are involved in composting. The weekly amount of food waste in households was reported between 250 g - 1 kg.

Keywords: Food, waste, Serbia, survey, attitude

Acknowledgements: The research was done within Erasmus + KA2 project ReS-Food (no. 2022-1-RS01-KA220-VET-00008846) and supported by Studentski dom „Evropa" – Európa Kollégium Egyetemista Központ, Novi Sad, Serbia.

THE EXAMINATION OF THE LOSS OF FRANKFURTERS BEFORE PACKAGING AT A HUNGARIAN MEAT INDUSTRY COMPANY

Tamás Kulcsár[1,2], Adrienn Gál[2], József Mihalkó[1]

[1]Department of Food Engineering, Faculty of Engineering, University of Szeged, Moszkvai krt. 5-7, H-6725 Szeged, Hungary
[2]Pick Szeged Zrt., H-6725 Szeged, Hungary
e-mail: tamaskulcsar500@gmail.com

ABSTRACT

The purpose of our research was to examine the shrinkage of the various gutted products produced there, as well as the resulting losses and other losses - which arise during production, e.g. length and Caliber - to be determined. Such other losses included lubrication, heat treatment and recooling losses. Our tests covered products filled with natural casings, artificial casings, peelable casings, digestible casings and permanent casings. The chemical parameters of the products - both the meat paste and the finished product - were also measured, such as moisture and fat content.

Based on our results, we came to the conclusion that it is not worth storing any product for more than 24 hours without packaging, because in almost all cases the shrinkage reaches the value of 2-3%, which is associated with a significant loss with such a large production volume (exception: the products filled with long-lasting guts, in which less loss occurred due to the water vapor barrier properties of the gut). From the results of the chemical composition tests of the products, we concluded that, in general, it can be said about the products that the fat content of the products increases proportionally with the decrease in moisture content.

Keywords: Frankfurters, losses, chemical composition

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OSMOTIC TREATMENT OF ORANGE AND PINK SWEET POTATO-MASS TRANSFER RATE AND EFFICIENCY

Biljana Lončar[1], Vladimir Filipović[1], Olja Šovljanski[1], Lato Pezo[2], Violeta Knežević[1], Danijela Šuput[1],Milica Aćimović[3]

[1]Faculty of Technology Novi Sad, University of Novi Sad, bul. cara Lazara 1, 21000 Novi Sad, Serbia,
[2]Institute of General and Physical Chemistry, University of Belgrade, 11000 Belgrade, Serbia
[3]Institute of Field and Vegetable Crops Novi Sad, Maksima Gorkog 30, 21101 Novi Sad, Serbia
e-mail: biljanacurcicc@gmail.com

ABSTRACT

Sweet potatoes *(Ipomoea batatas)* are globally cultivated due to their adaptability, high nutritional value, short growing season, tolerance to high-temperature soils, low fertility, and minimal disease issues, making them a valuable asset to the food industry. Eaten as a vegetable, sweet potatoes are prepared through boiling, frying, baking, or even fermenting for various dishes and beverages. The drying process of sweet potatoes typically combines the effects of blanching and/or freezing pre-treatments along with higher drying temperatures. This study specifically focused on osmotically treating samples of pink and orange sweet potatoes in sugar beet molasses (80% w/w) to explore the influence of solution temperatures (20°C, 35°C, and 50°C) and osmotic treatment durations (1h, 3h, and 5h) on mass transfer rate and treatment efficiency. The Principal Component Analysis and color correlation analysis were employed to illustrate the connections between different sweet potato samples. Findings indicate that the mass transfer rate peaks at the onset of the process, particularly with the highest temperature for both orange and pink sweet potatoes. Notably, diffusion is most rapid within the initial three hours, suggesting potential reductions in processing time aligned with these results. The mass transfer rate was more rapid, and the osmotic treatment was more efficient for the orange sweet potato samples.

Keywords: osmotic drying, sweet potato, sugar beet molasses, dehydration efficiency, PCA

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COMPARISON OF THE EFFECT OF HOMOGENIZATION AND SONICATION ON THE TEXTURE PROPERTIES OF GOAT MILK YOGURT

Ádám Lőrincz, Balázs P. Szabó, Diána Bánáti, Krisztina Varga, József Csanádi

Department of Food Engineering, Faculty of Engineering, University of Szeged, Moszkvai krt. 5-7, H-6725 Szeged, Hungary
e-mail: lorincz@mk.u-szeged.hu

ABSTRACT

In our study, we investigated the effect of homogenization and ultrasound treatment on the goat milk yoghurt.

After pasteurisation of the milk, the samples were homogenised at 100 and 200 bar and sonicated at 100 W for 5 and 15 minutes. Untreated milk was the control sample. Samples were inoculated with yoghurt culture, fermented at 45°C to pH 4.6 and stored at 5°C until testing. Texture properties were tested using a Brookfield CT3 Texture Analyzer and whey separation was tested by centrifugation.

The homogenisation improved the hardness of the product in both cases, but ultrasound treatment only gave a significant improvement during the 15 min treatment. The hardness of the control sample was 105.5 mN, hardness of the sonicated sample 116.75 mN. For the homogenized samples (100- and 200-bar), the values were 114.25 mN and 122.75 mN, respectively. The whey separation of the samples was significantly reduced in the homogenised and in the 15 min sonicated samples. The whey separation of the control sample was 58.9 % while that of the 15 min sonicated sample was 43.6 %, and that of the 100 and 200 bar homogenised samples was 41.3 % and 34.3 %, respectively.

Keywords: homogenization, sonication, texture, goat milk

COMPARATIVE ANALYSIS OF POLYPHENOL EXTRACTION FROM OLIVE POMACE: A STUDY ON MICROWAVE-ASSISTED AND TRADITIONAL METHODS

Ana Marđokić, Gyula Vatai, Szilvia Bánvölgyi

Department of Food Process Engineering, Institute of Food Science and Technology, Hungarian University of Agriculture and Life Sciences, H-1118 Budapest, Hungary
e-mail: mardjokic.ana@phd.uni-mate.hu

ABSTRACT

The term 'alperujo' denotes olive pomace resulting from the two-phase extraction of olive oil, posing an environmental challenge due to hazardous phenolic compounds. Conversely, polyphenols in olive pomace offer antioxidants with disease-preventing potential. This research compares conventional (CM) and microwave-assisted (MAE) extraction methods to maximize polyphenol yield and antioxidant activity and address environmental concerns. Olive pomace from Picual variety grown in Montenegro was dried at 50 ℃ and a Central Composite design of experiment (CCD) assessed power (100-800 W), time (30- 180 s), and solid ratio (2-12 gr/100 ml) in case of MAE, and time (20-120 min), solid ratio (2-12 gr/100 ml) and temperature (40-80 ℃) in case of CM. Twenty extractions, using an optimal ethanol-water mixture, were performed. Total Phenolic Content (TPC) and Antioxidant activity (AA) were measured via Folin-Ciocalteu and Ferric Reducing Antioxidant Power (FRAP) methods.

The research demonstrated that MAE exhibited superior effectiveness in extracting polyphenols from olive pomace, achieving a maximum concentration of 9.49 mg GA/g_{dw}. surpassing the highest concentration obtained with the CM, which was 5.355 mg GA/ g_{dw}.

This research provides insights into sustainable practices and valuable components for food and pharmaceutical industries and contributes to both environmental solutions and economic opportunities

Keywords: olive pomace, polyphenols, extractions, environmental protection

INVESTIGATING THE POTENTIAL OF MARLOO VARIETY FOR SPONTANEOUS CABBAGE FERMENTATION

Anita Milić, Aleksandra Tepić Horecki, Milana Vujičić, Ivana Petrović, Zdravko Šumić

Faculty of Technology Novi Sad, University of Novi Sad, Bulevar Cara Lazara 1, 21000 Novi Sad, Serbia

e-mail: anitavakula@gmail.com

ABSTRACT

This study explores the suitability of the Marloo cabbage variety for spontaneous fermentation within industrial settings. The primary aim is to closely examine the entire fermentation process, beginning with the characterization of the Marloo cabbage variety and proceeding to carefully monitor the fermentation process. Essential input parameters such as fermentation temperature, quantity of added salt, and potassium sorbate are thoroughly assessed, alongside output parameters including dry matter, total acidity, salt content, sugar content, and potassium sorbate content. Through thorough analysis, it is evident that the Marloo variety exhibits high suitability for spontaneous cabbage fermentation. The findings of this research hold significant implications for industrial-scale fermentation practices, offering insights into optimizing fermentation conditions to enhance efficiency and product quality. This study contributes to the understanding of spontaneous fermentation processes and highlights the potential of the Marloo variety as a promising potential for industrial fermentation applications.

Keywords: Marloo variety, cabbage fermentation, industrial application

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COMPARISON OF THE NOVEL AND TRADITIONAL EXTRACTION TECHNIQUES FOR THE ISOLATION OF THYME BIOACTIVE COMPOUNDS

Sanja Milošević[1], Danica Božović[1], Maja Živanović[1], Nemanja Teslić[2], Nevena Gladikostić[1], Zoran Zeković[1], Branimir Pavlić[1]

[1]Faculty of Technology, University of Novi Sad Blvd. cara Lazara 1, 21000 Novi Sad, Serbia
[2]Institute of Food Technology, University of Novi Sad, Blvd. cara Lazara 1, 21000 Novi Sad, Serbia
e-mail: sanjamilosevic9898@gmail.com

ABSTRACT

Thyme *(Thymus vulgaris)* from *Lamiaceae* family is a widely distributed spice in the world which provides strong medicinal potential. Thymol followed by carvacrol, and linalool, the major volatile compounds in thyme essential oil, express high antioxidant, anti-inflammatory and antibacterial activity. The aim of this research was to select the most efficient technique in terms of antioxidant activity and the amount of bioactive compounds. Within the experiential part of this research, two tipes of essential oil obtained by hydrodistillation (HD) and microwave-assisted hydrodistillation (MWHD), and lipophilic extracts obtained by Soxhlet extraction (Sox) and supercritical fluid extraction (SFE) were subjected to comparison in terms of extraction yield and in vitro antioxidative activity against DPPH (2,2-diphenyl-1-picrylhydrazyl) and ABTS (2,2'-azino-bis-(-3-ethylbenzothiazoline-6-sulfonic acid) diammonium salt) radicals. Moreover, the differences in the essential oils and lipophilic extracts chemical profile were distinguish by gas chromatography-mass spectrometry (GC-MS). Finally, a properly chosen extraction technique can enable obtaining valuable thyme's products that can be applied in various forms to increase the bacteriological safety of food and cosmetic products.

Keywords: Thyme, essential oils, lipophilic extracts, antioxidant activity, GC-MS

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POTENTIAL SOLUTIONS TO LIFESTYLE AND SOCIO-ECONOMIC INEQUALITIES AND DEALING WITH THE PREVALENCE OF NON-COMMUNICABLE DISEASES IN LOW AND MIDDLE-INCOME COMMUNITIES IN SOUTH AFRICA

Zibuyile A. Mposula, Endre Máthé

Institute of Nutrition Science, Faculty of Agricultural and Food Sciences and Environmental Management, University of Debrecen, H-4032 Debrecen, Hungary
e-mail: zibuyile.angel@agr.unideb.hu

ABSTRACT

Potential solutions to lifestyle and socio-economic inequalities and dealing with the prevalence of non-communicable diseases in low and middle-income communities in South Africa.

South Africa has been undergoing a nutrition transition where micronutrient deficiencies and other forms of under-nutrition co-exist with the pervasiveness of obesity and diabetes. Such health conditions together with the emergent over-nutrition presents a complex series of challenges. What we consume, is to a large extent affected by our traditions and customs, food availability, what we can afford and preference.

The aim of the study was to develop the prototype of a 'super-food' that would promote the health status of middle and old age individuals diagnosed with diabetes. The source chosen was malted sorghum.

We interviewed 99 elderly participants over the age of 50 to get a perspective on their socio-economic, food security, health status and food preferences. We then proceeded with the development of a breakfast soft porridge using malted sorghum. Ultrahigh-performance liquid chromatography mass spectrometry (UHPLC–MS) analysis was carried out to characterize the health-promoting bioactive compound profile of the sorghum grains which had been malted. An analysis was also conducted on an already developed South African porridge which is made from malted sorghum in order to make a comparison between the two products.

Results indicated that our prototype had a slightly higher protein content (10.96) than the established brand (10.87). Total fat was higher (3.58) in the established brand, compared to the prototype (2.48). Dietary fibre was much higher (22.45) in the prototype than the established brand (16.28).

Results suggest that the malted sorghum would make a good source of nutrition for individuals suffering from NCDs. Product fortification through the addition of plant-based products that would further increase the nutritional value of the prototype.

Keywords: Noncommunicable diseases, sorghum, dietary habits, elderly nutrition,

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EVALUATION OF THE EFFECTS OF SORGHUM FLOURS ON THE VIABILITY AND DEVELOPMENT ON *DROSOPHILA* LARVAE

Róbert Nagy, Bence Pecsenye, Endre Máthé, Péter Sipos

Institute of Nutrition Science, Faculty of Agricultural and Food Sciences and Environmental Management, University of Debrecen, H-4032 Debrecen, Hungary
e-mail: nagy.robert@agr.unideb.hu

ABSTRACT

Sorghum has a wide range of health related aspects such as anti-bacterial, anti-obesity, and anti-inflammatory effects that have been studied extensively in vitro and in vivo. Due to the relatively high content of polyphenols and flavonoids, especially tannins sorghum can alleviate chronic diseases like Type 2 diabetes or cardiovascular related diseases, by initiating mechanisms on molecular and cellular level. The amount of these bioactive compounds are greatly dependent on the plant, variety and the processing steps. *Drosophila melanogaster* is a key animal model species for studying the genetic regulative immunophysiological effects. Our research is aimed to evaluate the nutritional effect of sorghum based media by estimating viability and the development of *Drosophila* individuals. Furthermore, we will also study how viability reduction caused by a high sugar diet can be alleviated using sorghum based media utilizing the antidiabetic effect of sorghum. We also evaluate how sorghum based extracts can be used as a food supplement and influence our nutrition. Preliminary results show great potential as flavonoid rich plant material depending on the variety used for extraction. Early trials with *Drosophila* also showed beneficial development progress in the hatching and development stage, but the results are still under analysis.

Keywords: Sorghum, polyphenols, Drosophila

DYNAMIC MODELLING OF THE MOLECULAR COMPOSITION OF HUMAN MILK

Tünde Pacza, József Baranyi

Doctoral School of Nutrition and Food Sciences, Institute of Nutrition, Faculty of Agriculture, Food Sciences and Environmnetal Management, University of Debrecen, H-4032 Debrecen, Hungary
e-mail: pacza.tunde@unideb.hu

ABSTRACT

Human milk is essential for child's development and health, yet its complexity remains under-explored. To address this, we developed MilkyBase, a database compiling published data on human milk's biochemical composition, aiding in identifying patterns and associated factors over time.

MilkyBase's data, influenced by maternal, infant, and environmental factors, is organized dynamically, reflecting milk's biochemical response to these factors and measurement methods, thereby enabling predictive analysis. A model fitted to MilkyBase's data revealed patterns in milk components, potentially clarifying hypotheses on optimal milk composition considering specific infant, mother, and milk aspects.

The temporal trajectories of specific components were described by a two-phase primary model: an initial linear phase postpartum and a subsequent stabilizing phase. This suggests the need for non-equidistant sampling times in research, particularly after the first postpartum week. Secondary modelling showed that variation in component concentrations is mainly due to biological differences between mothers, rather than geographic location.

MilkyBase supports the scientific community in understanding how different conditions influence human milk composition. It also aids researchers in food science and related fields by providing a standardized data format, simplifying the identification of deviations from standards. This database is a significant step towards a comprehensive understanding of human milk and its roles in child development.

Keywords: Food composition, Human Milk, predictive modelling, data science

ASSESSING THE HEALTH PROMOTING EFFECT OF MALT, USING *DROSOPHILA MELANOGASTER* MODEL SYSTEM

Bence Pecsenye, Endre Máthé

Institute of Nutritional Science, Faculty of Agricultural and Food Sciences and Environmental Management, University of Debrecen, H-4032 Debrecen, Hungary
e-mail: bence.pecsenye92@gmail.com

ABSTRACT

Studying the effect of malting of cereal grains have been gaining more and more interest in the past years. Though the malting process has been shown to result in increased bioactive compounds, such as polyphenols, and some nutritional studies have been done to investigate the biological effects, there is a considerable knowledge gap. The human body's response to changes in dietary conditions cannot be ignored, therefore we need a model organism to study the effect of biochemicals under different conditions.

Drosophila melanogaster provides us with the obvious translational model system due to its high gene homology to humans and similarity in metabolic pathways, as well as ease of use in the laboratory.

We propose three different nutritional environments: Normal Media, Zero Media, High Sugar Media - acting as our balanced diet, low nutrient diet, and diet high in sugar respectively. We assess the effect of different malt flours under such conditions, following the development of the flies from embryo to adult, including larval survival rate, hatch rate, life cycle length.

We aim to gain insight into the effect of biochemicals while following different diets, so that we could emphasise the importance of a person's nutrition while taking supplements or medication.

Keywords: malt flour, Drosophila melanogaster, nutrition, polyphenols,

THE INFLUENCE OF THE PROCESS PARAMETERS OF THE BIOPOLYMER POUCHES SYNTHESIS ON THE QUALITY OF PACKAGED EDIBLE OIL

Senka Popović, Nevena Hromiš, Danijela Šuput, Sandra Bulut, Ranko Romanić, Tanja Lužaić

Faculty of Technology Novi Sad, University of Novi Sad, Bulevar cara Lazara 1, 21000 Novi Sad, Serbia
e-mail: madjarev@uns.ac.rs

ABSTRACT

Application of high oxygen-barrier and antioxidative edible materials has been in focus of current research, since oxidation is a major deleterious factor that reduces shelf-life of lipid-containing food products. Oxidation affects the formation of toxic aldehydes through the degradation of polyunsaturated fatty acids, reducing the nutritional value of food, but also leads to significant changes in sensory properties. Biopolymer packaging materials may provide good alternative to plastic, due to excellent barrier properties to gases, their nature and biodegradability. In this paper, pumpkin oil cake (PuOC) pouches were prepared under two different temperature treatments, and with two drying conditions. As a control, original oil packed in glass bottle was used. The influence of process parameters (temperature of film-forming solution preparation and drying atmosphere with and without etheric oil) on edible flaxseed oil chemical and sensory characteristics was examined. Results showed that PuOC-based films ensure good both chemical and sensory quality of oil, applying all examined conditions, compared to control.

Keywords: packaging, pouches, pumpkin oil cake, flaxseed oil, quality

Acknowledgements: Research within this work was financed by the Ministry of Science, Technological Development and Innovation of the Republic of Serbia, program number:451-03-65/2024-03/ 200134 and 451-03-66/2024-03/ 200134

COMPARATIVE ANALYSIS OF MILLING TECHNOLOGIES IN DARK AND MILK COCOA TOPPING PRODUCTION FOR ICE CREAM

Tijana Popović[1], Milica Stožinić[2], Ivana Lončarević[2], Biljana Pajin[2], Danica Zarić[3], Ivana Nikolić[2], Jovana Petrović[2]

[1]Barry Callebaut Manufacturing South East Europe d.o.o., Zrenjaninski put 32, 21000 Novi Sad, Serbia

[2]Faculty of Technology Novi Sad, University of Novi Sad, Bulevar cara Lazara 1, 21000 Novi Sad, Serbia

[3]Innovation Centre of the Faculty of Technology and Metallurgy, University of Belgrade, Karnegijeva 4, Belgrade, Serbia

e-mail: tijana.popovic.96.tp@gmail.com

ABSTRACT

Chocolate and cocoa toppings are widely used for confectionery products. Toppings used for ice creams contain higher fat content (about 40-60%) to ensure a greater flow to cover the whole product. The dark cocoa topping consists of cocoa and sugar powder distributed in vegetable fat, while cocoa topping with the added 7% non-fat milk fraction is regarded as a milk cocoa topping. This research aimed to determine and compare the impact of the ball mill, and five-roll mill and conching used for the production of dark and milk cocoa toppings regarding the particle size distribution, rheology properties and content of moisture, sucrose, fat and lactose. The obtained results showed that the volume-weighted mean parameter D (4,3) was lower in the samples produced in a ball mill. Additionally, the viscosity, linear and Casson, slightly increased in samples produced in a ball mill except for the milk cocoa topping which had 0.55 fold higher value of linear viscosity compared to the sample produced using a five-roll mill and conching. Regarding the results of NIR spectroscopy, it was found that the samples produced in a ball mill showed higher values of moisture, but lower values of sucrose, lactose and fat.

Keywords: cocoa topping, ball mill, five-roll mill, rheology, particle size distribution

Acknowledgements: This research was supported by the Ministry of Education, Science, and Technological Development, Republic of Serbia program (451-03-47/2023-01/200134).

NATIVE TRITICALE AS A STAND-IN FOR BARLEY MALT

Milana Pribić, Lenka Grubač, Jelena Pejin

Faculty of Technology Novi Sad, University of Novi Sad, Bulevar cara Lazara 1, 21000 Novi Sad, Serbia
e-mail: milana.pribic@tf.uns.ac.rs

ABSTRACT

The average beer contains over 450 different substances, all of which have the potential to affect its quality, making beer one of the world's most complex beverages. Beer is typically made from water, barley malt, hops, and yeast. While malted barley is the most commonly used cereal grain in traditional brewing processes, more than 80% of global beer production incorporates adjuncts as a cost-effective and environmentally friendly option.

One of the main drawbacks of brewing with unmalted adjuncts is the decrease in amylolytic, cytolytic, and proteolytic enzymatic activities in the grist, as these enzyme systems are typically synthesized during the malting process. However, triticale, the first man-made cereal resulting from a cross between wheat and rye, presents an exception. Triticale can be used as a partial substitute for barley malt and exhibits promising brewing properties due to its high levels of amylolytic and proteolytic enzyme activity, even in its unmalted form.

The objective of this study was to evaluate the possibility of triticale application as a partial substitute for barley malt in beer production. The obtained results indicate that native triticale has good technological parameters and could be used as a partial substitute for barley malt in beer production.

Keywords: Triticale, Barley, Brewing Technology

Acknowledgements: This research was funded by the Ministry of Education, Science and Technological Development of the Republic of Serbia (Agreement No. 451-03-65/2024-03/ 200134)

ANTIMICROBIAL ACTIVITY OF SOME MEDICINAL PLANTS FROM TERITORY OF SERBIA

Aleksandra Ranitović[1], Dragoljub Cvetković[1], Olja Šovljanski[1], Ana Tomić[1], Tara Budimac[1], Milica Aćimović[2], Jelena Vulić[1], Teodora Cvanić[1]

[1]Faculty of Technology Novi Sad, University of Novi Sad, Boulevard cara Lazara1, 21102 Novi Sad, Serbia,

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

e-mail: a.ranitovic@uns.ac.rs

ABSTRACT

Filipendula vulgaris Moench, *Lythrum salicaria* L. and *Teucrium montanum* L. are plants found in Serbian mountains that are traditionally used as a folk medicine for prevention and treatment of various diseases such as rheumatism, fever, skin and mucosa infections, gastrointestinal tract ailments etc. This paper introduces antimicrobial potential of water and ethanolic extracts of tested plants using disc diffusion method. Tested strains were: Gram-negative bacteria (*Escherichia coli* ATCC25922, *Salmonella Typhimurium* ATCC 14028, *Pseudomonas aeruginosa* ATCC27853), Gram-positive bacteria (*Listeria monocytogenes* ATCC35152, *Bacillus cereus* ATCC11778, *Staphylococcus aureus* ATCC 25923), yeasts (*Saccharomyces cerevisiae* ATCC 9736 and *Candida albicans* ATCC 10231) and mould (*Aspergillus brasiliensis* ATCC 16404). The results revealed that both water and ethanolic extracts of *F. vulgaris* and *L. salicaria* in concentration of 100 mg/ml expressed bactericidal activity toward all tested bacteria, among which Gram positive bacteria were the most susceptible. Only ethanolic extract of *T. montanum* showed bacteriostatic activity against *Staphylococcus aureus* i *Listeria monocytogenes*. Tested extracts did not show any activity against yeasts and mould. Results indicate a great antibacterial potential of some tested medicinal plants, which could be used as an antibacterial agents after investigation of minimal bactericidal concentrations.

Keywords: medicinal plants, water extract, ethanolic extract, antimicrobial activity

Acknowledgements: This research was funded by the Republic of Serbia program of the Ministry of Science, Technological Development and Inovation, grant numbers: 451-03-66/2024-03/200134 and 451-03-65/2024-03/200134.

DESIGN AND DEVELOPMENT OF A MONITORING SYSTEM BASED ON WIRELESS DATA COLLECTION FOR FOOD INDUSTRY PURPOSES

Ágnes Rédey

Doctoral School of Food Science, Hungarian University of Agriculture and Life Sciences, H-1118 Budapest, Hungary
e-mail: redeyagi@gmail.com

ABSTRACT

One of the biggest challenges for the food industry in terms of food safety is traceability, particularly for food that is stored chilled or frozen, especially in situations where wiring cannot be managed (e.g. transport). It may be worth introducing digitalisation tools such as RFID technology to identify potential problems.

RFID (Radio Frequency Identification) is a wireless technology that has many uses. In this work, I have used transponders, also known as tags, which are semi-passive, we can record temperature and humidity data, and read out via radio frequency antennas.

I have written a program to read and program the tags, which allows us to set the sampling frequency too.

I have tested this monitoring system during the delivery and sale of dairy products on the market. Thanks to the measurements, an unforeseen problem was discovered. I had assumed that the slow cooling of the display fridge could cause problem. We can conclude that the system could have serious food safety, and thus indirectly economic, benefits.

This traceability system can be cost-effectively integrated into the digitalisation of the food industry, which is a significant component of the competitiveness of micro, small and medium-sized enterprises.

Keywords: RFID, temperature traceability

THE RELATIONSHIP BETWEEN THE NUTRIENT CONTENT OF POTATOES AND THE STRUCTURE STABILITY, COLOR CHANGES, OF THEIR FREEZE-DRIED PRODUCTS

Zoltán Répás[1,2], Róbert Nagy[1,2], Zsolt Géza Polgár[3], Zoltán Győri[2]

[1]Institute of Nutritional Science, Faculty of Agricultural and Food Sciences and Environmental Management, University of Debrecen, H-4032 Debrecen, Hungary
[2]Doctoral School of Nutritional and Food Sciences, University of Debrecen, H-4032 Debrecen, Hungary
[3]Hungarian University of Agriculture and Life Sciences, H-2100 Gödöllő, Hungary
e-mail: repas.zoltan@agr.unideb.hu

ABSTRACT

The aim of this study was to determine the nutritional values related to structural stability during the storage of freeze-dried potato cubes and investigate the color changes that occur during cooking, freeze-drying, and rehydration. Significant relationships detected between the protein content and various color values of the raw and cooked potatoes, as well as the change in color values after rehydration. Significant relationship detected between protein content, L* and b* values in the raw sample, b* values in cooked potatoes, and L*(negative) and b* values after rehydration, as well as the (negative) change in L* between cooked and rehydrated potatoes. Significant relationship was between the amount of starch in the raw sample, L* after freeze-drying (positive), and the L* change between cooked and rehydrated potatoes (positive). The study on structural stability found a significant correlation between the protein content and the amount of unbroken, whole freeze-dried potato parts. Significant correlation was observed between the raw L* and cooked L* value changes in relation to the structural stability. Significant relationship was measured between the amount of protein calculated in dry matter and the structural stability of freeze-dried cooked potatoes.

Keywords: potato, freeze-dried, colorimetria, structure analysis, food quality

Acknowledgements: We would like to say thank you to the University of Debrecen for the support and the Nano-food lab for the technical support.

EFFECT OF THE FOOD COMPOSITION ON THE MICROBIAL KINETICS IN PLANT-BASED MILK

Maha Rockaya, József Baranyi

Doctoral School of Food and Nutrition Science, Institute of Nutrition, University of Debrecen, H-4032 Debrecen, Hungary
e-mail: maha.rockaya@agr.unideb.hu

ABSTRACT

Predictive microbiology researchers studied deeply various factors, like temperature, pH, water activity and preservatives, that affect the bacterial kinetics in food. In our study our focus is on plant-based milk where we aim to increase the resolution of the predictions by including its biochemical composition in these factors. The advantage of such refinement is that the biochemical composition of the food matrix is quantifiable and generic enough to make it a suitable candidate for predictive modelling. These premises justify the hope that in-vitro and in-silico studies will be aligned with real scenarios in the food matrices (in-vivo).

A validation of the idea needs a lot of laboratory data, but already published data can be used for a feasibility study. The start is a summary of available information on the biochemical compositions and microbiological characteristics of various plant-based milk matrices and collate them into a database with well-defined ontology. Such database is key to find patterns, draw conclusions and generate predictions. In addition, such study helps to find gaps, optimize experimental design for new laboratory observations. It can also be used as an objective tool to decide whether extrapolations from similar food matrices like bovine milk and infant formulae are applicable.

Keywords: Plant-based milk, Predictive microbiology, Databases, Chemical composition, Bacterial Kinetics

Acknowledgements: As a scholarship-funded PhD candidate I thank and acknowledge the Tempus Foundation and the Stipendium Hungricum Scholarship.

THE POTENTIAL OF FUTURE SUPERFOOD-MICROGREENS: BIOACTIVITY AND BIOACTIVE CONTENT OF THREE *BRASSICACEAE* MICROGREENS

Anja Saveljić, Olja Šovljanski, Jelena Vulić, Slađana Stajčić, Jasna Čanadanović-Brunet

Faculty of Technology Novi Sad, University of Novi Sad, Bulevar cara Lazara 1, 21000 Novi Sad, Serbia

e-mail: anja.saveljic@uns.ac.rs

ABSTRACT

Microgreens, a burgeoning category within the realm of fresh produce, have garnered significant attention in recent years. These young, immature greens represent a stage of growth between sprouts, and baby greens and they are considered a true powerhouse of essential vitamins, minerals, and antioxidants. They contribute to sustainable agriculture and serve as novel specialty crops, boasting significant health benefits for consumers. As interest in healthy eating and sustainable agriculture continues to rise, microgreens have emerged as a versatile ingredient in various culinary dishes. This study aimed to explore the bioactive compounds (phenolics, flavonoids, carotenoids, and chlorophylls) and antioxidative potential (DPPH, ABTS+, and reduction power assays) in three *Brassicaceae* microgreen species (kale, daikon radish, and mustard). Following lyophilization and extraction, spectrophotometric analyses revealed promising functional food potential for all samples. Daikon radish exhibited the highest vitamin C content (578.38 mg/100g), while mustard boasted the highest content of total phenolics (3700.82). Kale excelled in flavonoids (237.18 mg/100g), carotenoids (52.22mg/100g), chlorophyll (4409.04 mg/100g) content, and antioxidant activity (up to 14.94 mM TE/100g). This study highlights the nutritional richness and antioxidant potential of *Brassicaceae* microgreens, particularly kale, daikon radish, and mustard, suggesting their role as promising functional foods in promoting health and sustainability.

Keywords: Brassicaceae, microgreens, antioxidant activity, bioactive compounds

Acknowledgements: Ministry of Science, technological development and innovation, Republic of Serbia, (451-03-66/2024-03/ 200134 and 451-03-65/2024-03/ 200134)

THE EFFECTS OF ULTRASONIC TREATMENT IN CANNING TECHNOLOGY

Tamás Somogyi, Mátyás Lukács, Mercy Mukite, Éva Stefanovits-Bányai, Viktória Zsom-Muha, Tamás Zsom

Doctoral School of Food Science, Hungarian University of Agriculture and Life Sciences, H-1118 Budapest, Hungary
e-mail: somogyi.t92@gmail.com

ABSTRACT

In case of dry red kidney beans, the most time consuming process of the technology is the soaking in the canning industry. The ultrasound treatment is a possible method to reduce the process time required for soaking. In our experiment, the traditional soaking procedure (untreated) with the ultrasonic-assisted soaking one was compared. The ultrasonic treatment was performed at 40 kHz and 300 W of power level. Both soaking experiments were carried out at 25 °C. Based on our results, the soaking time required to double the initial weight of the beans by water uptake can be described by an exponential function. Significant difference was found between the soaking intensity of the untreated control and ultrasound-treated samples. The change in the quality of the soaking water was analyzed also. Significant difference was found between treated and untreated soaking water samples conserning ΔE* values. Our results showed that ultrasonic treatment provides a significant influence on the a* (increase, redder) and L* (decrease, darker) color parameters of the soaking water, clearly showing increased mass transport and faster water uptake features induced by the applied ultrasonic treatments. As a possible positive outcome, this kind of relationship can provide the successful application of ultrasound treatments in canning industry technology development.

Keywords: ultrasounds, canning, technology, hydration

THERMAL DEGRADATION OF ANTHOCYANIN IN BLUEBERRY JUICE AS AFFECTED BY SUCROSE AND VITAMIN C

Nisa Sulejmani, Rejhana Luma, Kaltrina Selmani, Kaltrina Sejdiu, Fatbardha Tërstena, Rihan, Abduramani, Leonora Aliu, Florentina Behluli, Blerta Ajdari, Ermira Alija, Sulejman Xhezairi, Xhabir Abdullahi, Erhan Sulejmani

Department of Food Technology, University of Tetova, 1200 Tetovo, Macedonia
e-mail: erhan.sulejmani@unite.edu.mk

ABSTRACT

Blueberry (*Vaccinium myrtillus* L.) fully ripe fruits were harvested in the first decade of August during the year 2023 in the (Sun Hill) area of Sharr Mountain, North Macedonia. A wild cultivated blueberry population, grown in localities with an altitude of 1698 m above sea level (42°33'41", 20°88'19") was used. The fruits were picked by hand, packed in polyethylene bags, and stored in a refrigerator at a temperature of -18°C within 7 months and were the subject of the study of this research. The sample weighing 500g was taken out of the freezer and left at a temperature of 4°C for 12 hours. Then 100g of the melted sample was taken and blended with a blender. The samples are homogenized, and diluted for the determination of further procedures. The present study analyzed the thermal degradation of anthocyanin in pure blueberry juice with added sugars and vitamin C. The results show that the degradation of blueberry anthocyanin follows a degradation constant degradation order with treatment time. The highest rate of anthocyanin stability was achieved by using additional vitamin C during the processing of blueberry juice during 40 minutes of heat treatment compared to that with added sugar. Further studies on blueberry anthocyanin stabilization are needed if the juice is to be processed with other ingredients in the food industry.

Keywords: spectrophotometer, cyanidin-3-glucoside, thermal degradation, vitamin C

THE INFLUENCE OF THE TYPE AND CONCENTRATION OF PLASTICIZER ON THE PROPERTIES OF BIOPOLYMER FILMS BASED ON WILD FLAX (*CAMELINA SATIVA*)

Danijela Šuput[1], Biljana Lončar[1], Senka Popović[1], Nevena Hromiš[1], Slađana Rakita[2], Nedeljka Spasevski[2]

[1]Faculty of Technology Novi Sad, University of Novi Sad, 21000 Novi Sad, Bulevar cara Lazara 1, Serbia

[2]Institute of Food Technology, University of Novi Sad, 21000 Novi Sad, Bulevar cara Lazara 1, Serbia

e-mail: suput.danijela@gmail.com

ABSTRACT

The development of biodegradable packaging materials using naturally occurring, renewable biopolymers has gained attraction due to consumer demand for high quality products and concerns about the environmental waste problems. However, the inferior mechanical properties and low water resistance of packaging materials based on natural polymers pose a significant obstacle to their wider use. One of the ways to improve the properties of biopolymer-based packaging materials is the addition of plasticizers during their synthesis. In this work, the influence of the type and concentration of plasticizer on the properties of new biopolymer films based on wild flax *(Camelina Sativa)* was investigated. *Camelina Sativa* oil cake (CSoC) remains after edible oil cold pressing as a by-product. One of the possibilities for its valorization is the synthesis of biopolymer materials. During the synthesis, different plasticizers - glycerol and polyethylene glycol 400 - were added in different concentrations - 20%-60%. The obtained CSoC-based biopolymer films were analyzed for the following properties: Moisture content, solubility, thickness, tensile strength, elongation at break and water vapor permeability. The results obtained showed significant differences when different plasticizers were applied at different concentrations. The biopolymer film with optimal properties was obtained by adding glycerol at a concentration of 40%.

Keywords: biopolymer films, Camelina Sativa, plasticizers, properties

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RHEOLOGICAL ANALYSIS OF MICROALGAE

Patrik Szatmári, Ernő Gyimes, Dóra Csercsics

Department of Food Engineering, Faculty of Engineering, University of Szeged, Moszkvai krt. 5-7, H-6725 Szeged, Hungary
e-mail: patrik.szatmari@gmail.com

ABSTRACT

The objective of this thesis was to perform basic experiments on two microalgae species, *Chlorella vulgaris* and *Arthrospira platensis (Spirulina)*. Our basic research focused on the rotational characterisation of solutions prepared using microalgae. Viscosity measurements using a rotational viscometer. In a storage experiment we investigated how the gel-forming properties of microalgae change over time. The viscosity was tested for solutions containing 1-2-3-4-5% microalgae. Based on the measured values, statistics were prepared and evaluated. Viscosity was measured at 4 different RPM, with higher RPM observed significant foam formation was observed. Due to the foaming property and similarity to agaragar the gel forming properties of the viscosity determined were investigated during the preparation of gel products properties in practice. We have several results.

Keywords: rheology, microalgae, viscosity

EXAMINATION OF THE SURFACE CHANGES OF UV-C TREATED CARROTS

Balázs Szegedi[1], Réka Dobozi[2], Katalin Papp-Sziládi[1]

[1]Department of Mechanical Engineering, Faculty of Engineering, University of Szeged, Mars tér 7, H-6724 Szeged, Hungary
[2]Department of Food Engineering, Faculty of Engineering, University of Szeged, Moszkvai krt. 5-7, H-6725 Szeged, Hungary
e-mail: szegedib@mk.u-szeged.hu

ABSTRACT

After harvesting, the carrot surface is more exposed to microbial contamination, so the vegetable is subjected to a rough wash. Washing does not result in sterility, but it greatly reduces surface contamination. As a result of washing, the epidermal layer is damaged and the carotenoid compounds begin to oxidize, resulting in an aesthetic defect. UV-C irradiation provides an opportunity to delay surface browning, with which we can achieve further germ reduction as well. During our tests, we developed a treatment device that illuminates the carrot with UV-C light while it is being rotated. We assessed possible microbiological changes and the degree of surface browning without treatment and after treatment. Based on our experience, UV-C lighting effectively reduced the total number of surface microbeads and delayed the formation of brown spots.

Keywords: UV-C, UV-C treatment, Carrot, Carrot preserving

DUCKWEEDS: SUSTAINABLE NOVEL FOODS

Dóra Szepesi-Bencsik, Ádám Lőrincz, Eszter Trenyik, Balázs P. Szabó

Department of Food Engineering, Faculty of Engineering, University of Szeged, Moszkvai krt. 5-7, H-6725 Szeged, Hungary
e-mail: bencsikd@mk.u-szeged.hu

ABSTRACT

The overpopulation of our planet and the excessive use of resources are causing an increasing problem. The population's need for protein is classically met from animal sources (meat, milk, eggs, fish) and from arable crops (soy, peas, chickpeas, etc.). The amount of agricultural land available on Earth is limited, so it is necessary to open up to new possibilities.

As of December 2021, 2 species of water millet, *Wolffia arrhiza* and *Wolffia globosa*, have been included in the range of new foods. In addition to these, widely known duckweed species such as *Lemna gibba* or *Lemna minor* are candidates for this status. Lentils have outstanding content values, the protein content of the dried plants is between 20-30%, and their fatty acid composition is also excellent. They can be grown easily and quickly without soil.

These plants are not unknown in the folk diet, they have been consumed for a long time in some Southeast Asian countries, but in the Western world they were not considered as potential food until now.

Keywords: sustainability, duckweed, Wolffia, Lemna

EFFECT OF DRYING METHODS ON QUALITY OF FRUIT POMACE

Judit Tarek-Tilistyak, Zoltan Cziaky, Tamas Antal, Mohamed Tarek

Agricultural and Molecular Research and Service Institute, University of Nyíregyháza, H-4400 Nyíregyháza, Hungary
e-mail: judit.tilistyak@gmail.com

ABSTRACT

In accordance with the NOVA food classification, drying results healthy food. It can be a solution in case of recirculation of bioactive components in food industrial waste like fruit pomace to turn into high value added products. We aimed a comparative analysis of drying methods on chemical and physical parameters of sour cherry and elderberry pomace. The pomace was obtained from a local industrial partner. On the raw fruit pomace, convective drying, vacuum drying, and lyophilisation alone and in combination with vacuum drying were applied in laboratory scale. Total polyphenol content, total anthocyanine content, water activity, and colour parameters (CIE Lab) were measured. We stated that the lyophilisation was the most effective method for the preservation of bioactive constituents like polyphenols and anthocyanines.

Keywords: fruit pomace, liophilization, drying, antioxidant, poliphenol

PHYSICO-MECHANICAL PROPERTIES OF PURPLE WHEAT IN HUNGARY

Eszter Trenyik, Antal Véha, Balázs P. Szabó

Department of Food Engineering, Faculty of Engineering, University of Szeged, Moszkvai krt. 5-7, H-6725 Szeged, Hungary
e-mail: trenyik.eszter@mk.u-szeged.hu

ABSTRACT

Wheat is a nutritionally important cereal that contributes significantly to meeting our protein, carbohydrate and dietary fibre nutrient needs.

The different coloured varieties of *Triticum aestivum* wheat have become familiar to consumers in recent decades. There are purple, blue and black varieties, which are rich in anthocyanins, which act as antioxidants. These are natural plant pigments found in the skin of the fruit. Pigmented wheat varieties are grown in small quantities. They are promising raw materials because of their phytochemical composition and their characteristic colour.

In our work, two common and two purple wheat genotypes of two vintages (2022 and 2023) were analysed using Perten Single Kernel Characterisation System (SKCS) 4100 (Perten Instruments) equipment. We compared the seasonal effect taking into account kernel weights, kernel sizes, hardness and moisture.

Overall, hardness and moisture content decreased in 2022 compared to 2023 for the genotypes tested.

Keywords: purple wheat, hardness, moisture

EVALUATION OF RHEOLOGICAL, SENSORY AND NUTRITIONAL QUALITIES IN GLUTEN-FREE BREAD FORMULATIONS

Gafur Xhabiri, Namik Durimishi, Xhezair Idrizi, Erhan Sulejmani, Blerta Ajdari, Ermira Alija

Faculty of Food Technology and Nutrition, University of Tetova, 1200 Tetovo, North Macedonia
e-mail: gafur.xhabiri@unite.edu.mk

ABSTRACT

The increase in the number of people suffering from celiac disease has also increased the demand for gluten-free breads, which are mainly of poor sensory quality and low nutritional value. Therefore, the purpose of this paper is to create new formulations using rice flour, chickpea flour, and beans and to study the rheological, nutritional, and sensory qualities of the bread.

The results showed that the gluten-free bread had different rheological qualities, and only mixes M5 and M6 had similar rheological qualities such as dough development, stability, and degree of softening to the control bread M1. Gluten-free bread from mixes M2 and M3 had higher contents of protein, fat, cellulose, and minerals, while breads from mixes M5 and M6 had medium contents. Bread M2 and M3 had acidity levels above the allowed limits. Sensory analyses showed that bread M5 and M6 have similar sensory qualities to the control bread M1 and fall into the same quality category, but bread from the M5 mixture has a much better taste and aroma. For consumption, we recommend using gluten-free bread from the M5 mix, which in its composition has 80% rice flour, 7.5% chickpea flour, 5% bean flour, and 7.5% egg powder.

Keywords: bean flour, sensory properties, nutritional value, gluten free bread.

Session 4.
Intelligent Systems and Logistics

APPLICATION OF ARTIFICIAL TECHNIQUES IN THE POULTRY INDUSTRY

Lili Dóra Brassó, Zsófia Várszegi, István Komlósi

Department of Animal Husbandry, University of Debrecen, H-4032 Debrecen, Hungary
e-mail: brasso.dora@agr.unideb.hu

ABSTRACT

Due to the increasing demand for poultry meat globally, the poultry sector has to improve production efficiency, meat quality, animal health, and welfare.

The definition of animal welfare includes the healthiness, good emotional state and natural behaviour of chickens. Nowadays, the primary goal of farms is to cut production costs and the salary of employees, while sustaining or increasing population size. All of this had negative impacts on animal welfare and behaviour. The latter facts together with the decreasing labour force have led to the application of intelligent technologies. There is a great variety of Precision Livestock Farming tools that help to reduce production costs by monitoring environmental conditions (housing and microclimate), animal health (disease and hygiene control), behaviour (locomotion, activity and sound analysis), and performance (weight monitoring) in a real-time manner. The automatic and continuous data collection enables the acquisition of up-to-date information on production parameters and welfare indices including early and rapid notifications for the farmer to take action in case of problems. Precision technologies also help to accelerate and improve the decision-making process in production management and contribute to the mitigation of economic losses.

Keywords: poultry sector, artificial intelligence, production efficiency, automatisation, PLF technologies

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REALTIME-AT: IMPROVED ONLINE ANOMALY DETECTION IN STREAMING MULTIDIMENSIONAL TIME SERIES

Burak Colak, Károly Farkas

Department of Networked Systems and Services, Faculty of Electrical Engineering and Informatics, Budapest University of Technology and Economics, Műegyetem rkp. 3., H-1111 Budapest, Hungary
e-mail: burakcolak@edu.bme.hu

ABSTRACT

Currently, there is a growing significance of real-time data monitoring and analysis on multivariate time series data with the rapid increase of infrastructure complexity. Detecting anomalies now plays a crucial role in risk, resource and cost management in domains ranging from industrial networks to financial markets. While machine learning-based anomaly detection algorithms show great potential, many of them are designed to run in an offline environment, and adapting those models in an online setting remains a challenge. A novel algorithm by Xu et al., Anomaly Transformer, shows impressive offline performance; however, it is not fit for online use.

To solve this challenge, we introduce RealTime-AT, an optimised improvement of Anomaly Transformer designed for online anomaly detection. We redefine the sliding window mechanism to ensure the model continuously processes the most recent relevant data points, leading us to more accurate anomaly identification. RealTime-AT's core uses a novel dual-buffer system to handle streaming online data, enhancing its real-time capabilities.

Experiments show that RealTime-AT maintains comparable accuracy and other anomaly detection metrics to Anomaly Transformer. More significantly, while maintaining similar performance, it noticeably reduces computational resource demands. This optimisation carries vital importance in resource-constrained real-time environments.

Keywords: Real-time anomaly detection, Online streaming data, Multivariate time series, Machine learning

IMPACT OF ANTENNA ORIENTATION ON LOCALIZATION ACCURACY USING RSSI-BASED TRILATERATION

Dominik Csík[1,2], Ákos Odry[1], Richárd Pesti[1,2], Péter Sarcevic[1]

[1]Department of Mechatronics and Automation, Faculty of Engineering, University of Szeged, Moszkvai krt. 9, H-6725 Szeged, Hungary
[2]Doctoral School of Applied Informatics and Applied Mathematics, Óbuda University, Bécsi street 96/B, H-1034 Budapest, Hungary
e-mail: csikd@mk.u-szeged.hu

ABSTRACT

The goal of the indoor localization is to determine the position and orientation of people, devices, and mobile robots. With the rise of Industry 4.0, wireless communication technologies have emerged as a rapidly evolving and crucial area for achieving this goal. Various radiocommunication-based technologies, including Bluetooth, Bluetooth Low Energy (BLE), Wi-Fi, Ultra-Wideband (UWB), and ZigBee offer means to indirectly estimate distance. These methods leverage diverse principles such as time-based measurements, signal strength, and angle of arrival. Indoor positioning systems can be categorized into two approaches: distance-based and distance-independent techniques. The Free Space Path Loss (FSPL) model describes the connection between distance and Received Signal Strength Indicator (RSSI). The parameters within this model significantly impact distance estimation and localization accuracy. Therefore, a method that accurately characterizes the model is critical. This work proposes an orientation-based localization technique utilizing RSSI and trilateration. Measurements were conducted between two ESP32 units in various orientations to obtain optimal parameters for each specific scenario. To assess the effectiveness of this approach, two scenarios were evaluated: one considering orientation and another neglecting it. The results show that incorporating orientation information leads to significantly more accurate positioning compared to the orientation-agnostic approach.

Keywords: indoor localization, fingerprinting-based methods, received signal strength indicator, radicommunication-based technologies

SEQUENTIONAL PROBABILITY RATIO TEST FOR VIBRATION ANALYSIS TESTING

Tibor Dobján

Department of Mechatronics and Automation, Faculty of Engineering, University of Szeged, Moszkvai krt. 9, H-6725 Szeged, Hungary
Department of Information Technology, GAMF Faculty of Engineering and Computer Science, John von Neumann, H-6000 Kecskemét, Hungary
Faculty of Horticulture and Rural Development, John von Neumann, H-6000 Kecskemét, Hungary
e-mail: dobjan.tibor@mk.u-szeged.hu

ABSTRACT

I would like to demonstrate how Wald's Abraham's Sequential Probability Ratio Test can be used as a non-destructive material testing solution in vibration analysis tests. The method is different from traditional spectral-based solutions and can be well used in the field of Structural Health Monitoring tests.

Keywords: Sequentional Probability Ratio Test, Vibration Analysis Test, Non-Destructive Testing, Structural Health Monitoring

Acknowledgements: Thank for University of Dunaújváros for the masurement data.

DEVELOPING EXCEL VBA FUNCTIONS FOR THE MATHEMATICAL MODELING OF THREE-DIMENSIONAL VECTORS

Zoltán Fabulya, György Hampel

Department of Engineering Management and Economics, Faculty of Engineering, University of Szeged, Mars tér 7, H-6724 Szeged, Hungary
e-mail: fabulya@mk.u-szeged.hu

ABSTRACT

The current computer support for operations involving three-dimensional vectors is insufficient, even in widely used programs like Excel. These programs lack customized features specifically designed for vector operations. However, this limitation can be overcome by utilizing the options provided by Visual Basic for Applications. By creating user functions, we can effectively calculate various results related to the mathematical application of vectors. These functions include determining the magnitude and absolute value of a vector, calculating the angle between two vectors or the cosine of that angle, finding the scalar product and vector product of two vectors, as well as evaluating the mixed product of three vectors. By incorporating these custom functions into the spreadsheet program, users can easily perform mathematical calculations pertaining to three-dimensional vectors.

Keywords: Excel VBA, programming, vector operations

THE RISKS OF USING AI

György Hampel, Zoltán Fabulya

Department of Engineering Management and Economics, Faculty of Engineering, University of Szeged, Mars tér 7, H-6724 Szeged, Hungary
e-mail: hampel.gyorgy@szte.hu

ABSTRACT

The integration of artificial intelligence (AI) in agriculture has the potential to revolutionize the agriculture, but it also brings challenges and risks that need to be carefully managed. AI can improve planning, streamline work processes, and enhance decision-making in crop cultivation and animal husbandry, ultimately leading to higher returns for farmers. However, the lack of training and high implementation costs can make it difficult for some farmers to adopt AI, creating a competitive disadvantage and concentrating agricultural resources. Additionally, AI may contribute to unemployment among those with lower skill levels and poses cybersecurity risks that need continuous monitoring. Legal concerns also arise regarding data ownership and usage rights, with questions about who can access and utilize collected data. Farmers often have to rely on AI systems as "black boxes," with limited understanding of how they work. If these systems fail and cause damages, accountability becomes an important issue. It is crucial to assess the drawbacks and risks of AI implementation in agriculture and educate farmers about these risks to prevent significant damage. Managing these risks effectively and ensuring data accuracy and security are essential in the global adoption of AI in agriculture.

Keywords: artificial intelligence, agriculture, dangers, risks

MARKERLESS MEASUREMENT TECHNIQUES FOR MOTION ANALYSIS IN SPORTS SCIENCE

Yao Meng[1,2], István Bíró[2], József Sárosi[2]

[1]Doctoral School on Safety and Security Sciences, Óbuda University, Népszínház street 8, H-1081 Budapest, Hungary
[2]Faculty of Engineering, University of Szeged, Mars tér 7, H-6724 Szeged, Hungary

ABSTRACT

Markerless motion capture system and X-ray fluoroscopy as two markerless measurement systems were introduced the application method in sports biomechanical areas. An overview of the technological process, data accuracy, suggested movements, and recommended body parts were explained. The markerless motion capture system consists of four parts: camera, body model, image feature, and algorithms. Even though the markerless motion capture system seems promising, it is not yet known whether these systems can be used to achieve the required accuracy and whether they can be appropriately used in sports biomechanics and clinical research. The biplane fluoroscopy technique analyzes motion data by collecting, image calibrating, and processing, which is effective for determining small joint kinematic changes and calculating joint angles. The method was used to measure walking and jumping movements primarily because of the experimental conditions and mainly detect the data of lower limb joints.

Keywords: markerless measurement, motion analysis, biomechanics

EFFECT OF FOOT ORTHOSES ON MULTI-SEGMENT FOOT KINEMATICS: A SYSTEMATIC REVIEW

Yao Meng[1,2], István Bíró[2], Yaodong Gu[3]

[1]Doctoral School on Safety and Security Sciences, Óbuda University, Népszínház street 8, H-1081 Budapest, Hungary
[2]Faculty of Engineering, University of Szeged, Mars tér 7, H-6724 Szeged, Hungary
[3]Faculty of Sports Science, Ningbo University, Fenghua Road 818, Ningbo, China

ABSTRACT

The systematic review aims to identify and summarize the effects of foot orthoses on foot kinematics at the forefoot, midfoot, and rearfoot. Method: The literature search was conducted following the inclusion criteria: (1) running or walking as the experience tasks, (2) three-dimensional kinematics were only included because the transverse alignment of the foot affects movement in the frontal plane in the two-dimensional analysis and exclusion criteria: (1) considering the foot to be a rigid part of the body, (2) those participants with neurological conditions, systemic diseases, or degenerative conditions were excluded from the study. (3) unpublished or non-peer reviewed articles was excluded, (4) studies on sensor insoles and vibration insoles were excluded. Three orthoses categories were categorized for data synthesis: (1) non-posted moulded, which customed or contouring the participants foot; (2) non-moulded posted, which flat orthoses without contouring, but with adding posting; (3) posted moulded that had customed-contouring and additional posting. The Down and Black Quality Index in an adapted version to assess the methodological quality of each study. Result: A total of 22 studies were included. Meta-analyses were not conducted due to comparisons were absence the same across orthosis design, foot posture, and gait. The significant differences that had a large effect size are described below. Forefoot: moulded posted orthoses effect the peak forefoot eversion during walking (ES 1.14); posted orthoses decrease the dorsiflexion at heel contact at heel contact (ES 0.6) and effect the peak eversion during running (ES 0.69). Midfoot: In walking gait, moulded orthoses decrease the midfoot mean medial longitudinal arch (ES 0.43). Moulded orthoses and posted orthoses both increase the mean dorsiflexion (ES >0.4) and the mean abduction (ES >0.4). Rearfoot: In walking gait, moulded orthoses and posted orthoses both increase the mean rearfoot abduction (ES>0.04) and reduce the peak eversion (ES 0.63). Posted orthoses and moulded posted orthoses both increase the mean rearfoot plantarflexion (ES 0.47). In running gait, posted orthoses increase the rearfoot peak eversion(ES 0.4) and dorsiflexion at heel contact (ES 0.53). Conclusion: Molded posted orthoses are significantly effective in controlling forefoot eversion. Forefoot kinematics in the frontal plane did not show significant results. Posted orthoses are more effective on the midfoot and rearfoot kinematics in all three planes. There are several limitations in data analysis of this study: as measurement of midfoot kinematics in the transverse plane is difficult, there was not sufficient data to analyze. Multi-segment running kinematics data are limited by the small number of studies included.

Keywords: foot multi-segement, foot orthoses, motion analysis, biomechanics

A SOFT EXOSKELETON FOR HAND FINGER REHABILITATION APPLICATION USING FULLY ELASTIC PNEUMATIC ACTUATORS

Attila Mészáros, Réka Mátó, József Sárosi

Department of Mechatronics and Automation, Faculty of Engineering, University of Szeged,
Moszkvai krt. 9, H-6725 Szeged, Hungary
e-mail: m-attila@mk.u-szeged.hu

ABSTRACT

In recent years, there has been a growing demand for wearable actuators, that can be worn on individual body parts. This demand is dynamically increasing due to the numerous potential applications such as rehabilitation and enhancing load-bearing capabilities. Exoskeletons are mechanical structures that supplement or facilitate human movements and increase the body parts natural capabilities. Despite their wide range of applications, rigid exoskeletons have several deficiencies that required further developments. Soft actuators have been developed to address these deficiencies, forming one of the main categories of easily wearable exoskeletons. The two categories - rigid and soft exoskeletons - complement each other in their structures during applications. Soft robotic elements enable precise and delicate movements while providing adequate flexibility during use and rigid units are responsible for the stable frame structure and fixation. Their combined use is applied for rehabilitation, occupational safety, and enhancing work performance purposes. The aim of this article is to physically realize a device that has a legitimate purpose in the field of human hand rehabilitation. The goal was to design, manufacture, and functionally test the elements of a device capable of assisting in the rehabilitation of fingers using completely flexible actuators.

Keywords: soft actuator, soft exoskeleton, soft robotics, flexible hand rehabilitation

WITH CHATGPT ABOUT CHATGPT...

Valeria Nagy

Department of Mechanical Engineering, Faculty of Engineering, University of Szeged, Mars tér 7, H-6724 Szeged, Hungary
e-mail: valinagy78@mk.u-szeged.hu

ABSTRACT

We often say that the need for innovation is indisputable, and the reason in many cases is that the world is changing. But if we think about it more, we change the world through our actions. According to one of the thoughts of Mahatma Gandhi (Mohandas Karamchand Gandhi) (1869–1948), an Indian lawyer and politician, "We must act as we would like to shape the world." At the same time, we are not, we will not and cannot always be aware of the impact our actions and the innovations we create have and will have on our lives. This is undoubtedly true, that is why it is worthwhile to approach and study each (future) innovation from several points of view: examine and analyze, then draw conclusions about its values and effectiveness and think further. This paper undertakes to reveal with the help of an artificial intelligence (AI) solution, a large language model, the Chat GPT (Generative Pre-trained Transformer), how ChatGPT defines itself, what it thinks about itself, how it answers questions about itself: How predictable it is? What its self-limiting ability is? How provocative it is? What level of text generation it is? etc.

Based on the "machine" answers to "human" questions, it can be concluded that humans and artificial intelligence perform better together than separately. Questions and tasks formulated with sufficient thoroughness, as well as problems described with scientific sophistication, can be approached from several aspects simultaneously. And with this human–machine collaboration, the environmental, economic, technical, and social expectations of desired sustainability are met.

Keywords: Industry 5.0, "human" question, "machine" answer, intelligence, collaboration

MEASUREMENT SYSTEM FOR THE CALIBRATION OF ACCELEROMETER ARRAYS

Richárd Pesti[1,2], Dominik Csík[1,2], Ákos Odry[1], Péter Sarcevic[1]

[1]Department of Mechatronics and Automation, Faculty of Engineering, University of Szeged, Moszkvai krt. 9, H-6725 Szeged, Hungary
[2]Doctoral School of Applied Informatics and Applied Mathematics, Óbuda University, Bécsi út 96/b, H-1034 Budapest, Hungary
e-mail: pestir@mk.u-szeged.hu

ABSTRACT

This paper addresses accelerometer array calibration, focusing on determining the errors between sensors. MEMS based triaxial accelerometers, key components of Inertial Measurement Units (IMUs), are used in localization, robotics, and navigation systems. The requirements of these applications necessitate low-cost sensors, which makes MEMS IMUs a reasonable choice. However, these low-cost IMUs are significantly affected by systematic (bias, misalignment, scale-factor) and random errors. As a result, using these sensors can be a challenging task. Achieving reliable sensor output depends on the precision of the executed calibration method. While traditional laboratory-based sensor calibration using specialized equipment (e.g., three-axis turntable) is accurate, it is time-consuming and costly. In contrast, in-field calibration techniques, which can be performed using a mechatronic actuator or a robotic arm, have gained popularity. These techniques involve comparing sensor measurements to established reference values. The MEMS sensors are increasingly being used in multi-sensor applications, which demands not only individual sensor error calibration but also important to determine the axis misalignment between the used sensors. During calibration process, various optimization algorithms (e.g., GA, PSO) can also be used to find the error parameters. The proposed work presents a measurement system for the calibration of between sensor errors of accelerometer arrays.

Keywords: inertial measurement unit, accelerometer, in-field calibration, genetic algorithm, particle swarm optimization

AUGMENTED REALITY BASED INDUSTRIAL DIGITALIZATION AND LOGISTICS

János Simon

Department of Mechatronics and Automation, Faculty of Engineering, University of Szeged,
Moszkvai krt. 9, H-6725 Szeged, Hungary
e-mail: simon@mk.u-szeged.hu

ABSTRACT

The virtualization systems enable the examination of the system's virtual elements by manufacturers, thus allowing them to be analysed and designed where real-world changes are necessary. Unnecessary planning is reduced by virtual reality, which allows engineers to experiment with changes before the final solution is created. Realistic and risky simulations occurring in the manufacturing environment, such as chemical spills, hazardous machinery, and noisy surroundings, can be simulated through virtual reality training programs without exposing workers to actual danger. In the event of an inevitable occurrence, employees will have usable experience and are more likely to respond appropriately to the situation. The paper presents and describes some of the most important Logistics 4.0 technologies: Internet of Things, robotics and automation, augmented reality, 3D printing and automatic guided vehicles. The aim of this paper is to describe the concept of Logistics 4.0, define its significance, components and technologies using augmented reality.

Keywords: Industry 4.0, Augmented Reality, Head-Worn Displays, Logistics 4.0

PRE-PROCESSING FOR ENHANCED ANOMALY DETECTION ON PERIODIC SERVER FARM TELEMETRY DATA

Dániel László Vajda, Károly Farkas

Department of Networked Systems and Services, Faculty of Electrical Engineering and Informatics, Budapest University of Technology and Economics, Műegyetem rkp. 3., H-1111 Budapest, Hungary
e-mail: dvajda@hit.bme.hu

ABSTRACT

With increased network infrastructure complexity on all levels, telemetry has become instrumental in maintaining desired operations within server farms. No matter the application, operators and users benefit significantly from the continuous telemetry of interconnected networking devices. Once data collection to an operations centre is achieved, anomaly detection is an essential step in the monitoring process: an algorithm aims to identify and raise alerts for signs of abnormal behaviour, helping increase maintenance efficiency and decrease downtimes. However, we identified challenges that some modern approaches face with periodic datasets, causing performance degradation. As a solution, we present a novel pre-processing procedure to improve anomaly detection in the telemetry of server farms. Our procedure removes signals with regular patterns (termed modes) from the incoming data using a mathematically well-grounded transformation algorithm while preserving signs of anomalies in the data that remain. We performed experiments measuring the improvement of our pre-processing procedure to our latest and other state-of-the-art anomaly detection algorithms using the well-established F-score metric. As expected, we achieved significant improvement in the case of our latest anomaly detection algorithm when experimenting with periodic data. At the same time, we also managed to improve the performance of all other detectors tested.

Keywords: Server farm telemetry, anomaly detection, periodic time series, pre-processing, mode removal

Acknowledgements: We would like to thank dr. Tien Van Do for his valuable comments on algorithm implementation along with the test infrastructure and office space he provided us with.

Session 5.

Mechanical Engineering, Materials Science and Energetics

PRODUCTION OF HIGH-QUALITY GAS BY PYROLYSIS

András Betovics, Viktor Madár, Norbert Schrempf, László Tóth

Institute of Technology, Hungarian University of Agriculture and Life Sciences, 2100 Gödöllő, Páter Károly u. 1., Hungary
e-mail: Betovics.Andras.Mate@phd.uni-mate.hu

ABSTRACT

In the past, competitiveness with the cost of energy produced by fossil energy carriers was almost exclusively decisive in relation to the topic, but today environmental protection and the circular economic model play a decisive role. For example, methane and carbon dioxide emissions can be reduced to such a clear extent during pyrolysis and combined CHP power generation that it is remarkable. In the case of the developed pyrolysis (heat decomposition) equipment, 0.9 - 1.15 kg of wood (containing 15 - 20% moisture) is required to produce 1.0 kWh of electricity.

Keywords: biomass, pyrolysis, gas generator, waste heat, CHP

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DENSITY MEASUREMENTS OF NANOFLUIDS USING PYCNOMETER – REVIEW OF THE EXISTING RESULTS

Siniša Bikić[1], Saša Laloš[2], Milivoj Radojčin[1], Ivan Pavkov[1]

[1]Faculty of Agriculture, University of Novi Sad, Trg Dositeja Obradovića 8, 21000 Novi Sad, Serbia
[2]Faculty of Mechanical Engineering, University of Banja Luka, Bulevar Vojvode Stepe Stepanovića 71, 78000 Banja Luka, Bosnia & Herzegovina
e-mail: bika@uns.ac.rs

ABSTRACT

The subject of the work are colloidal suspensions of nanoparticles in the base fluid. It is about fluids that could be used in the future as heat transfer fluids in heat exchangers. By suspending of nanoparticles could be intensified heat transfer by forced convection of fluids in heat exchangers. The density of nanofluids is measured for the purposes of studying the forced convection of nanofluids in heat exchangers. The density of the nanofluids is most often measured using a pycnometer due to the presence of nanoparticles in the fluid. The aim of the work was to determine whether the density results obtained with a pycnometer are adequate for the analysis of forced convection of nanofluids. The density of nanofluids obtained by pycnometer at atmospheric conditions could be more applicable in systems where atmospheric pressure prevails.

Keywords: nanofluids, density, pycnometer

MODELLING HYSTHERESIS WITH MEMRISTORS

Sándor Csikós, Ádám Bálint, József Sárosi

Department of Mechatronics and Automation, Faculty of Engineering, University of Szeged,
Moszkvai krt. 9., H-6725 Szeged, Hungary
e-mail: csikos-s@mk.u-szeged.hu

ABSTRACT

In the realm of electronics, the foundational passive components—resistors, inductors, and capacitors—are well-established. However, in 1971, Leon Chua introduced a theoretical fourth element, the memristor, identified by its distinctive characteristic of memristance and its manifestation in a pinched hysteresis loop. This intriguing property suggests potential applications beyond conventional electronics, particularly in modeling hysteresis phenomena across various domains. This paper delves into the exploration of memristance as a mathematical framework for simulating hysteresis in electrical and mechanical systems. We commence by elucidating the theoretical underpinnings of memristance and its hysteresis behavior, followed by a comprehensive overview of existing hysteresis models. Subsequently, we propose a novel approach that leverages the memristor model to offer enhanced insights and predictive capabilities for hysteresis in these systems. Through analytical examination and simulation studies, we demonstrate the versatility and applicability of the memristor model, underscoring its potential as a universal tool for hysteresis modeling. This research not only broadens the understanding of memristive properties but also opens new avenues for cross-disciplinary applications, ranging from electronic circuit design to mechanical system analysis.

Keywords: memristor, hystheresis

ENHANCING HYDRODYNAMIC CHARACTERISTICS THROUGH THE INTEGRATION OF 3D-PRINTED SPACERS WITHIN THE VSEP MEMBRANE FILTRATION MODULE

Imre Vajk Fazekas[1], Martin Trancsik[1], Aws N. Al-Tayawi[1], József Richárd Lennert[2], Sándor Beszédes[1], József Csanádi[3], Tamás Szabó[4], Cecilia Hodúr[1], Gábor Veréb[1], Zsuzsanna László[1], Szabolcs Kertész[1]

[1]Department of Biosystems Engineering, Faculty of Engineering, University of Szeged, Moszkvai krt. 9, H-6725 Szeged, Hungary
[2]Department of Power Electronics and E-Drives, Audi Hungaria Faculty of Automotive Engineering, Széchenyi István University, H-9026 Győr, Hungary
[3]Department of Food Engineering, Faculty of Engineering, University of Szeged, Moszkvai krt. 5-7, H-6725 Szeged, Hungary
[4]Department of Physical Chemistry and Materials Science, Faculty of Science and Informatics, University of Szeged, H-6720 Szeged, Hungary
e-mail: kertesz@mk.u-szeged.hu

ABSTRACT

In our work, different 3D printed spacers were tested in a special Vibratory Shear Enhanced Processing (VSEP) device during model dairy wastewater ultrafiltration. Our goal is to change the hydrodynamic flow conditions in the filtration module in order to increase the membrane surface shear forces with mechanical module vibration and the integration of spacers into the module. It can significantly reduce the fouling tendency of the used polymer membranes.

We were curious as to whether better results could be achieved with a further developed, redesigned shapes (shape test) and PETG material usage next to PLA (material test) compared to the previously tested one. We performed our experiments with and without spacers of different shapes, as well as with and without module vibration of variable amplitude. The laboratory membrane separation experiments were carried out with 30 kDa cut-off ultrafiltration membrane at room temperature, at transmembrane pressure of 0.8 MPa, with a recirculation volume flow of ~15 L/min.

Compared to the control measurements, the results obtained when the spacer was inserted into the module, the values obtained with module vibration and the results obtained when the spacer and module vibration were used together resulted in improvements in all cases.

Keywords: Dairy Wastewater, Ultrafiltration, Membrane Fouling Mitigation, 3D Printing and Design, Spacers

Acknowledgements: This study was financed by the Hungarian National Research, Development and Innovation Office, project NKFI-FK-142414.

ALTERNATIVE METHOD FOR MODELING DYNAMIC SYSTEMS

Gusztáv Fekete[1], István Bíró[2]

[1]Department of Material Science and Technology, Audi Hungaria Faculty of Automotive Engineerging, Széchényi István University, H-9026 Győr, Hungary
[2]Department of Mechanical Engineering, Faculty of Engineering, University of Szeged, Mars tér 7, H-6724 Szeged, Hungary
e-mail: fekete.gusztav@sze.hu

ABSTRACT

Multibody Dynamics is special course since it includes the basic dynamic laws, mechanical modeling and the numerical solution of the derived equations of motion. Numerical solutions are often carried out by the help of mathematical programs or by a multibody dynamics software. In this article, an example will be shown to demonstrate the benefits of using the principle of Virtual Power in mechanical modeling, as an alternative method. In addition to the derivation of the equations of motion, approximate methods, which are studied and applied in this course, are also presented.

Keywords: multibody dynamics, approximate methods, virtual power

NUMERICAL STUDY OF KNEE PROSTHESIS WEAR AS A FUNCTION OF PROSTHESIS SIZE

Gusztáv Fekete[1], Endre Jánosi[2]

[1]Department of Material Science and Technology, Audi Hungaria Faculty of Automotive Engineerging, Széchényi István University, H-9026 Győr, Hungary
[2]Savaria Institute of Technology, Faculty of Informatics, Eötvös Loránd University, H-9700 Szombathely, Hungary
e-mail: fekete.gusztav@sze.hu

ABSTRACT

Wear is a key factor that significantnly limits the survival of total knee arthroplastys (TKAs). Wear itself is known to be highly dependent on load, local kinematics taking place in the knee joint and presumably on the geometry of the TKA. This article has investigated, by means of multibody models, how different TKA sizes and TKA-related geometric parameters affect wear during squatting and gait motion. It has been demonstrated that wear rate does increase, closely linearly, as a function of TKAs size, while the influence of TKA-related geometric parameters on wear propagation can be described by linear or quadratic functions. These results, together with the newly introduced dimensionless parameters, demonstrate that the wear rate of TKAs can be reduced by choosing the right dimensions.

Keywords: multibody simulations, wear, TKA dimensions

DESIGN AND IMPLEMENTATION OF A WIRELESS SMART HOME HEATING CONTROL SYSTEM: INTEGRATING IOT FOR ENHANCED EFFICIENCY

László Gogolák

Department of Mechatronics and Automation, Faculty of Engineering, University of Szeged,
Moszkvai krt. 9, H-6725 Szeged, Hungary
e-mail: gogolak@mk.u-szeged.hu

ABSTRACT

In the paper, the design and implementation of a smart home heating control system will be discussed. The work begins with the introduction of necessary technical solutions and their application in the project, extending to the physical realization of the system. The aim is to precisely and functionally design a temperature control system and execute its practical implementation. The work includes the realization of the electronics needed for measurement and control, the writing of the microcontroller firmware, and the software development and configuration of the communication between wireless nodes The fundamental concept of the smart heating control system is centralized control that is easily configurable and expandable with measuring and control wireless nodes not making decisions independently. This approach allows for the potential integration of existing nodes into a completely different infrastructure in the future without hardware modifications, merely through the insertion of software layers. The work hopes to provide insight into the exciting and complex world of heating control systems and highlight the promising possibilities of IoT technology in this field.

Keywords: IoT, Wireless Sensor network, Heat controll

DESIGN, IMPLEMENTATION, AND INVESTIGATION OF ETHERCAT AND SERIAL COMMUNICATION SERVO CONTROL SYSTEM AND IT'S INDUSTRIAL APPLICATION

László Gogolák[1], Tamás Tornai[2], Igor Fürstner[3]

[1]Department of Mechatronics and Automation, Faculty of Engineering, University of Szeged, Moszkvai krt. 9, H-6725 Szeged, Hungary
[2]Department of Mechatronics, Subotica Tech-College of Applied Sciences, Marka Oreškovića 16 24000 Subotica, Serbia
[3]Bánki Donát Faculty of Mechanical and Safety Engineering, Óbuda University, Népszínház utca 8, H-1081 Budapest, Hungary
e-mail: gogolak@mk.u-szeged.hu

ABSTRACT

In the paper, the possibilities provided by EtherCAT and serial communication servo controllers. The work begins with the presentation of the necessary technical solutions, and with their application in the project, extending to the physical realization of the system. The aim of the work is to create an accurate description of the advantages and disadvantages of the two servo controllers, extending to the physical realization of the systems. The work includes communication between PLC and controllers, description of servo controllers, and software development. The basic concept of servo controllers is centralized control, which is implemented with the help of a PLC, whose easily modifiable program and expandable sensors make the process even easier to follow. The work provides insight into the exciting and complex world of servo controllers, illustrating their use in industry.

Keywords: Linear Servo Drives, EtherCAT communication, Serial Communication

THERMAL OPTIMIZATION AND TECHNOLOGICAL TRANSFORMATION OF PHOTOVOLTAIC SYSTEMS

Saadi Hasna, Péter Emőd Korzenszky, Péter Hermanucz

Doctoral School of Mechanical Engineering, Hungarian University of Agriculture and Life Sciences, H-2100 Gödöllő, Hungary
e-mail: hasnasaadi2021@gmail.com

ABSTRACT

The increasing need for renewable energy sources highlights the significance of improving the efficiency of photovoltaic (PV) systems. This study employs a two-pronged approach to enhance the efficiency of photovoltaic (PV) panels by focusing on thermal regulation and technological adaptation. The first experiment is to define the optimal heat capacity for PV panels under changing weather conditions to maximize electrical production. Utilizing a combination of empirical data analysis and simulation modeling, this study intends to build a dynamic framework for changing PV heat capacity, hence boosting electrical efficiency across varied climatic conditions. The second aspect of the research investigates the practicality of transforming traditional PV panels into Photovoltaic-Thermal (PVT) systems. This inquiry thoroughly assesses the benefits, difficulties, and crucial factors associated with such a conversion, encompassing thermal and electrical conductivity as well as the incorporation of cooling/heating fluids. This study seeks to clarify the circumstances in which each system (photovoltaic vs. photovoltaic-thermal) demonstrates superior performance, taking into account factors such as heat capacity and specific meteorological conditions. This research is important because it has the potential to improve the efficiency and adaptability of PV systems, making solar energy more viable in different environmental conditions. Within the framework of a circular economy, generating energy on-site and consuming it in the same locale means we avoid creating waste and, consequently, prevent environmental pollution.

Keywords: Thermal Management, Heat Capacity, Simulation Modeling, Photovoltaic Systems Conversion, Cooling/Heating Fluids Integration

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ENERGETIC CHARACTERIZATION OF LIQUID, SOLID, AND GASEOUS PRODUCTS DERIVED FROM PLASTIC PYROLYSIS

Balázs Hegedüs, Zsolt Dobó

Department of Energy, Ceramic- and Polymertechnology, Faculty of Materials and Chemical Engineering, University of Miskolc, H-3515 Miskolc, Hungary
e-mail: balazs.hegedus@uni-miskolc.hu

ABSTRACT

The escalating global demand for plastics and synthetic polymers highlights the need to develop technologies to address the environmental impact of waste accumulation. Pyrolysis presents a promising waste processing method. Among the products obtainable from pyrolysis are high carbon content coke, combustible gas, and hydrocarbon oil with a wide range of possible applications. In this study, the energetic characteristics of these products obtained from the pyrolysis of low- and high-density polyethylene (LDPE, HDPE), polypropylene (PP) and polystyrene and their blends were investigated. The liquid fraction was further separated to obtain a light hydrocarbon fraction with the boiling point of the components not exceeding the gasoline range (0-210 °C). The higher heating value (HHV) of all the pyrolysis products has been determined in addition to a commercially available gasoline sample to asses the energy potential of the pyrolysis-derived fuels. We found that pyrolysis oil possesses a greater HHV compared to traditional gasoline, which shows promise for plastic-derived fuels. Additionally the energy content of the pyrolysis gas surpasses that of natural gas, further highlighting the potential of pyrolysis as a sustainable and potentially economically viable waste processing method.

Keywords: plastic waste, pyrolysis, energy, fuel, sustainability

METHODOLOGY FOR MEASURING TEMPERATURE CONDITIONS OF HEAT PUMP OUTDOOR UNIT

Peter Hermanucz, Gábor Holló

Institute of Technology, Hungarian University of Agriculture and Life Sciences, H-2100 Gödöllő, Hungary
e-mail: hermanucz.peter@uni-mate.hu

ABSTRACT

Heat pumps that use ambient air as a heat source are becoming increasingly popular. The primary reason for this is that this type can be installed at low cost, while at the same time there is no significant difference in annual COP compared to geothermal models. Importantly, however, the energy density of the air heat source is extremely low, a large amount of it has to be passed through the heat exchanger of the outdoor unit. For this reason, care must be taken when setting up the outdoor unit to ensure that nearby buildings and structures do not interfere with the air flow. If the installation conditions are inadequate, a hydraulic short circuit may occur between the intake and exhaust sides, resulting in a drop in the temperature of the intake air. This phenomenon has a direct impact on the achievable COP and thus on the energy consumption of the overall system. Given that this phenomenon is not detectable by the outside observer, a measurement procedure has been developed to detect and measure the effect. Our aim is to develop a method that can be implemented with the simplest possible measurement procedure, using the fewest possible sensors, which gives results that are as accurate as those obtained using many instruments and a complex evaluation procedure. This will allow the environmental parameters of previously installed outdoor units of heat pumps to be studied, with particular reference to temperature conditions.

Keywords: Heat pump, outdoor unit, temperature condition, inlet air temperature, COP.

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TOTAL KNEE REPLACEMENT WEAR MEASUREMENT METHODS

Endre Jánosi[1], Gusztáv Fekete[2]

[1]Savaria Institute of Technology, Faculty of Informatics, Eötvös Loránd University, H-9700 Szombathely, Hungary
[2]Department of Material Science and Technology, Audi Hungaria Faculty of Automotive Engineerging, Széchényi István University, H-9026 Győr, Hungary
e-mail: je@inf.elte.hu

ABSTRACT

Wear is considered the main mechanical factor that limits the lifetime duration of total knee replacements (TKR-s). The presented research propose some measurement methods wich can be used in case of the TKR-s wear measurement.

Keywords: wear, measurement

INVESTIGATION OF THE CUTTING OF ENGINEERING POLYMERS

Róbert Kovács, Péter Korzenszky, Róbert Keresztes

Department of Farm and Food Machinery, Institute of Technology, Hungarian University of Agriculture and Life Sciences, H-2100 Gödöllő, Hungary
e-mail: kov.robert93@gmail.com

ABSTRACT

During the turning process, we have investigated the problems that can arise, such as avoiding the formation of flow chips, which are eliminated by sawing the workpiece longitudinally. Furthermore, we measured the main cutting forces acting on the blade and the cutting forces in the feed direction at different feed rates, depths of grip and cutting speeds, and investigated possible correlations between these.

Chips produced at different cutting parameters and with different materials were investigated. All turning operations are carried out without emulsion and all other coolants for environmental and other reasons.

The specific cutting resistances have been determined, which are essential for determining good tool utilisation and also for planning the economics of machining

The aim of this research is to define machining parameters that can be used in practice for the engineering plastics under investigation, so that the machining of these materials by turning can be made more economical.

Keywords: Turning, cutting, polymers

Acknowledgements: The research was supported by the project 'The feasibility of the circular economy during national defense activities' of 2021 Thematic Excellence Program of the National Research, Development and Innovation Office under grant no.: TKP2021-NVA-22, led by the Centre for Circular Economy Analysis.

DESIGN AND IMPLEMENTATION OF A 3 DEGREES OF FREEDOM ROBOTIC ARM POWERED BY PNEUMATIC ARTIFICIAL MUSCLE

Dávid Kóczi, József Sárosi

Department of Mechatronics and Automation, Faculty of Engineering, University of Szeged,
Moszkvai krt. 9., H-6725 Szeged, Hungary
e-mail: koczid@mk.u-szeged.hu

ABSTRACT

The development of a 3-DOF robotic arm powered by pneumatic artificial muscles is represented as an innovative approach in the field of robotics, with the advantages of lightweight and flexible design being combined with the power and control benefits of pneumatic actuation. The design process, challenges, and solutions that were encountered in the development of the robotic arm are outlined in this paper, with an emphasis on its potential applications in industrial and research settings being highlighted. Additionally, the robotic arm's modular design is enabled to allow easy customization and scalability, making it possible for the arm to be tailored to a wide range of tasks, from precise laboratory work to more robust industrial applications.

Keywords: Robot, Artificial muscle, Pneumatic

DESIGN OF THE DRIVE CHAIN AND BACK SUSPENSION OF A PNEUMOBILE RACING CAR

Erik Kőműves, István Péter Szabó

Department of Mechanical Engineering, Faculty of Engineering, University of Szeged, Mars tér 7, H-6724 Szeged, Hungary
e-mail: pszi@mk.u-szeged.hu

ABSTRACT

The topic of our article is the design of the rear suspension and drivetrain of the newly developed "Airrari Classic" pneumatic racing car. The construction of the chassis of this car is completely different from the chassis of all the cars developed by the team so far. The new car will have four wheels, both rear wheels will be driven, but instead of using a differential gear, we are planning a different solution in order to reduce the weight. The task is to design and examine the sprung suspension and the power transmission system with joints connected to it, as well as their connection. The entire undercarriage must meet the requirements of the pneumatic competition regulations. An important goal is to achieve the lowest possible weight, and to this end, optimizing the design of the components.
The car is ready, we are currently waiting for the next competition announcement.

Keywords: pneumobile, pneumatic racing car, chassis, drivetrain

STUDY AND COMPARISON OF SURFACE ROUGHNESS PARAMETERS IN TURNING

Áron Lóránd, Ágota Drégelyi-Kiss

Bánki Donát Faculty of Mechanical and Safety Engineering, Óbuda University, Népszínház street 8, H-1081 Budapest, Hungary
e-mail: dregelyi.agota@bgk.uni-obuda.hu

ABSTRACT

Surface roughness is a key parameter in many industrial devices and significantly affects the quality and equipment composed of several machined components. There are standards related to the calculation of the several surface roughness parameters. The aim of this research is to compare the parameters and the calculation of ISO 4287:1997 with ISO 21920-2:2021 standard. During the research three different turned surface were chosen and were measured with a stylus-type surface roughness measuring instrument. The calculation of the “old” and “new” surface roughness parameters were calculated in Python.

Despite the fact that how important calculating surface roughness parameters is, one can hardly find an in-depth description of the proper evaluation process for the measured skin model. The aim of our research is to show a detailed mathematical calculation according to the new standard, supported by the numerical execution of the calculations, and to highlight the differences between the old and new standard definitions and numerical values of quantities related to surface roughness, such as Ra or Rz.

However, comparing the two standards it can be observed that the aforementioned differences are not significant from our point of view, except that previously the parameters were determined per sampling length, then averaged over the 5 lengths, now the surface roughness is calculated over the entire length.

ANALYSIS OF THE SPANWISE EFFECT BEHIND A CYLINDRICAL BODY

Bence Molnár, Péter Bencs

Department of Fluid and Heat Engineering, Faculty of Mechanical Engineering and Informatics,
University of Miskolc, H-3515 Miskolc, Hungary
e-mail: peter.bencs@uni-miskolc.hu

ABSTRACT

The study of the flow around the cylinder is still a focus of research in various aspects. In this case, the flow around an electrically heated cylinder with a diameter Ød=10 mm is investigated at low velocities (mainly in the laminar range). In the literature, the wall temperature Tw is used in many places to characterize such flows. This is usually considered constant, because experimental tests are mainly performed with electrically heated rods of small diameter (max ~2 mm). Since in our case the rod diameter is a multiple of this, the question arises whether the two-dimensional nature of the flow behind the cylinder is preserved. The spanwise effect behind a transversely placed heated cylinder was investigated. The results obtained provide a good basis for designing further measurement options.

Keywords: cylinder, spanwise, numerical simulation, PIV

MECHANICAL PROPERTIES AND MICROSTRUCTURAL CHARACTERISTICS OF STEEL PIPES AFTER LONG-TIME HYDROGEN EXPOSURE

Nóra Nagy, János Lukács

Institute of Materials Science and Technology, Faculty of Mechanical Engineering and Informatics, University of Miskolc, H-3515 Miskolc, Hungary
e-mail: nora.nagy@uni-miskolc.hu

ABSTRACT

There are three possible ways to transport hydrogen by pipeline (i) blending hydrogen into the existing natural gas pipeline system, (ii) using the natural gas transporting pipeline system to transport (pure) hydrogen, (iii) building a new pipeline system to transport (pure) hydrogen. In all three cases should be known the behaviour of the pipe material and its welded joints influenced under high pressure hydrogen. For this aim pipeline sections made of P355NH base material were investigated without and with hydrogen exposure, where the exposure time was 41 days. Gas metal arc welding and hybrid tungsten arc welding / gas metal arc welding were applied for preparation of the girth weld joints. Tensile, three point bending and hardness tests, furthermore microstructural investigations were performed both on base materials and girth welds of the pipeline sections. The testing results were analysed and compared with each other (base material vs. welded joints, without exposure vs. with exposure) and with data can be found in the literature. Conclusions were drawn on the behaviour of the investigated pipe material and its welded joints.

Keywords: transporting pipeline, hydrogen, welding, mechanical behaviour, microstructural characteristics

MODELLING OF A RECENTLY INVENTED SOLAR POT

Márton Rátkai, Richárd Kicsiny, László Székely

Doctoral School of Mechanical Engineering, Hungarian University of Agriculture and Life Sciences, H-2100 Gödöllő, Hungary
e-mail: ratkaymarton@gmail.com

ABSTRACT

The subject of the research, the solar pot, is a new invention protected at the Hungarian Intellectual Property Office (utility model, patent number 5489). The pot can be used for heating or cooking (foods, drinks or other fluids). It has a similar structure to a double pipe heat exchanger with an outer jacket and an inner cooking space. Although it has been manufactured, its capabilities have not been tested neither by modelling and simulation nor with measurements and experiments, so these investigations represent a completely new research field. The goal of this work is the mathematical modelling of the pot and the solar collector providing heat necessary for operation, which allows the prediction of the temperature of the jacket and the cooking space, as well as the temperature of the collector. The modelling and the first simulation results based on it are presented, based on which conclusions can be drawn regarding the efficiency and applicability of the pot. Future research plan is presented which includes the construction of an experimental system of the pot and the collector, on which measurements will be made under different conditions, allowing the assessment of the pot's functionality and the validation of the mathematical model(s).

Keywords: solar pot, solar collector, mathematical modelling, simulation results, planning of experiments

ROTATION VECTORS FOR MULTI DEGREE OF FREEDOM VIBRATIONI

Peter Szuchy

Department of Mechanical Engineering, Faculty of Engineering, University of Szeged, Mars tér 7, H-6724 Szeged, Hungary
e-mail: szpeter@mk.u-szeged.hu

ABSTRACT

This paper introduces the description of Multi-Degree-of-Freedom vibration with a traditional method: rotating vectors. The translational model of the vibrating systems consists of springs, masses and dampers with linear characteristics, excited on the first, main mass. The description starts with the basis relations of Two-Degree-of-Freedom, then it is extended first to parallel, then to serial, after that to mixed attached components. At the end the paper shows a description of a Five-Degree-of Freedom mixed system.

Keywords: vibration, rotating vectors, metamaterial

OPTIMIZATION OF PARAMETERS FOR SYNTHESIS OF ALGINATE BASED HYDROGELS

Jelena Tanasić, Marija Krstić, Vesna Svrkota, Ivan Ristić

Faculty of Technology Novi Sad, University of Novi Sad, Bulevar cara Lazara 1, 21000 Novi Sad, Serbia

e-mail: jelenatanasic@uns.ac.rs

ABSTRACT

Hydrogels represent a special class of polymer networks that are elastic and swell in water, but do not dissolve in it. The hydrophilic structure makes hydrogels capable to absorb large amounts of water in their three-dimensional networks. The most important property of hydrogels is swelling, which depends on the nature of the polymer, the degree of crosslinking, the charge density, but also the environmental conditions. In the last five decades, hydrogels that change their volume and structure as a result of respond to external stimuli such as pH, temperature, ionic strength, electric, magnetic field have been intensively studied. In this work, hydrogels sodium alginate-based with the addition of chitosan were synthesized. The proportions of chitosan were changed in relation to alginate in order to examine their influence on the production of hydrogels. It was obtained at high temperature. After the synthesis, the samples were dried and then subjected to characterization by infrared spectroscopy with Fourier transformation (FTIR), differential scanning calorimetry (DSC) and degree of swelling. These hydrogels have potential application as biomaterials for many medical applications (in systems for targeted drug delivery, wound healing, tissue engineering), in water purification systems, and in systems where high water absorption capacity is required.

Keywords: hydrogels, alginate, polymer crosslink

THE ENERGETIC ANALYSIS OF THE PYROLYSIS OF TIRE AND ADDITIVES MIXTURES

Csenge Emese Tóth, Gábor Nagy

Institute of Energy and Quality, University of Miskolc, H-3515 Miskolc-Egyetemváros, Hungary
e-mail: csenge.emese.toth@uni-miskolc.hu

ABSTRACT

Approximately 1.4 billion tires are sold annually, leading to a significant amount of waste that requires proper disposal. The development of environmentally friendly technologies are encouraged by the fact that the landfilling of waste tires is prohibited by law throughout the European Union. In addition, strict emission limits are set for incineration. Thereby, the increasing presence of waste tires offers numerous research opportunities. We used pyrolysis as a potential waste treatment method in laboratory conditions. Various additives (such as eggshell, mussel shell, dolomite, alginite, zeolite, calcined mussel shell, calcined eggshell, calcined dolomite, calcined alginite, calcined zeolite) were mixed in a 1:1 ratio with shredded tires to explore the synergistic effects between these during heat treatment. Since one of the most important uses of pyrolysis products is energy utilization, we examined the energy content of the products in addition to the material balances. In this way, we determined the materials which can be beneficial in terms of energy production from pyrolysis products. Based on these findings, we evaluated the results in terms of energy applications.

Keywords: waste tire, pyrolysis, additives, energetic analysis

THE LOGIC OF A TECHNICAL INNOVATION

Istvan Tibor Tóth, Katalin Papp-Sziladi

Department of Mechanical Engineering, Faculty of Engineering, University of Szeged, Mars tér 7, H-6724 Szeged, Hungary
e-mail: istvan.tibor.toth@gmail.com

ABSTRACT

For many years, the universal auxiliary tool used in one of the decisive production machines of the production plant, a surface grinder has been used to fix the parts of different diameters and lengths using the force-locking principle. The handling and size of the tool did not bother the user, but a careful technological review brought substantial comments, which ended with the redesign of the auxiliary tool. The fundamental difference of the new tool is the modification of the fastening principle, which significantly improved handling and space utilization, and as a result, the same machine, with the same personnel, could achieve one and a half times the capacity. The essence of the principle is the replacement of the force-locking joint with a shape-locking joint and the resulting area gain and simplification of handling without any substantial change in the cutting conditions brought about a revolutionary improvement in efficiency.

As a special benefit, the service life of the new auxiliary tool has also increased due to the transformation of the geometry that excludes human error. Strictly speaking, it didn't even cost the production plant any extra.

Keywords: auxiliary tool, force clamp, shape clamp, surface grinder

THE CONSUMPTION OF E-CARS CAN BE IMPROVED WITH A NEW MODE OF OPERATION

Istvan Tibor Tóth, Katalin Papp-Sziladi

Department of Mechanical Engineering, Faculty of Engineering, University of Szeged, Mars tér 7, H-6724 Szeged, Hungary
e-mail: istvan.tibor. toth@gmail.com

ABSTRACT

The economy of a vehicle is a very complex concept. It can be energy efficient, in terms of the use of built-in materials, in terms of total operating costs, in terms of input costs, maintenance costs and, of course, environmental
costs. In this paper, we examine the question primarily from the point of view of the energy comparison, but we also try to make the interested parties at least a little unsure about the other aspects as well. A more complete energy balance, which also takes into account kinetic energy, the energy requirement of the passenger compartment, the energy required for the operation of the engine and the drive system, and the resistances, leads the technical thinker who is inclined to it to quite interesting conclusions, even directly in the case of the vehicle.
It is interesting to compare the energy requirements from the movement of masses, the consequences of different losses on the development of energy consumption. We are looking for answers to seemingly simple questions such as the minimum and maximum value of the possible energy recuperation, or how much the driver's style can affect the efficiency or how the ambient temperature affects the energy balance in the case of ICEV (Internal Combustion Engine Vehicle) and BEV (Battery Electric Vehicle).

The conclusion may even influence the development of the vehicle industry.

Keywords: kinetic energy, recuperation, losses, environment

MECHANICAL CHARACTERISTICS ANALYSIS OF 3D PRINTING MATERIALS USED FOR INTEGRATION INTO FILTER MODULES

Kevin Tóth[1], László Tóth[2], Szabolcs Kertész[1]

[1]Department of Biosystems Engineering, Faculty of Engineering, University of Szeged, Moszkvai krt. 9, H-6725 Szeged, Hungary

[2]Department of Innovative Vehicles and Materials, GAMF Faculty of Engineering and Computer Science, John von Neumann University, H-6000 Kecskemét, Hungary

e-mail: kevin2.toth@gmail.com

ABSTRACT

In this study, the mechanical characteristics of a wide range of thermoplastics used in FDM 3D printing were tested. Our goal was to find a suitable material to be integrated into filtration modules. It is an innovative approach to enhance the hydrodynamics into the membrane separation modules which can result in better filtration efficiencies. Flexure, tensile and Charpy impact tests were carried out on the following plastics: high temperature PLA, ABS, CNT infused ABS (0.05%, 0.4%), PLA, PLA advanced pro, PETG, ASA, TPU. Our focus was on comparing the tensile and flexural strength, impact resistance and durability of these materials. TPU is an elastic plastic with exceptionally high impact resistance and flexibility but with minimal structural integrity, was excluded from the following results.

The impact test showed that PETG had the greatest impact resistance and all the different types of PLA were vulnerable due to the brittle nature of it. However, same materials from different manufacturers had drastically different impact resistance. The flexure and tensile tests revealed similar results. PLA withstood the most amount of force with the least amount of bend and strain before failure while ABS had greater flexibility but broke and tore apart under minimal load.

Keywords: Mechanical characteristics; 3D printing materials; Flexure, tensile and Charpy impact tests; Membrane Fouling Mitigation

Acknowledgements: This study was financed by the Hungarian National Research, Development and Innovation Office, project NKFI-FK-142414.

PREPARATION, CHARACTERIZATION AND APPLICATION OF MAGNETIC NANOFLOWERS

Viktória Varga[1], Erzsébet Illés[1,2]

[1]Department of Physical Chemistry and Materials Science, University of Szeged, Aradi Vt. 1, H-6720 Szeged, Hungary
[2]Department of Food Engineering, Faculty of Engineering, University of Szeged, Moszkvai krt. 5-7, H-6725 Szeged, Hungary
e-mail: vhornok@chem.u-szeged.hu

ABSTRACT

The colloid aqueous dispersion of superparamagnetic iron oxide nanoparticles (SPIONs) is very popular partly due to their potential theranostic application. Their favourable magnetic properties can be further improved by preparing flower-like structures. The MNFs were prepared both in an autoclave and in a round-bottom flask (either with or without continuous mixing) in organic solvent mixture. The results verified the crucial importance of some preparation conditions, such as the composition of the reaction solvent mixture, reaction time and rate of heating and cooling. Transmission electron microscopic images (TEM) of the nanoparticles revealed that as an effect of mixing, more fluffy structures with an average particle diameter of 18.3 ± 2.3 nm were obtained. As a stabilizing agent, based on earlier results, poly(acrylic acid-co-maleic acid) (PAM) was applied both during and after synthesis. The optimal amount of stabilizing polymer was confirmed by both zeta-potential and dynamic light scattering measurements. Magnetic hyperthermia measurements were carried out to confirm the possibility of application in cancer treatment, which also proved the increased effect of magnetic nanoflowers to spherical-shaped magnetic nanoparticles.

Keywords: magnetic nanoparticles, nanoflowers, hyperhermia

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