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FACULTY OF TECHNOLOGY

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Banja Luka, October 30th 2020
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ПРИВРЕДНА КОМОРА РЕПУБЛИКЕ СРПСКЕ
ПОДРУЧНА ПРИВРЕДНА КОМОРА БАЊА ЛУКА

University of Banja Luka

Faculty of Technology,University of Banja Luka, October 30th 2020

International Scientific Conference
„XIII Conference of Chemists, Technologists and Environmentalists of Republic of Srpska“

CONFERENCE PROGRAM

$09\text{-}09^{30}$ - Login to the virtual platform ZOOM
$09^{30} – 09^{45}$ Opening ceremony

PLENARY LECTURES:

$09^{30} – 10^{30}$
„ORGANIC ENVIRONMENTAL POLLUTANTS, OLD AND NEW: OCCURRENCE, FATE, AND REMOVAL“,
Helena Prosen[1*], Ester Heath[2], Borislav N. Malinovic[3]
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$10^{30} – 11^{15}$
„THE EUROPEAN CIRCULAR ECONOMY APPROACH – CONTRIBUTIONS FROM HYDROMETALLURGY“
Srecko Stopic, A. Birich, B. Friedrich,
IME- Process Metallurgy and Metal Recycling, RWTH Aachen University, Germany

$11^{15} – 12^{00}$
„TESTING AND CERTIFICATION PROCEDURES IN AREAS OF PRINT PROPERTIES, COLOR AND PRINT PRODUCTION IN DIGITAL PRINTING“,
Sandra Dedijer, Nemanja Kašikovic, Dragoljub Novakovic
Faculty of Technical Sciences, University of Novi Sad

$12^{00}\text{-}13^{00}$ - Poster presentation

13^{00} -13^{15} - Closing

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PLENARY LECTURES

ORGANIC ENVIRONMENTAL POLLUTANTS, OLD AND NEW: OCCURRENCE, FATE, AND REMOVAL

Helena Prosen,[1]* Ester Heath,[2] Borislav N. Malinović[3]

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Abstract

Man has influenced his environment from the very beginning of humankind, but his chemical impact was relatively low for several hundreds of years. From the industrial revolution onwards, more of anthropogenic chemical pollution occurred, mainly with inorganic pollutants such as heavy metals. Pollution with organic chemicals is even more recent and is related to mass production of new synthetic organic materials and chemicals in the second half of 20th century. The first to be recognized as an organic environmental pollutant was the infamous pesticide DDT. Soon followed other organochlorine pesticides (OCP), polychlorinated biphenyls (PCB), polycyclic aromatic hydrocarbons (PAH), Freons (CFC), other groups of pesticides, etc. All these are now considered "old" organic pollutants. With some rare exceptions, those produced synthetically are mostly restricted or banned from production. For all of them, there are legislative measures present worldwide that determine their allowable limits in the environment. As opposed to these, the focus of environmental chemists shifted to a group of "new" or "emerging" pollutants some twenty years ago. These are mostly organic chemicals from either industrial or everyday use that enter the environment due to insufficient removal from wastewaters, or from the landfill sites. Currently, they are not well regulated and their impact on the environment is still the subject of intensive research.

In the present contribution, an overview of several years of research on organic pollutants will be presented. Results and conclusions of some specific studies done in our labs for environmental analytical chemistry will be shown. In the study on the occurrence of neonicotinoid insecticides in bee products, we developed analytical methods for the determination of these compounds in honey and in propolis. The methods were applied to survey the pollution of Slovenian honey and propolis products with neonicotinoids. Another study focused on the determination of illicit drugs and their metabolites in wastewaters, as well as river and drinking water.

We did a rather extensive research on the fate of organochlorine and triazine pesticides in the soil and surface water environment. Their distribution into the naturally present organic matter was studied, as well as their natural degradation under the influence of humic substances and natural sunlight.

Finally, two studies on the removal of pollutants are shown. The first determined the self-cleaning ability of the soil provided by soil microbiota. Soil contaminated by heavy metals was remediated by EDTA and its ability to degrade specific pesticides was tested. The second study is still in process and is done in collaboration with Faculty of Technology, UBL. Electrodegradation of corrosion inhibitor benzotriazole is studied in the synthetic wastewater under different conditions to determine those that would be feasible to apply to real wastewater.

Key words: organic pollutants, occurrence, fate, removal

THE EUROPEAN CIRCULAR ECONOMY APPROACH – CONTRIBUTIONS FROM CARBONATION OF AN OLIVINE AND INDUSTRIAL WASTES UNDER HIGH PRESSURE CONDITIONS IN AN AUTOCLAVE

Srecko Stopic, Alexander Birich, Bernd Friedrich

IME Process Metallurgy and Metal Recycling, RWTH Aachen University, Aachen, Germany

Abstract

The establishment of a circular economy, a system which regenerates used materials and energy in a constant flow, could be the solution to many environmental problems brought about by the wasteful linear economy approach and benefit society, nature and industry alike. The EU Action plan for the circular economy features a concrete and ambitious programme of action, contributing to closing the loop of product life cycles through greater recycling of industrial wastes and re-use bringing both the environmental and economic benefits.

Global warming has been labelled as the two biggest environmental problem facing the world. In this study the IME is utilising its metallurgical know about high pressure hydrometallurgical treatment in order to study a CO_2 capture and utilisation. Mineral sequestration by carbonation of magnesium or calcium silicates under high pressure and high temperature was successfully carried out by processing in an autoclave. Amorphous silica, magnesite and calcium carbonate, respectively, were the main reaction products in a carbonation of olivine and slag from ferro-chromium production under high pressure conditions in an autoclave. Maximal carbonation efficiency (360 kg_{CO2}/ t) was reached for an industrial waste such as a slag from ferrochromium production in an electric arc furnace (EAF), what is three time higher than a carbonation of olivine under same conditions (T=175°C, P=70 bar). In addition, Carbon capture and utilization by CO_2 mineralization can be a promising technology to reduce greenhouse gas emissions by storing CO_2.

Keywords: carbonation, autoclave, olivine, industrial wastes, circular economy

TESTING AND CERTIFICATION PROCEDURES IN AREAS OF PRINT PROPERTIES, COLOR AND PRINT PRODUCTION IN DIGITAL PRINTING

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Abstract

Due to rapid technical and technological innovations in the field of digital printing machines and dies, we are the witnesses of the digital printing market growing tendencies as well as the expansion of the digital printing into conventional printing techniques markets. Today, we can firmly state that digital imprints deliver high quality in terms of desirable print properties. The ability to print on a variety substrate, supporting small print runs and customised printing, have made that digital printing become highly valued. In the same time, the need for the colour reproduction accuracy and repeatability assessment methods is still a must and something that should be defined through upcoming standards in the field of digital printing. Unlike conventional printing processes, where the print properties assessment procedures are grounded in the appropriate standards, in the field of digital printing, there are certification procedures which aims to define uniform metrics in order to uniformly asses the digital imprint quality. Thus, this paper aims to present the current testing and certification procedures in areas of print properties, colour and print production in digital printing.

Keywords: certification, print properties, colour reproduction, digital printing.

GENERAL AND APPLIED CHEMISTRY

ADSORPTION OF DIETHYL ETHER FROM GAS PHASE ONTO ZSM-5 ZEOLITE

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Abstract

This paper studies the adsorption of diethyl ether from the gas phase onto synthetic ZSM-5 zeolite (NaZSM-5) and onto CoZSM-5 (obtained from mordenite by ion exchange) at temperature of 300 K, determined by volumetric method. Isotherms of diethyl ether adsorption on both zeolites are linear type. The linear isotherm is characterized by a constant distribution of the adsorbate between gas phase and the adsorbent, as well as rectilinear relation between the amount of adsorbed substance in equilibrium and the equilibrium pressure of the adsorbate. The experimentally data were examined by Freundlich isotherm model. The amount of adsorbed diethyl ether was found to be higher on CoZSM-5 than on NaZSM-5 zeolite.

Keywords: ZSM-5 zeolite, adsorption, diethyl ether, Freundlich isotherm.

ANTIOXIDANT AND ANTIMICROBAL ACTIVITY OF SOME TETRADENTATE SCHIFF BASES AND THEIR CU (II) COMPLEXIS

Mijatović A.[1], Nikolić M.[2], Spasić S.[3], Žerađanin A.[3], Joksimović K.[3], Lolić A.[2], Baošić R.[2]

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Abstract

Schiff bases, and their Cu(II) complexes, are known for their biological activity. In this work, antibacterial activity against Gram-negative strains of *Escherichia coli*, *Pseudomonas aeruginosa* and *Staphylococcus pyogenes*, as well as Gram-positive *Staphylococcus pyogenes* and *Pseudomonas aeruginosa* was studied, together with antifungal activity against *Candida*, *Aspergillus*, and *Mucor* strains. Also, technically simple, and rapid tests like ABTS, HORAC, and ORAC were used to investigate the antioxidant activity in order to compare obtained results with different type of tests. Despite that principle of each group of the antioxidant assay methods is similar, The sensitivity of the antioxidant assay methods applied depends on various factors, such as media pH, the presence of lipophilic and/or hydrophilic part and substituents of the investigated compounds. The studied Cu(II) complexes showed better antimicrobial activity compared to corresponding Schiff bases. The compounds exhibited antioxidant properties of scavenging free radicals. The results from different methods revealed that compounds can donate an electron or hydrogen and subsequently react with free radicals or terminate chain reactions in a dose-dependent pattern.

Keywords: Schiff base, Cu (II) complexes, Antioxidant activity, Antimicrobial activity

DETERMINATION OF TOTAL AND WATER-LEACHABLE MAJOR ELEMENTS IN ASH FROM LUPM WOOD CHARCOAL

Uđilanović M.[1], Stanojević Šimšić Z.[1], Urošević D.[1]

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Abstract

Charcoal is made from different lump wood (beech, cherry, ash, maple, poplar, willow, plum, etc.). It is used daily for home heating and food preparation. As a product of combustion, a significant amount of ash is produced, which contains important major nutrients, such as K, Na, Ca, Mg, P and Fe. N-P-K fertilizers are most often used as fertilizers, but ash can be a very good replacement. Also, due to the presence of alkali and alkaline earth metals, ash is used to regulate the pH of the soil. Using the inductively coupled plasma optical emission spectrometer (ICP-OES) nine ash samples were analyzed and the content of major elements was in the following order: $CaO > K_2O > MgO > P_{tot} > S_{tot} > Fe_2O_3, Al_2O_3 > Na_2O > BaO$. The water-leaching test showed that the concentration of Al, Ba and Fe was below LOQ. The pH value of the water-extract was high, with an average value of 10.61. Based on the obtained results for the total content and the water-leaching test of ash, the ash should be analyzed for leaching of major elements and in an acidic environment in order to get a more complete picture of the mobility of major elements.

Keywords: Charcoal ash, Major elements, ICP-OES, Nutrients mobilization.

STUDY SERIES OF TWELVE STRUCTURALLY SIMILAR SCHIFF BASE CU(II) COMPLEXES: INTERACTIONS WITH HUMAN SERUM ALBUMIN AND MOLECULAR DOCKING STUDIES

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Abstract

Copper ions are known as an endogenous metal for humans with a large number of possibilities for the investigation of different interactions with biologically important molecules. Human serum albumin (HSA) being the most abundant carrier protein in the blood and the important regulator of the pharmacokinetic properties of bioactive molecules. We studied the interactions of twelve structurally similar tetradentate Schiff base Cu(II) complexes with human serum albumin. All reactions were investigated using fluorescence spectroscopic techniques. The spectroscopic measurements were carried out at 298 K in a phosphate buffer (pH 7.4). The binding constants and activation parameters are calculated using computational program Origin 8.1. The complexes bind to serum albumin displaying relatively high binding constant in the order of Ksv from $3.2 \cdot 10^4$ M^{-1} to $65.7 \cdot 10^4$ M^{-1}. All the studied complexes exhibited good HSA interaction ability. Molecular docking has been employed in order to understanding interaction between Schiff base Cu(II) complexes and HSA which is responsible for the transportation of drugs. Detailed of molecular docking showed that the test compounds binds to HSA on subdomain IB. Results in this study showed that the introduction of derivatives of Schiff bases as a ligand can be used to improve the stability and reactivity of copper(II) complexes. Molecular docking studies confirm our experimental findings of different interactions through which complexes are binding to the protein molecule.

Keywords: Schiff base, Cu(II) complex, albumin, molecular docking

SORPTION OF DICLOFENAC FROM AQUEOUS SOLUTION TO TEMPO OXIDIZED CELLULOSE

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Abstract

Pharmaceutically active compounds represent a large class of water pollutants. The most commonly detected pharmaceutically active compound in aqueous recipients is diclofenac. There are several methods for removing these compounds, and one of the most commonly used is sorption. Different materials are used as sorbents. The sorption of pharmaceutically active compounds into polysaccharides is determined by the type of polysaccharide and the method of its modification, as well as the structure of the drug itself. In this work, samples of selectively oxidized cellulose with 0.057 mmol/g COOH and 0.0845 mmol/g CHO (sample-OC1) and 0.063 mmol/g COOH and 0.0875 mmol/g CHO (sample-OC2) were used as polysaccharide sorbent. They were obtained by oxidation of the cellulose bandage using TEMPO reagent for 2 hours at a temperature of 25±1°C. Sorption of diclofenac was performed from an aqueous solution of concentrations $c=1,5\cdot10^{-3}$ and $3,0\cdot10^{-3}$ mol/L at a temperature of 25±1°C for 48 hours. Release was performed under static conditions at 25±1° C for 24 hours. The amounts of bound and released drug were determined spectrophotometrically at a wavelength of λ_{max} = 276 nm. The maximum amount of bound drug after 24h was 0.0465 mmol/g OC (from solution $c=3,0\cdot10^{-3}$ mol/L, on a sample OC2). The paper studies the possibility of using a TEMPO oxidized bandage for sorption of diclofenac. Also, the paper studies, influence of the content of COOH and CHO groups and the sorption properties of OC, the concentration of diclofenac solution and the duration of sorption on its sorption.

Keywords: TEMPO-oxidized cellulose, diclofenac-K, sorption of diclofenac.

STUDY ON ADSORPTION PROPERTIES OF NATURAL AND MODIFIDED TUFF FROM TERITORY OF REPUBLIC OF SRPSKA

Bodroža D.[1], Levi Z.[1], Petrović R.[1], Sladojević S.[1], Gajić D.[2]

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Abstract

This paper studies adsorption of nitrate ions (KNO_3) from aqueous solution onto zeolitic white tuff (Novakovići) and its modifications. Increased nitrate ions concentration in water represent big problem for humans health, because it causes cancer of digestive system and other anomalies. The largest sources of nitrates in groundwaters are fertilizers, used in agriculture for plants growth and development. Adsorption proved to be an adequate method for nitrates removal from water. This study monitored adsorption of nitrate ions on the original sample, annealed sample and Fe-modified sample.
Original sample was characterized by different instrumental methods: BET, SEM-EDS and XRD analysis. The potentiometric titration method showed that the adsorption of nitrate ions was better at the pH values lower than 7.
Obtained data are analyzed using Freundlich and Langmuir adsorption isotherms. A modified tuff sample found to has the best adsorption properties.

Keywords: Zeolite, tuff, adsorption, nitrate, water

CHEMICAL ENGINEERING

ELECTROOXIDATION OF POLAR BENZOTRIAZOLE - THE IMPACT OF SUPPORTING ELECTROLYTE

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Abstract

Polar benzotriazoles are heterocyclic compounds widely used in industry, and as such are easily released into the environment. These compounds show harmful and toxic effects on plants and some aquatic organisms, biodegrade quite slowly, and some, depending on the structure, have the ability to bioaccumulate. They can only be partially removed by conventional wastewater treatment, and are therefore found in a variety of waters as well as solid waste. In this paper, synthetic wastewater containing polar benzotriazole was treated by an electrooxidation process. The efficiency of the treatment was tested depending on various parameters, such as: anode material (mixed metal oxide - MMO and boron-doped diamond - BDD), applied current density (10 and 20 mA/cm^2), type of supporting electrolyte (NaCl, Na_2CO_3, Na_2SO_4, H_2SO_4) and treatment time (0.5 - 2.5 h). Obtained results showed the treatment was more effective at higher current density and by using BDD anode. Also, the efficiency of the treatment increases with the prolongation of the electrolysis time. After 2.5 h of treatment, 97.9% of benzotriazole was removed, in the presence of sulfuric acid as supporting electrolyte.

Keywords: electrochemical treatment, wastewater, BDD anode.

INFLUENCE OF COOLING RATE ON THE STRUCTURE AND MECHANICAL PROPERTIES OF ALUMINIUM AND ALUMINIUM COPPER ALLOYS

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Abstract

The effect of cooling rate on the structure and properties of pure aluminium and on the structure and properties of Al-Cu alloys is investigated using two types of mould. The results show that the rate of cooling is faster in the die mould and the specimen obtained has the highest value of strength and hardness. Also, the results show that the secondary dendrite arm spacing (DAS) are better refined by using this technology with rate of cooling is faster. It was observed that as the cooling rate increased the secondary dendrite arm spacing of the alloys decreased but their hardness and tensile strength increased. Phase-transformation temperatures and enthalpy of solidification of these alloys have been measured using differential scanning calorimetry.

Keywords: aluminium - copper alloys, cooling rate, thermal analysis, microstructure

STRUCTURE INVESTIGATION OF THE AL-CU ALLOYS USING EDS AND X-RAY POWDER DIFFRACTION ANALYSIS

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Abstract

Al–Cu alloys are widely used in aerospace, automobile, and other fields, due to their high strength-to-weight ratio. Among all compounds in the Al–Cu system, the Al_2Cu phase has been extensively investigated due its significant effect on the properties of Al–Cu alloys. The formation of Al_2Cu compound is monitored by the application of X-ray powder diffraction method. The X-ray diffraction analysis was performed on the Al-Cu alloys and on pure aluminium and pure copper, using a wide range of angles (2θ) from 5 to 100^o with a step size of $0{,}02^o$ and a holding time of 0,40 sec. at each step. The following microstructural parameters have been calculated: the average sub-grain size, the microvoltage and the dislocation density. Al_2Cu phase were identified in all samples in view of the XRD and EDS analyses.

Keywords: aluminium - copper alloys, EDS analysis, X-ray powder diffraction method

THE STATISTICAL ANALYSIS OF THE BIODIESEL PRODUCTION OVER HAZELNUT SHELL ASH AS A CATALYST

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Abstract

The hazelnut processing factories generate a significant amount of biomass waste (hazelnut shells) which can be used to produce energy by combustion. However, the combustion of this material results in waste ash. The chemical composition of ash (mainly contains K, Na, Ca) indicates its catalytic properties, which were tested in the transesterification of sunflower oil with methanol to fatty acid methyl esters (FAME) i.e. biodiesel. The aim of this study was the statistical evaluation of the effect of the reaction parameters (catalyst loading, methanol-to-oil molar ratio, and reaction time) on the FAME content using a three-level factorial design with 3 central points. The catalyst was prepared by the combustion of waste hazelnut shells followed by calcination of the obtained ash in a furnace at 800 °C in the air atmosphere. The FAME synthesis was conducted in a batch stirred reactor at the reaction temperature 60°C and the atmospheric pressure. The reaction parameters were investigated in the following ranges: catalyst loading 1–5% of oil weight, methanol-to-oil molar ratio 6:1–18:1, and reaction time 10–50 min. The analysis of variance revealed the significant effect of all three parameters, the two-way interaction of catalyst loading and reaction time, as well as the quadratic term of reaction time on FAME content. The order of significance was reaction time > catalyst loading > methanol-to-oil molar ratio. Based on the obtained results, the quadratic model was suggested for the prediction of FAME content.

Keywords: Analysis of variance, biodiesel, hazelnut shell ash, transesterification.

CHEMICAL TECHNOLOGY

INFLUENCE OF HYDROCHLORIC ACID ON TEXTURAL AND MORPHOLOGICAL CHARACTERISTICS OF DOMESTIC BENTONITE WITH DIFFERENT CONTENT OF MONTMORILLONITE

Petrović Z.[1], Đokić A.[1], Begić S.[2], Botić T.[3], Panić S.[4], Milovanović M.[1]

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Abstract

Bentonites are aluminosilicate clays that mainly consist of minerals belonging to the smectite group. Montmorillonite has the largest share in bentonite, and in smaller quantities are present: feldspar, kaolinite, illite, quartz, calcite, etc. Due to their porosity, layered structure and composition, and the possibility of modification by various methods, they are widely used, especially in adsorption processes. In practice, the activation process with acids or alkalis is widely used, which leads to modification of the structure, chemical composition, porosity, specific surface area, porosity, surface acidity, and adsorption characteristics. The degree of change depends on the characteristics, quality and preparation of natural bentonite, and the parameters at which the activation takes place.

In this paper, a modification of previously annealed domestic bentonite of different montmorillonite content with 8% hydrochloric acid solution at the appropriate temperature, bentonite: hydrochloric acid ratio and contact time was performed. The results of the analysis of textural and morphological characteristics of activated bentonite samples showed that there was a significant improvement in specific surface area and adsorption capacity, and the changes were greater in bentonite powder with a higher montmorillonite content. These results indicate the possibility of using bentonite activated in this way, as an adsorption agent in the processes of refining mineral oils, bleaching edible oils, and in environmental protection processes. For a more complete analysis of these changes, it is necessary to determine the chemical and structural composition, the capacity of the cation exchange by applying appropriate modern methods of analysis.

Keywords: bentonite powder, montmorillonite, hydrochloric acid activation, textural and morphological characteristics

AIR QUALITY IMPROVEMENT IN ROOMS WITH INCREASED BENZENE CONCETRATION

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Abstract

Pollutants that are present in closed spaces are increasingly becoming a problem for people's health. One of the most present pollutants in developed urban and industrial areas is benzene. This paper shows the adsorption characteristics of ZSM zeolites (ZeoFlair 100 and ZeoFlair 110), silica gel (silica gel 60/0-40μm) and 50:50 silica gel and ZEOflair 100 compound (ZEOflair 100 + silica gel 60/0-40μm (50:50)). Adsorption isotherms of the benzene on the examined adsorbents are generated by simulating the adsorption process in the closed room conditions (with atmosphere presure, 26°C temperature and 60% chamber humidity at the beginning of adsorption), using free difusion mechanism. High coefficients of determination were obtained by using the nonlinear models (Langmuir and Freundlich). For ZEOflair 110, ZEOflair 100 + silicagel 60 /0-40 μm samples and silica gel 60/0-40μm, determination coefficients obtained by using nonlinear Langmuir model (0,9495; 0,9711 and 0,9829 respectivly) were bigger than those obtained by using Freundlichnonlinear model. Low value of the Langmuir constant (K_L) for examined samples shows high affinity between examined adsorbents and benzene. The maximum adsorption capacity values Q^0_m, were obtained by experiments and models with silica gel (248,74mg/g), and the lowest for ZEOflair 100 (38,13mg/g).

Key words: benzene, adsorption isotherms, maximum adsorption kapacity, zeolite, silica gel

BIOTECHNOLOGY

TOTAL PHENOLIC CONTENT IN EDIBLE PARTS OF SELECTED *ALLIUM* SPECIES BIOFORTIFIED WITH SELENIUM

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Abstract

Species of the genus *Allium* have great importance in human nutrition due wide range of therapeutic properties and great health benefits. Their nutritional value is primarily determined by the chemical composition of the edible parts. The nutritional quality of *Allium* crops is possible to improve through agronomic practices (plant nutrition and agrotechnic measures) by the process known as biofortification. In this paper, the effect of biofortification with different concentrations of selenium (0 g, 10 g, 20 g and 30 g per hectare) in open field condition on selected *Allium* species (*Allium sativum* var. *saggitatum* L.; *A. fistulosum* L.; *A. ampeloprasum* var. *ampeloprasum* L.; *A. nutans* L.; *A. odorum* L.; *A. schoenoprasum* L.) was investigated, with a goal to improve nutritional value of the edible parts. For this purpose 24 samples of fresh plant material were prepared and extracted with 80% methanol. Total phenolic content (TPC) was determined using the standard spectrophotometric *Folin-Ciocalteu* method. The obtained results are expressed as mg of ferulic acid equivalents (FAE) per g of fresh weight. TPC was in range from 0.36 to 2.60 mg/g FAE. The obtained research results indicate that TPC in the edible parts differs between species, as well as within the species, and depending on the applied dose of selenium. The obtained results indicate the necessity of determining the optimal doses of selenium in the process of biofortification, in order to obtain edible parts of *Allium* species with high nutritional value.

Keywords: *Allium*, biofortification, nutritional value, phenolic content

UTILISATION OF WASTE GLYCEROL OBTAINED IN BIODIESEL PRODUCTION BY *ENTEROCOCCUS FAECALIS* ISOLATED STRAIN FROM MILK PRODUCTS

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Abstract

The results of the study of the utilization of waste glycerol obtained in sunflower and rapeseed oil-based biodiesel production by *Enterococcus faecalis* MK3-10A are presented in this paper. The most of members of lactic acid bacteria can convert glycerol to lactic acid [1]. It was reported that some strains of lactic acid bacteria can successfully convert crude glycerol to lactic acid [2]. There are a few published research that shows that some strains of *E. faecalis* can produce lactic acid using glycerol and waste glycerol [3, 4].

The strain *E. faecalis* MK3-10A was isolated from traditional milk product (kaymak) [5]. The isolated strain *E. faecalis* was cultivated in an incubator at 28º without shaking on MRS liquid media (pH 6.4) (Torlak, Belgrade) with pure and waste glycerol as a sole carbon source. Waste glycerol was obtained in biodiesel production from sunflower and rapeseed oil. The microbial growth (OD_{620}) was measured on a spectrophotometer at λ=620 nm (Cole Parmer 2100 UV/VIS) while the concentrations of lactic acid were determined by the HPLC method (Aminex HPX-87H column).

Isolated strain *E. faecalis* MK3-10A grew the best (OD_{max}=0.64) and reached the highest productivity rate of lactic acid (14,6 mg/ml/d) in the medium with waste glycerol from sunflower oil as a carbon source which was a slightly higher than it was obtained in medium with pure glycerol (OD_{max}=0.62 and $Y_{P/S}^{LA}$=13.4 mg/ml/d). The weakest growth (OD_{max}=0.40) and the lowest concentration (9.3 mg/ml) and productivity rate (8.2 mg/ml/d) of lactic acid were obtained while the *E. faecalis* MK3-10A was gained in medium with waste glycerol from rapeseed oil.

Waste glycerol obtained in sunflower oil-based biodiesel production has proved as a carbon source with great potential in bioprocesses with lactic acid bacteria. To increase the utilisation potential of waste glycerol obtained in rapeseed oil-based biodiesel production, it is necessary to change growing conditions and continue with further research.

Keywords: *Enterococcus faecalis*, waste glycerol, biodiesel, lactic acid

INFLUENCE OF APPLE JUICE ADDITION ON CHARACTERISTICS OF MINT AND NETTLE KOMBUCHA BEVERAGES

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Abstract

Kombucha tea is slightly sweet and acidic refreshing beverage consumed worldwide, tasting like sparkling apple cider and mostly produced by fermentation of black or green tea and white sugar using a tea fungus. In addition to black and green tea, some herbal teas can also be used, so the aim of this work is to produce Kombucha beverages by fermentation of mint and nettle herbal teas and honey with the addition of different concentrations of apple juice (2.5; 5 and 10% v / v). For the purposes of this study, the following parameters were measured: pH value, acidity, dry matter and residual sugar content. For the determination of antioxidative capacity the content of total phenolics was measured and two tests were performed: DPPH and FRAP. The fermentations lasted for 10 days, and with regard to the results of measuring the pH value, acidity, dry matter and residual sugar content, there is no excessive difference between the obtained Kombucha beverages. Mint Kombucha beverages showed better antioxidant activity, and in most cases the best effect was shown in samples in which the smallest amount of apple juice was added (2.5% v / v). Mint and nettle herbal teas proved to be adequate substrates for obtaining Kombucha beverages, and the addition of apple juice had a positive effect on the characteristics of the product.

Keywords: Mint and Nettle herbal teas, Kombucha, apple juice

EFFECT OF DIFFERENT FERTILIZATION TREATMENTS ON THE TOTAL PHENOLIC CONTENT OF PEPPER FRUITS

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Abstract

Pepper *(Capsicum annuum* L.) is a very important agricultural crop in Serbia, and has great economic importance. Pepper fruits are used in the food industry like fresh or processed products and are characterized by excellent culinary and nutritional properties. They are an exceptional source of bioactive substances (carotenoids, ascorbic acid, phenolics, capsaicin) which are considered strong antioxidants, so in addition to application in the food industry, peppers is also used in the pharmaceutical and cosmetic industries. Due to the increased tendency of the use of pepper fruits in human nutrition, researchers aspire to find cultivation technology that will provide both high yield and nutritious fruit with good quality. In this paper six different starter fertilizer (*Super Star*, Elixir Zorka, Šabac) doses (0, 15, 20, 25, 30, 35 kg/ha) were examined in combination with four treatments of biostimulator (*Kelpak*, Kelp Products Ltd.) application (without, once, twice and three times) at different stages of plant development on pepper variety *Slonovo uvo* (Superior, Velika Plana) in open field conditions. Extracts of fresh fruits were prepared with 80% methanol. Total phenolic content (TPC) was determined using the standard spectrophotometric *Folin-Ciocalteu* method. The obtained results are expressed as mg of ferulic acid equivalents (FAE) per g of fresh weight. TPC was in range from 0.51 to 2.31 mg/g FAE. The obtained preliminary results do not show a clear influence of used fertilizers on the increase of total phenolic content in peper fruits, so it is necessary to continue research in order to find an appropriate model of fertilizers use to improve the pepper fruits quality.

Keywords: biostimulator, pepper, phenolic content, starter fertilizer

OIL PRODUCTION BY ISOLATED STRAINS OF *CHLORELLA* AND *CHLOROCOCCUM* UNDER THE AUTOTROPHIC AND HETEROTROPHIC CONDITIONS

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Abstract

The results of the autotrophic and heterotrophic cultivation of isolated freshwater microalgae are presented in this work. Many studies are concentrated on the cultivating of algae as the suitable producers of inedible oil favorably for biodiesel production [1]. Microalgae are known for their ability to grow very fast and accumulate oil rapidly [2]. Algae, as the many microorganisms, successfully can grow using glycerol and convert it into valuable products [3, 4]. Some of them may utilize heterotrophic pathways and grow successfully on the organic source without a light source [5]. Two isolated strains of freshwater microalgae, identified as members of the *Chlorococcum* and *Chlorella* genera were used in this study. The strains were isolated from the samples of South Serbian swamps in the Laboratory for Microbiology and Food Technology of the Faculty of Technology in Leskovac [6]. Cultivation of strains was performed in liquid Bolds Basal Medium (BBM) (pH 6.6) at 22 ^{o}C under the constant light for 30 days at an orbital shaker (140 min^{-1}) and a complete experiment was also done in the same medium with added pure glycerol (15 g/l, Sigma Aldrich, 99.5 %). The concentration of dry biomass was determined gravimetrically after the algae entered the stationary phase. The content of algal oil was determined using the Bligh-Dayer method [6]. The *Chlorella* strain grew better under the autotrophic conditions whereby reached 1.2 g/l of dry biomass which was 9 % higher than it was obtained under the heterotrophic conditions. As opposed to that, it produced a 3 % higher amount of algal oil than it was obtained under the autotrophic cultivating conditions (33 % of dry biomass). *Chlorococcum* strain better grew and produced a higher amount of oil during the cultivating in medium with pure glycerol and reached 1.7 g/l of dry biomass and 17 % of oil in dry biomass which was 13 % and 6 % higher than it was obtained in medium without a carbon source. During the heterotrophic cultivating, the *Chlorella* strain spent 6.97 mg/ml, and the *Chlorococcum* strain spent 13.77 mg/ml of pure glycerol which was 51 % and 100 % of the available amount. It can be concluded that isolated strains of the microalgae *Chlorococcum* can grow better and produce a higher amount of algal oil by cultivating in heterotrophic conditions with pure glycerol as a carbon source. Isolated strain *Chlorella* can produce a

higher amount of oil by cultivating on glycerol but the growth is lower. Both of the studied strains can be grown successfully in media with glycerol as a carbon source.

Keywords: freshwater microalgae, pure glycerol, oil

THE INFLUENCE OF THE ADDITON OF VARIOUS TEAS ON THE PRODUCTION OF METHELGIN

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Abstract

Mead is a traditional alcoholic beverage containing between 8 and 18 vol % alcohol produced by fermentation of diluted honey under the influence of yeast. By adding various spices or herbs, a drink called methelgin is obtained. The aim of this work is production of mead with the addition of three types of tea (green, linden and elderberry) in three different concentrations. For the purposes of this study the pH value and dry matter were measured before and after fermentation. Also, the changes in the weight of the bottles was monitored daily. For the determination of antioxidative capacity the content of total phenolics was measured and two tests were performed: DPPH and FRAP. Fermentation activity was improved by the addition of tea, especially for the samples with added green tea. The obtained results showed differences in antioxidant properties for mead to which different types of teas were added and the strongest antioxidant effect was shown by the samples to which green tea was added. Also, with the increase in the amount of tea that was added, the antioxidant properties of the beverages were more pronounced.

Keywords: Mead, Methelgin, tea, antioxidant activity

FOOD TECHNOLOGY

LIPOLYSIS AND LIPID OXIDATION DURING SMOKED DRY-CURED HAM PROCESSING

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Abstract

Lipolytic and oxidative changes of intramuscular lipids during the dry-cured ham processing have a significant impact on the final quality of the product. An objective of this study was to investigate lipolysis and lipid oxidation in *Biceps femoris* (BF) and *Semimembranosus* (SM) muscles throughout the 12-month production period of smoked dry-cured ham at 5 different stages (raw ham, after salting, after smoking, after drying, after ripening). Lipolysis and lipid oxidation were analysed by the total fat content, free fatty acids (FFA) composition and thiobarbituric acid reactive substances (TBARS) test values. Total fat content in both muscles increased after the drying stage, with significantly higher ($p<0.05$) values in SM along the processing. The FFA profile in investigated muscles showed significant ($p<0.05$) changes during processing. After the ripening, BF and SM contained 37.99 and 38.07 % SFA, 51.82 and 50.61 % MUFA and 10.19 and 11.32 % PUFA, respectively. The location of the muscles did not have a significant effect ($p>0.05$) on the proportion of SFA, MUFA, and PUFA. Lipid oxidation increased in BF and SM throughout the process of production, from 0.13 to 0.45 mg MDA/kg and 0.13 to 0.53 mg MDA/kg, respectively. The external location of the SM muscle due to stronger dehydration resulted in significantly higher ($p<0.05$) total fat content and TBARS values.

Keywords: dry-cured ham, lipolysis, lipid oxidation, free fatty acids, TBARS

ADSORPTION OF INDIVIDUAL POLYPHENOL GROUPS FROM APPLES ONTO *B*-GLUCAN

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Abstract

The aim of this work was to obtain information about interactions between individual groups of polyphenols from apples and β-glucan. Polyphenols were extracted from peel and flesh of apple Idared with ultrasonic assisted extraction. Different groups of polyphenols from apple were separated by using the gel chromatographic method in a glass column with Sephadex LH-20 gel. Polyphenols were characterized by using reversed-phase high-performance liquid chromatography. In the apple flesh flavan-3-ols were present in the first fraction, then phenolic acids in the second and the flavonols in the third. In the apple peel flavan-3-ols were presented in the first fraction, then anthocyanins in the second and flavonols in the third. Interactions between polyphenols from apples and β-glucan were studied through adsorption process. The adsorption was conducted at 25 °C and pH 5,5 for 16 h. Adsorbed polyphenols were determined with reversed-phase high-performance liquid chromatography. In order to obtain information about adsorption process different models were applied. The experimental data (amount of adsorbed (q_e) and un-adsorbed (c_e) polyphenols) were modelled with non-linear regression using adsorption isotherm equations like Langmuir, Freundlich and Dubinin-Radushkevich. Apple polyphenols interacted with β-glucan. Polyphenols from peel showed slightly higher adsorption capacity than polyphenols from flesh. It was shown that adsorption was concentration depended process. It can be suggested that bonds between individual gropus of polyphenols and β-glucan were H bonds and Van der Waals forces.

Keywords: adsorption, interactions, polyphenols, β-glucan

EFFECT OF FREEZING RATE, FROZEN STORAGE TIME AND THAWING METHODS ON CONCENTRATION OF THYMOSIN PROTEINS IN PORK MEAT

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Abstract

Proteins are the most important ingredients in meat. They are found in meat in different forms and with different functions. Thymosins are small proteins present in many animal tissues with molecular weights of 1000–15000 Da. The technological processing of meat causes changes in the amount and shape of the basic ingredients take place. During the freezing of meat and its storage in the frozen state, various chemical reactions take place causing changes in the proteins. The aim of this paper was to examine the influence of the freezing rate and thawing methods on changes and behaviour of thymosin proteins in pork meat (*M. longissimus dorsi*) during storage. Protein analyses were performed using capillary gel electrophoresis (CGE) and the SDS-MW Analysis Kit (Beckman Coulter). The meat samples were frozen at 10 different rates (from 0.23 cm/h to 1.43 cm/h). The samples were tested at different times during 60 days of storage at -20^{o}C (after 1, 15, 30, 45, 60 days). Before analysis, the samples were thawed in the refrigerator, at room temperature and in the microwave oven. After one day of storing frozen meat samples, the relative concentration of thymosin was less than 1% in all tested samples. During 60 days of storage, most samples had a slight increase in the relative concentration of thymosin. The highest relative concentration of thymosin after 60 days of storage (1.67%) was recorded in a meat sample that was frozen at a rate of 1.10 cm/h and thawed in a microwave oven.

Keywords: thymosin, freezing, pork meat.

EFFECT OF PARTIAL REPLACEMENT OF SODIUM CHLORIDE WITH POTASSIUM CHLORIDE ON THE PROPERTIES OF ACID-COAGULATED CHEESES

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Abstract

Excessive sodium intake is considered to be the cause of certain health problems in humans, such as hypertension and cardiovascular disease. The aim of this paper is to investigate the effect of partial replacement of sodium chloride (NaCl) with potassium chloride (KCl) on chemical composition, water activity, pH value, acidity, colour, textural properties and sensory properties of acid-coagulated cheeses. A control sample with sodium chloride (100% NaCl) was produced as well as samples in which a certain amount of sodium chloride was replaced by potassium chloride (25%, 50% and 75%). Based on the obtained results, it was determined that the replacement of sodium chloride with potassium chloride affects ($p<0.05$) the examined physico-chemical and sensory properties of the produced cheeses. Cheeses with reduced sodium content had statistically significant ($p<0.05$) higher water content and a lower fat and protein content, and therefore a lower dry matter content. It was also found that cheeses with a higher amount of KCl had statistically significant ($p<0.05$) lower hardness and higher values of lightness (L*) and higher values of yellow colour (b*) compared to samples produced with 100% sodium content. Complete replacement of sodium chloride with potassium chloride in the production of acid-coagulated cheeses gives an unacceptably bitter product. The obtained results showed that, in the production of these types of cheese, up to 50% of sodium chloride can be replaced by potassium chloride without negatively affecting the sensory properties, while a higher level of substitution negatively affects the quality of the produced cheese.

Keywords: cheese, sodium replacement, potassium chloride.

INFLUENCE OF TRADITIONAL AND MODERN TECHNOLOGICAL PROCESSES ON THE CHEMICAL COMPOSITION AND BIOACTIVITIES OF PLANT SPECIES *SAMBUCUS NIGRA* L.

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Abstract

Sambucus nigra L. commonly known as elderberry is a wild-growing plant from Adoxaceae botanical family. Elderberry represents an unutilized biopotential for the production of new phytopreparates. This investigation included collection, drying plant material by traditional techniques, and preparation extracts, using modern extraction techniques such as microwave and ultrasound-assisted extractions, as well as using two solvents (water or 50% EtOH). Analyses of extracts were done spectrophotometrically, quantification of the individual phenolic compounds was carried out by LC-MS/MS method. The biopotential of elderberry was evaluated by examining antioxidant, neuroprotective, and antidiabetic activity by several *in vitro* assays. Comparison of the applied extraction techniques, microwave extraction proved superior, while 50% EtOH was better solvent than water as exceptional results were achieved when it comes to biological activity. The strongest antioxidant activity was achieved using the FRAP assay. Also, 50% EtOH proved to be a better solvent than water, and microwave extraction is more efficient than ultrasound extraction when it comes to neuroprotective and antidiabetic activity. The following values have been obtained, which demonstrate the ability of the elderberry extract to inhibit acetylcholinesterase and α-amylase enzymes (4.89±0.09 mg GALE/g extract for acetylcholinesterase and 0.29±0.01 mmol ACAE/g extracts for α-amylase). The obtained results open a new possibility for further research on this wild-growing plant, which thanks to very good phytopharmacological activity could be a multi-target agent for various diseases that are growing in modern society.

Keywords: *Sambucus nigra* L., extraction techniques, biological activity, phytopreparates

THE EFFECT OF CORIANDER ESSENTIAL OIL ON SENSORY QUALITY OF COOKED SAUSAGES PRODUCED WITH DIFFERENT LEVELS OF SODIUM NITRITE

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Abstract

It is well known that essential oils cause formation of strong flavor in meat products. Therefore, the optimization of their concentration before the application in meat products is essential.

The aim of this study was to evaluate the effect of coriander (*Coriandrum sativum* L.) essential oil (CEO) addition (0.075, 0.100, 0.125 and 0.150 µL/g) on sensory properties (i.e. color and flavor) of cooked sausages formulated with different levels of sodium nitrite (0, 50 and 100 mg/kg).

The Difference-Control-Test was carried out by 34 trained assessors, who were asked to evaluate the control sample and then to evaluate coded (experimental) samples and rate the difference from the control (sausages without CEO) on a scale from 0 to 6, where 0 = no difference; 1 = very slight difference; 2 = slight/moderate difference; 3 = moderate difference; 4 = moderate/large difference; 5 = large difference; and 6 = very large difference.

Color of sausages produced with CEO was sensory evaluated as the same or redder compared to control counterpart. Moreover, CEO has shown significant ($p<0.05$) influence on sausage flavor. For each level of nitrite, the addition of 0.100 µL/g and 0.125 µL/g CEO affected to very slight differences of flavor. However, slight/moderate differences of flavor were observed for sausages produced with 0.150 µL/g of CEO compared to those without CEO.

Hence, obtained results showed that the addition of CEO in concentrations ≤ 0.125 µL/g had no negative impact on sensory properties of cooked sausages produced with different levels of sodium nitrite.

Keywords: coriander essential oil, sodium nitrite, cooked sausage, colour, flavour;

APPLICATION OF 2-D NMR TECHNIQUE FOR CHARACTERISATION OF POLYPHENOLS FROM PLANT MATERIALS

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Abstract

Nuclear magnetic resonance spectroscopy (NMR) is wide spread method for investigation of organic compounds structure including polyphenols. For the identification of polyphenols the most common NMR technique include one - dimensional NMR techniques such as ^{1}H and ^{13}C. However, to overcome problems of spectral overlap two-dimensional nuclear magnetic resonance spectroscopy (2D NMR) is used. 2D NMR is a set of NMR methods that gives data plotted in a space defined by two frequency axes rather than one. The most popular two-dimension NMR experiments are the homonuclear correlation spectroscopy (COSY) sequence, heteronuclear single-quantum correlation spectroscopy (HSQC) and heteronuclear two-bond or multiple-bond correlation spectroscopy (H2BC, HMBC, respectively). In this study, results of eight different polyphenol compounds structure determined by advanced 2D-NMR technique (COSY, HSQC, H2BC, and HMBC) are shown.

Keywords: NMR, COSY, HSQC, H2BC, HMBC

POTENTIAL OF CHAMPIGNONS CULTIVATED ON DIGESTED ORGANIC WASTE IN THE PREVENTION AGAINST OXIDATIVE STRESS AND NEURAL DAMAGE

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Abstract

Agaricus bisporus also known as champignon or white button mushroom was cultivated on digested organic waste. Its aqueous extract was investigated for the antioxidant potential, which could strengthen the protection of organism against oxidative stress damages. Likewise, acetylcholinesterase (AChE) inhibitory activity was observed. The crucial role of AChE in neural transmission makes it a primary target of a large number of cholinesterase-inhibiting drugs involved in the prevention of neurodegenerative diseases e.g. Alzheimer's disease (AD). The antioxidant activities were evaluated by *in vitro* models including, 1,1-diphenyl-2-picrylhydrazyl (DPPH) free radical scavenging activity, prevention of lipid peroxidation (LPx) in a linoleic acid model system and chelating ability on ferrous ions. Based on the analysis, hot water extracts showed a typical carbohydrate pattern with the presence of polyphenols and small amounts of proteins. With regard to scavenging ability on DPPH radicals, the EC_{50} value for *A. bisporus* was 0.89 mg/ml, the EC_{50} value of the chelating abilities on ferrous ions was 1.38 mg/ml and for inhibition of LPx EC_{50} value was found to be 1.77 mg/ml. Extract of *A. bisporus* had a noticeable inhibition towards AChE, IC_{50}=1.02 mg/ml and exerted weak toxicity against healthy human peripheral blood mononuclear cells (PBMC). More than 60% of cell viability was observed at 2 mg/ml. The good antioxidative properties and AChE inhibitory activity of *A. bisporus* aqueous extract make it suitable for everyday use as an inexpensive dietary supplement.

Keywords: champignons, digested organic waste, hot water extract, antioxidant potential, acetylcholinesterases inhibotors.

EXTRACTION AND DETERMINATION OF BIOLOGICAL AND FUNCTIONAL POTENTIAL OF *HELICHRYSUM ITALICUM* (ROTH) G. DON

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Abstract

Nowadays medical plants are taking an important role in preventing and treating many diseases. Species of *Helichrysum* have been known in traditional medicine for healing and anti-inflammatory properties, which includes the application for the treatment of allergies, colds, cough, skin, liver disorders, inflammation, infections, and sleeplessness. *Helichrysum italicum* (Roth) G. Don is the most common species in the Mediterranean region. After collecting, removing impurities, and drying, plants were used to make extracts. Extracts were obtained using traditional (maceration) and modern extraction techniques (microwave-assisted MAE, and ultrasound-assisted UAE extraction), and water or 50% ethanol were used as solvents. Based on the performed investigation of extracts, results are shown that 50% ethanol extracts have a higher amount of total phenols and total flavonoids compared with water extracts. The highest amount of total phenolic compounds was in 50% ethanol MAE extract (119.77 mg GAE/g E). Microwave-assisted extraction was more favourable for phenolic and flavonoid extraction. Further, ethanol extracts showed better antioxidant activity by all applied assays. The most effective antioxidant activity was achieved by 50% ethanol MAE extract by CUPRAC assay (506.46 mg TE/g E). All examined extracts showed very good inhibitory activity against amylase and glucosidase enzymes. Most potential in the inhibition process was accomplished by 50% MAE extract in both assays performed. According to these results, *Helichrysum* extracts have a high content of phenolic compounds and strong biological activity, with potential in health promotion and prevention diseases.

Keywords: *Helichrysum italicum* (Roth) G. Don, extraction techniques, antioxidant potential, antidiabetic activity

ALUMINIUM CONTENT IN THE MEAT OF MALE SAANEN GOAT KIDS FROM VOJVODINA (NORTHERN SERBIA)

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Abstract

At present, aluminium (Al) is the second most widely used metal in the world. Al is the third most abundant element (8%) in the earth's crust and is therefore a natural component of foodstuffs and drinking water. Al is not considered to be an essential element in humans, but its toxicity is known, particularly in patients with chronic renal failure and Alzheimer's disease. In the 2008 the EFSA established a TWI (tolerable weekly intake) of 1 mg Al/kg body weight. Goats, the earliest ruminant to be domesticated, are traditional sources of meat, milk, fibre, leather, related products of animal origin and as draught and pack animals. Meat is the major product of the goat. Meat quality is the sum of all sensory, nutritive, technological and hygienic-toxicological factors of meat. The nutritive factors of meat quality include proteins and their composition, fats and their composition, minerals, vitamins, utilisation, digestibility and biological value. The aim of this study was to investigate the Al content of four different muscles (*M. psoas major* - PM, *M. longissimus dorsi* - LD, *M. semimembranosus* - SM and *M. triceps brachii* - TB) of Saanen goat male kids and to determine whether the Al contents differed between the muscles. Al content was determined using ICP-OES method, after dry ashing mineralisation. Al content was significantly higher ($p<0.01$) in SM (1.37 mg/kg) than in LD and TB (0.81 and 0.75 mg/kg, respectively). Al content in PM was 1.11 mg/kg.

Keywords: Aluminium, Meat, Saanen goat

ANTILISTERIAL POTENTIAL OF SELECTED FOREST MUSHROOMS OF SERBIA

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Abstract

From ancient times, in the tradition of many cultures forest mushrooms were used for food, but they also played an important role in the treatment of numerous health disorders. In modern life, people still face many health challenges, and one of the most worrying is the growing resistance to antibiotics that are in widespread use. Therefore, new sources of antimicrobial components are constantly being researched, and mushrooms are one of the most important. In light of this approach, the aim of current study was to determine the antilisterial potential of water and alkali extracts obtained from mushrooms *Ganoderma lucidum*, *Ganoderma applanatum*, *Fomitopsis pinicola*, *Craterellus curnucopioides*, *Meripilus giganteus* and *Boletus edulis*. For all tested water extracts, a minimum inhibitory concentration (MIC) towards *Listeria monocytogenes* ATCC 19111 was found to be in the concentration range of 0.0—20 mg/mL, while this bacteria was inhibited in the presence of 2.5—20 mg/mL of alkali extracts. A minimum bactericidal concentration (MBC) of 20 mg/mL was determined for all observed alkali extracts. Overall, the most pronounced antilisterial effect was confirmed in *G. applanatum* and *F. pinicola* alkali extracts (MIC - 2.5 mg/mL, MBC - 20.0 mg/mL). The results of this study are very promising and indicate the potential use of the tested extracts as antilisterial agents. Since mushrooms used for this research are already known as culinary/medically important mushrooms, their extracts in the production of functional food products would be welcome.

Keywords: antilisterial, mushrooms, antibacterial

QUALITY CONTROL AND FOOD SAFETY

OPTIMIZATION OF TEMPERATURE AND GRILLING TIME OF LESKOVAC GRILL SPECIALTIES

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Abstract

The paper examines grilling of Leskovac Grill Specialties in order to optimize the existing grilling process. The main goal of this study was to determine the optimal temperature and duration of grilling these products. Leskovac Grill Specialties received Registered Trademark based on presented preparation according to precisely prescribed traditional procedures and grilled on a classic grill that is heated by burning beech charcoal. The key raw material for the production of these specialties is traditionally prepared meat to which onion is added in the amount of 10% in relation to the weight of meat. Leskovac Grill Specialties are made by hand. The grill temperature was measured with a thermal imaging camera and a laser thermometer. Preliminarily test includes grilling at a higher temperature (220-240^0 C) than the applied one. At this temperature, the product burned superficially after 5 minutes, while the middle of the product remained raw and ungrilled. Further tests were performed at a moderate temperature (170-190^0 C). The end of the baking process was determined by measuring internal temperature of the finished products with a puncture thermometer which was 72-75^0 C. Satisfying sensory properties of the finished product are light brown to brown colour, soft consistency, uniform colour in cross section, juiciness, characteristic smell and taste. The weight loss of the product was 15-20%. By comparing the sensory properties of the finished products, the optimal grilling conditions were determined, which are the temperature of 180^0 C and the grilling time which is 8 to 11 minutes, depending on the type of specialty.

Keywords: (meat specialties, grilling, optimization, temperature, time).

SWEET BAKERY PRODUCTS FOR DIABETICS' DIET AND ANALYZE THE RISKS ASSOCIATED WITH SELECTED INGREDIENTS

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Abstract

Diabetes is a complex, chronic illness that demands healthy diet. The overall quality of consumed food is important for diabetics, but benefits are expected from whole grains and lower-energy food. The problem for diabetics in meal planning may present choice of appropriate sweet bakery product. **The aim of this research** is to provide an overview of some opportunities for new food product development for persons with diabetes and to analyze the risks associated with selected food ingredients, which can be used. It includes identification of special requirements for controlled nutrition. Quality parameters and food product composition are determined on formulation for muffins, but modified to contain ingredients recommended and safe for diabetics' diet with lower energy value, but to keep prescribed and acceptable product quality. The assessment of the risks analysis associated with selected ingredients on example of muffins-like cake formulation modelling in this research is performed for use of wheat flour, sugars, fats, salt and some additional ingredients, milk, eggs and cocoa powder, based on experience, insight into recommendations for diabetics' nutrition and scientifically identified indicators aimed at health protection. Methodology for selection ingredients for energy-reduced muffins-like cakes with whole-grain wheat flour and cocoa, suitable for diabetics' diet presented in the paper, can use as model for other products development aimed to improve nutrition of persons with healthy food preferences or diseases. In addition, it present an opportunity for the food industry contribution to healthy lifestyle by developing products adapted to modern dietary recommendations and target consumers group.

Keywords: diabetics' diet, energy-reduced cakes, selection ingredients, risks analysis

POLYPHENOL CONTENT AND ANTIOXIDANT ACTIVITY OF WILD AND CULTIVATED BLACKBERRIES (*RUBUS FRUTICOSUS L.*) JUICES

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Abstract

Blackberry fruits (*Rubus fruticosus L.*) have been valued as an excellent source of polyphenol content and antioxidant activity. In this study, blackberry juices of two cultivated blackberry cultivars and two wild blackberry cultivars were evaluated as potential sources of polyphenolic compounds and antioxidant activity. Content of polyphenols (total polyphenols, total flavonoids, flavonols, total and monomeric anthocyanins) and antioxidant activity (DPPH, ABTS, and OH radicals tests) was determined by the spectrophotometric method. Wild blackberry varieties indicated the higher content of total polyphenols (2.16 - 2.25 mg GAE/g fw (fresh weight)), total anthocyanins (0.83 - 1.34 mg Cy/g fw), and monomeric anthocyanins (0.70 - 1.14 mg Cy/g fw), while juice of cultivated blackberry variety had higher content of flavonoids (0.45 mg GAE/g fw) and flavonols (0.68 mg GAE/g fw). The results of the DPPH and the ABTS tests showed that wild blackberries possessed higher antioxidant activity compared to cultivated blackberry ($p < 0.05$). All blackberry juices showed high concentrations of total polyphenols, including flavonoids, and anthocyanins content. The antioxidant activities of wild variety samples were stronger than cultivated varieties. Significant correlations were determined between content of total polyphenols, total and monomeric anthocyanins and capacities of inhibition DPPH and ABTS radicals.

Keywords: cultivated blackberry, wild blackberry, juice, polyphenol content, antioxidant activity.

QUALITY OF REDUCED-ENERGY MUFFIN-LIKE CAKES PRODUCED WITH WHOLE-GRAIN WHEAT FLOUR, SAFE FOR DIABETICS' NUTRITION

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Abstract

The aim of this research was developing a recipe for muffins-like cakes, produced with whole-grain wheat flour, suitable and safe for nutrition of people with carbohydrate metabolism disorders (diabetics). Recommendations for diabetics' nutrition were analyzed to develop cake of appropriate quality and safe for consumption. Following were determined: (a) the essential parameters of technological and sensory quality of final product; (b) nature and quantity of basic ingredients, making five different model-samples of cakes; (c) moisture, ash, fat, salt, starch, protein, fiber and sugar content of cakes; (d) quality of cakes were evaluated by descriptive sensory analysis; (e) nutritional composition was compared with similar cakes. The basic chemical composition and achieved quality of cake-samples were analyzed after production and the best one was selected, produced combining following ingredients: 32% whole-grain wheat flour; 30% water; 10% skimmed milk; 9% fructose; 5% sunflower oil; 6.5% eggs; 3.2% fat-reduced cocoa powder; 3% yeast; 0.3% salt; 0.3% flavours (chocolate, vanilla, rum); 0.16% additives blend. Cakes had high overall sensory quality (4.73±0.22 points of 5 possible), characteristic regular shape and volume, uniform pores distribution, moderate elasticity and moisture during chewing, uniform dark brown colour, pleasant harmonious smell and sweetish taste of baked chocolate cake. It was concluded that muffins-like cakes were suitable and safe for diabetics nutrition regarding basic ingredients content (whole-grain wheat flour, skimmed milk, fructose, vegetable oil) and nutritional composition with reduced content of: energy 38-59%, fats 30-70%, sugars 64-80%, when compared to five similar chocolate cakes, available in the market.

Keywords: energy-reduced muffins, diabetics' nutrition, whole-grain wheat flour.

QUALITY ASSESSMENT OF SAUSAGES WITH REGARD TO PROTEIN CONTENT AND COLLAGEN CONTENT FROM THE REPUBLIC OF SRPSKA MARKET

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Abstract

The Regulation on chopped meat, semi-finished products and meat products ("Official Gazette of the Republic of Srpska, No. 46/15) prescribes quality requirements for meat products. In addition to the content of meat proteins or total proteins, one of the prescribed quality requirements for sausages is the relative content of connective tissue proteins in meat proteins or total proteins, respectively collagen content.

The aim of this research is to examine the protein content and collagen content in different types of sausages from the Republic of Srpska market and to determine the quality of the product based on the test results. As part of the official control and self-control, in the period from April 2018 to April 2019, the mentioned tests were conducted by reference accredited methods.

A total of 136 samples were analyzed, of which 29 samples of fermented dry sausages, 97 samples of heat-treated sausages and ten samples of cooked sausages. Lower protein content was found in 11 products (8,09%), of which in one sample of dry sausage, nine samples of heat-treated sausages and one sample of cooked sausage. The higher content of the collagen was determined in eight products (5.88%), of which in two samples of dry sausages, five samples of heat-treated sausages and one sample of cooked sausage.

The obtained results indicate the need for constant control and improvement of the quality of basic ingredients, as well as determination and improvement of certain phases of the technological production process, which affect the quality of the final product, all in order to achieve uniform and required quality of sausages placed on the market of Republic of Srpska. and the required quality of sausages.

Keywords: sausages, quality requirements, protein content, collagen content.

TEXTILE TECHNOLOGY

APPLICATION OF WASTE FLAX FIBRES AS SORBENT OF HEAVY METAL IONS FROM AQUEOUS SOLUTION

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Abstract

In this paper, waste flax fibres were used for the removal of heavy metals present as contaminants in industrial wastewater. Short, tangled flax fibers have no significant practical application and they are treated as waste. These natural, biodegradable materials are very interesting for new areas of application, including the field of water purification. Sorption of heavy metal ions was tested from single ion solutions, where initial concentrations of heavy metal ions in the solution were 10 mg/l and 25 mg/l. The degree of sorption of heavy metal ions from aqueous solution of concentration 10 mg/l was in order $Pb^{2+} > Zn^{2+} \sim Ni^{2+} > Cu^{2+} > Cr^{3+}$, while in the case of sorption from a solution of concentration 25 mg/l was in order $Pb^{2+} > Zn^{2+} > Cu^{2+} > Ni^{2+} > Cr^{3+}$. The results show that flax fibers can be used as a cheap, environmentally friendly sorbent for sorption of heavy metal ions from aqueous solution, where the sorption capacity of the fibers depends on the type of heavy metal and the initial concentration of metal ions in the solution.

Keywords: flax fibres, sorption, heavy metals

APPLICATION OF PLASMA FOR TEXTILE FINISHING

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Abstract

Textile finishing is applied to achieve the desired effects on the textile materials and produce textile products according to market demands. Finishing can modify the appearance and feel of the textile material and improve its performances. Traditional textile finishing wet processes, based on the application of chemicals, use large amounts of water and energy and generate large amounts of wastewater, which significantly increases the ecological footprint of textile. Growing concern for the environment and efforts to save energy have led to numerous studies aimed at replacing many wet finishing processes with low water consumption processes and dry finishing.

Plasma treatment is one of the specialized finishing procedures to achieve the desired functional properties of textiles, in which there are no harmful substances, no wet processes / wastewater and no mechanical damage to the textile material being treated.

The paper deals with plasma techniques application suitable for textile processing, functionalities achieved by this processing, as well as the advantages of plasma application as a unique efficient engineering tool for functionalization / improvement of surface properties of textile materials.

Keywords: textile materials, textile finishing, plasma technology.

THE EFFECT OF PLASMA ON THE STRUCTURE OF TEXTILE MATERIALS

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Abstract

In this paper, changes in the structure of textile materials due to plasma exposure were investigated. Textile materials of different raw material compositions: cotton, polyester and a mixture of cotton/polyester were used. Textile materials have been treated for 5 minutes in radiofrequency (RF) plasma with argon gas. A high voltage RF generator with a standard frequency of 13.56 MHz was used to obtain RF discharges in the plasma. By modifying the surface of the textile materials with plasma, certain groups in the fiber structure were activated. The presence of carboxyl and carbonyl groups in the structure of cotton knitwear after plasma treatment increases the degree of coloration, as well as the color fastness. Structural changes in textile materials were examined by FTIR spectroscopy. FTIR analysis is a very powerful method for determining structural changes in materials. Small changes in the structure of the material change the intensity and position of the peaks on the FTIR spectrum. The structural changes of knitwear and fabrics are discussed, as well as the changes caused by the irradiation of the material with plasma.

Keywords: plasma, structure of textile, cotton, polyester, FTIR.

ULTRASOUND PROCESSING OF TEXTILE

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Abstract

There are many potential advantages of using ultrasound in wet processing of the textile. Ultrasound, with a frequency above the upper limit of human hearing, has been widely explored as a means of intensifying various wet processes for textile processing, including desizing, scouring, bleaching, dyeing, printing and finishing, as well as nanoprocesses (nanopretreatment, nanodyeing, nanoprinting and nanofinishing). Ultrasonic energy is used for development of diferent processes in the textile industry, which are environmentally friendly technologies with saving of energy, chemicals, water and time, including less generation of wastewater and solid waste, compared to classical processes. Also, introducing ultrasonic energy during some treatments of textile significantly improves processes efficiency without affecting the properties of textile. All this increases the competitiveness of the textile industry.
In this paper are presented various possibilities of ultrasound application in the textiles area, especially recent developments in ultrasonic processsing of textile.

Keywords: textile materials, textile finishing, ultrasound processing.

UNCONVENTIONAL DYEING OF POLYAMIDE FABRIC WITH DIRECT DYE

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Abstract

The possibility of unconventional dyeing of polyamide fabric with direct dye was investigated in this paper. Dyeing of polyamide fabric with direct dye was realized in the laboratory with the tendency to apply it in industrial conditions. 100% raw polyamide 6.6 fabric was used. Polyamide belongs to the group of synthetic fibers. The fabric was dyed with a direct dye of a specific structure that has a predisposition to binding to the fiber. Direct dyes are sulfonated azo compounds derived from benzidine and its derivatives or amines of the diaminostilbene type, etc. and are commonly used to dye of cotton. The samples were dyed at a temperature of 95 °C. The dye used is Solophenyl green 5BL (Huntsman, USA). Samples of polyamide 6.6 fabric were dyed in a time period of 5, 10, 20, 30, 40, 50 and 60 minutes. The solution contained dye concentrations of 5, 10, 15, 20, 25 and 30 mg/dm^3. Adsorption isotherms are of great importance for the investigation of the dyeing process, so several of them, Halsey, Jovanovic and Temkin, were used in this research. The Halsey model proved to be the most suitable for explaining polyamide dyeing with direct dye. The successful process of dyeing polyamide with direct dye has expanded the range of dyes that can be used for polyamide.

Keywords: direct dye, polyamide 6.6 fabric, Halsey's isotherm, Jovanovic's isotherm, Temkin's isotherm

OPTIMIZATION MODEL DEVELOPMENT FOR TEXTILE FIBRILIZED POLYPROPYLENE FOIL STRIPS

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Abstract

A scholar approach was used in performing an experiment done under process conditions during extrusion of polypropylene (PP)-strip type 450 tex-2223 from pure and admixture granulate FY-6. Studied were the interaction factors during technological process using the theory of multiple and partial correlation. The dependence between the yarn foil fineness [Nm] tex, which was dependently variable, on the line operation time interval (h_i) and the temperature (t_i), regulated by warm air flow in the strip stretching chamber, was studied. The line speed was kept constant. Compared was the goodness degree of two fiber products, one made from pure granules and the other with an admixture of secondary regenerate type FY-6 up to 8%, under the same production and technological conditions. It has been proven that the continuous operation time of the line with pure compared to granulate containing 8% of secondary impurities was 88/72 [h].

Keywords: extrusion, PP-strip, granulate FY-6

GRAPHIC TECHNOLOGY AND DESIGN

INFLUENCE OF PROCESS COLOURS ON WATER VAPOUR RESISTANCE PREDICTION OF INKJET PRINTED TEXTILE SUBSTRATE

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Abstract

In the case of excessive body temperature, the human body activates the sweat mechanism, and heat evaporation leads to heat loss. Clothing, by its characteristics, largely determines the exchange of heat between the body and the environment. Today's clothing is often subjected to the printing process, in order to increase its aesthetic value. The printing process changes textile materials, and thus changes clothes made from these materials. This paper presents research on the influence of individual process colours on the thermo-physiological features of textile materials. The effects of process inks on thermo-physiological characteristics of substrate materials were determined by measuring water vapour resistance. The obtained results show that process inks, in combination with material characteristics, have an impact on the water vapour resistance of textiles.

Keywords: Inkjet textile printing, Water vapour resistance.

TRENDS IN GRAVURE PRINTING

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Abstract

Printed products can be divided in three main categories: publication, commercial printing and packaging. Packaging group is growing consistently. Publication volumes and value are declining significantly, because there are alternative media versions of some traditional print products. For example E-books, online, electronic and social media are direct replacements for print product. Commercial printing shows a decline to 2015 with volume static to 2020 and a small rise in value. One of the major processes in print market is gravure printing. Gravure printing is mainly used for high-volume publication and for packaging production. The aim of this paper is to present the current state of the market and predictions of gravure printing techniques future direction on major geographic market.

Keywords: gravure printing, trends

ENGINEERING AND ENVIRONMENTAL PROTECTION

SPATIAL AND TEMPORAL VARIABILITY OF $PM_{2.5}/PM_{10}$ RATIO IN REPUBLIC OF SRPSKA

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Abstract

Bosnia and Herzegovina is facing a wide range of challenges regarding air quality. The country's residents are exposed to the high levels of health-damaging particulate air pollution which are caused by a range of different emission sources and geographic circumstances.

The particulate matter (PM) value is usually used to indicate the degree of air pollution. In addition to that of $PM_{2.5}$ and PM_{10}, the use of the $PM_{2.5}$ /PM_{10} ratio as an indicator and assessor of air pollution has also become more widespread. This ratio reflects the air pollution conditions and pollution sources. However, application of the ratio needs its varying pattern because PM concentrations change significantly at time and space. Hourly and daily $PM_{2.5}$ and PM_{10} observations at one monitoring site in urban area, one urban-background site and one urban-industrial site in Republic of Srpska in 2017-2019 were collected to investigate both long-term, short-term temporal variation and spatial distribution of the ratio.

The results show that annual average $PM_{2.5}/PM_{10}$ ratio is 0.45 at urban-site and 0.70 at urban-background site and 0.57 at urban-industrial site with apparent seasonal, monthly and daily variations. Stable atmospheric conditions are prerequisite for maximum ratio in winter season. There are apparent night-day differences of daily variation of the ratio and obvious spatial gradients of the ratio from urban, urban-background and urban-industrial sites. This study provides further insights to the spatial and temporal variability of $PM_{2.5}/PM_{10}$ ratio that should be noticed in its applications.

Keywords: Air quality, particulate matter, PM, pollution sources.

GLYCEROL-BASED DEEP EUTECTIC SOLVENTS AS COSOLVENTS IN THE COLD-PRESSED BLACK MUSTARD (*BRASSICA NIGRA* L.) SEED OIL ETHANOLYSIS CATALYZED BY NON-CALCINED CALCIUM OXIDE

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Abstract

The present paper deals with the application of the glycerol/choline chloride and glycerol/lecithin deep eutectic solvents (DESs) with a molar ratio of 2:1 as co-solvents in the ethanolysis of cold-pressed black mustard (*Brassica nigra* L.) seed oil catalyzed by non-calcined calcium-oxide as a catalyst. The individual components of the used DESs were also tested as co-solvents. The reactions were carried out in a batch magnetically stirred reactor under the following reaction conditions: the temperature of 70 °C, the ethanol-to-oil molar ratio of 12:1, and the amounts of DESs and calcium-oxide of 20 and 10 wt.% of the oil, respectively. Besides that, a control reaction with the presence of no cosolvent was performed under the same conditions. The fatty acid ethyl esters (FAEE) contents obtained in the reactions with the glycerol/lecithin and glycerol/choline chloride DESs after 3 h were 96.0% and 98.1%, respectively while the FAEE contents achieved for the same reaction time with lecithin, choline chloride, and glycerol were 84.3%, 81.1%, and 26.0%, respectively. The control reaction was rather slow, providing an FAEE content of 48.8% after 6 h. Therefore, the used glycerol-based DESs successfully activated non-calcined calcium oxide, providing a more cost-effective procedure than thermal activation.

Keywords: black mustard seed oil, deep eutectic solvents, biodiesel, lecithin, choline chloride.

A COMPARISON OF THE METHANOLYSIS OF VEGETABLE OILS AND FATS OVER HOMOGENEOUS AND HETEROGENEOUS CATALYSTS

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Abstract

In this work, the effects of homogeneous (KOH) and heterogeneous (CaO and quicklime) on the methanolysis of waste lard from piglet roasting and some vegetable oils (sunflower, canola, and used cooking oils), carried out at moderate temperatures (below the boiling point of methanol) in batch stirred and continuous packed-bed reactors, were compared. In the case of the KOH-catalyzed methanolysis of fats and oils at a methanol:lard molar ratio of 6:1, the reactions of sunflower and used cooking oils were much slower than the reaction waste lard. A higher TAG conversion degree in shorter reaction time was obtained with waste lard than with the oily feedstocks. The same conclusion was drawn by comparing the values of the pseudo-first-order reaction rate constants. The value for the reaction rate constant for pure lard was one or two orders higher than the so far published values for jatropha, cottonseed, and sunflower oils regardless of the type of alcohol and catalyst. In the heterogeneously catalyzed methanolysis, waste lard in the presence of CaO reacted faster than sunflower, canola, and used cooking oils under the same or approximately the same reaction conditions, regardless of the type of catalyst.

Keywords: waste lard, vegetable oils, KOH, CaO, quicklime, methanolysis.

BIOLOGICAL AND CHEMICAL PERSPECTIVES OF SAMBUCUS EBULUS L. WATER EXTRACTS

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Abstract

From ancient times, various wild medicinal herbs have been used for treatment of many diseases. One of such medicinal plants with a prominent place in folk medicine of people from the Balkan Peninsula is *Sambucus ebulus* L. (Adoxacea). This perennial herbaceous plant has proven to be very effective in treating various diseases such as burns, infectious wounds, edema, eczema, urticaria, arthritis and sore-throat. Due to the great importance of *Sambucus ebulus* L. in human medicine, in this paper the special attention will be paid to this plant and a retrospective of the known data about its composition and beneficial effect will be given. Chemical composition showed that all parts of the plant are rich in phenols and flavonoids, while their highest content is recorded in the leaves. Also, that plant have other important bioactive compounds including gallic acid, catechin and chlorogenic acid. The presence of numerous bioactive compounds explains the high antioxidant activity, anticancerogenic and antitumor effects shown by the extracts of this plant. Water extracts made of this plant have shown their cytotoxic activity toward the cell lines of different tumours. It could be concluded that the water extracts obtained from *Sambucus ebulus* may be used as a source of bioactive compounds for designing new biological formulations, including pharmaceuticals and functional food ingredients.

Keywords: herbaceous plant, *Sambucus ebulus* L. water extracts, bioactive compounds, antioxidant activity, cytotoxic activity.

REMOVAL OF SODIUM LAURYL SULFATE FROM WASTEWATER BY ADSORPTION ON ACTIVATED CARBON

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Abstract

Sodium lauryl sulfate (SLS) is one of the main components present in detergents and personal hygiene products, therefore, it is the most common anionic surfactant substance in municipal wastewater, which during discharge endanger flora and fauna of the recipient.
During the present study, adsorption of sodium lauryl sulfate (SLS) was performed from wastewater suspension model sample onto powdered activated carbon (PAC). The experiment was performed at room temperature (20°C) and the pH value range of the initial model samples from 6,40 to 7,51. The influence of adsorbent dose (PAC), the adsorbate concentration (SLS) and adsorption time on the removal efficiency of SLS from the model sample were monitored. The process was additionally controlled by meausuring pH value.
The use of powdered activated carbon gives satisfactory results in the removal of sodium lauryl sulfate from water, and the presented results of this research can serve as a foundation for further testing and implementation of this adsorption process for the removal of anionic surfactants from real wastewater samples.

Keywords: adsorption, sodium lauryl sulfate, powdered activated carbon, wastewater

OTHERS

DATA ABOUT CHENOPODIACEAE FAMILY ALLOCATION ON NEW HOLOCENE PERIOD IN ELBASAN CITY – ALBANIA

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Abstract

Paleopalynological data given in this scientific paper were taken from the deposits samples of the last historical period of New Holocene in Elbasan city, one of the oldest cities positioned in Middle Albania. This study provides some palynological data on the distribution of the Chenopodiaceae family during New Holocene period.
The purpose for which this scientific research work has been undertaken is to present the connection that is created between the depth and the distribution of the Chenopodiaceae family over different time periods. All paleopalynological data on the Holocene presence of the Chenopodiaceae family in Elbasan city are given for the first time, having so far no paleopalynological studies on this family.
In our judgment, based on the results obtained, the palynomorphs allocation of Chenopodiaceae family is clearly presented, where we can emphasize that: palynomorphs are present at all depths (in total 508 spores) also having at each depth level a constant distribution

Keywords: Chenopodiaceae Family, Paleopalynological, Palynomorphs, New Holocene, Elbasan city.

PISTACIA TYPE PALYNOMORPHS DISTRIBUTION IN ELBASAN, ALBANIA

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Abstract

This paper presents paleopalynological data about the New Holocene period for *Pistacia* type palynomorphs (Anacardiaceae family). The results achieved on fossil pollen were obtained from land deposits of the last 20th centuries (New Holocene or Last Quaternary period) in Elbasani town.
All paleopalynological data are given for the first time without any study on *Pistacia* type palynomorphs. This scientific work was carried out with the aim of presenting the distribution of *Pistacia* type palynomorphs during the New Holocene periods.
Based on the data and the achieved results we can say that: *Pistacia* type palynomorphs (in total 476 palinomorphs) are absolutely present in all processed samples, also from the depth to the soil surface there is a stable presence of these palynomorphs. The change of vegetation over the years, in our opinion, has to do with the influence of human impact.

Keywords: Palynomorphs, Paleopalynological, *Pistacia* type, New Holocene, Elbasani town

DATA ABOUT SOIL POLLUTION AND THE IMPACT ON AGRICULTURAL CULTURES IN ELBASAN, ALBANIA

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Abstract

In this paper are given chemical data of the soil composition in Elbasan city. The distribution of heavy metals that are presented above the allowed norm cause soil pollution, were obtained by analyzing soil samples that as geographical location include the industrial area of the Elbasan city.
The purpose of this paper is to provide the link between chemical soil pollution caused by the productive activity of heavy industries and the impact of these pollutants on agricultural crops. To achieve this goal we have taken soil samples, during April - June 2020. It should be noted that the area of Elbasan, especially in recent years has been the epicenter of air pollution, both chemical and microbiological nature, a fact that is dedicated to the heavy industries that have been operating in this city for a long time.
Based on the analysis of the obtained results we consist of a considerable level of chemical pollution of the soil mainly for the element Chromium (Cr) which is above the standard values set by the EU Regulation.

Keywords: Heavy metals, Chemical, Chromium, Agricultural cultures, Elbasan.

SOIL CONTAMINATION BASED ON CHEMICAL, PHYSICAL AND MICROBIOLOGICAL FACTORS IN ELBASAN AREA, ALBANIA

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Abstract

This paper provides chemical, physical and bacteriological data obtained in Elbasan area, located in Central Albania. This study enabled us to provide sufficient data on physico-chemical and bacteriological parameters and to judge on soil pollution for the Elbasan city in order to present a current assessment of soil pollution as a factor of particular importance affecting citizens' health, based mainly on the cultivation of agricultural crops..

For this purpose, many soil samples were taken during 2020, mainly in the area where the heavy industries of Elbasani town develop their activity. Physico-chemical and bacterial data on soil pollution in Elbasan area also for the analyzed period are provided for the first time.

We emphasize the indisputable fact that Elbasan has always been valued over the years as one of the most polluted Albanian cities, where among the main causes are light and heavy industries that operate without applying the rules of environmental protection. Soil pollution is mainly due to pollution caused by human hands in agriculture mainly in the indiscriminate use of pesticides and chemical fertilizers, from the non-treatment of wastewater and above all from industrial activity.

Keywords: Physico-chemical, Bacterial, Soil contamination, Agricultural crops, Elbasan.

S P O N S O R S

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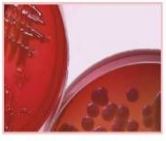

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