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Croatian Society of Chemical Engineers
Faculty of Food Technology University of Josip Juraj Strossmayer in Osijek
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"TODAY SCIENCE - TOMORROW INDUSTRY"

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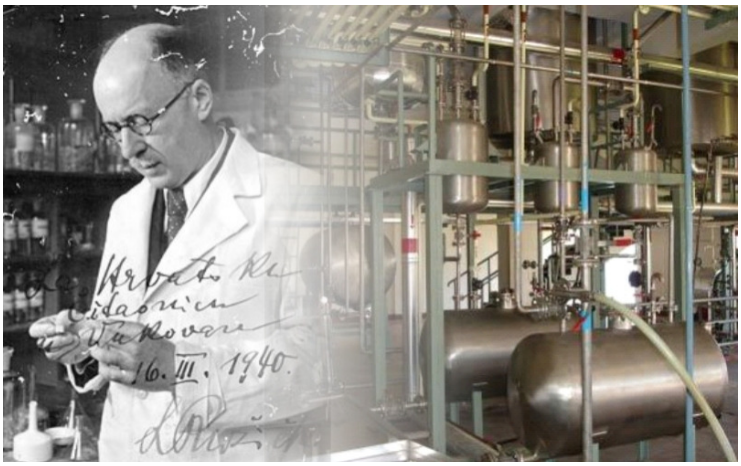
Prehrambeno-tehnološki fakultet Sveučilišta Josipa Jurja Strossmayera u Osijeku
European Federation of Food Science and Technology

Međunarodni znanstveno-stručni skup

XIII. Ružičkini dani

"DANAS ZNANOST – SUTRA INDUSTRIJA"



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Osijek, 2010.

KNJIGA SAŽETAKA XIII. Ružičkini dani
DANAS ZNANOST - SUTRA INDUSTRIJA

BOOK OF ABSTRACTS *13th Ružička days*
TODAY SCIENCE – TOMORROW INDUSTRY

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EMERGING TECHNOLOGIES AND THEIR PERSPECTIVES IN FOOD INDUSTRY

TEHNOLOGIJE U NASTAJANJU I NJIHOVA PERSPEKTIVA U PREHRAMBENOJ INDUSTRIJI

Janez Hribar

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The food industry is currently interested in a variety of novel production and processing technologies that may result in economical and improved quality products.
Some alternative technologies regarding fruit and vegetable storing and preservation are discussed. Preharvest aproach to control ripening and harvest date is to apply either amynoetoxy vinil glicin or a special formulation of 1-methyl cyclopropen (1-MCP). In order to more preciselly control the storage life of fruits and vegetables, the post-harvest application of 1-MCP or dynamic atmosphere seems promising tool to control postharvest life of fruits. In fruit storing dynamic atmosphere may control some physiological diseases in a biological way thus preventing the application of phytochemicals.
Enhancing microbial safety without compromising the nutritional and sensory characteristics of foods presents a big challenge in food industry. Due to the above mentioned facts there is an increasing interest in new non thermal innovative technologies that rely on physical processes. The emerging technologies include ultrasound, high pressure processing (HPP), pulsed electric fields (PEF) and low-temperature plasmas (LTP). Combining two or more emerging technologies in a hurdle technology can potentially enhance the overall quality of minimally processed foods. Value-added food ingredients with positive biological properties have attracted great attention in recent years due to their potential applications in functional foods and nutraceuticals. While biological properties of some ingredients can be inactivated during conventional heat processing, some of the emerging non-thermal processing technologies, including HPP and PEF, offer a potential alternative to the existing heat preservation processes without compromising biological properties. The review also deals with aspects related to radiation processing of food, oscillating magnetic field, nano composite materials in food processing and biopolymers for food packaging. The fact that nowadays consumer is a key protagonist; food industry must be vigilant in their knowledge of consumer attitudes toward these processes in order to avoid unexpected failure of these products upon market introduction.

TOWARDS SUSTAINABLE FOOD PRODUCTION

USUSRET ODRŽIVOJ PROIZVODNJI HRANE

Vlasta Piližota

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Sustainability became a high priority issue in all areas of interest and activities of the human kind, and growing awareness of environmental issues is affecting our lifestyles.
Sustainable development is defined as meeting 'the needs of the present generations without compromising the ability of future generations in meeting their needs'.
There are several related principles of sustainable food production, but probably the most central, is not to use resources faster than they renew.
As the food is one of the most important human needs there is a need to pay attention to food production from all aspects among which the most important are food safety or healthy products, high nutritious food (to meet all consumers' nutritious demands), permanent high standard food supply, reduction in energy consumption, minimizing resource inputs, using renewable energy and packaging materials whenever possible, as well as high standards in working environment and continuous employees' education.
As applied to the food industry it may be said that…"sustainable food system" is one that provides healthy food to meet current food needs while maintaining healthy eco-systems that can also provide food for generations to come with minimal negative impact to the environment.

COMMERCIALIZATION OF SCIENTIFIC RESEARCH IN THE FUNCTION OF CROATIA'S COMPETITIVENESS

KOMERCIJALIZACIJA ZNANSTVENIH ISTRAŽIVANJA U FUNKCIJI GOSPODARSKE KONKURENTNOSTI HRVATSKE

Dragan Kovačević

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As a consequence of the 3rd Scientific-Technical Revolution caused by the development of ICT, biotechnology, automatization, cybernetisation…, the classical economy that was based on labour, land and capital was transformed into the knowledge economy, where the main role is played by intellectual capital, i.e. by the creative application of knowledge in production. Commercialisation, that is, transformation of knowledge into a new economic value became a benchmark of economic competitiveness. More than half of GDP of the world's most developed countries is based on intellectual capital, whereas intellectual capital accounts for more than 75% of the overall market value in the most powerful global brands (Coca-Cola®, GE, IBM®, Microsoft®, McDonald`s®...). At the end of the 1990-ies, the European Union was facing the so-called „European paradox", that is, the conjecture that high science does not automatically produce new technologies and economic growth, due to which the EU lags behind countries such as the USA and Japan, which allocate 2-3 times more GDP funds to science in comparison with the EU (64.32%), and where the share of industry in total R&D is significantly higher (72.4% and 78.53% respectively). A turning point in the EU policy, which focuses on strengthening interaction between industry and science, commercialising knowledge, increasing investments in science and achieving the objective of transforming the EU into „the most competitive and dynamic knowledge economy" is a path that Croatia should aspire to. The current economic crisis and structural crisis in Croatia, in addition to economic policy measures, necessitate changes in the education and scientific system, which is not in the function of economic competitiveness to the required extend (e.g. the education structure of Croatia's labour force is not compatible with the requirements of the market, the share of students of natural and technical sciences is relatively low, etc.). In addition, the export sector, in particular the processing industry that has the highest share in exports (91.4 %) should become the main consumer of innovations and education where the state appears as an investor, and this calls for changes in the structure of scientific programmes and projects. Without the demand of the export sector for products of the „knowledge economy" the entire project will boil down to creating expensive and well-educated labour force for which there would be no sustainable jobs in Croatia over the long term.

keywords: intellectual capital, innovation, manufacturing, competitiveness

FOOD PROCESSING WITH HIGH PRESSURE

OBRADA PREHRAMBENIH NAMIRNICA VISOKIM TLAKOVIMA

Damir Ježek

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Main purposes of new methods and technologies in the food industry are enhancement of process control and monitoring, standardization and establishment of new production norms, preparation of raw materials and production of final products.
Implementation of the new technologies and methods such as magnetic fields, ultrasound, microwaves and high pressure already gradually started, and most of novel technologies are in some way applied in different industrial production processes. These technologies and methods lead to improvement in control of production processes and control of food safety, which are introduced in food and chemical industry and biotechnology, as well as in their control laboratories.
Some of the fields in which mentioned technologies are used are food preservation, inhibition of microbial growth, pasteurization and sterilization of products, polymer production, etc. Among other things, they are also used for improvement of drying process, detection of foreign bodies in raw materials and final products, crystallization processes, nitrogen removal, colour stabilization, homogenization, cleaning, sieving, freezing, enzyme deactivation in microorganisms, extending shelf life of products, preparation and production of new products.
This procedures and methods are implemented as standards in the quantitative and qualitative production, but also in control of foodstuff and final food products in industry and validated analytical laboratories. In this manner, procedures for preparation and using of new technologies are defined, which enhance process control, quality control and safety of final products.

NOVEL FOOD PATHOGEN TESTING TECHNOLOGIES: MOLECULAR BIOLOGY METHODS

NOVE TEHNOLOGIJE ISPITIVANJA PATOGENA U HRANI: MOLEKULARNO-BIOLOŠKE METODE

Aleksandra Stjepanovic, Hilde Marit Østlie, Therese Faye, Siv Borghild Skeie

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Food borne pathogens and spoilage bacteria are influencing the safety and quality of foods and can cause serious adverse effects for human and animal health as well as for the food quality. Consequently, microbiological quality control in the food industry has become the priority of the food producers and it aims towards minimizing the risks connected to food pathogens and spoilage bacteria. Conventional methods, used until recently, for food testing have had many obstacles in the terms of the time needed for their application as well as their accuracy. They often involved utilization of suitable media for the pre-enrichment and enrichment, isolation of the pathogens on selective media and the confirmation by the employment of morphological, biochemical an/or serological testing. These methods require intensive work, longer time and, however, obtained results often can be false considering the presence of viable but not cultivable microorganisms. Development of biotechnology and bioinformatics has resulted in the development of novel testing technologies that enable tracking and more reliable and faster detection of food pathogens. Furthermore, molecular-biology methods, although still not applied routinely in everyday practice, are the promising alternative that can replace or be auditioned to current reference methods in this area.

keywords: food borne pathogens, molecular biology methods, rapid tests, biosensors

ACTUAL AND POTENTIAL USE OF ZEOLITES IN MEDICINE AND PHARMACOLOGY

AKTUALNA I POTENCIJALNA UPORABA ZEOLITA U MEDICINI I FARMAKOLOGIJI

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Zeolites are hydrated natural and synthetic three-dimensional microporous crystalline solids with well-defined structures containing AlO_4 and SiO_4 tetrahedra linked through the common oxygen atoms in a regular framework. The properties of zeolites such as ion-exchange, inter-crystalline pores that discriminate between molecules of different dimension, strong acidic sites and active hosts for metal catalyzed reactions have earned them extensive industrial uses, and fundamental zeolite research has also become an area of great interest. Besides, there is abundant evidence that zeolites (molecular sieves) possess positive biological activity as a basis for their present and potential application in medicine and pharmacology.

To better understanding the interactions between inorganic microcrystalline materials (zeolites) and biological systems, fundamental chemical, physical and structural properties of zeolites will be presented in the first part of presentation. In addition, a short review of the most expressive actual application of zeolites in medicine and pharmacology will be given.

Although most of studies of the interaction of zeolites and living systems include natural zeolites (most frequently clinoptilolite), the latest studies showed a great potential of the synthestic ones. Hence the advantage of synthetic zeolites over natural ones, based on a great number of structural entities (mere than 300), purity, defined cationic forms and possibility of their controlled modification and controlling of particulate properties (crystal shape and size from micro to nano) will be critically evaluated.

HETEROCYCLIC CONDENSED QUINOLONES AND QUINOLINES AS POTENTIAL ANTITUMOR AGENTS

HETEROCIKLIČKI KONDENZIRANI KINOLONI I KINOLINI KAO POTENCIJALNI ANTITUMORSKI AGENSI

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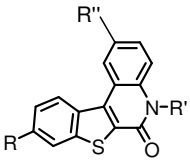
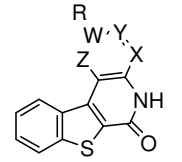
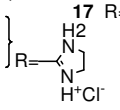
A lot of condensed benzothienoquinolones, benzothienonaphthyridones and thienothienylquinolones, as well as, benzimidazo[1,2-a]quinolines and their heterocyclic analogues diazacyclopenta[c]fluorenes were prepared in multistep synthesis. The pharmacophore groups were introduced in the main structure. Amoung the lot of prepared compounds the best antitumor activities "in vitro" on a few human tumor cell lines showed the compounds as follows

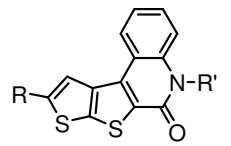


1 R = OCH_3; R' = $(CH_2)_3N(CH_3)_2$ R"= H
2 R = $COOCH_3$; R' = $(CH_2)_3N(CH_3)_2$, R" = H
3 R = CONHPh, R' = $(CH_2)_3N(CH_3)_2$, R" = H
4 R= $CONH(CH_2)_3N(CH_3)_2$, R' = H, R" = H
5 R=H; R' = H, R"= iso-pr-amidin,
6 R=CH_3;R' = H, R"= iso-pr-amidin ,
7 R=$COOCH_3$;R' = H, R" = iso-pr-amidin,
8 R= iso-pr-amidin; R' = H, R"= $COOCH_3$,
9 R= iso-pr-amidin; R' = H, R"= Br

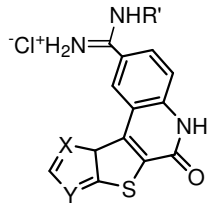


10 X=Y=Z= CH; R= H; W= NH^+Cl^-
11 X= N; Y=Z= CH; R= CN; W= C
12 X=Z= CH; Y=N; W=C;
13 X=Y= CH; Z= N; W=C;
14 X= N; Y=Z= CH; W=C;

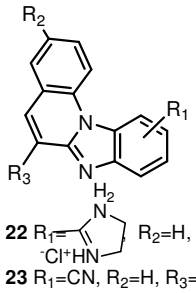




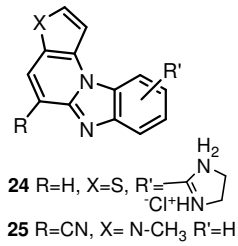
15 R= H; R' = $(CH_2)_3N(CH_3)_2$
16 R=$COOCH_3$;R'=$(CH_2)_3N(CH_3)_2$
17 R=$CONH(CH_2)_3N(CH_3)_2$, R'=H



18 X=C,Y=S, R' = H
19 X=C;Y=S, R' = $CH(CH_3)_2$
20 X=S,Y=C, R' = H
21 X=S,Y=C, R' =$CH(CH_3)_2$



22 R_1= R_2=H, R_3=H
23 R_1=CN, R_2=H, R_3=H



24 R=H, X=S, R'=
25 R=CN, X= N-CH_3 R'=H

The change of the terminal benzene nuclei of the acidic part of the molecule with thiophene in quinolones didn't significantly influenced on the antitumor activity, while the substitution of the quinolone nulei with the naphthyridone nuclei increased antitumor activity. Quinolones and quinolines showed very similar and good antitumor activity. DNA binding reactions were detected by changes in fluorescence, UV and CD spectra and CD spectra.

Usmena priopćenja
Oral presentations

A NEW POTENTIOMETRIC SENSOR FOR DETERMINATION OF STARCH

NOVI POTENCIOMETRIJSKI SENZOR ZA ODREĐIVANJE ŠKROBA

Nikola Sakač, Milan Sak-Bosnar, Marija Horvat

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Starch is one of the major polysaccharides used by plants for energy storage. It is widespread in seeds, roots and tubers as well as in stems, leaves, fruits and pollen. It consists of amylose and amylopectin in different ratios, which depends on the botanical origin of starch. Starch forms with triiodide a complex of violet-blue colouration, a starch-triiodide complex [1] (the colour depends on the starch nature). These reactions have been studied extensively by many investigators and are used widely for determining the amylose content of starches by both potentiometric and spectrophotometric methods. The subject has been reviewed by Banks and Greenwood [2] and given additional study by numerous workers.

Our approach is based on the redox potential and absorption change. At different starch concentrations, the change of triodide ion concentration (which exists only in excess of iodide ion) causes the change of the triiodide/iodide redox couple ratio, which results with the changes the electrode potential of a redox sensor according to the Nernst equation. The composition and stability of potassium triiodide (KI_3) solution have been optimised and mathematical model for starch-triiodide complex stoichiometry has been proposed. The electrode potential changes were used for the development of a new potentiometric starch sensor.

The aim of these investigations was the development of a new fast and reliable sensing methodology for starch quantification using potentiometric and optical sensing principles.

References:

1. Rendleman J.A.Jr., The reaction of starch with iodine vapour. Determination of iodide-ion content of starch–iodine complexes, Carbohydrate Polymers 51 (2003) 191–202.
2. Banks, W., Greenwood, C.T., Starch and its components, Edinburgh, Edinburgh University Press (1975).

FUNCTIONALIZATION OF THE BENZOBICYCLO[3.2.1] OCTADIENE SKELETON

FUNKCIONALIZACIJA BENZOBICIKLO[3.2.1] OKTADIENSKOG SKELETONA

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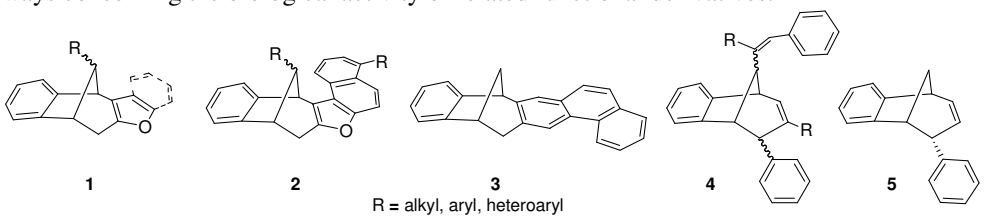
Many new rigid polycyclic structures **1**-**5** was obtained by photochemical cycloadditions of conjugated furan and butadiene systems in only one step, having benzobicyclo[3.2.1]octadiene skeleton.[1] Exactly this skeleton represents the basic structural unit of the great number of important biologically active natural compounds.[2] To achieve that objective, great intention was focused to the stereoselective formation of this structure[3] and also to the determination of the relative stereochemistry on that bridged bicyclic system.[4] Although the reactions of variously substituted bicyclo[3.2.1]octadiene structure has been thoroughly investigated, there is a need for new synthetic pathways concerning the biological activity of related functional derivatives.



For that reason, various transformations were carried out on the benzobicyclic structures **1**-**5** obtained by photochemical methodology,[1] posessing furan ring or a double bond functionality for further transformations. Functionalization of this type of skeleton has been performed by oxidation and addition reactions to obtaine novel reactive and water-soluble derivatives.

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THERMODYNAMIC PROPERTIES OF RbBr AND CsBr IN 2-BUTANOL (5 MASS. %) + WATER MIXTURE

TERMODINAMIČKA SVOJSTVA RbBr I CsBr U SMJESI 2-BUTANOL (5 MAS. %) + VODA

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Molar conductivities of dilute solutions of rubidium and cesium bromide in binary mixtures of 2-butanol and water with 5 mass. % of alcohol were measured in the temperature range from 15 °C to 35 °C. Data were processed using conductivity model based on the Lee-Wheaton equation. A three-parameter adjustment did not give uniform values for the association distance R. Therefore, the Bjerrum critical distance was chosen as a fixed value of that parameter ($R = q$). By repeated treatment, the limiting molar conductivity (Λ_o) and the ion-pair formation constant (K_A) were solved at each temperature, and the thermodynamic quantities of the association reaction (ΔG^o, ΔH^o and ΔS^o) were derived at 25 °C. The obtained thermodynamic quantities, together with Walden product, were compared with literature data for RbBr and CsBr in mixtures with 2-butanol mass fraction (w) 70, 80, 90 and 95 %. From the thermodynamic quantities it is seen that the association reaction is spontaneous, endothermic and leads to an increased disorder in the system; all these features are more pronounced in mixtures with a higher alcohol content.

keywords: 2-butanol + water mixtures, RbBr, CsBr, association to ion-pairs, thermodynamic quantities

ACETYLCHOLINESTERASE INHIBITORY EFFECTS OF THE ESSENTIAL OIL OF *NIGELLA SATIVA* L. SEEDS AND ITS SELECTED COMPONENTS

INHIBICIJSKA SPOSOBNOST ETERIČNOG ULJA TE ODABRANIH SPOJEVA IZOLIRANIH IZ SJEMENKI BILJKE *NIGELLA SATIVA* L.

Franko Burčul[1], Ivana Carev[1], Mila Jukić[1], Olivera Politeo[1], Mladen Miloš[1], Antonia Dražić[2]

[1]*University of Split, Faculty of Chemistry and Technology, Teslina 10/V, 21000 Split,* e-mail: *franko@ktf-split.hr*
[2]*Faculty of Pharmacy, Uppsala University, Uppsala, Sweden*

Alzheimer's disease (AD) is the most common progressive form of dementia exhibited as progressive loss of memory and reduction of crucial neurotransmitter acetylcholine. Increase of acetylcholine can be achieved by inhibition of its metabolic enzyme acetylcholinesterase (AChE).
AChE inhibitors are still the best available pharmacotherapy for AD patients. Plants are potential source of bioactive compounds and offer a promising strategy for the treatment of neurological disorders such as AD.
The aim of this study is to isolate essential oil from *Nigella Sativa* L. seeds, determine its chemical composition, identify main components and investigate AChE inhibition of both essential oil and its components.
Inhibitory activity of essential oil and some of its components were evaluated using simple colorimetric assay based on Ellman's method. Kinetic studies were also performed for selected compounds and kinetic parameters were determined.
As main constituents of the essential oil thymoquinone, *p*-cymene, isolongifolene, α-thujene and carvacrol were identified. The results of the Ellman assay showed that carvacrol was the strongest inhibitor, followed by *p*-cymene, thymoquinone and last essential oil.
Further research should be addressed to indigenous plant *Nigella Damascena* L. and compare it to *Nigella Sativa* L. in all aspects.

DEVELOPMENT AND VALIDATION OF AN HPLC METHOD FOR DETERMINATION OF ATORVASTATIN AND ITS IMPURITIES WITH DAD AND MS DETECTOR

RAZVOJ I VALIDACIJA HPLC METODE ZA ODREĐIVANJE ATORVASTATINA I ONEČIŠĆENJA PRIMJENOM DAD I MS DETEKTORA

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Atorvastatin is one of the most often used drugs for treatment of hypercholesterolemia, and the therapy is daily and longeterm. Therefore it is very important to control atorvastatin content in active pharmaceutical ingredient and in the pharmaceutical formulation, and to identify and quantify present impurities.

For the analysis Agilent 1100 Series HPLC system was employed and Symmetry C18 column (Waters) 150 mm x 4.6 mm, 3.5 μm was used. A binary gradient method was developed. Spectrums were measured with DAD detector at λ_{max} 246 nm. MS detector was operated with electrospray ionization source in the positive mode. The ion mass spectra were recorded in the range m/z 100 - 800. Method was validated according to ICH guidelines. For the linearity determination of atorvastatin DAD detector was used in the concentration range 100 – 1200 μg/mL. LC/DAD method proved to be precise (RSD<3.9%) and accurate (R=99.83-103.27%), but not sensitive enough. Therefore for the determination of impurities MS detector was employed with a much lower limit of quantification. Linearity was determined in the 0.05 – 10 μg/mL concentration range, and LOQ was 21.5-70.8 ng/mL. The use of MS detector also enabled structural characterization of present impurities.

This work was supported through a grant (Investigation of new methods in analysis of drugs and bioactives substances, no. 006-0061117-1240) from the Ministry of Science, Education and Sports of the Republic of Croatia.

COMPARISON OF THREE METHODS FOR LYSIS OF LACTIC ACID BACTERIA CELLS

USPOREDBA TRI RAZLIČITE METODE ZA LIZU STANICA BAKTERIJA MLIJEČNO KISELOG VRENJA

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Proteomics has during the years become an important tool in food microbiology and dairy technology. Finding the best method of cell lyses is the key step in detection and identification of extra/intracellular proteins in all applications of proteomic approaches. Before the process of measuring the amount of proteins by using different methods of quantification, the most important step is to know whether we have lysed all the cells or not. The representative cells of *Enterococcus, Lactococcus,* and *Pediococcus* strain they have been used us a representative strain of lactic acid bacteria (LAB) before continuing with quantification, SDS-page or 2D gel analysis. For this aim, sonication, mechanic rupture by glass beads (FastPrep), and centrifugation were used. Our results suggest that each of the methods has advantages and disadvantages relative to each other, related to sensitivity, stability of the proteins, and acceptance of literature, accuracy and organisms. All of the methods show that they can be used to lyse the LAB strains. However, LAB provided 6 time's higher amount of proteins by lysis of the cell with Fast Prep, comparing with sonication and centrifugation which shows the similar protein concentration. In the end we can conclude that mechanic rupture by glass beads seems to be more useful for lyses the large number of the cell e.g. for metabolic purposes.

keywords: Fast Prep assay, sonication assay, centrifugation/Fast Prep, lactic acid bacteria (LAB)

MATHEMATICAL MODELLING OF KINETICS OF HETEROGENEOUS REACTION SYSTEMS

I. Modelling of kinetics of reaction systems having a conversion function with inflexion

MATEMATIČKO MODELIRANJE KINETIKE HETEROGENIH REAKCIJSKIH SUSTAVA

I. Modeliranje kinetike reakcijskih sustava koji imaju konverzijsku funkciju s infleksijom

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Fluid – solid reaction systems having a conversion function with inflexion form an important group of heterogeneous systems. So far their kinetics has been modelled by a conversion function that would define the kinetic function for the total process time

$$(d\alpha/dt = k_0 \exp(-E/RT)\cdot f(\alpha)) \text{ yielding } g(\alpha) = k_0 \exp(-E/RT)\int_0^t f(\alpha)dt).$$

The analysis of the conversion function with inflexion indicates a more complex approach to the kinetics of such systems. It indicates a need for a deeper insight into the kinetics, i.e. existing of several mechanisms that follow one another in sequence and govern the overall rate of the process studied. The problem is solved by carrying out kinetic functions $d\alpha/dt = f(t)$ or $d\alpha/dt = f(\alpha)$ from conversion functions $\alpha = f(t)$ by defining the initial conditions for the differential equation. The conditions for transition from one process into another are determined from observed experimentally established characteristic points. This study introduces a kinetic model based on two and three processes in sequence in which $f(\alpha)$ functions have been derived from the knowledge of the process mechanisms. As mechanisms change, the activation energy changes during process development. This study is a contribution to the overview of possibilities of kinetic descriptions of such systems. Modelling can also be done with the empirical type functions. The model developed is based on standard differential equations with initial conditions. This study is of theoretical nature and is a prerequisite for better understanding of phenomena in the solid phase and better reactor design.

PREPARATION OF DEFINED PORE GEOMETRY SILICA GEL WITH SOL-GEL METHOD

PRIPRAVA SILIKA GELA DEFINIRANE GEOMETRIJE PORA SOL-GEL METODOM

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The work was carried out obtaining porous silica-gel with sol-gel process, with the addition of poly (vinyl alcohol) (PVAL). The silica sol obtaining process was carried out with stoichiometric conditions with the addition of an acidic catalyst and accurately defined period of intense mixing. There were prepared 4 sols at a temperature of 60 °C, with intense mixing and reaction time of 90 minutes.

After 12 hours of fostering at ambient conditions, there were added 3, 5, 10 and 15 wt. % PVAL to obtained silica sols and these sols were divided into two series. The first series of samples were dried for 24 hours at 60 °C in a vacuum dryer, while the second series of samples were fostered 12 days at 20 °C in a vacuum dryer with the constant underpressure of 30 kPa.

Samples from both series were additionally dried at 130 °C to constant mass and were annealed at 700 °C. Silica gels from both series were crumbled into irregular shape with a diameter up to 5 mm by drying at 130 °C. Silica-gel with a smaller amount of the addition was crumbled into smaller pieces. Silica-gel was prepared with the addition of PVAL and after annealing it was remained with the silica network without organic components and formed pores had the dimensions and geometry of PVAL moleculas.

ISOFLAVONE CONTENT AND ANTIOXIDANT PROPERTIES OF SOYBEAN SEEDS

SADRŽAJ IZOFLAVONA I ANTIOKSIDACIJSKA SVOJSTVA ZRNA SOJE

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The isoflavone content and antioxidant properties of five Croatian soybean seed cultivars from two locations were analysed. The content of total and individual isofavones was determined by high performance liquid chromatography. For determination of antioxidant properties scavenging capacity on $DPPH^{\cdot}$ radicals has been applied. The total phenolic content, oil and protein content in soybean cultivars were also determined. Significant differences in the content of individual isoflavones were observed within the soybean cultivars. The total phenolic content in soybean cultivars ranged from 87.2 to 216.3 mg GAE/100g of soybean. The total isoflavone content in soybean seeds ranged from 80.7 to 213.6 mg/100g of soybean. The most abundant isoflavone in soybean seeds was genistein. There was statistically significant difference ($p < 0.05$) among two locations in total and individual isoflavone contents. The highest contents of total isoflavones were found in cultivar ”os55-95”. Conversely, cultivars poor in isoflavones also showed low levels of DPPH-radical scavenging activity.

keywords: isoflavone, soybean seeds, antioxidant activity, total phenolic content, HPLC

THE POSSIBILITY OF OBTAINING UNIMODAL SIZE DISTRIBUTION OF GLYCINE CRYSTALS

MOGUĆNOST DOBIVANJA UNIMODALNE RASPODJELE VELIČINA KRISTALA GLICINA

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In order to obtain unimodal size distribution of glycine crystals from batch cooling crystallization, the influence of the hydrodinamic and seeding conditions has been investigated. Different types and dimensions of impellers and mixing rates were used. Four types of impellers that generates different flows in the crystallizer have been selected: turbine impeller (d_m = 5 cm), Rushton turbine (4 and 6 blades; d_m = 3,5 cm), centrifugal impeller (d_m = 5 cm) i pitched blade turbine dawnpumping (d_m = 3,5 i 5 cm). Agitation rate was 300 and 550 rpm. Multimodal distribution functions were obtained for almost all experiments. Unfavorable hydrodinamic conditions were acheved when impeller that generate radial flow is used. On the other hand, if solution was mixed with the turbine impeller, unimodal crystal size distribution is obtained. Turbine impeller enhances axial flow in the crystallizer. The influence of the seed mass and size added to the solution within the metastable zone was also investigated. During seeded crystallization solution is at a relatively low supersaturation. Consequently, final crystal size distributions were improved and the glycine structure was changed. The biger seed size and higher seed loadings leads to a unimodal size distribution of the final crystals.

keywords: glycine, hydrodinamic conditions, mixing, seeded crystallization

INFLUENCE OF IONIC LIQUID CONTENT ON PROPERTIES OF DENSE POLYMER MEMBRANES

UTJECAJ SASTAVA IONSKE KAPLJEVINE NA SVOJSTVA GUSTIH POLIMERNIH MEMBRANA

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Pervaporation was used for the removal of butan-1-ol from its 5 wt. % aqueous solution at which concentration *Clostridium acetobutylicum* fermentation slows down. Two types of membranes were used: a polydimethylsiloxane (PDMS) membrane containing 0, 10, 20 or 30 wt. % of ionic liquid benzyl-3-butylimidazolium tetrafluoroborate ([BBIM][BF_4]) and a polyethylene (PE) membrane in which [BBIM][BF_4] was sandwiched between two PE films. Differential scanning calorimetry measurements showed that PDMS and [BBIM][BF_4] are not compatible and although optically homogeneous, PDMS-[BBIM][BF_4] membranes contained PDMS and [BBIM][BF_4] phases. Pervaporation selectivity increased and the total flux through the membrane moderately raised with the increased content of [BBIM][BF_4] in the PDMS-[BBIM][BF_4] membranes. Hence, the immobilization of a proper ionic liquid in the membrane could be the good method for removal the alcohol from fermentation broths by pervaporation. On the contrary, [BBIM][BF_4] layer sandwiched between two PE films had no practical effect on the pervaporation properties.

THE EFFICIENCY OF ARSENIC REMOVAL USING OXIDATION PROCESSES IN THE WELL WATER TREATMENT

USPJEŠNOST UKLANJANJA ARSENA OKSIDACIJSKIM POSTUPCIMA PRI PRERADI BUNARSKE VODE

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Well water which is used for water-supply of the city of Osijek, generally does not meet health standards for drinking water due to the high content of organic matter, iron, manganese, arsenic and ammonia. A particular problem in the treatment process of this well water is arsenic.
Researches show that it is difficult to remove trivalent arsenic with conventional water treatment technologies, and it appears an inevitable need for the oxidation of highly toxic As (III) to less toxic As (V). The parameters that control the mobility of arsenic are pH and redox-potential (PE). Electrostatic charge of As (III) and As (V) significantly affect the removal process.
The purpose was to find the most appropriate oxidation process to ensure adequate water quality. The results suggest that oxidation of the Osijek groundwater with 1.5 mgO_3/l with the addition of 1.2 mgFe/l decreases total arsenic concentration for about 30 % and As(III) for 33 % of initial concentration, while oxidation with 3.0 mgO_3/l with the addition of 1.2 mgFe/l, decreases total arsenic concentration for about 74 %, and As (III) for 65 %. About 85 % of total arsenic and 93 % of arsenic (III) are removed when 1% $KMnO_4$ solution with coagulant $FeCl_3$ is used, while the polyaluminium chloride coagulant removed 64 % of total arsenic and 75 % of arsenic (III).

keywords: well water, oxidation, processing technology, arsenic removal

LIQUEFIED WOOD – POTENTIAL APPLICATION IN WOOD INDUSTRY

UTEKUĆENO DRVO – POTENCIJALNA UPORABA U DRVNOJ INDUSTRIJI

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Wood is one of the most abundant and accessible renewable resources available to men. All the main chemical wood components are high-weight-molecular polymers and form an interwoven network in the wood cell wall; consequently we can say that the wood is a natural polymer with polyphenolic character. With growing emphasis on sustainable development, new methods involving alternative wood use are being explored. Great efforts are directed to new technology development for achieving effective wood utilization, and obtaining ecologically acceptable materials on their base. Particularly interesting is application of wood as a feedstock for producing polymers that could replace a part of the conventional fossil oil based plastics. Wood liquefaction is novel method, and its aim is to convert wood material in biodegradable polymer materials and increase percentage of wood utilization. Maximum attention attracted wood liquefaction in presence of some organic reagents and the most interesting are two methods. The first one is the preparation in presence of phenol, which resulted in liquefaction products rich with phenol units. The second liquefaction method was achieved in presence of polyhydric alcohols. Therefore, a overview of previous researches related to wood liquefaction and its potential application in the wood industry was made in this paper.

PREDICTING SOLUBILITY OF Cd, Zn, Cu AND Pb IN SOILS BY REGRESSION MODELS

KORIŠTENJE REGRESIJSKIH MODELA ZA PREDVIĐANJE TOPLJIVOSTI Cd, Zn, Cu I Pb U TLU

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Total concentration of heavy metals (HMs) is commonly used for determination of maximum permissible levels of metals in the soil. However total metal does not represent the actual phytoavailable fraction and as such it is a poor predictor of toxicity. Most readily available metals for the plant are the one in the soil solution and their concentrations are controlled by several different abiotic soil properties. Soil parameters, such as pH, soil organic carbon (SOC), dissolved organic carbon (DOC) and total metal concentration, control the solubility of metals in the soil. Using these parameters as predictors, Tipping *et al*. derived a regression model predicting metal solubility for four HM's (Cu, Cd, Zn and Pb) in the upland soils of England and Wales. We tested their equation for the same elements on the 74 soil samples of eastern Croatia. The same predictors and the same regression coefficients were taken into account for Croatian soils as were used in Tipping *et al.* equation. Soils examined in England and Wales were in the same pH range as in the east Croatia, however the English soils had much higher organic matter content than Croatian soils. The results showed good correlation between the prediction by Tipping equation and the measured data in Croatia. However the model seem to overestimate the metal concentration, therefore the best fit regression models were created to correct the equation and to get as accurate prediction as possible. In addition, to already mentioned soil parameters, cation exchange capacity (CEC) has been added to the best fit model as it seems it plays an important role in controlling the metal solubility in east Croatian soils. The research has showed that pH, DOC and CEC play an important role in the solubility and mobility of HM in the soils investigated, rather than the total metal concentration. However the total HM concentration is often used as an indicator of toxicity levels.

keywords: water extraction, heavy metals, soil solution, metal mobility

ENVIRONMENTAL MANAGEMENT IN CROATIA: CHALLENGES FOR SMALL BUSINESS

UPRAVLJANJE OKOLIŠEM U HRVATSKOJ: IZAZOVI ZA MALO GOSPODARSTVO

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The paper examines entrepreneurs' attitudes and responses towards environmental management in Croatian economy, based on a large sample survey of small businesses and crafts. The paper investigates environmental issues such as attitudes towards the importance of environmental regulation changes for the operation of businesses within the framework of the accession of Croatia to the EU, level of awareness of these changes, positions in relation to stringency and demand of environmental regulations and related environmental costs.
The results of the survey show that environmental regulations are indeed recognized and ranked as one of the top three legislative areas important for Croatian businesses, with exporters having the top score. Almost half of entrepreneurs who consider environmental regulations to be important have already undertaken specific activities in order to ensure compliance. More entrepreneurs find environmental regulations to be demanding for their business compared with those who consider them undemanding. At the same time, the level of environmental compliance costs is very low, with most businesses spending nothing or a marginal amount. Despite the high importance of environmental regulations to small businesses, the findings are mixed as well as impact on doing business in agricultural and manufacturing sectors.

keywords: small businesses, environmental management and compliance, regulations

Sekcija: Kemijska analiza i sinteza

Topic: Chemical analysis and synthesis

FORMATION OF POLYELECTROLYTE-PROTEIN MULTILAYERS ON SiO_2 PARTICLES

NASTAJANJE POLIELEKTROLITNO-PROTEINSKIH VIŠESLOJEVA NA ČESTICAMA SiO_2

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The modification of surfaces by adsorption of polyelectrolyte-protein multilayers[1] is being intensively studied by means of optical reflectometry[2], UV-Vis spectrophotometry, ellipsometry, QCM, AFM, etc. By the use of optical reflectometry it was shown earlier[3] that the presence of a precursor layer and the protein concentration significantly influence the adsorption of protein on previously formed polyelectrolyte multilayer.
The aim of presented study is to examine the formation of polyelectrolyte-protein multilayers on silica particles using electrophoretic and spectrophotometric measurements and to compare the obtained results with previous ones on flat surfaces.
Polyelectrolyte multilayers were formed by alternate adsorption of a weakly charged polyelectrolyte poly(allylamine hydrochloride) (PAH) and a strongly charged polyelectrolyte poly(styrenesulfonate) (PSS) on which the protein bovine serum albumin (BSA) was additionally adsorbed.
In the pH region from pH = 2 to pH = 10 SiO_2 particles were suspended and the multilayer SiO_2/PAH/PSS/PAH/BSA was formed. Depending on pH region, dominantly due to the electrostatic interactions, the change in zeta potential of the system was observed which was detected by electrophoretic measurements. It was shown that zeta potential depends on the BSA concentration. The most pronounced change in zeta potential was noted at the highest BSA concentration which leads to the conclusion that adsorption increases with the protein concentration increase. The concentrations of non-adsorbed PSS and BSA were determined spectrophotometrically and their adsorbed amount was calculated.
The obtained results confirm that the polyelectrolyte-protein multilayers were formed on silica particles. It was shown that the adsorption of BSA on previously formed multilayer increases with its concentration and that the electrophoretic light scattering is a useful method for monitoring such processes.

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SYNTHESIS OF NOVEL ANALOGUES OF VITAMIN B_6 AND EVALUATION OF THEIR ANTIBACTERIAL ACTIVITY

SINTEZA NOVIH ANALOGA VITAMINA B_6 I ODREĐIVANJE NJIHOVE ANTIBAKTERIJSKE AKTIVNOSTI

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Pyridinium oximes, such as 2-PAM and toxogonin, are a key component of the nerve-agent antidotes fielded by numerous militaries. In order to assess the potential antimicrobial properties of pyridinium oximes and their structural analogues they were tested against a variety of model organisms for a variety of pathogens.

A series of novel pyridinium oximes were prepared by reactions of quaternization of pyridoxal oxime with phenacyl bromide and substituted phenacyl bromides.

Four prepared oximes were studied for their antibacterial activity against four gram-negative and four-gram positive microorganisms.

In order to examine the influence of anion, bromo derivatives 1-(4'-fluorophenacyl)-3-hydroxy-4-hydroxyiminomethyl-5-hydroxymethyl-2-methylpyridinium bromide (3) and 3-hydroxy-4-hydroxyiminomethyl-5-hydroxymethyl-2-methyl-1-(4'-methoxyphenacyl) pyridinium bromide (5) were converted to chlorides (6) and (7) by halogene exchange reaction.

Minimal bactericidal and minimal inhibitory concentration were determined. Minimal bactericidal concentration ranged from 250 ppm to > 1000 ppm while inhibitory concentration was lower, 125 ppm to 1000 ppm. Tested gram-negative bacteria were more sensitive to all synthesized compounds, compared to gram-positive. Compounds with bromide substitution by chloride atom exhibited more potent bactericidal and inhibitory activity. *Bacillus subtilis* was the most sensitive gram-positive bacteria while, of four tested, *Yersinia enterocolitica* was the most sensitive gram-negative bacteria to all analyzed pyridinium oximes.

SPECTROPHOTOMETRIC STUDY OF REACTION OF VANADIUM(V) AND 3-HYDROXY-2-METHYL-1-(*p*-AMINOPHENYL)-4-PYRIDONE

SPEKTROFOTOMETRIJSKO PROUČAVANJE REAKCIJE VANADIJA(V) I 3-HIDROKSI-2-METIL-1-(*p*-AMINOFENIL)-4-PIRIDONA

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Vanadium is chemical element required for enzyme activity. It is especially used by some nitrogen–fixing microorganisms. Deficiencies of vanadium result in reduced growth at some mammals and birds. In addition some vanadium complexes diminish symptoms of diabetes. The vanadium compounds that have biological activity are used for investigation of the biochemical processes.[1,2,3.]
Former investigations have shown that new synthesized 4-pyridone derivative, 3-hydroxy-2-metil-1-(*p*-aminophenyl)-4-pyridone (HZ) is good complexing agens for Fe(III). Due to high Fe chelating affinity HZ has potential pharmacological use mostly related to removal therapies of the unbalanced metal ions in human body.[4]
The reaction between 3-hydroxy-2-methil-1-(*p*-aminophenyl)-4-pyridone (HZ) and vanadium(V) in aqueous solution has been investigated by spectrophotometric measurements as well as the possibility of the extraction of formed complexes in the organic phase.
The pink coloured complex formed in aqueous acidic solution has an absorption maximum at 508 nm, and addition of ethanol enhances the intensity of the absorption. V(V)–HZ complex can be extracted in chloroform, and organic phase has an absorption maximum at 500 nm. The presence of chloride ions enhances the intensity of the absorption of the extracted V(V)–HZ complex. The molar ratio of V(V) : HZ in the complex formed at investigated conditions was found to be 1:3.
Vanadium is often present in the biological systems in coordination complexes. For instance, the tissues of sea cucumber or amanita muscaria contain relatively high concentrations of this chemical element. Therefore the study of interaction of vanadium with the pyridone derivatives contributes to the understanding of the mechanism of the accumulation process of vanadium in organisms.

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ASSOCIATION OF NITRATE ION WITH METAL CATIONS IN AQUEOUS SOLUTION

ASOCIJACIJA NITRATNOG IONA S METALNIM KATIONIMA U VODENIM OTOPINAMA

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Ion association in aqueous solutions of varied concentrations of $LiNO_3$, $NaNO_3$, $Ca(NO_3)_2$, $Sr(NO_3)_2$, $Ba(NO_3)_2$, $Mn(NO_3)_2$, $Co(NO_3)_2$, $Ni(NO_3)_2$, $Cu(NO_3)_2$, $Zn(NO_3)_2$ and $Cd(NO_3)_2$ was studied by means of UV spectrometry. The formation and the number of spectrally active species in the investigated electrolyte systems were detected by principal component analysis (PCA). The concentrations of associated ion pairs in each solution were determined by means of evolution factor analysis (EFA)[1,2] which also yielded their spectral profiles, $\varepsilon(\lambda)$. Concentration profiles were used to calculate the ion pairs fractions and their stability constants.

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ELECTROANALYTICAL CHARACTERIZATION OF Cu(II)-RUTIN COMPLEX

ELEKTROANALITIČKA KARAKTERIZACIJA Cu(II)-RUTIN KOMPLEKSA

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The Cu (II)-rutin complex was prepared by mixing stoichiometric amounts of rutin (1 mmol) and $CuCl_2 \cdot 2H_2O$ (1.5 mmol) in methanol and refluxed for 5 h. Pale yellow precipitate was formed immediately when the cooled mixture was poured into water. The formed complex was left to stand overnight and after that was collected by vacuum filtration, washed 3 times with 1:3 ethanol/water mixture, several times with water and dried under vacuum [1,2].

The obtained complex was characterized by UV/Vis spectroscopy and direct potenctiometry. Its sensing properties were tested. Response characteristics of the mentioned Cu (II)-rutin sensor were investigated regarding inorganic cations. Redox properties were also investigated as well as electrochemical properties of rutin [3].

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SYNTHESIS OF 1-ADAMANTAMINE DERIVATIVES OF MANNOSE AND GALACTOSE AND THERMODYNAMICS OF COMPLEXATION WITH β-CYCLODEXTRIN

SINTEZA 1-AMINOADAMANTILNIH DERIVATA MANOZE I GALAKTOZE I TERMODINAMIKA KOMPLEKSIRANJA S β-CIKLODEKSTRINOM

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Protein lectins that specifically bind carbohydrate molecules are key components in cell recognition process and transfer of biological information.[1] It is well known that cyclodextrin molecules are suitable models that contribute to better understanding of the noncovalent interactions. Adamantane derivatives bind well into β-cyclodextrin cavity. and adamantyl glycosides also proved to be suitable substrates for further study of these interactions.[2] We present in this work the synthesis of adamantyl glycoconjugates in which adamantyl unit was indirectly connected to monosaccharides mannose or galactose through chiral linkers (methyl esters of (*R*)- or (*S*)-3-hydroxypropanoic acid). Linker was connected to monosaccharide molecule through *O*-glycosidic bond and to 1-adamantamine molecule with amide bond.

The complexation of adamantyl glycoconjugates with β-cyclodextrin was studied in water at 25 ºC by means of titration calorimetry. The thermodynamic parameters of complexation; namely reaction enthalpies, standard reaction entropies and binding constants were determined. In the case of all investigated derivates the complexation process was enthalpically controlled. The standard reaction entropy was positive for all examined reactions. In general, the complexation parameters of different adamantyl glycoconjugates and β-cyclodextrin were very similar. It can be concluded that the sugar structure and the configuration of the anomeric carbon and of the stereogenic center of the linker do not influence the complexation thermodynamics significantly.

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DIFFERENTIAL POTENTIOMETRIC TITRATION OF CATIONIC AND ETHOXYLATED NONIONIC SURFACTANTS MIXTURES

DIFERENCIJALNA POTENCIOMETRIJSKA TITRACIJA SMJESA KATIONSKIH I ETOKSILIRANIH NEIONSKIH TENZIDA

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A sensitive potentiometric surfactant sensor based on 1,3-didecyl-2-methyl-imidazolium cation and a tetraphenylborate antagonist ion has been used as the end-point detector in ion-pair surfactant potentiometric titrations using sodium tetraphenylborate as titrant. Several analytical and technical grade cationic (CS) and ethoxylated nonionic surfactants (EONS), single and the mixtures of both were potentiometrically titrated. Barium ion forms pseudocationic complex with ethoxylated nonionic surfactant that can be titrated simultaneously with cationic surfactant (CS) using the same anionic titrant. Due to differences in hydrophobicity of both, nonionic and cationic surfactant investigated, ion associates formed during the titration revealed different stability constants resulting in two, more or less pronounced, analytically usable inflexions in the titration curve.
The sensor showed satisfactory analytical performances within a pH range of two through eleven, and exhibited satisfactory selectivity for both, CS and EONS investigated.
The sensor was tested on several formulated powdered and liquid detergent products of various composition complexity too.

THERMODYNAMIC PROPERTIES OF $CdCl_2$ IN *TERT.* BUTANOL (5 MASS.%) + WATER MIXTURE

TERMODINAMIČKA SVOJSTVA $CdCl_2$ U SMJESI *TERC.* BUTANOL (5 MAS.%) + VODA

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The electromotivity of a galvanic cell without liquid junction:

$$\text{Cd(Hg) (l, satd.)} \mid \text{CdCl}_2(b), \textit{t}\text{-butanol (5 mass.\%) + water} \mid \text{AgCl(s)} \mid \text{Ag(s)},$$

molality (b) being increased by continuous addition of concentrated electrolyte solution, was measured in the temperature range (293.15 K – 313.15 K) at 5 K intervals. The measured values were processed in order to obtain the standard molal electromotivity (E_b°) of the cell for each temperature by means of a method that takes into account the chlorocadmium complex formation reactions; their equilibrium constants were not measured but obtained by interpolation into the literature data. The E_b° values were used to calculate the standard thermodynamic quantities for the cell reaction and the stoichiometric mean molal activity coefficients of $CdCl_2$. The thermodynamic values obtained have been compared with those in similar systems.

keywords: cadmium chloride, *tert.* butanol + water mixture, potentiometry, thermodynamic quantities

SIMULTANEOUS DETERMINATION OF AMMONIUM, NITRATE AND NITRITE IN WASTEWATER BY MEANS OF DIRECT POTENTIOMETRY

ISTOVREMENO ODREĐIVANJE AMONIJEVOG, NITRATNOG I NITRITNOG IONA U OTPADNOJ VODI DIREKTNOM POTENCIOMETRIJOM

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Nitrogen is one of the most commonly occurring elements in nature and forms many inorganic ionic species, such are ammonium, nitrate and nitrite ions, being most important. The simultaneous determination of ammonium, nitrate and nitrite ions in water, food, biological and environmental matrices is of vital significance due to their toxicity to humans (infants) and water systems (eutrophication). Ion –selective electrodes (ISE) are a promising approach because of their small size, rapid response, and ability to directly measure the analyte.
In this study the simultaneous determination of ammonium, nitrate and nitrite ions was performed in modelled and real systems (wastewater) using commercial ISE (ELIT, NICO2000 Ltd.). The used ISE respond to ammonium, nitrate and nitrite ion according to the Nernst equation. The accuracy of determination (95,8% - 101,0%) can be considered satisfactory for the ammonium, nitrate and nitrite determination in complex matrices. A satisfactory fit of the theoretical models to the experimental values was obtained in all cases for the tested sensors and the calibration parameters.

keywords: ion – selective electrodes (ISE), ammonium, nitrate, nitrite, wastewater

EFFECT OF RUTHENIUM ON THE FLUORESCENCE OF SALICYLIC ACID

UTJECAJ RUTENIJA NA FLUORESCENCIJU SALICILNE KISELINE

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Salicylic acid and its derivates are an important class of pharmacological active compounds with wide range of use e.g. in reducing pain or swelling and as anti-inflammatory agent. It is also used as a food preservative, as an antiseptic in toothpaste, in aspirin production, etc. However, salicylic acid is toxic if ingested in large quantities.

Salicylic acid is a simple analogue of humic acid (HA) and has been commonly used as modelling substance for HA. Recently, salicylic acid and its derivatives find useful application in analysis of metal ions. Simple and sensitive spectrophotometric and spectrofluorimetric methods for determination of iron(III),[1,2] aluminium(III),[3,4] and cooper(II)[4] ions can be found in literature.

In order to understand the contribution of the metal coordination and the type of interaction between salicylic acid and metal ion, the reaction of the ruthenium(III) with salicylic acid in water-alcoholic solution using spectrofluorimetric method was investigated in this study.

The fluorescence of salicylic acid was strongly quenched by ruthenium(III), and the quenching was highest at pH = 5.5–8 (controlled by acetate and phosphate buffers) at λ_{ex} = 290 nm, λ_{em} = 405 nm. The decrease in the emission intensity was linearly proportional to the ruthenium(III) concentration in the 0.5–14.2 μg cm^{-3} range when the salicylic acid concentration was 5×10^{-6} mol dm^{-3} at constant ionic strength of 0.2 mol dm^{-3} (adjusted with NaCl), and the ratio of ethanol 65 %.

The advantage of present method when compared to other commonly used methods is that the reaction occurs at room temperature which makes the method time-saving. Also, the presented method has a good sensitivity.

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GLUCOSINOLATE HYDROLYSIS PRODUCTS FROM *BRASSICACEAE* PLANTS

HIDROLITIČKI PRODUKTI GLUKOZINOLATA BILJAKA PORODICE *BRASSICACEAE*

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Three wild-growing Brassicaceae plants, *Aurinia leucadea*, *Cardaria draba* and *Capsella rubella*, were investigated to uncover their glucosinolate contents using indirect method consisting of either non-enzymatically (thermal degradation) or enzymatically (with exogenous myrosinase) hydrolysis followed by GC-MS analysis of volatile hydrolysis products. The identification of volatile hydrolysis products isolated from *Aurinia leucadea* revealed the presence of three glucosinolates, namely gluconapin, glucobrassicanapin and glucoberteroin. Gluconapin and glucobrassicanapin were the main glucosinolates regardless of the hydrolysis method. *Capsella rubella* contained five glucosinolates, with sinigrin, 10-(methylthio)decyl glucosinolate and 9-(methylthio)nonyl glucosinolate identified only in sample obtained by thermal degradation, and glucoarabin and glucocamelinin identified only after exogenous myrosinase hydrolysis. Glucoerucin was the major glucosinolate obtained by non-enzymatic hydrolysis of *Cardaria draba*, while the sample obtained after enzymatic hydrolysis contained five glucosinolates: glucoraphanin (the most abundant compound), glucosinalbin, glucoerysolin, glucoerucin and gluconapin.

keywords: glucosinolates, *Aurinia leucadea*, *Cardaria draba*, *Capsella rubella*, non-enzymatically hydrolysis, enzymatically hydrolysis

Sekcija: Kemijsko i biokemijsko inženjerstvo

Topic: Chemical and Biochemical Engineering

IN-LINE BULK CONCENTRATION MEASUREMENT IN BATCH COOLING CRYSTALLIZATION OF BORAX DECAHYDRATE

KONTINUIRANO MJERENJE KONCENTRACIJE DINATRIJEVOG TETRABORAT DEKAHIDRATA TIJEKOM PROCESA ŠARŽNE KRISTALIZACIJE HLAĐENJEM

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Information of the bulk concentration is an important parameter to support process control and for the evaluation of crystallization experiments. The aim of this work was to develop appropriate method for in-line bulk concentration measurement over batch cooling crystallization of borax decahydrate. For that reason feasibility of using potentiometric method i.e. sodium ion selective electrode were investigated in details. Application of ion selective electrode requires a calibration curve which expresses the correlation between electrode potential and known concentration of bulk solution at the constant temperature. Since in batch cooling crystallization the bulk temperature changes continuously, for calibration of ion-selective electrode it is necessary to predetermine cross-correlation between the concentrations, electrode potential and temperature of the bulk solution. Therefore the calibration has to be carried out at the same process conditions as subsequent crystallization regarding to cooling rate and volume of bulk solution. In order to control potentiometric method the solution concentration was analyzed by a volumetric method as well. It was found very good agreement between these two methods. In this work crystallization was carried out at different mixing conditions. The changes of bulk concentration determined by potentiometric method as well as supersaturation changes over crystallization process are presented and analyzed.

MATHEMATICAL MODELLING OF KINETICS OF HETEROGENEOUS REACTION SYSTEMS

II. Modelling of catalytic systems kinetics from mass balance on the catalyst of regular geometry

MATEMATIČKO MODELIRANJE KINETIKE HETEROGENIH REAKCIJSKIH SUSTAVA

II. Modeliranje kinetike katalitičkih sustava iz bilance mase na katalizatoru pravilne geometrije

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A catalytic system has been examined in which, together with the chemical reaction, a deactivation reaction also takes place, reducing the active surface and thereby the main reaction rate $(A \rightarrow B \;\; P - P \downarrow)$. The study has established the balance for the main reaction and for the poisoning reaction. The mass balance for reactant A in its dimensionless form is $\frac{D_e C_{A0}}{R^2}\left(\frac{d^2Y_A}{dX^2}+\frac{\lambda}{X}\frac{dY_A}{dX}\right)=C_{A0}^n(Y_A)^n$ and for poison P $\frac{d^2Y_A}{dX^2}+\frac{\lambda}{X}\frac{dY_A}{dX}=\frac{dQ_P}{d\tau}$. The adsorption (secondary reaction) is assumed to take place according to the Langmuir law $\left(\frac{Q}{Q_{\max}}=\frac{K_pP}{(1+K_pP)}\right)$ by whose substitution in the balance the partial differential equation transforms into a form that can be solved. The differential equation for the main reaction balance is solved numerically by orthogonal collocation; the partial equation for the secondary reaction is also solved by orthogonal collocation until reduced to an ordinary one and solved by the Runge-Kutta method. The software has been made in MathCad.

SOFT SENSOR APPLICATIONS IN REFINERY PRODUCTION

PRIMJENA SOFTVERSKIH SENZORA U RAFINERIJSKOJ PROIZVODNJI

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One of the common problems in industrial facilities is inability of real-time and continuous measurement of key process variables, especially when it comes to the composition of process streams and the characteristics of the product. The development of advanced sensors, which are based on new technologies of analytical chemistry and modern electronic devices, is important area of scientific research, but the price of their development is very high.
Soft sensors are becoming an important alternative to the "on-line" measurements in cases where, on the basis of fundamental and empirical models, one could conclude about the state of immeasurable variables and process analyses. In this case the knowledge about the process is associated with statistical methods for identification and is applied for process optimization. The possibility of soft sensors application is wide especially in process industry, but in other areas, such as in biochemical research. Since the soft sensors are implemented as computer software, it is possible to estimate in advance and thus optimize the operation and process control.
In this work the soft sensors for refinery application have been developed. The models have been developed using data from industrial DCS system and laboratory databases. First soft sensor model for estimation cold filter plugging point of diesel fuel, as a side-product of distillation column, have been developed. Another soft sensor for estimation the beginning and the end product of the distillation peak column have been developed. The third soft sensor for process control and estimation of H_2S and SO_2 emissions based on experimental data gathered from Sulphur Recovery Unit (SRU) have been developed. Soft sensor models are based on multivariable linear regression techniques, neural networks and fuzzy logic. The results have been statistically analyzed, and the validity of developed models have been conducted.

NANOSTRUCTURED POLYMERIC MATERIALS BASED ON ALKYL METHACRYLATES AND MULTIWALLED CARBON NANOTUBES

NANOSTRUKTURIRANI POLIMERNI MATERIJALI NA TEMELJU ALKIL-METAKRILATA I VIŠESTJENIH UGLJIKOVIH NANOCIJEVI

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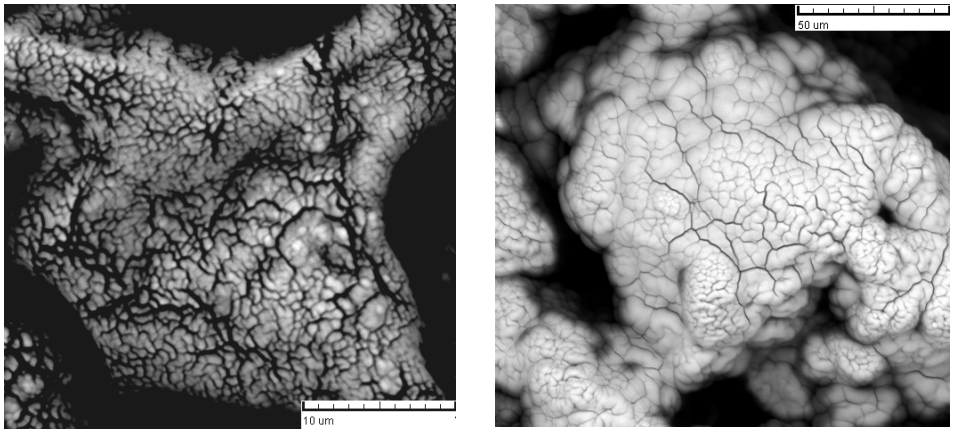
Preparation and characterization of nanostructured polymeric composites based on alkyl methacrylates and multiwalled nanotubes was performed in view of obtaining advanced materials. Variation in composition and structure of alkyl methacrylate copolymers enables alteration of their physico-chemical properties such as molecular interactions regarding their nature and intensity, macromolecules segment mobility, plasticity, elasticity, etc. Aim of investigation is establishment of functional relations between reaction-process parameters, intrinsic as well as application characteristics of polymeric matrix and nanocomposites. Thereby, production of the materials of advantageous properties for certain applications would be achieved.



SEM micrographs of nanostructured polymer composites with different content of multiwalled carbon nanotubes.

EFFICIENCY OF THE RINSING AGENT ON REDUCTION OF THE B_2O_3 MASS FRACTION IN SEAWATER–DERIVED MAGNESIUM OXIDE

UČINKOVITOST SREDSTVA ZA ISPIRANJE NA SMANJENJE MASENOG UDJELA B_2O_3 U MAGNEZIJEVU OKSIDU IZ MORSKE VODE

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This study has examined the combined method of rinsing the magnesium hydroxide precipitate (3+2) in which alkalized distilled water with pH = 12.50 is used in the decanting procedure in the first phases, followed by fresh distilled water with pH = 5.30. In multiple rinsing on filter paper (up to three times) the alkalized distilled water with pH = 12.5 and/or combined rinsing method (2+3) was applied, i.e. after the precipitate had been rinsed 2 times by alkalized distilled water, it was rinsed with fresh distilled water (up to 3 times). The purpose of the study was to establish the efficiency of these methods of rinsing the seawater-derived magnesium hydroxide precipitate on reduction of the mass fraction of boron (III) oxide in calcined magnesium oxide, as the properties of seawater-derived high-temperature sintered magnesium oxide are greatly affected by the B_2O_3 fraction. The experimental results indicate that it suffices to perform the rinsing on filter paper by alkalized distilled water with pH = 12.50 two times. This method of rinsing attains the total reduction of the B_2O_3 fraction by approx. 61 % relative to the B_2O_3 fraction in samples prepared without rinsing of the magnesium hydroxide precipitate (B_2O_3 = 0.2533 mass %). If, together with rinsing on filter paper, the combined method (2+3) is applied, the mass fraction of B_2O_3 in calcined magnesium oxide is reduced by approx 69 % relative to the not-rinsed sample.

POLYMER MODIFIED BITUMEN

POLIMEROM MODIFICIRANI BITUMEN

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The use of polymer modified bitumen in road pavement has been continually increasing worlwide, because a relatively small quantity of added polymer can significantly enhance performance and durability of bitumen. The most common of polymer as a modifier of bitumen is a thermoplastic styrene-butadiene-styrene block copolymer, SBS. Rheology of bitumen and polymer modified bitumen is one of the most useful tools for defining their properties. Rheology of bitumen and polymer modified bitumen provides the best insight on the resistance on the permanent deformation of the BIT and PmB. Modification of bitumen with SBS results in better rheological properties of the BIT at a constant cyclic loading and stress in the cycle, as well as less permanent deformation.

This paper investigates the rheological properties of bitumen with different contents of radial SBS based on oscillating dynamic measurements. The measurements were done by dynamic shear rheometer, DSR, Physica MCR 301, Anton Paar in the linear viscoelastic range in the frequency range at different temperatures.

The primary viscoelastic functions were determined, complex shear module, G*, complex shear viscosity, h* and phase angle,d in dependence as a function of frequency at temperatures in BIT use. The mastcurves were designed at reference temperature 30°C.

Thermooxidative aging of BIT and PmB was conducted in a standardized device for hardening in a Roll Thin Film Oven Test, RTFOT in order to gain insight into the intensity of thermooxidative degradation and changes in rheological properties of the investigated material.

From the quotient value $G^*/\sin\delta \geq 1$kPa before and quotient value $G^*/\sin\delta \geq 2{,}2$kPa after RTFOT of the proposed Strategic Highway Research Program, SHRP is determined the resistance to temperatures and loads, respectively resistance of bitumen and polymer modified bitumen on the occurrence of permanent deformation.

In order to obtain a complete picture of the properties the conventional tests according to certain standard Croatian norms were investigated.

The results of investigations show that BITs modified with radial SBS in comparision with BIT show higher shear modulus and complex shear viscosity while phase angle of PMBs decreases. It is more express at higher temperatures as well as at lower frequencies. PMBs with higher polymer content show higher viscoelasticity , faster increase of complex shear modulus and complex shear viscosity while phase angle as indicator of material elasticity decreases .It is in correlation with conventional tests.

After thermooxidative ageing the rheological properties are affected. The elasticity is droped while stiffness and viscosity are increased. The resistence on loading and temperature against SHARP increases with the content of polymer and values remain unchanged after ageing.

DETERMINATION OF MOISTURE AND HEAT TRANSFER PARAMETERS FOR CLAY PLATE SUBJECTED TO CONVECTION DRYING

ODREĐIVANJE PARAMETARA PRIJENOSA TOPLINE I VLAGE TIJEKOM KONVEKCIJSKOG SUŠENJA GLINENE PLOČICE

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The mass and heat transfer properties of clay plate subjected to convection drying were investigated in laboratory scale at different drying potential of humid air.
Dimensionless moisture and temperature distributions of samples were obtained at constant air velocity and used for determination of moisture and heat process parameters (lag factor and drying coefficient) by using the simple exponential equation. The thermal diffusivity, heat transfer coefficient, moisture diffusivity and moisture transfer coefficient for clay plate were assessed from evaluated process parameters according to analytical technique that proposed by Dincer for determination of transfer parameter for wooden slabs subjected to drying.
Results show that the used analytical method can be employed for assessing the transfer properties and drying kinetics in easy and effective manner. The assessed values of Biot number ($0.1 < Bi < 100$) were suggested the presences of certain internal and external resistances to heat and mass transfer during clay drying at experimental conditions. The drying potential of humid air significantly influences the moisture and heat transfer parameters.

ANODIC BEHAVIOUR OF ALUMINIUM IN CHLORIDE SOLUTION

ANODNO PONAŠANJE ALUMINIJA U KLORIDNOJ OTOPINI

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The objective of our research was to study the anodic behavior of super pure Al (99.999%) and technical grade Al in 2M NaCl solution at 25, 35 and 45 °C. The samples were polarized anodically at different current density (from 100 up to 500 mA cm^{-2}) through a 15 minute period. During the anodic polarization potential-time responses were recorded, the volume of the evolved hydrogen was measured and the mass loss of samples was determined. After the experiments, the surface of the tested materials was observed by using a light microscope and photographed.

The dissolution of Al is accompanied by strong hydrogen evolution and the rate of these reactions has been found to increase with the increase in the anodic polarization which is a characteristic of the negative-difference effect (NDE). Furthermore, conducted studies have shown that present impurities do not affect the anodic behavior of aluminum in chloride solution. For both samples the same values of NDE (of ≈ 16.6 %) and anode efficiency (of ≈ 0.86 %) were obtained, which indicated that instead of super pure aluminum the much cheaper and more readily available technical grade aluminum can be used as anode material for aluminum/air battery systems.

The temperature of solution does not affect the rate of hydrogen evolution. However, the increase of temperature has negative effect on anodic efficiency of both aluminum samples.

DYNAMIC THERMOGRAVIMETRIC DEGRADATION OF PVC/PEO BLENDS

DINAMIČKA TERMOGRAVIMETRIJSKA RAZGRADNJA MJEŠAVINA PVC/PEO

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Poly(ethylene oxide) (PEO) in the blend with poly(vinyl chloride) (PVC) can be used as thermal energy storage material, packaging material and as membrane material for CO_2 capture because of the strong affinity of *PEO* segments for CO_2. Since these blends are in contact with heat during their processing and their application as well, a good knowledge of their thermal stability is important.
To investigate the behaviour of PVC/PEO blends in the inert atmosphere, accelerated thermal degradation of PVC/PEO blends was investigated by means of dynamic thermogravimetric analysis. The thermal degradation of pure PVC and PVC/PEO blends occurs through two basic degradation steps, while thermal degradation of PEO occurs through one degradation step. To estimate the thermal stability of the blends, the different characteristics of TG curves for the first basic degradation steps were used. The interactions of blend components and its degradation products were evaluated by comparison of the experimental thermogravimetry curves with those calculated according to the additivity rule. From the TG curves recorded at the different heating rates the activation energies were calculated by isoconversional Flynn-Wall-Ozawa method. The activation energies of thermal degradation of PVC and PVC/PEO blends depend on the degree of conversion, while the activation energies of PEO thermal degradation are independent. Dependence of the activation energies on the degree of conversion provides information about complexity of polymeric material degradation.

DETERMINATION OF LIGHT INTENSITY IN MARINE ALGAE CULTIVATION PHOTOBIOREACTOR

ODREĐIVANJE INTENZITETA SVJETLA U FOTOBIOREAKTORU ZA UZGOJ MORSKIH ALGI

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A tubular photobioreactor has been designed for simulation of natural conditions in cultivation of marine algae. Parameters in the bioreactor space are recorded by a light sensor, a sensor of quantity of oxygen dissolved, a pH sensor and a temperature sensor. Optimum conditions are attained by automatic regulation of introduction of CO_2 and air, and by regulation of temperature of the cooling/heating medium that circulates around the reactor mantle. The regulation is based on data recorded by the sensors. The intensity of the light provided by lamps placed next to the photobioreactor mantle can be measured vertically by height and horizontally by circular cross section. This is an essential indicator of the effect of hydrodynamics on algae density and its distribution in the reactor space. Furthermore, it provides an insight into hydrodynamic flows generated by the mixer and into non-stationary conditions formed that determine the level of the hydrodynamic stress. The computer program for determination of light intensity has been based on the Lambert – Berr law, and has been made in the MathCad mathematical tool. The light intensity is measured by a sensor connected to the computer, so that the changes in intensity due to algae growth can be traced numerically and graphically. This provides the necessary input data for the program. The algorithm includes the calculation of light intensity (I) relative to radius (r) at a specified height (H=const.) and mass density of the biomass (X).

INVESTIGATION OF CORROSION BEHAVIOUR OF AISI 316L STEEL IN NaCl SOLUTION

ISPITIVANJE KOROZIJSKOG PONAŠANJA ČELIKA AISI 316L U NaCl OTOPINI

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Austenitic stainless steel finds a wild range of applications as construction materials due to its favorable mechanical properties, good corrosion resistance and acceptable price. High corrosion resistance of austenitic stainless steels is primarily attributed to the passive oxide film formed on its surface. Under the action of aggressive anions local breakdown of passivity occurs, mainly at sites of local heterogeneities, causing pitting corrosion.

In the present work, the corrosion behavior of AISI 316L stainless steel on 0.5 mol dm^{-3} NaCl solution were investigated in quiescent solution and with electrode rotation rate of 400 rpm, and at electrolyte temperatures 20, 40 and 60 ºC. Investigations were included open circuit potential measurements, linear polarization measurements and potentiodynamic polarization measurements. The corroded electrode surface was investigated on optical microscope after potentiodynamic polarization measurements.

Results of investigations have shown that increasing in electrolyte temperature leads to the increase of the corrosion current densities and to decrease the values of polarization resistance, which means the higher corrosion of steel. Electrode rotation also leads to increase the values of corrosion current density and to decrease of the values of polarization resistance.

Microscopic investigations have shown that the dominant corrosion attack is pitting corrosion. Increase in electrolyte temperature leads to increase the number of corrosion pits on electrode surface.

Sekcija: Prehrambena tehnologija i biotehnologija

Topic: Food technology and biotechnology

PHYSICOCHEMICAL CHARACTERISTICS OF THE CROATIAN BLACKBERRY WINE

FIZIKALNO – KEMIJSKA KARAKTERIZACIJA KUPINOVOG VINA IZ HRVATSKE

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The production of blackberry wine has been increasing in Croatia for years, but there is no available information or data on its physicochemical characteristics. The objective of this work was to evaluate the physicochemical composition of Croatian blackberry wines. Fifteen samples were collected during 2006 - 2007 and classified into two groups according to blackberry growing: conventional and organic samples. The eight physical and chemical characteristics of blackberry wines were estimated based on procedure described by OIV. The results obtained showed that relative density (20/20), ash, alkalinity of ash, reducing sugars, alcoholic strength by volume, pH, total acidity and total nitrogen in the studied blackberry wines were: 1.0017–1.0660, 1.59–4.11 g/L, 22.3-55.0 meq/L (or 1.54-3.80 g K_2CO_3/L), 13.5-177.6 g/L, 9.37–14.78 % vol, 3.11-3.56, 89.00–241.67 meq/L (or 6.68–18.13 g tartaric acid/L) and 69.05-347.13 mg N/L, respectively. Furthermore, total acidity and total nitrogen data sets were non-normally distributed and accordingly non-parametric statistics was applied. To sum up, the main physicochemical parameters analyzed demonstrated that blackberry wine represent a high quality beverage and all components tested have in general contents below the maximum concentration admissible.

keywords: blackberry wine, functional food, physical and chemical characteristics

BLACKBERRY WINE AS A GOOD SOURCE OF ESSENTIAL MINERAL NUTRIENTS

KUPINOVO VINO – DOBAR IZVOR ESENCIJALNIH MINERALA

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Blackberry wine is a popular alcoholic beverage in Croatia and mainly produced in the continental part of the country. Traditionally, this fruit wine has been used as a popular medicine for anaemia and the iron deficiency. The aims of this study were to evaluate the mineral content in Croatian blackberry wines and investigate whether this kind of wines are a good source of essential mineral nutrients. Fifteen samples were collected during 2006 - 2007 and classified into two groups according to blackberry growing: conventional and organic samples. The mineral content of investigated blackberry wines was determined using FAAS/FAES after dry ashing procedure. The concentrations of potassium, sodium, calcium, magnesium, iron, copper, manganese and zinc were between (in mg/L) 564 - 2014, 57.84 – 212.60, 109.7 – 205.1, 69.6 – 175.5, 1.10 – 8.41, 0.085 – 0.490, 0.96 – 8.03 and 0.557 – 3.569, respectively. According to the content found, minerals were classified in two categories: the main group including K, Na, Mg, Ca, and the secondary set consisting of Fe, Mn, Cu and Zn. In regard to the obtained results, Croatian blackberry wines could be considered health safe and as a good additional source of investigated essential nutrients.

keywords: blackberry wine, essential mineral nutrients, functional food

TEMPUS PROJECT: IMPROVING ACADEMIA – INDUSTRY LINKS IN FOOD SAFETY AND QUALITY (FOODLINKS)

JAČANJE VEZA SVEUČILIŠTE-INDUSTRIJA U PODRUČJU SIGURNOSTI I KVALITETE HRANE

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Food safety and the protection of consumers interest is of increasing concern to the general public, nongovernmental organization, professional associations, international trading partners, etc. Food business operator is best placed to devise a safe system. Application of the food safety system has benefits and the potential of strengthening food safety.
Foodlinks project is one of the European Commission funded projects called TEMPUS-TACIS Joint European Project, 158714-TEMPUS-1-2009-1-ES-TEMPUS-JPHES. The Project consortium is led by the University in Lleida Spain with the participation of 14 consortium members from Croatia, Macedonia, Serbia, Austria, Bulgaria, Greece, Portugal, and UK. Project started in January 2010 (duration of project is 3 years).
The objectives of the project are: to develop Academia – Industry interfaces to enhance the relation between the parts; to promote the transfer of knowledge in areas of food safety and food quality; to develop and implement training courses to promote life long learning for formation of skills and knowledge in the area of food safety and quality; to develop methodology of knowledge transfer between academia and industry in the area of food safety and quality; to establish 7 centres of knowledge resources in the area of food safety and quality, including legislation.

keywords: Tempus project, food safety, academia, industry

QUALITY CONTROL DURING REFINING SUGAR FROM SUGAR BEET AND RAW BROWN SUGAR FROM SUGAR CANE

KONTROLA KVALITETE TIJEKOM PROIZVODNJE ŠEĆERA IZ ŠEĆERNE REPE I SIROVOG ŠEĆERA IZ ŠEĆERNE TRSKE

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Production and consumption of sugar is increasingly growing and today it totals around 150 million tons per year. Sugar on the market is mostly produced from sugar beet and sugar cane. Quality control during sugar production is crucial, since it enables production of high quality sugar.
The aim of this research was to conduct analyses of raw materials, semi-products and final products in the production of sugar from sugar beet and raw sugar from sugar cane. In addition, results of analyses conducted during sugar production from different raw materials (sugar beet and sugar cane) were compared. During production of sugar from sugar beet, analyses were conducted at the beginning of the campaign and every month during campaign, while during production of sugar from sugar cane analyses were conducted every week during one month period.
Results showed that sucrose content decreased towards the end of campaign. Concentration, polarisation, purity and pH values were similar for afinated sugar from sugar beet and afinated sugar from brown cane sugar. Molasses from sugar cane had higher purity compared to molasses from sugar beet. Quality analysis of consumption sugar showed that sugar was produced in accordance with quality requirements.

keywords: sugar production, sugar beet, sugar cane, quality control

DETERMINATION OF POTENTIAL FACTORS FOR OCCURRENCE OF BIOGENIC AMINES IN WINE

ODREĐIVANJE POTENCIJALNIH FAKTORA KOJI UTJEČU NA NASTANAK BIOGENIH AMINA U VINU

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Biogenic amines are organic bases alifatic, aromatic or heterocyclic. In wine they are created by yeasts during fermentation, by lactic acid bacteria during malolactic fermentation and during maturation of wine. Biogenic amines are produced by enzymatic decarboxylation of amino acids. The most common amines in wine are cadaverine, putrescine, histamine and tyramine accordingly determined by the following amino acids: ornithine, lysine, histidine and tyrosine. Potential factors that influence the occurrence of amines in wine are as follows: pH, SO_2, the presence of precursor amino acids, presence of decarboxylase-positive microorganisms, length of fermentation phase, spontaneous malolactic fermentation, the turbidity of wine ripening. We analyzed twenty wines from Croatian territory, and we were determined: biogenic amines (putrescine, cadaverine, histamine and tyramine), organic acids (tartaric, acetic, malic, lactic and citric), pH and total SO_2. All analytes were determined by high performance liquid chromatography. The aim of the analysis was to examine the impact of these factors on the occurrence of biogenic amines in wine.

keywords: wine, biogenic amines, amino acids

INFLUENCE OF FREEZE-DRYING AND MICROENCAPSULATION ON FUNCTIONALITY OF PROBIOTIC STRAINS IN THE INTESTINAL TRACT

UTJECAJ RAZLIČITIH NOSAČA KOJI SE PRIMJENJUJU U MIKROINKAPSULACIJI NA FUNKCIONALNA SVOJSTVA PROBIOTIČKIH BAKTERIJA

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Probiotic preparations need to contain 10^6-10^8 viable cells per gram of the product to exert the probiotic activity in the human intestinal tract. Therefore, freeze-drying with the different lyoprotectors has been performed with the aim to produce probiotic strains *Lactobacillus helveticus* M92, *Lactobacillus plantarum* L4 and *Enterococcus faecium* L3 in powder form with high viable cell number for application as biotherapeutics. Skim milk and inulin have shown as optimal lyoprotectors between tested ones, as higher viability was achieved after freeze-drying compared to control and other lyoprotectors. The viable cell counts of probiotic strains after freeze-drying in skim milk was above 10^7 CFU/g, after 1 year of storage at 4 ºC what is in accordance with the claims set up for probiotic products. Another approach for the increasing the viable cell number of probiotic strains during freeze-drying and storage as well as oral target delivery could be microencapsulation. Hence, the microencapsulation of wet biomass and freeze-dried bacterial cells of *L. helveticus* M92, *L. plantarum* L4 and *E. faecium* L3 were undertaken. The microencapsulation of probiotic cells was performed in alginate, κ-carrageenan and by transglutaminase-induced gelatination of caseinate in order to investigate the effect of the microencapsulation on the functionality of probiotic strains. The higher percentage of the survival of microencapsulated cells of *L. helveticus* M92, *L. plantarum* L4 and *E. faecium* L3 compared to the percentage of the survival of non-microencapsulated probiotic cells, in simulated gastrointestinal tract conditions, indicates the protective effect of the microencapsulation on the probiotic strains.

keywords: freeze-drying, oral delivery, microencapsulation, probiotics, simulated gastrointestinal tract conditions

CHARACTERIZATION OF FLOW PROPERTIES OF DIFFERENT FLOUR TYPES AND MIXTURES USED IN BREAD MAKING

KARAKTERIZACIJA SVOJSTVA TEČENJA RAZLIČITIH TIPOVA BRAŠNA KORIŠTENIH U MJEŠAVINAMA ZA PROIZVODNJU KRUHA

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In order to avoid major problems in cereal handling and processing industry, it is necessary to determine flour flow properties. Although flour and starch powders under normal storage conditions exhibit relatively good flowability. This research presents a characterization and comparison of cohesion index, powder flow speed dependency and caking properties of different flour types and flour mixtures used in bread making industry. Stable Micro Systems TA.HDPlus Powder Flow Analyzer was used to determine flow properties of flours and flour mixtures. Wheat flour particles are heterogeneous and anisotropic. They have been considered as relatively free flowing, poorly cohesive powders, which do not cause caking problems (Peleg et al., 1973). However, whole meal wheat flour used in this research is categorized as very cohesive (CI = 17.61) and wheat flour as very cohesive (CI in the range 14-16). Based on powder flow speed dependency test, flours and flour mixtures do not show dependence on flow speed. Whole meal wheat flour is more susceptible to caking than other flour samples. Flour mixtures flow properties depend on the percentage of flour types added to the mixture. White wheat flour, whole meal wheat flour and corn flour exhibit different flow properties in dependence on their particle size and chemical composition. Mixture characteristics depend on the percentage of flour types added to the mixture.

FUNCTIONAL PRODUCT – A NEW TREND IN CONFECTIONERY INDUSTRY

FUNKCIONALNI PROIZVOD – NOVI TREND U KONDITORSKOJ INDUSTRIJI

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World trends are causing a more significant and efficacious sinergy between food industry and pharmacy. Alimentary habits of third millenium consumers are changing rapidly so, when making a decision on what to buy, they're paying more attention and give advantage to product dievrsity and healthy products evein in confectionery industry.
In order to achieve success, it is necessary to oppose the globalization of tastes. Some of temporary food tendencies will have their implication on demands of future consumers, who'll bring certain food habits.
Modern consumers, when deciding on what they will buy, are more and more aware of importance of healthy food. Functional products are products which insure functional advantages to consumers such as soothing of a sore throat, cleansing of respiratory ways, breath refreshment, dental care etc.
For that reason it is important to make research into new trends in confectionery industry, that is *brand stretching* into ne product categories and introducting *limited edition products* with one single purpose; drawing attention of new buyers.
These products, mostly from candy group of products, are primarily intended for the older group groups of consumers and they actually present the biggest growing segment of confectionery.
The demand for such products with health benefits (such as chocolate with increased content of polyphenols, bars based on vegetables etc.) is growing bigger every day.

keywords: functional product, candy, trend

DETERMINATION OF METALS IN OLIVE OIL BY ELECTROTERMAL ATOMIC ABSORPTION SPECTROMETRY

ODREĐIVANJE METALA U MASLINOVOM ULJU ELEKTROTERMIČKOM ATOMSKOM APSORPCIJSKOM SPEKTROMETRIJOM

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The aim of this work is to compare the efficiency of three procedures for preparation of olive oil samples for analysis of copper, cadmium, nickel, lead and iron by electrothermal atomic absorption spectrometry, and to assess its content in Croatian virgin olive oils. Selected chemical modifiers were 1 g L^{-1} $Pd(NO_3)_2$ for copper, nickel and iron determinations, and 5 g L^{-1} $NH_4H_2PO_4$ for cadmium and lead deteminations. Digestion with HNO_3, H_2SO_4 and H_2O_2 assisted by microwave energy in open glass test tubes was not efficient for copper, cadmium, nickel and lead determination, except for iron determination for which precision was low. Extraction of metals with HNO_3, c = 1.5 mol L^{-1}, was precise but not complete. The most suitable procedure was heating of samples at 300 °C for 24 hours and dry ashing in muffle furnace at 450 °C for 16 hours. The procedure was sufficiently precise and accurate for the determination of copper, cadmium, lead and iron, but the precision of nickel determination was low. The detection limits were: 6 ng g^{-1} Cu, 0.2 ng g^{-1} Cd, 12 ng g^{-1} Ni, 6 ng g^{-1} Pb and 153 ng g^{-1} Fe. The measurement uncertainties were higher than results of metal trace analysis in olive oil, except for iron. The latter method was applied for analyses of metals in olive oil samples collected from local family growers in Dalmatia region.

Of 17 Croatian olive oils analysed in 53% samples Cu ranged from 6 to 12 ng g^{-1} and in 35 % samples Cu was bellow detection limit. Cd and Ni were detected in one sample each (0.7 ng g^{-1} and 36 ng g^{-1}, respectively), Pb in two (7 ng g^{-1} and 10 ng g^{-1}) and Fe in six (153 – 1102 ng g^{-1}). Pressing had stronger effect on metal content in oils since mass fractions of Cu ($P < 0.05$), Pb ($P < 0.05$) and Fe ($P < 0.05$) were higher in oils produced by pressing than in oils produced by centrifugation; Cd and Ni contents were similar under both types of olive extraction. Olive oils were classified by cluster analysis in three groups. Except four samples with undetected metals, samples from Korcula, Kastela and Plano constituted one group, samples from other regions of Middle Dalmatia with Paklenica and Brodarica constituted second group and Rogoznica alone was in third group. First group characterized middle amounts of Cu and Fe and undetectable Cd, Ni and Pb. The measured mass fractions of metals in olive oils did not exceed the maximum permissible levels (Bylaw NN 16/05), and were in close agreement with data reported for Spanish and Italian olive oils.

EFFECT OF PHYSICAL-CHEMICAL VARIABLES ON SENSORY DESCRIPTIVE ATTRIBUTES OF TASTE OF *PROŠEK* WINE

UTJECAJ FIZIKALNO-KEMIJSKIH VARIJABLI NA SENZORNA DESKRIPTIVNA SVOJSTVA OKUSA VINA PROŠEK

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From Dalmatian selected varieties of grapes and specific production technologies, a dessert sweet wine, *Prošek* comes on the market. Four types of *Prošek* wine were experimentally produced using traditional technology from dried grape cv. *Plavac mali* and *Pošip*. A list of descriptive attributes describing the taste of the wine *Prošek* was obtained by sensory evaluation of wine. The intensity of taste attributes was assessed by the scale from 0 to 9. The analysis of the basic physical-chemical parameters of *Prošek* wine which the wine must meet was conducted when the wine is offered on the market as well as further analysis on determining the total phenols, total anthocyanins, vanillin index, proanthocyanidins and the antioxidant activity using the Briggs-Rauscher method. In this paper sensory assessment of *Prošek* wine was related to physical-chemical variables using multivariable analysis (factor analysis and principal components) with the aim to classify the properties into logical groups as well as to identify the effect of physical-chemical parameters on individual sensory attributes of *Prošek* wine. According to factor analysis, the results pointed out that the fullness of the wine was significantly associated with the content of dry extract and to the greater extent with the content of total phenols and regarding *Plavac mali* also with the content of total anthocyanins ($p < 0.05$). In addition, the bitterness of *Prošek* wine is in inverse proportion with the content of total phenols and astringency is inversely proportionate with proanthocyanidins. The taste of sweetness of *Prošek* demonstrated the moderate correlation with real alcohol ($r = 0.5$) while the acidity of *Prošek* wine revealed a significant correlation with the variables of volatile and non-volatile acidity ($p < 0.05$).

DETERMINATION OF SPECIFIC HEAT CAPACITY OF RASPBERRIES PUREE

ODREĐIVANJE SPECIFIČNOG TOPLINSKOG KAPACITETA KAŠE MALINA

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Specific heat capacity (c_p) is a property of materials that depends upon temperature and composition. The specific heat capacity of raspberries puree was determined as a function of temperature.

The standard methods for determination of specific heat for food are not known and because of that the calorimeter for determination of specific heat capacity was constructed. The calorimeter is based on standard methods for determination of materials such as metals, and different construction and packaging materials. The apparatus is modified in way of heat transfer between food materials (which is subjected to specific heat determination) and substances for heat exchange. The method for determination of c_p of raspberries puree were consist of immersing the sample, which was vacuuming in PVC bags, into water (substance for heat exchange) specified temperature. The temperature of water was measured until the thermal equilibrium between water and sample was reached. The temperature of samples (before the measuring) was lower in comparation to temperature of water. Specific heat capacity of raspberries puree was determined thought temperatures interval from 35 to 95°C. The values of specific heat capacity of the raspberries puree are in linear correlation with the temperature increase in investigated temperature range and were in range from 3.22 to 3.94 kJ/kg°C.

COMPARISON OF FREE AND COMERCIAL SOFTWARE PACKAGES FOR ENGINEERING PROBLEM SOLVING AND EDUCATION

USPOREDBA SLOBODNIH I KOMERCIJALNIH PROGRAMSKIH PAKETA POGODNIH ZA RJEŠAVANJE INŽENJERSKIH PROBLEMA I OBRAZOVANJE

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Engineering is application of scientific principles in real life problem solving, or in other words solving practical problems with application of accumulated scientific facts and more or less personal experience. Solving engineering problems often means application of numerical methods for differential equation solving, no matter what engineering branch is in concern. With fast development of personal computers in last two decades of last century, numerical methods moved from mainframe computers in research centers to widely available program packages written for PCs. This transition resulted in development of tools for product design, modeling and simulation which now could be used at universities for education as well as scientific work. MATLAB® is dominant commercial package today, but also there is number of free packages like Scilab or Octave. This work focuses on comparison of free software packages with commercial reference to determine their fitness to be used as tool for modeling and simulation as well as teaching engineering principles.

INFLUENCE OF MACERATION PROCESS ON ANTHOCYANINS COMPOSITION OF cv. TERAN WINES

UTJECAJ PROCESA MACERACIJE NA SASTAV ANTOCIJANA U VINU cv. TERAN

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The colour of red wine is a sensory attribute, related to the extraction of anthocyanins from grape skin during maceration. The extraction of anthocyanins from the grape into the wine is therefore main diffusion process. Rate and extent of extraction are influenced by concentration of anthocyanins, its localization in the berry, and processing methods where temperature and duration of maceration are determinating factors.
The free anthocyanins in wine are mono- or diglucosides of five anthocyanidins, namely delphinidin, cyanidin, petunidin, peonidin and malvidin. The acylated anthocyanins are esters of the glucose part of the free anthocyanins with acetic, *p*-coumaric or caffeic acid.
The aim of the present work was to study the influence of different temperatures (pre-fermentative cryomaceration, maceration at 25˚C and 25˚C + short-term, post-fermentative warming to 35-40˚C) on extraction of anthocyanins, colour density and hue of wine, from Croatian native red grape variety Teran.
Anthocyanins were quantified using a high performance liquid chromatography (HPLC) with UV-Diode Array detection.
Pre-fermentative cryomaceration increased the pigment extraction, and the wine produced by this technique contained a significantly higher content of total monoglucosides and total monoglucoside *p*-coumarats then the other wines. Quantitatively, malvidin derivates were the most abundant anthocyanin compounds in all studied wines. With the respect to the colour, pre-fermentative cryomaceration has proved to be a useful technique to obtain darker and less brown wines.

keywords: anthocyanins, colour density, cryomaceration, hue, Teran

MENU OPTIMISATION WITH SPECIFIC OBJECTIVES - GESTATION

OPTIMIRANJE JELOVNIKA S POSEBNIM POTREBAMA – TRUDNICE

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An appropriate lifestyle and diet of pregnant woman during prenatal development contributes to the proper development of the foetus. Since the third month of pregnancy, the physical activity of the foetus and the nourishment of the mother should follow the metabolic needs and the foetus. Decreased or excessive intake of vitamins and other nutrients associated with various congenital disorders and significant impact on prenatal development and postpartum life. In this paper, linear programming has been applied in meal planning according to the guidelines recommended for women between 19 and 30 years with an emphasis on nutrient intake during the all nine months of pregnancy. Data used as the nutritional composition of the seven-day supply, where each day consisted of 4 meals; breakfast, lunch, dinner and snack. Linear optimization was carried out using the LINDO program. The program included 28 variables and 19 constraints; energy, water, proteins, fats, carbohydrates, cholesterol, dietary fibres, vitamins soluble in fats; A, D, water-soluble vitamins, B_1, B_2, niacin, B_6, folate, B_{12}, C, and minerals; calcium, iron, magnesium, and sodium. The results show that balanced meal offers can be offered for pregnant women of any quarter. The results alsoindicate that thewell-balanced, diverse and regular diet, based on prescribed guidelines, throughout pregnancy, can provide adequate amounts of nutrients for the pregnant woman and foetus without taking additional supplements.The analysis indicates that in the menu planning is not enough only to observe and macronutrients and energy intake, but it is very important also to observe the micronutrient composition of the planned meals. The, vital ingredients in the offers of pregnant woman must be victuals rich with folate and magnesium.

AUTOCHTONOUS FUNCTIONAL STARTER CULTURES AND MYCOTOXINS IN "SLAVONSKI KULEN"

AUTOHTONE FUNKCIONALNE STARTER KULTURE I MIKOTOKSINI U SLAVONSKOM KULENU

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The purpose of this study was to isolate the indigenous microbial population from "Slavonski kulen", produced in rural households. Dominant microbial populations consisted of lactic acid bacteria (LAB): *L. plantarum*, *L. delbrueckii*, *Leuconostoc mesenteroides* and *L. acidophilus* in number from 3.0 – 9.23 log10 CFU / g sample. The bacteria from the genus of *Staphylococcus* was also dominated microbial population in "Slavonski kulen", as follows: *S. xylosus*, *S. warneri*, *S. lentus* and *S. auricularis* in number from 3.30 - 5.56 log10 CFU / g sample. From samples were also isolated yeasts: *Candida famata*. From the surface 4 of 6 analyzed "Slavonski kulen" were isolated molds from the genus *Penicillium* sp. and *Aspergillus* sp. The presence of mycotoxins were also determined. Mycotoxins concentrations were 0.9 to 1.6 ppb for ochratoxin A (OTA) and 0.1 to 0.5 ppb for aflatoxin B1 (AFB1) and were defined not only on the surface layer, but also in the centre of "Slavonski kulen". In the samples which were not isolated molds, it was not proven the presence of mycotoxins. All LAB isolates showed significant antimicrobial activity against tested pathogenic microorganisms, and showed one of the important properties of potential starter cultures.

LACTOBACILLUS PLANTARUM 1K FROM "SLAVONSKI KULEN" AS NATURAL PROBIOTIC STARTER CULTURE

LACTOBACILLUS PLANTARUM 1K KAO PRIRODNA PROBIOTIČKA STARTER KULTURA IZ SLAVONSKOG KULENA

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The aim of this work was to investigate adhesion ability of bacterial strain *L. plantarum* 1K, isolated from "Slavonski kulen", on the small and large intestine of mice *in vitro* and *in vivo* conditions. Considering that *L. plantarum* 1K was satisfied the basic criteria for selection of probiotic strains *in vitro* conditions, *in vivo* studies in experimental mice were carried out. *L. plantarum* 1K significantly reduced the number of bacterial cells of *Salmonella* sp. in mice infected with bacterium *Salmonella* sp. and reduced the translocation of bacteria *Salmonella* sp. in the liver of mice. Considering that *L. plantarum* 1K has demonstrated the basic functional criteria for the selection of probiotic strains, as such, it can be used as functional autochthonous starter culture for fermented meat products.

INFLUENCE OF HEAVY METALS FROM WILD BOAR MEAT ON CONSUMERS HEALTH IN CROATIA

UTJECAJ TEŠKIH METALA U MESU DIVLJIH SVINJA NA ZDRAVLJE POTROŠAČA U RH

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Based on the findings of the monitoring of heavy metals in the meat of wild animals (wild boar, deer and Roe deer), which was implemented in the 2006 and 2007 in Republic of Croatia, in Virovitica – Podravska County and Osijek – Baranja County (the transitional zone between two counties) in a number of samples were found elevated amounts of heavy metals, (lead, cadmium, mercury and arsenic). In order to determine their impact on the health of consumers, the Croatian Food Agency launched the development of scientific study which included all three wildlife species listed in three counties (including Vukovar - Srijemska County) in the three gender classes (mature, middle age and the young), and both gender (males and females). The amounts of the heavy metals were determined by apsorbic atomic spectrophotometry (AAS).

HAPLOTYPE ANALYSIS OF 17 Y-SHORT TANDEM REPEAT LOCI IN WESTERN CROATIA

ANALIZA HAPLOTIPOVA NA 17 KRATKIH UZASTOPNO PONAVLJAJUĆIH LOKUSA KROMOSOMA Y U ZAPADNOJ HRVATSKOJ

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Introduction: Y-chromosome haplotype reference database (YHRD) is very important in forensic community, because it stores Y chromosome haplotypes from global populations. The aim of this study was to perform the population genetic study on 17 short tandem repeat (STR) loci on the Y chromosome in western Croatia.
Methods: We performed a statistical analysis of the data from previously performed genetic analysis collected during routine forensic work by the Forensic Science Centre "Ivan Vučetić". A total of 220 unrelated men from western Croatia were selected for this study. Genomic DNA was extracted by Chelex from FTA cards. Y-chromosomal STRs were amplified using the AmpFlSTR Yfiler PCR amplification kit. Haplotype frequencies were analyzed using the Arlequin software v.3.1 and AMOVA analysis calculated with the YHRD online analysis tool.
Results: Average locus diversity was 0.6038, and it ranged from 0.226 for DYS392 to 0.778 for DYS458. A total of 213 haplotypes were identified, 207 of which were unique. Total haplotype diversity was 0.994 and total discrimination capacity was 96.8%. AMOVA indicated that our western Croatian population was the closest to populations from Zagreb, Croatia and Mostar, Bosnia and Herzegovina.
Conclusion: Future studies are needed to create a reference Croatian Y-STR database

BIOLOGICAL VALUE AND QUALITY OF OLIVE OIL VARIETIES FORMS *OBLICA* IN RELATION TO THE FARMING AREA

BIOLOŠKA VRIJEDNOST I KVALITETA ULJA MASLINE SORTE *OBLICA* U ODNOSU NA PODRUČJE UZGOJA

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Conducted research quality and biological value of olive oil major Croatian varieties *Oblica* in relation to the farming area in the North (Zadar area) and South (Dubrovnik area) Dalmatia. Quality and biological value of virgin olive oil varieties *Oblica* depends on the degree of maturity of olives, harvesting method, manner and time of harvest, storage and processing of oil and the preservation of oil. Virgin olive oils are defined by the following indicators: the fatty acid composition, the ratio of polyunsaturated and saturated fatty acids, ratio of ω-6 and ω-3 fatty acid, content of polyphenols, ratio of polyphenols and polyunsaturated fatty acid, proportion and composition of sterols, free fatty acid content, peroxide value and organoleptic evaluation. Index of maturity suitable for harvesting olives is achieved earlier in the Dubrovnik area then in the Zadar area. Oil derived from the Zadar area had a smaller proportion of free fatty acids, lower peroxide value, polyphenol values were significantly higher and the ratio of polyphenol and polyunsaturated fatty acids, and there is no significant difference in the ratio of ω-3 and ω-6 fatty acids and in the Dubrovnik area there was a significant higher value of palmitic acid (C 16:0). Except 2004 the other examined samples organoleptic rating showed significant differences in favor of the Zadar area. Among all the investigated sterols noticed a significant difference in cholesterol and stigmasterol. Samples of the Zadar area of the two sterol content was lower. The results obtained are in interaction with climatic parameters, temperature, precipitation and wind, and statistically analyzed with the Wilcoxon matched pairs test.

CHEMOMETRIC ANALYSIS OF WHEAT CULTIVARS

KEMOMETRIJSKA ANALIZA KULTIVARA PŠENICE

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In this work applied is chemometric analysis for classification and modeling of 28 domestic and foreign wheat cultivars from 2007 year of production. The analysis is aimed for investigation of genetic divergence of cultivars and determination of effects of gliadin fractions and HMW glutenin subunits on technical quality parameters. For each cultivar are determined the following 35 parameters: genotypes, composition and mass fractions of gliadin fractions determined by RP-HPLC method, composition of HMW subunits determined by SDS-PAGE electrophoresis and physical and rheological quality parameters. Since single parameter analysis does not reveal the complexity of interaction on quality applied is the multivariate approach. Samples of cultivars are projected from 35 dimension of the parameter space to the 5 dimensional space of principal components (PCA) by which 95 % of the original data variability is retained (correspond to the level of accuracy). Cluster analysis of the cultivars is based on the PCA projections. Input-output linear models are derived from the projections, by the method of partial least squares (PLS), for prediction of rheological and technological quality parameters (outputs) from projections of genotype and biochemical data (inputs). The obtained chemometric models are viewed as a potential for rational selection of wheat cultivars based on statictical multivariate data and derived predictive models.

THE INFLUENCE OF INTERACTIONS AMONG PHENOLIC COMPOUNDS FROM CHOKEBERRY ON THE ANTIRADICAL ACTIVITY OF CHOKEBERRY

UTJECAJ INTERAKCIJA FENOLNIH SPOJEVA ARONIJE NA NJEZINU ANTIRADIKALNU AKTIVNOST

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Phenolic compounds are widely distributed in fruits and vegetables, and have been shown to have good antiradical properties. The antiradical activity of these compounds can be affected by interactions that can occur among phenols itself and among phenols and different compounds from fruits. Moreover, these complex interactions can promote changes in the total antiradical activity of fruits. In this study, the antiradical activity of various phenolic classes from chokeberry fruits (*Aronia melanocarpa*) and the interactions that can occur among phenolic classes were investigated. Phenolic fractions were isolated from chokeberry fruits. First phenol fraction was enriched with phenolic acids and flavonols, the second with anthocyanins, and the third with insoluble phenols and proanthocyanidins. The main phenolic compounds in fractions were identified by using the high performance liquid chromatography (HPLC). The antiradical activity of fractions was studied by using the DPPH test, over a period of 300 minutes. Furthermore, phenolic fractions were mixed in different concentration ranges and the antiradical activity of mixtures was studied. The antiradical activity of phenolic mixtures was lower in comparison to the individual phenolic fractions. This suggests the existence of complex interactions among phenolic compounds which promoted the decrease of the antiradical activity.

IRON CONTENT IN THE TRADITIONALLY CONCENTRATED JUICE OBTAINED FROM INDIGENOUS VARIETIES OF APPLES

SADRŽAJ ŽELJEZA U TRADICIONALNO PROIZVEDENOM KONCENTRIRANOM SOKU OD AUTOHTONIH SORTI JABUKA

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Bosnia and Herzegovina has strong tradition in producing concentrated juice obtained from indigenous varieties of apple named ”pekmez od jabuka”. This product is used in folk medicine for nutritional treatment of anemia diseases, but iron content in these products has not been investigated.

The aim of this research was to determine iron content in concentrated apple juice in relation to variety, and present basics for production and product standardization. Results of iron content analysis of the traditionally concentrated juices obtained from indigenous varieties of apples are presented. Samples were obtained from mixtures of indigenous apple varieties, as well as from the apple variety called ”*Samoniklica*”. All samples were produced by traditional technologies.

The iron content was determined by atomic absorption spectrometry. The iron content of the concentrated juice obtained from the apple cultivar of ”*Samoniklica*” was in range 6.072 to 6.549 mg/100g. The concentrated juices from the other indigenous varieties had lower iron content (3.769 to 4.545 mg/100g).

Because of the relatively high content of iron, traditionally concentrated apple juice could be used as a functional food or raw material in the manufacture of food supplements. The utilization of traditionaly produced apple juice in the nutrition can be subject to the further research.

INFLUENCE OF EXTRUSION ON THE QUALITY OF GLUTEN-FREE RAW MATERIAL USED FOR CREAM-SOUP PRODUCTION

UTJECAJ EKSTRUZIJE NA KVALITETU BEZGLUTENSKE SIROVINE ZA PROIZVODNJU KREM JUHA

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Food production is nowadays often encountered with demands for food products targeted for special consumer groups. Particularly, it is well known that human with gluten sensitive enteropathy (celiac disease) cannot consume products containing gluten, which is mainly present in wheat, rye, barley and oat. Instant soups and gravies present on market often contain ingredients derived from grains which give them organoleptic properties, but also make them unsuitable for increasing consumer groups.

The aim of this research was definition of parameters for production of extruded product targeted for application as supplement for gluten containing grains in production of instant soups and gravies.

Therefore, mixture of milled pulse and degermed maize grits was extruded at different process conditions. Expanded mixture was produced, which had better sensory, culinary and nutritive properties compared to non-extruded material. In addition, preparation time was reduced. In order to obtain products with specific standard properties, quality and chemical composition of raw materials were defined, as well as parameters of extrusion process and quality of the final product.

keywords: extrusion, raw material, cream soup

COMPARISON OF THERMO-SONICATION, THERMAL AND ULTRASOUND TREATMENTS ON MICROBIOLOGICAL QUALITY AND SENSORY PROPERTIES OF FRESH SWEET WHEY

USPOREDBA TOPLINSKOG TRETMANA, TERMOSONIFIKACIJE I TRETMANA ULTRAZVUKOM NA MIKROBIOLOŠKU KVALITETU I SENZORSKA SVOJSTVA SVJEŽE SLATKE SIRUTKE

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In this study the influence of different ultrasound power inputs (400 W, 320 W, 240 W) without and with heat pre-treatment (35 ºC, 45 ºC, 55 ºC) on microbial inactivation and sensory properties of fresh sweet whey in comparison to conventional pasteurization batch process were investigated.
In general, ultrasonication and thermo-sonication treatments with pre-heating to 35 ºC showed no impact on reducing any group of studied microorganisms. Thermo-sonication treatment performed for 8 minutes at power level 100 (400 W) and preheating to 55 ºC was the only one that resulted in greater reduction of total viable cell count in comparison to that observed by simulating conventional batch pasteurization process. Reduction of coliform bacteria number and yeasts and moulds number increased with power input, exposure time and temperature of heat pre-treatment.
Sensory properties after ultrasonication and thermo-sonication improved in comparison to that after conventional pasteurization batch process. Preheating to 55 ºC resulted in occurrence of metallic aftertaste regardless the ultrasound power input, while applying power level 60 and/or preheating to 35 ºC resulted in poorer mouthfeel. Therefore, thermo-sonication treatments when power levels 100 (400 W) and 80 (320 W) were combined with preheating to 45 ºC, regardless exposure time, appeared to be the optimal for purpose of improving sensory properties of whey.

TEHNICAL CRITERIA FOR THE DEVELOPMENT MOISTURE METER CALIBRATIONS

TEHNIČKI KRITERIJI ZA RAZVOJ KALIBRACIJA ZA VLAGOMJERE

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Dielectric (capacitive) technology used by the moisture meters for grains and oilseeds is based on the principle of the relation between the moisture content and the dielectric constant. The dielectric constant increases with the increase in moisture (water) content. Since the rate of increase is not the same for all types of grain, the unique calibration constants have to be developed for each type of grain whose moisture is measured using the moisture meter.
Water content in grain is important for the storage of grain, and the accuracy of the results affects forming of the price on the market. Due to different measurement results, which are within the bounds of the maximum permissible error and occur in cases of the same model of moisture meters, there may be a lack of trust between the producers and the buyers of grain. Since it is a quick method and the instrument has a clearly defined permissible error at verification, the only solution to this problem is standardisation of calibration constants.
The testing laboratory of the State Office for Metrology, which prepares samples for verification of moisture meters, has initiated the development of calibration constants for barley and wheat that render possible maximum level of homogeneity of measurement results. The laboratory has also set the technical criteria for making and testing in the first phase, followed by the implementation and the development of the constants for other agricultural cultures.
The technical criteria for the development of calibrations are a group of methods consisting of sample collecting, determination of the moisture content for the grain using the standard ISO 712:2009 method, measuring with the moisture meter, computer processing of the results using the programme for calibrations and our own method of monitoring the conditions of handling the samples used for verification of moisture meters.

keywords: moisture meters, moisture content, calibration, standardisation

NEW MODEL FOR PREDICTING THE SOLUBILITY OF SOYBEAN OIL AND FATTY ACIDS IN SUPERCRITICAL CO_2

NOVI MODEL ZA PROCJENU TOPLJIVOSTI SOJINOG ULJA I MASNIH KISELINA U SUPERKRITIČNOM CO_2

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The solubility of soybean oil and main fatty acids (linoleic, oleic, palmitic, stearic and linolenic acid) in supercritical CO_2 has been determined in the pressure range of 100-300 bar and temperature range of 313-323 K. A new equation was developed for predicting the solubility of soybean oil and fatty acids in supercritical CO_2 as a function of temperature and density. The accuracy of the proposed model was evaluated by calculating the average absolute relative deviation (AARD). The proposed model was very successfully employed for calculation of soybean oil and fatty acids solubility in supercritical CO_2 (AARD values ranging from 0.14 to 11.45 for all extraction conditions).

keywords: solubility, soybean oil, fatty acids, supercritical CO_2, modeling

TEXTURAL CHARACTERISTICS OF READY-TO-EAT BREAKFAST CEREALS PRODUCED FROM DIFFERENT TYPES OF CEREAL AND WITH VARYING WATER ADDITION DURING EXTRUSION PROCESS

UTJECAJ RAZLIČITIH VRSTA ŽITARICA TE RAZLIČITE KOLIČINE DODANE VODE U PROCESU EKSTRUZIJE NA STRUKTURU ŽITARICA ZA DORUČAK

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Textural characteristics of ready-to-eat breakfast cereals were evaluated in order to determine the influence of wheat, corn and rice flour, as well as a varying water addition during the extrusion process. Extruded breakfast cereal balls were made of wheat semolina in combination with wheat, corn or rice flour. Three different levels of water addition (21%, 23% and 27%) were used during the extrusion process. Samples were prepared with and without surface sugar coating. Sensory and instrumental assessments (TA.XT Plus) were used to evaluate textural attributes of dry samples and samples during immersion in milk. Weibull equation was used for nonlinear estimation of experimental data obtained for milk absorption and crispiness as a function of time. Crispiness of dry extruded balls without coating was much higher than for samples with coating. The highest values for crispness were observed for wheat extruded balls and the lowest for samples with corn flour addition. Increasing water addition during the extrusion process significantly increased crispness of ready-to-eat breakfast cereals. The rate of milk absorption and loss of crispiness were significantly higher for samples without coating than for samples with coating. Also, significant correlations were found between the data obtained from milk absorption measurements, sensory scores and instrumental evaluation.

keywords: ready-to-eat breakfast cereals, textural properties, milk absorption

ANTIBROWNING EFFECT OF NOVEL COUMARIN DERIVATIVES ON APPLES (*var. Idared*)

UTJECAJ NOVIH DERIVATA KUMARINA NA POSMEĐIVANJE JABUKA (*var. Idared*)

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Browning reactions of apples become evident during postharvest handling when material is subjected to processing or mechanical injury. Those changes are undesirable and can affect appearance, flavor or nutritional value of the apples. Inhibition of such reactions has become a subject of many researches and there are many more or less effective methods used to prevent browning. Coumarin derivatives have already shown to be potent tyrosinase inhibitors, as well as antioxydative agents. In our work we have synthesized various coumarin derivatives which are examined for their potency to prevent browning of the apple slices. Apple slices were treated with coumarine derivatives solutions and their inhibitory effect on the browning reaction was monitored in a period of 15 days. Color measurement was performed on Minolta Chroma meter (CR 400) using CIE *L*a*b** color. Results have shown that some derivatives have been very potent antibrowning agents and further research will elucidate inhibitory effect of these derivatives.

BIOACTIVE POTENTIAL OF HERBAL INFUSIONS PREPARED FROM TRADITIONAL MEDICINAL PLANTS

BIOAKTIVNI POTENCIJAL INFUZIJA PRIPREMLJENIH OD TRADICIONALNO KORIŠTENIH LJEKOVITIH BILJAKA

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Naturally derived antioxidants, especially polyphenols currently present the main focus of scientific community, due to their excellent antioxidant properties, which makes the consumption of foods rich in these compounds highly recommended. A wide array of positive health effects has been ascribed to plant polyphenols, such as their ability to protect against cancer and cardiovascular diseases, as well as their antimicrobial, antiinflammatory and anticariogenic properties. Although significant attention has been paid to the antioxidant capacity of polyphenols present in green tea and medicinal herbs and spices, it is much less known that leaf tissues of some common plants and spices, traditionally used in folk medicine, also posses high content of these beneficial bioactive compounds.

The aim of this study was to evaluate the polyphenolic compounds and antioxidant properties of 10 medicinal plants prepared as infusions. The content of total phenols, flavonoids, flavan-3-ols and tannins of herbal infusions of lemon balm (*Melissa officinalis* L.), thyme (*Thymus serpyllum* L.), mint (Mentha piperita L.), nettle (*Urtica dioica* L.), blackberry leaf (*Rubus fructicosus*), olive leaf (*Olea europaea*), chamomille (*Matricaria recutita* L.), yarrow (*Achillea millefolium* L.), black locust (*Acacia pseudorobinia*) and lavender (*Lavandula officinalis*) were evaluated quantitatively by using UV/Vis spectrophotometric methods. Antioxidant capacity of herbal infusions was evaluated by using the ABTS (2,2`-azino-bis(3-ethylbenzthiazoline-6-sulphonic acid) and FRAP (ferric reducing/antioxidant power) assays.

The highest content of total phenols was found in the infusion prepared from the leaves of lemon balm, followed by infusion made from mint, while the infusion prepared from the flowers of camomile contained the lowest phenolic content. Linden infusion was characterized with the highest flavan-3-ols content, while the raspberry leaf infusion exhibited the highest tannin content, which is in accordance with the results obtained by previous findings of other authors. The ranking of herbal infusions based on their decreasing antioxidant potential correspondes to the one obtained for the total phenol content, which is confirmed by a high correlation obtained between the results, pointing out to the fact that the phenolic compounds are responsible for the antioxidant capacity of herbal infusions.

FLAVONOIDS IN CROATIAN CHESTNUT (*CASTANEA SATIVA*) HONEY

FLAVONOIDNI PROFIL HRVATSKOG MEDA KESTENA (*CASTANEA SATIVA*)

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All honey types can be generally described as supersaturated sugar solutions, but at the same time they differ in components, such as flavonoids, which are present in them in small amounts but are responsible for many of their specific properties. The aim of this study was to determine the content of flavonoids in Croatian monofloral chestnut (*Castanea sativa*) honey. For that purpose 9 chestnut honey samples, for which characterisation was achieved by the combination of physicochemical properties and pollen analysis, have been analysed. Flavonoid fraction was extracted from honey and then analysed using reversed-phase high performance liquid chromatography (RP-HPLC) method. Flavonoids myricetin, quercetin, luteolin, kaempferol, apigenin, isorhamnetin, chrysin and galangin were identified and quantified in each sample. Total amount of identified flavonoids varied from 149 μg/100 g of honey to 313 μg/100 g of honey, with the average of 231 μg/100 g of honey. All analysed samples showed common flavonoid profile.

TRAININGS FOR LIFE

OBRAZOVANJE ZA CIJELI RADNI VIJEK

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Higher education plays an important role in development of all countries. Properly educated and trained employees are the basis of successful businesses. However are the higher education institutions aware of the real training needs of the industry, or they simply deliver education according their curriculums which were developed some years ago? The main aim of the TEMPUS Project No 144596 Higher Education Learning Partnerships (HELP) is to establish learning partnerships in transitional countries of South Eastern Europe between higher education and enterprises. For that purpose training needs of industries were evaluated using short questionnaire, and furthermore through direct discussion with representatives from the food industry which is of greatest interest for HELP partnership in Croatia. Short programmes encompassing combination of up-to-date theoretical information and practical examples were chosen as the most convenient method of training delivery. As a result specific trainings should increase the quality and availability of skills needed by local enterprise, encourage innovation, increase competitiveness and raise productivity and economic growth on the local level. Additionally, international character and partnerships between HELP partner countries should improve mobility and therefore employability of trained workers on the regional level.

INFLUENCE OF TREHALOSE ADDITION ON SELECTED AROMA COMPOUNDS IN STRAWBERRY FRUIT FILLINGS

UTJECAJ DODATKA TREHALOZE NA ODABRANE TVARI AROME U PASTI OD JAGODA

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Aroma is one of the most important quality properties in food products and has great influence on acceptability of foods. Since it is very difficult to control it, in this study addition of different amounts of trehalose (3, 5 and 10 %) to strawberry cream fillings was used as possible tool for retention of selected aroma compounds which are the most responsible for strawberry aroma. Selected aroma compounds were fruity esters (ethyl acetate, ethyl butanoate, 2 methyl-ethyl butanoate, 3 methyl-ethyl butanoate, ethyl pentanoate, methyl-ethyl pentanoate, ethyl hexanoate, methyl hexanoate, methyl butanoate), γ-decalactone and furaneol. Samples were prepared without and with addition of strawberry aroma, thus influence of initial amount of aroma compounds was also observed.

Overall looking, trehalose addition caused retention of fruity esters with exception of ethyl acetate. Increase of trehalose addition did not cause proportional increase in fruity esters amount. However, in the case of γ-decalactone and furaneol, results showed that trehalose addition did not have the same effect as in case of fruity esters. Initial amount of aroma compounds had high influence on number and amount of aroma compounds detected in samples, as well as on effect of trehalose on selected aroma compounds probably due to interactions of all compounds of the samples.

keywords: aroma compounds, trehalose addition, strawberry cream filling

CRYOPROTECTIVE EFFECT OF MALTOSE ON CHICKEN MYOFIBRILLAR PROTEINS (CMP)

KRIOPROTEKTORSKO DJELOVANJE MALTOZE NA MIOFIBRILARNE PROTEINE PILEĆEG MESA (MPP)

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The cryoprotective effects of maltose (w = 0 - 10%) on chicken myofibrillar proteins (CMP) were investigated. CMP were produced from broiler mixed with different mass fraction of maltose (w_m = 0 - 10 %), frozen and stored for 30 days on -30 °C. Myofibrillar protein functional stability was monitored by salt extractable protein (SEP) and differential scanning calorimetry (DSC). Salt extractable protein (SEP) showed that the addition of maltose (w_m = 0 - 10%) caused smaller decrease in protein solubility after 30 days of frozen storage. Peak thermal transition temperatures (T_p) and denaturation enthalpy (ΔH) of myofibrillar proteins were evaluated. Differential scanning calorimetry (DSC) revealed a shift in peak thermal transition temperature (T_p) of myosin and actin to higher temperature as the mass fraction of maltose increases. After 30 days of frozen storage transitions enthalpies (ΔH) of myosin and actin of CMP samples showed increase with the increase of mass fraction of maltose. Since the value of denaturation enthalpy is directly related to amount of native proteins, higher values of ΔH indicates to the higher cryoprotective effects of maltose on chicken myofibrillar proteins.

keywords: thermal transitions temperatures, cryoprotection, maltose chicken myofibrillar proteins, DSC, SEP

THE STUDY OF KINETICS OF ACID HYDROLYSIS OF SPENT BREWER'S YEAST

ISPITIVANJE KINETIKE KISELINSKE HIDROLIZE OTPADNOG PIVSKOG KVASCA

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In this study, acid induced autolysis of spent brewer's yeast was carried out with sulfuric (SA) and lactic acid (LA). The aim of this study was to estimate the success of autolysis induced with inorganic acid compared to autoysis induced with organic acid. The reaction was performed at pH and temperature range which enable the optimum activity of the yeast endoenzymes, so that the process can be considered on acid induced autolysis of yeast biopolymers. Process of hydrolysis was monitored by measuring the increase in the free amino nitrogen (FAN, α- amino N) concentration. Hydrolysis with sulfuric acid was conducted at the temperature range T = 45 - 60 °C, pH 5.0 - 5.4 and in the period of 12 - 36 h. Hydrolyses with lactic acid was carried out at the temperature range T = 48 - 62 °C, pH 5.4 - 6.2 and in the period of 12 - 44 h. The best results (3985,42 mg/L) obtained with (SA) were at the following process conditions: T = 60 °C, pH = 5.2 and t = 36 h. On the other hand, the best results (7144,01 mg/L) obtained with (LA) were at the T = 55 °C, pH = 6.0 and t = 44 h. In both performed acid hydrolysis, α- amino N content was not detected at temperature higher than 60 °C, suggesting the possible inactivation of yeast proteases.

keywords: yeast autolysis induced with acid, free amino nitrogen (α- amino N)

RELATIONSHIP BETWEEN OXIDATION STABILITY AND DIFFERENT PROCESSING CONDITIONS IN SUNFLOWER AND RAPESEED EDIBLE OILS

OVISNOST OKSIDACIJSKE STABILNOSTI O RAZLIČITIM PARAMETRIMA PROIZVODNJE U JESTIVIM ULJIMA REPICE I SUNCOKRETA

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Processing parameter effects during new refining testing were studied to improve the quality of edible oils by monitoring the oxidation indicators of thus refined edible sunflower and rapeseed oil. Monitored processing parameters were bleaching time and temperature, and oxidation indicators were peroxide value (evaluated by titration method), anisidine value (evaluated by absorbance measurement at 350 nm), rancimat test (evaluated using Rancimat instrument) and sensory testing. Sensory testing was done by certified sensory analysts.
Type and dosing of bleaching clay were held constant and all analytical characteristics were compared in crude, neutralised, bleached and deodorised oil. Only sensory testing of deodorised oil was evaluated. Improvements in the quality of refined edible sunflower and rapeseed oil by increasing oxidative stability were achieved by reducing bleaching time and temperature.

keywords: oxidative stability, bleaching time and temperature, edible oil

CHARACTERIZATION OF TRADITIONAL ISTRIAN DRY CURED HAM BY MEAN OF PHYSICAL AND CHEMICAL ANALYSIS AND VOLATILE COMPOUNDS

KARAKTERIZACIJA TRADICIONALNOG ISTARSKOG PRŠUTA FIZIKALNO-KEMIJSKIM ANALIZAMA I ANALIZOM HLAPIVIH KOMPONENATA

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Dry-cured ham is a traditional product popular with European consumers with a strong presence in markets in the Mediterranean area. Aroma is an essential parameter for consumer appreciation of meat products, especially aroma of dry cured ham. The aroma-active compounds of Istrian dry cured ham were investigated by using headspace- solid phase microextraction and gas chromatography-mass spectrometry (GC-MS). Samples of *Biceps femoris* were also evaluated by measuring physical and chemical characteristics: moisture, protein, fat, ash content, aw value and NaCl content; color: *L*, a*, b** and oxidation of fat: TBARS test. The results of GC-MS analysis indicated the involvement of numerous volatile constituents in the aroma of Istrian dry cured ham. About 50 volatile compounds were identified including alcohols, aldehydes, ketones, esters, terpenes and alkanes. It is known that flavor formation in dry-cured hams is related to lipolysis-oxidation of fat and to proteolysis, amino acid degradation which is shown in this work. Except volatile compounds derived from lipolysis and proteolysis the most abundant constituents were terpenes that originate from spices added in salting phase of the production process.

MYCOTOXINS IN WEAT STORED IN SLAVONIA AND BARANJA

MIKOTOKSINI U PŠENICI USKLADIŠTENOJ U SLAVONIJI I BARANJI

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Wheat is the major cereals in the diet of people in Croatia and it is very important that it is of safe for consumption. In order to prevent contaminated food coming into the market, it is necessary to implement the protection of crops in the fields, the proper processing and storage, and permanent control of the presence of mycotoxins, because it is known how the infestation of mold and mycotoxin production can continue during storage of wheat. In this regard, investigation on presence of mycotoxins in wheat stored in Slavonia and Baranja was made, as a result of previous monitoring studies conducted in Croatia which pointed to the presence of certain mycotoxins in cereals and cereal products as well as regular monitoring of their levels.

COMPARATIVE STUDIES OF OXIDATIVE STABILITY OF EDIBLE OILS BY SCHAAL OVEN TEST AND THE RANCIMAT METHOD

KOMPARATIVNA STUDIJA OKSIDACIJSKE STABILNOSTI JESTIVIH ULJA SA SCHAAL OVEN TESTOM I RANCIMAT METODOM

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Oxidative stability is an important parameter when evaluating the quality of oils and fats, as it gives a good estimation of their susceptibility to oxidative deterioration. The oxidative stability of different vegetable oils was studied using the Schaal Oven test (63 ^{o}C) method based on determination of peroxide value and Rancimat method based on conductometric measurements. Different vegetable oil samples were used in this study: sunflower oil, linseed oil, corn oil, peanut oil and rice bran oil. The oxidation was induced and measured using Rancimat equipment (model 743 Methrom). The result of oil oxidation was expressed as induction period (IP). Stability is proportional to the induction period. Peroxide values were expressed as mmol O_2/kg. The results obtained from Rancimat method measurements correspond with those based on the classical titration method Schaal Oven test. By applying these methods for tracking vegetable oils stability, it is observed that the rice bran oil has the highest stability against oxidation (the Rancimat method), and the corn oil has the highest stability measurable by the Schaal Oven test. Linseed oil shows a great susceptibility to oxidative deterioration, wen both methods applied.

keywords: vegetable oils, oxidative stability, Schaal Oven test, Rancimat method

PRODUCTION AND APPLICATION OF BACTERIAL EXOPOLYSACCCHARIDES IN BAKING

PROIZVODNJA I PRIMJENA BAKTERIJSKIH EGZOPOLISAHARIDA U PEKARSTVU

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Application of sour dough in the baking has a long tradition. However, sour dough today is not just a means for dough leavening but for more intensive uses in order to improve the texture, aroma and flavor of bakery products. In the production of sour dough as a starter culture, lactic acid bacteria (LAB) have the main role. In recent years LAB with the possibility of producing exopolysaccharides (EPS) are especially explored. Namely, in the bakery considerable amounts of additives containing hydrocolloids is currently being used. They are mostly of plant origin and are characterized by the ability of binding large amounts of water in the dough, which has a positive effect on the volume, texture, freshness and shelf life of bread. Microbial EPS synthesized in dough act as well as hydrocolloids. Consequently arises the idea that EPS synthesized by using LAB *in situ* could replace or reduce the use of all the expensive additives in bakery industry. In addition, synthesized exopolysaccharides may act as prebiotics and antioxidants.

LAB in sour dough produce various types of exopolysaccharides, of which the most significant homopolysaccharides are composed of one type of monosaccharide (glucose - glucans and fructose - fructans). Which EPS will be synthesized in sour dough, depends on the type of LAB that is present in sour dough.

The aim of this study was to optimize the EPS production in MRS medium and *in situ* using the LAB that are traditionally used in the production of sour dough.

keywords: exopolysaccharides, LAB, baking

ANALYSIS OF *RUSSULA CYANOXANTHA* MUSHROOM EXTRACTS

ANALIZA EKSTRAKATA GLJIVE *RUSSULA CYANOXANTHA*

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Russula cyanoxantha is one of the most common species of *Russula* in Europe. It is edible and delicious mushroom. Mushrooms are currently valued for biologically active substances as they contain many valuable compounds such as fatty acids, amino acids, proteins, carbohydrates, trace elements etc. Considering the growing interest for mushrooms, objectivity of this study was to investigate extracts obtained from *R. cyanoxantha.* Two different extracts were prepared.
Extraction yield of extract obtained using 50% ethanol was 37.67%. In this extract content of total phenolic compounds was determined as 26.66 mg GAE/g of extract. Antioxidant activity of this extract was analyzed using two different methods, DPPH and reducing power. It was found that *R. cyanoxantha* ethanolic extract reach IC_{50} value at the extract concentration of 0.062 mg/ml. Also, it was confirmed the extract is capable of reducing iron (III) and thus, is capable of donating electrons. Extraction yield of extract obtained by supercritical carbon dioxide was 2.06 %. High pressure carbon dioxide fluid extraction has been documented as an effective method for preparing bioactive products from plant materials. As fatty acids are one of valuable mushrooms compounds the extract fatty acid profile was determined by GC/MS and GC/FID analysis. Most dominant fatty acid was essential linoleic with content of 41.61%.

keywords: *Russula cyanoxantha,* antioxidant activity, phenols, supercritical extraction, fatty acids

ANTIOXIDANT PROPERTIES OF VARIOUS SOLVENT EXTRACTS OF MULBERRY LEAVES

ANTIOKSIDATIVNE OSOBINE EKSTRAKATA LISTA DUDA S ODABRANIM OTAPALIMA

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Mulberry (*Morus nigra*) is a fast-growing deciduous plant that grows under different climatic conditions. Reports indicate that mulberry leaves contain proteins, carbohydrates, calcium, iron, ascorbic acid, β-carotene, vitamin B-1, folic acid and vitamin D. They have been shown to possess medicinal properties such as diuretic, hypoglycemic and hypotensive. However, it is only recently that the mechanism of their action has been related to their antioxidant activity.
The antioxidant properties, total phenols and total flavonoids contents of methanol, ethanol, acetone and water extracts of mulberry leaves were examined. Drug-solvent extraction ratio was 1:10, 1:20 and 1:30 (m/v).
The highest amount of total phenols (72.18 mg ECA/g of dry extract) and total flavonoids (12.26 mg EC/g of dry extract) were achieved for mulberry extracts obtained by 70% acetone, i.e. water. Antioxidative activities of dry extracts were tested using a standard DPPH procedure and reducing power assay method. Using the same method antioxidant activity of investigated extracts was compared to antioxidant activity of standard antioxidant compound Vitamin C and BHT.
Extracts obtained by ratio drug: solvent of 1:20 (m/v) were approved the best antioxidative properties of all research.

keywords: extraction, mulberry extracts, antioxidant components, phenols, flavonoids

SHELF-LIFE OF FRESH-CUT PEARS PROCESSED AFTER HARVEST AND STORAGE IN CONTROLLED ATMOSPHERE

TRAJNOST SVJEŽE IZREZANIH KRUŠAKA PROCESIRANIH NAKON BERBE I NAKON SKLADIŠTENJA U KONTROLIRANOJ ATMOSFERI

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The aim of this work was to investigate the effect of different agents on shelf-life of fresh-cut pears *Packham's Triumph* variety. Treatments were obtained with pear fruits after harvest and after six months of controlled atmosphere storage. Colour and texture measurements, as well as visual evaluation of untreated and samples treated with different agents, during sixteen days of storage at 4 °C, were carried out. Fresh-cut pear slices were dipped for 2 minutes in water solution of hydrogen peroxide (HP), potassium sorbate (PS), ascorbic acid (AA), calcium ascorbate (CA), sodium hexametaphosphate (SHMP), calcium chloride (CC), and combinations of AA with SHMP (2 % AA + 1 % SHMP, 2 % AA + 2 % SHMP, 3 % AA + 1 % SHMP, 3 % AA + 2 % SHMP) and calcium chloride (2 % AA + 0.2 % $CaCl_2$, 3 % AA + 0.2 % $CaCl_2$). The shelf-life of fresh-cut pears (prepared from pears after harvest) could be prolonged, depending on treatment, on about 12 to 16 days (the best treatment was 2 % AA + 0.2 % $CaCl_2$). Shelf-life of samples, prepared from fruit stored in controlled atmosphere for 6 months was approximately 8 days, except for samples treated with 1 % calcium ascorbate (12 days). Addition of calcium (calcium ascorbate) significantly prevented tissue breakdown of samples during storage at 4 °C. Quality of minimally processed fruits depends on fruit (raw material) quality during prolonged storage.

keywords: pears, colour, texture, shelf-life.

CHEMICAL COMPOSITION OF INDUSTRIAL AND HOME-MADE FERMENTED SAUSAGES

KEMIJSKI SASTAV INDUSTRIJSKIH I DOMAĆIH FERMENTIRANIH KOBASICA

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The aim of the study was to determine and compare chemical composition of fermented sausages manufactured by Croatian meat industry and farm households. Standard analytical methods were employed to determine the proportion of water, raw protein, collagen and meat protein, raw fat and sodium chloride in sausage samples (N=80). In addition, pH value and level of the food additives sodium nitrite and polyphosphate were also tested. Study results showed the proportion of water to be about the same (<40%) in the two categories of sausages, whereas the proportion of raw fat and collagen was statistically significantly higher (P<0.05) and the proportion of raw protein and meat protein lower in industrial sausages. The level of sodium chloride was 4.46±0.65% and 4.99±0.90%, and acidity expressed as pH value was 5.11-5.76 and 4.86-6.29 in industrial and home-made sausages, respectively. The level of sodium nitrite was significantly below the level allowed by the act on this type of meat products (<50 mg/kg) in both industrial and home-made sausages. The mean level of polyphosphate was 4.52±0.74 g/kg in industrial sausages. In all samples of home-made sausages with high protein content, the polyphosphate level significantly exceeded the maximal allowed level of 5 g/kg. Study results pointed to variation in the composition and quality of home-made *versus* industrial fermented sausages.

keywords: fermented sausage, industrial sausage, home-made sausage, chemical composition, composition variation

INFLUENCE OF PECTIN ADDITION ON RHEOLOGICAL PROPERTIES OF APPLE PUREE AT LOW TEMPERATURES

UTJECAJ DODATKA PEKTINA NA REOLOŠKA SVOJSTVA KAŠE JABUKE PRI NISKIM TEMPERATURAMA

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Rheological properties of food are important for determining process parameters and defining sensory characteristics of certain food products. Apple puree is heterogenic colloid system that was made by pastring of mashed and termical treated fruit. This paper deals with the influence of pectin, insoluble dry solid content and soluble dry solid content, shear and cooling rate on rheological properties of apple puree at low temperatures before and during freezing. Basic apple puree of Idared sort was made by blanshing in 10% sucrose solution and different puree combinations with addition of pectin (0,2% and 0,4%) with different esterification stage (62% and 71%). Rheological properties were measured by rotational viscosimeter with refridgeration unit. Dependance of shear rate and shear stress at 5 °C and 0 °C; at constant shear rate by continuing and scale cooling were measured. The lowest sub-cooling temperature at which still shear occures (T_m) and the temperature after fast increasement of shear stress, apparent viscosity and lower temperature decreasement (T_k) were determined. It was proved that all apple purees are nonnewtonian pseudoplastic. Apparent viscosity and consistency coefficient were enhanced with the increasing content of higher stage esterification pectin while the lower esterification pectin had the opposite effect. The addition of pectin decreased the freezing temperature.

keywords: rheological properties, apple puree, low temperature, pectin

RHEOLOGICAL PROPERTIES OF SUCROSE MODEL SOLUTIONS WITH PECTIN AND CELLULOSE AT LOW TEMPERATURES

REOLOŠKA SVOJSTVA MODELNIH OTOPINA SAHAROZE, PEKTINA I CELULOZE KOD NISKIH TEMPERATURA

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The knowledge of rheological properties is important for conduction of processes in food production and achieving specific properties of food. The different carbohydrates are important ingredients of many food products.
The aim of this paper was to investigate the influence of soluble dry solid content, insoluble dry solid content and shear rate on rheological properties of sucrose model solutions at low temperatures before and during freezing. Model solutions were made from different mass weights of sucrose (20%, 30% i 40%) and different combinations of model solution of 30% sucrose with addition of pectin (0,2 % and 0,4% (71% esterification)) and cellulose (1%, 2%, 3% i 4%). Measurements were conducted by rotational viscosimeter with refridgeration unit. Dependance of shear stress and shear rate at 0 °C and 5 °C; at constant shear rate by continuing and scale cooling were measured. Results showed that all examined model solutions of pure sucrose at 0 °C and 5 °C had newtonian caracter. Pectin and cellulose addition in sucrose model solutions increase viscosity and it becomes pseudoplastic. The shear of investigated solutions was conducted at higher cooling temperatures at scale coling, while at continous cooling the temperatures were lower.

keywords: rheological properties, model solutions, low temperatures, sucrose, viscosity

ELECTRICAL CONDUCTIVITY AND ASH CONTENT OF SELECTED HONEY TYPES

ELEKTRIČNA PROVODNOST I UDIO PEPELA ODABRANIH VRSTA MEDA

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Electrical conductivity depends on ash and acid content in honey and today, due to its simplicity, is used as replacement for ash content determination. Objectives of this work were to determine electrical conductivity and ash content of selected honey types (bastard indigo, black locust, Christ´s thorn, sage, chestnut and honeydew) and relationship between those physicochemical parameters. Electrical conductivity was determined by conductometer and ash content by burning. A linear regression model for relationship between electrical conductivity and ash content as well as high correlation were found.

keywords: honey, electrical conductivity, ash content

EFFECT OF ULTRASOUND ON RHEOLOGICAL AND THERMOPHYSICAL PROPERTIES OF POTATO STARCH

UTJECAJ ULTRAZVUKA NA REOLOŠKA I TERMOFIZIKALNA SVOJSTVA KRUMPIROVOG ŠKROBA

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The aim of this paper was to examine the influence and effect of high and low power ultrasound on rheological and thermophysical properties of potato starch. Suspensions containing ten percent of potato starch have been treated with ultrasound. All analysis have been carried out before and after power ultrasound treatment. Ultrasound bath of 22 kHz frequency and nominal power of 150 W has been used, as well as ultrasound probe of 24 kHz frequency and nominal power of 100, 300 and 400 W for 15 and 30 minute treatments. Rheological parameters have been determined with rheometer, whereas enthalpy, onset and end temperature of gelatinization with Differential scanning calorimetry (DSC). Micrographical pictures of ten percent suspensions of native and ultrasound treated potato starch showed changes in morphological structure of starch after ultrasound treatment. Rheological parameters showed that all suspensions exhibited non-newtonian (dilatant) character. Onset gelatinization temperature is higher for all model suspensions as compared to native starch. From the data one can observe obvious basic starch properties: retrogradation and gelatinization. It was determined that treatment with ultrasound of 400 W nominal power has the highest deterioration properties on starch granule.

keywords: potato starch, ultrasound, rheology, thermophysical properties, micrography

ISEKI_Food NETWORK

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ISEKI_Food was designed as a network of University and Research Institutions, Professional Associations, Industrial partners and Students Associations to foster collaboration on a variety of joint interest projects. Several European and 6 global academic network projects received funding between 1998 and 2011 from the European Commission. Most of these partners founded the ISEKI_Food Association in order to cooperate after the support of the European Union.

ISEKI-Food 3 **I**ntegrating Food **S**cience and **E**ngineering **K**nowledge **I**nto the Food Chain, www.iseki-food.eu is one of the Academic Networks in the LLP program of the European Union (EU). Its main objectives are to continue to contribute to the European Higher Education Area (EHEA) in the field of Food Studies and to work towards the network sustainability. The work plan is fostering innovative developments, enhancement of food studies quality, and improvement of European higher education international attractiveness.

ISEKI_Mundus 2 Internationalization and Sustainability of ISEKI_Food Network, www.ISEKI-food.eu running from 2009 – 2011, is an extension of the ISEKI_Food 3 project including countries from all continents, from Canada to New Zealand. The main objectives are to ”Foster the internationalization and enhance the quality of the European higher Food Studies”.

The consortium is constituted by reputed HE institutions (76), Associations, Enterprises and Research Organizations with interest on Education, and the Food Industry Students European Council (FISEC). The total number of partners is 96.

ISEKI-Food Association (European Association for Integrating Food Science and Engineering Knowledge into the Food Chain, wwwiseki-food.net) is an outcome of ISEKI_Food, founded in 2005, to guarantee the sustainability of all the results from several projects after the financial support of the European Commission.

keywords: Foodnet, ISEKI-Food 3, ISEKI_Mundus 2, Food science, Food Engineering, Food Chain

TEXTURE PROFILE ANALYSIS OF ARTISANAL CROATIAN EWE'S HARD CHEESES

ANALIZA PROFILA TEKSTURE AUTOHTONIH HRVATSKIH TVRDIH SIREVA OD OVČJEG MLIJEKA

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The aim of this study was to analyze texture of artisanal Croaitian hard cheeses, produced according to long-lasting tradition, originally from some Adriatic islands, such as Pag and Krk. Except texture profile analysis (TPA), composition and some physico-chemical properties of analyzed cheeses (water activity, pH values, colour of cheeses) were determined. Obtained results show that wide range of variability between analyzed hard ewe's cheeses exists. Cheeses were differ in following textural parameters: hardness, cohesiveness, springiness, elasticity and chewiness. Furthermore, parameters of colour, analyzed on the base of colour measurements parameters (L^*, a^*, b^*) varied between analyzed cheeses. It has been indicate that yellow nouance of island cheeses dominate in relation to continent cheeses. Differences pH values was also statistically significant between cheeses, whereas the water activity (aw) between analyzed cheeses was not significantly different

keywords: artisanal ewe' hard cheeses, texture profile, colour, water activity, pH value

CORRELATION BETWEEN CATALASE ACTIVITY AND AFLATOXIN SYNTHESIS IN *Aspergillus flavus*

KORELACIJA AKTIVNOSTI KATALAZE I SINTEZE AFLATOKSINA *Aspergillus flavusa*

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The aim of this study was to determine whether there is a correlation between catalase activity of *Aspergillus flavus*, grown on substrates which either induce or inhibit the synthesis of aflatoxins. The work used GMS and PMS liquid media which only differ in glucose (GMS) and peptone (PMS) content. Following cultivation of mold, extraction, and immunoaffinity clean-up, aflatoxin levels were determined by HPLC. Based on the results, glucose has a higher degree of conversion to mold biomass than peptone. A total of 23 ppb aflatoxin was detected in the PMS medium, while the GMS had a significantly higher amount of up to 333 ppb. Pepton is a source of nitrogen in liquid medium which made the PMS medium more suitable for protein synthesis. Consequently, catalase activity in the GMS medium was lower. Catalase activity and the amount of aflatoxins were inversely proportional. Correlation coefficient in the GMS medium was -0.91 ($p = 0.03$), similar to the correlation coefficient in the PMS medium -0.94 ($p = 0.02$). Major decline of catalase activity may have brought about cellular oxidative stress prompting molds to aflatoxin synthesis.

INFLUENCE OF MILK POWDER AND STORAGE CONDITIONS ON STABILITY OF CHOCOLATES

UTJECAJ MLIJEKA U PRAHU I UVJETA ČUVANJA NA STABILNOST ČOKOLADA

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One of the most significant problems in confectionery industry is development of fat bloom which results in gray appearance and crumbly structure of chocolate and chocolate products. Although fat bloom has been studied extensively for many years, its actual mechanisms are not completely understood due to complexity of systems and interactions.
Influence of different milk powder types on fat bloom of chocolate was investigated in this research. For this purpose, milk chocolates with spray dried and skimmed milk powder were prepared. To induce development of bloom, chocolate samples were exposed to temperature cycling between 20 and 29 °C at 12 hr intervals at 50, 60 and 75 % r. h., respectively during 55 days. Color changes were monitored by tristimulus chromameter and changes in grey layer composition were monitored by DSC.
Results showed that type of milk powder and storage conditions had significant influence on fat bloom, which is especially pronounced at higher humidities, where hygroscopy caused additional blooming. Results of DSC measurements can be used in revealing of fat blooming.

keywords: milk chocolate, fat bloom, DSC, milk powder

PASTING AND THERMOPHYSICAL PROPERTIES OF WHEAT STARCH MODIFIED WITH MIXTURE OF ADIPIC ACID AND ACETANHYDRIDE

SVOJSTVA PASTE I TERMOFIZIKALNA SVOJSTVA ŠKROBA PŠENICE MODIFICIRANOG SMJESOM ADIPINSKE KISELINE I ACETANHIDRIDA

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Pasting and thermophysical properties are very important for starch use in food industry. Native starch often does not meet needs for these properties. Therefore, different types of modifications (chemical, physical or enzymatic) are conducted.
The aim of this research was modification of wheat starch with mixture of adipic acid and acetanhydride and investigation of the properties of modified starches, important for food industry. Starch was isolated from two Croatian wheat varieties (*Golubica* and *Srpanjka*), modified in 4, 6 and 8 % and pasting (pasting temperature, hot and cold paste viscosity) and thermophysical properties (gelatinisation temperature, enthalpy of gelatinisation and retrogradation) were investigated.
The results showed that pasting temperature decreased and paste viscosity increased by the modification. Gelatinization temperature wasn't significantly influenced by modification. Gelatinization enthalpy of *Golubica* starch increased, while gelatinization enthalpy of *Srpanjka* starch decreased as degree of modification increased. Retrogradation of starch was significantly influenced (decreased) by modification, where degree of changes depended proportionally on degree of modification.

keywords: wheat starch, pasting properties, DSC, adipic acid, acetanhydride

PRODUCTION OF LACTIC ACID BY LACTIC ACID BACTERIA *Lactobacillus amylovorus* DSM 20531^T AND *Lactobacillus coryniformis* subsp. *torquens* DSM 20004^T

PROIZVODNJA MLIJEČNE KISELINE S POMOĆU BAKTERIJA MLIJEČNE KISELINE *Lactobacillus amylovorus* DSM 20531^T I *Lactobacillus coryniformis* subsp. *torquens* DSM 20004^T

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A variety of simpler and complex carbohydrates present in renewable and waste materials may be utilized in the production of lactic acid. The use of pure cultures of lactic acid bacteria capable of fermenting mono- and disaccharides and directly converting polysaccharides to lactic acid without the need for saccharification (hydrolysis of polysaccharides) is advantageous because of the cost and efficiency of the bioprocess. Lactic acid bacteria *Lactobacillus amylovorus* DSM 20531^T and *Lactobacillus coryniformis* subsp. *torquens* DSM 20004^T were used in this work to produce lactic acid from monosaccharide (glucose), disaccharides (sucrose, maltose or cellobiose) and polysaccharides (starch or cellulose) as a sole carbon and energy sources in the MRS medium. Likewise, combinations of the two carbohydrates (glucose/maltose, glucose/cellobiose, glucose/cellulose, and cellobiose/cellulose) were used for the fermentative production of lactic acid in the medium. Except cellulose, all above mentioned carbohydrates added to the MRS medium (γ_{S_0} = 10 or 20 g L^{-1}) have been used as substrates by amylolytic lactic acid bacterium *L. amylovorus* DSM 20531^T. High product yields ($Y_{P/S}$ = 0.62 – 1.00 g g^{-1}) were reached during overnight incubation at 40°C in the medium with glucose, cellobiose and glucose/maltose without pH maintenance. Under the same conditions lactic acid has been produced also by *L. coryniformis* subsp. *torquens* DSM 20004^T from the substrates and their combinations. More efficient were fermentations of glucose, maltose, sucrose, glucose/maltose, glucose/cellobiose and glucose/cellulose to lactic acid ($Y_{P/S}$ = 0.40 - 0.70 g g^{-1}) while significantly lower product yields ($Y_{P/S}$ = 0,03 - 0,06 g g^{-1}) were obtained in the MRS media with cellobiose, starch, cellulose and cellobiose/cellulose. The production of lactic acid in the MRS medium with cellobiose (γ_{S_0} = 10 g L^{-1}) by the two bacterial strains was investigated in shaken-flasks experiments at 40°C. *L. amylovorus* DSM 20531^T biomass production occurred at maximum specific growth rate (μ_{max}) of 0,12 h^{-1} and, interestingly, cellobiose was almost stoichiometrically ($Y_{P_1P_2/S}$ = 0,90 g g^{-1}) fermented to lactic acid (P_1) and acetic acid (P_2).

APPLICATION OF NIR SPECTROSCOPY FOR MONITORING QUALITY OF SURIMI

PRIMJENA NIR SPEKTROSKOPIJE ZA NADZOR KAKVOĆE SURIMIJA

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Non-invasive spectroscopy in the near red range from 899 - 1699 nm (NIR) was applied with the aim to analyze commercial samples of surimi and analogs of see shrimp. In this paper the aim was to investigate the possibility of recording reflectance samples for potential monitoring in the production process and sorting of samples according the quality, in order to prevent adulteration, and classification. The surimi and scrimp analogs spectra samples were monitored at 4 °C room temperature of 21 °C over time intervals (0, 30, 60, 120 and 240 min) on both sides of the samples. The samples were treated by cooking in water and in a microwave oven in time intervals: 0; 0.5; 1 and 2 min. Analysis of the spectrums reveal changes in specific wave lengths of 919, 1177, 1201, 1343, 1458 and 1495 which correspond to O-H, C-H and N-H bonds that indicates possibility of determination of fat, protein and water in surimi and shrimp analogues enabling use of NIR for on-line monitoring of quality and selection.

ANALYSES OF METAL CONCENTRATIONS IN CROATIAN WINES USING IC AND ICP-OES

ODREĐIVANJE KONCENTRACIJA METALA U UZORCIMA HRVATSKIH VINA PRIMJENOM METODA IC I ICP-OES

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Ion chromatography (IC) and inductively coupled plasma optical emission spectrometry (ICP-OES) were used to analyze concentrations of nine metals in three northwestern Croatian wines. Two Pinot grey wines from different wine regions (denominated as A and B) were produced in 2009. *Blackberry wine (denominated as C) was produced in 2007.* IC was used to analyze concentrations of sodium, potassium, magnesium and calcium. Levels of potassium and magnesium were significantly higher in blackberry wine. The most pronounced difference in all samples was detected for calcium, which was 17.6-23.6 times higher in blackberry wine. *Concentrations of c*opper, iron, manganese, zinc, nickel and chromium were analyzed using ICP-OES. Concentrations of sodium and copper were almost similar in all three wines. The significant differences among wines were detected for iron and manganese. Concentration of iron in blackberry wine was five times lower, while manganese was 3.62-5.38 times higher, compared with Pinot grey wines. The highest level of zinc was found in Pinot grey wine denominated as A. Value of nickel in blackberry wine was up to nine times higher than in Pinot grey wines. According to the obtained data, levels of calcium, nickel, iron and manganese differed in all tested wines, while chromium was not detected.

keywords: blackberry wine, metal concentrations, Pinot grey, wine

MINOR POLAR COMPOUND AND FATTY ACID ANALYSES IN MONOCULTIVAR CROATIAN VIRGIN OLIVE OILS

ANALIZA NETRIGLICERIDNIH SPOJEVA I SASTAVA MASNIH KISELINA HRVATSKIH SORTNIH DJEVIČANSKIH MASLINOVIH ULJA

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Virgin olive oil is a typical component of the Mediterranean diet, consumed unrefined and rich in important molecules, such as minor polar compounds (hydroxytyrosol, tyrosol, secoiridoids and flavonoids) and fatty acids. These molecules not only influence the sensorial properties of both olives and virgin olive oil but they are also important markers for characterization, biodiversity and quality determination of this product. The aim of this study was to evaluate the minor polar compound and fatty acid contents of 5 monocultivar virgin olive oils, typical of middle Dalmatia region, in order to have better knowledge about the quali-quantitative profiles of these compounds in samples obtained from both the same collecting season and same processing technique. Quali-quantitative analysis (performed by HPLC/DAD and GC) could be a useful tool to better correlate the typicity of the virgin olive oil with its minor polar compound and fatty acid pattern. The organoleptic assessment was also performed on the investigated olive oils in order to define their sensorial profiles. Further studies are in progress to isolate the specific compounds and to further investigate the quality index of this food product.

keywords: virgin olive oil, monovarietal, minor polar compound, fatty acid

Sekcija: Medicinska biokemija i farmacija

Topic: Medical biochemistry and pharmacy

THE FORMATION ENCRUSTATES ON UROLOGICAL STENT

STVARANJE INKRUSTATA NA UROLOŠKOM STENTU

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Urolithiasis, despite many years of physico-chemical, metabolic and clinical investigations, still remains not completely understood process in human body. The reason is the complex nature of the processes involved in it, as well as the complexity of the environment in which it takes place. Many problems associated with urolithiasis can be overcome by ureteral bridging. Urological stents are synthetic polymer biomaterials which are prepared to maintain their position within the ureter and allow the flow of the urine. Since urine itself is unstable chemical environment, its supersaturation to the uromukoide and crystalloid on the surface between of the material and urine may lead to significant problems and complications such as migration, occlusion, encrustation, penetration and formation of the stones. Infection and encrustation are connected and one of the major limiting factors for long term use of the stents in the body. Encrustation may be complex process and represents risk factor for sepsis, pielenofritis, chronic renal injured, recurrent stone and metabolic abnormalities. Therefore, today, the research is focused on more effective encrustation formation prevention methods. The detailed knowledge of the composition of formed encrustes is the first step in achieving this goal.

The aim of this study was to characterized encrustates extracted from the stents by physical-chemical methods (by thermogravimetry (TG) analysis and FT-IR spectroscopy).

The compositions of the encrustates were compared with the composition of the primary stones detected in patients.

BIOLOGICAL ACTIVITY OF EXTRACTS FROM SELECTED *ASTERACEAE* PLANT SPECIES

BIOLOŠKA AKTIVNOST EKSTRAKATA ODABRANIH BILJAKA PORODICE *ASTERACEAE*

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Croatia flora is rich with plant species from *Asteraceae* familiy. Some of these species are well known medicinal plants, widely used in ethnomedicine. Since the substances used in treatment of some diseases are potentially harmful for human health, it is challenge to find active substances of natural origin like medicinal plants. Alzheimer disease (AD) is an incurable form of dementia which causes severe cognitive dysfunctions. AD is manifested as reduction of neurotransmitter acetylcholine inside the cholinergic system, hence the inhibition of acetylcholinesterase (AChE), enzyme that hydrolyses acetylcholine, has an important role in AD treatment. It is also considered that oxidative stress could be a trigger for AD development; hence the research of AChE inhibitors is accompanied by assessment of their antioxidative activity.

The aim of this work was to test AChE inhibitory activity as well as antioxidative activity of extracts from selected Asteraceae species: *Centaurea ragusina* L., *Inula verbascifolia* (Willd.) Hausskn and *Pallenis spinosa* (Cass.) Cass.

CHEMISTRY AND FUNCTIONS OF ALPHA-LIPOIC ACID IN NUTRITION

KEMIJA ALFA-LIPOIČNE KISELINE I NJENA FUNKCIJA U PREHRANI

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Alpha lipoic acid (ALA) is a unique short chain fatty acid with two sulphur atoms, synthesized enzymatically in the mitochondrion from octanoic acid. In addition to synthesis in human body, ALA is also absorbed intact from dietary sources, and it transiently accumulates in many tissues. In human diet, it is present mainly in meat and liver but it is undetectable in vegetables. During the aging, synthesis of ALA in the human body decreases and intake with food is often not enough. Therefore, its intake as dietary supplement is necessary. ALA has become a common ingredient in multivitamin formulas and anti-aging supplements.

Numerous studies have shown that ALA elicits an array of cellular actions, ranging from a potent antioxidant to a metal chelator to a mediator of cell signaling pathways. ALA is well-defined as a therapy for preventing diabetic polyneurophaties, it scavenges free radicals, chelats metals, and restores intracellular glutathione levels which otherwise decline with age. ALA has been described as a potent biological antioxidant, a detoxification agent, and an efficient diabetes medicine.

There is increased interest in research of ALA in biochemistry, food and clinical chemistry. There are numerous studies designed to investigate whether the effects of dietary supplementation with ALA could prevent the increase in mitochondrial superoxide production in the cells.

The paper summarizes evidence conected with ALA in human nutrition.

CHEMISTRY AND FUNCTIONS OF MELATONIN IN THE HUMAN BODY

KEMIJA MELATONINA I NJEGOVE FUNKCIJE U LJUDSKOM ORGANIZMU

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Melatonin is a natural compound occurring in animals, plants, and microbes. It could be also found in many types of food as a food supplement. Chemically is known as N-acetyl-5-methoxytryptamin.
In the biological systems melatonin can be synthesized from a number of precursors such as 5-methoxyndole-3-acetonitrile, 5-methoxytriptamine or, from numerous of reactive indoles. Aromatic amino acid tryptophan, which is also a precursor of synthesis of serotonin, serves as a precursor for synthesis of melatonin.
In humans, biosynthesis of melatonin is controlled by light and melatonin is secreted into the blood by the pineal gland in the brain. Biological effects of melatonin accomplish through activation of melatonin receptors.
Chemical identification and analysis of melatonin is most frequently performed by using immunological techniques (RIA, EIA), chromatographic methods (GC in particular), and also by using NMR, IR spectrophotometry, and other methods.
This paper presents the role of melatonin in human body with a particular attention to its function in circadian sleep rhythm. The functions of melatonin such as immunological, antioxidative and other have been presented in this paper.

DETERMINATION OF MITOTANE AND ITS METABOLITES IN BIOLOGICAL FLUIDS BY SPE-HPLC METHOD

ODREĐIVANJE MITOTANA I NJEGOVIH METABOLITA U BIOLOŠKIM TEKUĆINAMA SPE-HPLC METODOM

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Mitotane is the drug of choice for the treatment of adrenal cortical carcinoma and is used as a chemotherapeutic agent after resection. Its mechanism of action and pharmacokinetics are not fully known. To achieve optimal therapeutic concentration and to prevent dangerous side effects, it is very important to determinate the concentrations levels of mitotane and its metabolites in the body after administration.

The aim of this work was to develop and validate a SPE-HPLC method for determination of mitotane and its metabolites in plasma, erythrocytes and urine of a patient with adrenal cortical carcinoma.

Blood and urine samples were collected during 8 hours after administration of Lysodrena® (500 mg) pill.

SPE conditions: Discovery DSC column, 500 mg, 3 mL (Supelco), preconditioned with 1 mL of methanol and 2 mL of acetonitrile.

HPLC conditions: Symmetry C18 column (Waters), 150 × 4.6 mm; 3.5 μm. Mobile phase: acetonitrile : MiliQ water : formic acid = 90 : 10 : 0.1; flow rate 1 mL/min; DAD detector λ_{max} 230 nm.

Method was validated according to ICH guidelines and following parameters were examined: selectivity, linearity, limit of detection and determination, accuracy, precision and robustness.

The proposed method was successfully applied for determination of mitotane and its metabolites in plasma, erythrocytes and urine.

This work was supported through a grant (Investigation of new methods in analysis of drugs and bioactives substances, no. 006-0061117-1240) from the Ministry of Science, Education and Sports of the Republic of Croatia.

Sekcija: Kemija u poljoprivredi i šumarstvu

Topic: Chemistry in agriculture and forestry

DEVELOPMENT OF RUBBER BOOTS FOR FORESTRY WORKERS
(for the work with hand-held chain saws)

RAZVOJ GUMENE ČIZME ZA ŠUMARSKE RADNIKE
(otporne na prorezivanje lančanom motornom pilom)

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In last few years, in production of whole-rubber shoes, much attention is being focused on development of protective shoes. In addition to classic men worker, hunter, fishermen boots, women civil boots, strapped soft soled footwear and galoshes, rubber companies are increasingly focusing on development of protective shoes which must conform to very strict requests.
In that group is, indeed, rubber boot for forestry workers made by confection and vulcanization process in vulcanization boiler, which, like other whole-rubber shoes, provides protection from standard mechanical and atmospheric influences, protection from leaking, as well as against slipping of sole – so-called "anti-slip feature".
Due to its special components during confection which are:
aramid fabric or layered rubber-textile protection (PES textile "sandwich" + rubber reinforcement) in region of instep and lower leg, they protect the leg from cutting with chain of motor saw.
Chain of motor saw is stopped by following principles:

1) Chain slipping, due to material resistance to cutting;
2) Entering of fiber in slide (guideline) of chain and drive wheel;
3) Chain stopping by strong fibers and resistance of layered materials which decrease the speed and take over kinetic energy;
4) Steel toe cap in toe region protects toes from shock (hit) and crumple, and provides prescribed height after shock effect of 200 J and pressure of 10 kN;
5) Steel insole obstructs foot injury by rugged object on the ground (stones, glass,…);
6) 5 mm thick soft sponge with elliptical surface of 25 cm^2 protects the ankle from the shock (hit) and is built into the boot on in- and outside.

During our development, in the first stage boot with level II of protection from chain speed of 25 m/s was manufactured. With further development of technology, using PES textile "sandwich" and thicker rubber layer in region of the instep and lower leg, we manufactured boot with level III of protection from chain speed of 28 m/s.
During manufacturing of forestry boot following standards: EN/ISO 20344/04, EN/ISO 20345/04 and EN/ISO 17249/04 were applied.
Authorized and accredited institution "Euroinspect-eurotekstil d.o.o.", Zagreb issued us Certificate of tested and reached requested characteristics.
The above mentioned model of rubber boot we produce for domestic market, esp. for "Croatian forests" and successfully export on French and German market.

INFLUENCE OF MAIZE GENOTYPES ON THE PRODUCTION OF DON AND FUMONISIN

UTJECAJ GENOTIPA KUKURUZA NA PRODUKCIJU DON-A I FUMONIZINA

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The economic importance of maize cultivation in the world is huge as well as in Croatia. The reason is the largest yield potential compared to other cereals. High fertile line hybrids of maize have a high genetic yield potential that are under an influence of a number of factors, including the pathogens of diseases, especially *Fusarium* species. Many *Fusarium* species are capable of producing different mycotoxins, whereat one *Fusarium* species can synthesize different types of toxins, or different *Fusarium* species can synthesize the same type of mycotoxin (Eskola, 2002). The conducted research in this paper is focused on the quantity determination of deoxynivalenol (DON) and on the total fumonisins in the maize grain of domestic and Canadian genotypes, artificially infected with selected highly pathogenic isolates of *Fusarium graminearum* and *Fusarium verticillioides*. Taking into account that *F. graminearum* is the most important producer of DON and that the *F. verticillioides* is the most important producer of fumonisin and that the amount of produced toxins can be an indicator of the susceptibility to the cob maize rot, we determined the amount of those mycotoxins in the grains by using immunochemical methods of the determination of mycotoxins (ELISA). From a total of 288 isolates of *Fusarium spp*. three dominant *Fusarium* species were isolated: *F. graminearum, F. verticillioides* and *F. subglutinans*, of which the most pathogen isolates were performed the artificial infection of different maize lines in order to test their susceptibility to the cob maize rot. The presence and the intensity of symptoms of rot is not necessarily an indicator of toxin produced. Our study has identified a significant positive correlation between the index of the cob maize rot infection after artificial infection with *F. graminearum* and *F. verticillioides* and quantity of produced DON and total fumonisins.

EFFECT OF NATURAL ZEOLITE ON TOTAL NITROGEN CONCENTRATION IN PIG SLURRY

UTJECAJ PRIRODNOG ZEOLITA NA KONCENTRACIJU UKUPNOG DUŠIKA U TEKUĆEM GNOJU SVINJA

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Intensive pig production results in the rising of a large amount of manure, which among others nutrients contains potentially environmentally dangeorus nitrogen content. The aim of the study was to determine the effect of natural zeolite, mineral with high internal surface area and high cation exchange capacities, on total nitrogen concentration in the pig slurry. The study was carried out in intensive pig farm in 3 equal fattening units, each with 350 animals on an average, during final 2 months of the pig fattening. Unit 1 served as a control. In unit 2 the commercial preparation, a natural zeolite, with 80% of clinoptilolite, was added at the animal feed mix. In unit 3 the commercial preparation, a natural zeolite, also with 80% of clinoptilolite was daily uniformly spread over the partially slatted floor of the fattening unit. Slurry samples were collected every 10th day during investigated period. Total nitrogen was determined using standard laboratory methods. Study results demonstrated the total nitrogen concentration to be lower in both experimental units as compared with the control unit. Also, the total nitrogen concentration was lower in the unit 3 in relation with the unit 2.

keywords: zeolite, slurry, total nitrogen, fattening pigs

Sekcija: Zaštita okoliša

Topic: Environmental protection

INFLUENCE OF SODIUM DODECYL SULFATE (SDS) AND TRITONE X-100 ON THE FORMATION OF STRUVITE, $MgNH_4PO_4 \cdot 6H_2O$

UTJECAJ NATRIJ DODECIL SULFATA (SDS) I TRITONA X-100 NA NASTAJANJE STRUVITA, $MgNH_4PO_4 \cdot 6H_2O$

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Struvite has a number of potential application (naturally mineral guano, it is present in waste, as a scale deposit in pipe and infective stones). Waste which has formed in municipal waste can be dangerous to the human population and the environment, therefore wastewaters must be properly treated before their recovery. The sludge contains increased concentration of the NH_4^+, PO_4^{3-} and Mg^{2+} ions which under certain conditions may lead to the formation of struvite. Detergents may be found in the sludge, while in the wastewaters anionic and nonionic surfactants are more frequently found. The aim of this investigation was to study the influence of the surfactants to the formation of the struvite.

In this work the influence of different concentration $c(\text{cmc}) \leq c(\text{SAA}) \leq c(\text{cmc})$ of an anionic (SDS) and nonionic (Triton X-100) surfactant, on the spontaneous precipitaion of the struvite in the system with initial reactants concentrations $c(PO_4)_i = c(NH_4)_i = 2 \cdot 10^{-2}$ and $c(Mg)_i = 1 \cdot 10^{-3}$ mol dm^{-3}, at $pH_i =$ 8.5 and 25 ºC was investigated. The reaction was continously monitored by pH measurements, while the crystals were identifed by light microscopy. The solid phase composition was determined by thermogravimetric (TG) analysis and FT-IR spectroscopy.

The results in the system without and with different surfactants concentrations were compared.

MONITORING OF SURFACE WATER QUALITY IN BRČKO DISTRICT

MONITORING KVALITETE POVRŠINSKIH VODA U BRČKO DISTIKTU

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Since rivers play the major role in assimilation or carrying off the municipal and industrial wastewater and runoff from agricultural land, it is necessary to prevent and control the rivers pollution and have reliable information on water quality. Physicochemical determination of pollutants in the Sava River and its tributaries, Tinja and Brka, were conducted in Brčko District during 2008 and 2009. The obtained results showed that investigated river waters do not fulfill requirements for the second class of surface waters, since the average value of COD, ammonium, total solids dried at 105 °C, phosphorus compounds, the consumption of $KMnO_4$ and the coliform bacteria exceed the limit values for this category. Referring to the high level of coliform bacteria, the water of tributaries Tinja and Brka was classified as the class III, while the samples from the Sava River were on the border between the classes IV-V. The concentration of heavy metals in all samples was below the limit values of water quality of the class II, except for the iron concentration in the analyzed water from the Brka River. In addition, these results underlined the importance that physicochemical analyses of pollutants should be carried out constantly in the Sava River and its tributaries.

keywords: surface water, water quality class, pollutant

ASSESSMENT OF IRON AND MANGANESE CONTENT IN GROUNDWATERS FROM BRČKO DISTRICT DURING FIVE YEARS

PROCJENA SADRŽAJA ŽELJEZA I MANGANA U PODZEMNIM VODAMA BRČKO DISTRIKTA TIJEKOM PET GODINA

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Iron and manganese, essential minerals for human health at low concentrations, are commonly found in groundwaters. Their occurrence and concentrations in groundwater sources are controlled by many factors such as rock geochemistry, water chemistry and microbiological activity. This work was focused on the assessment of groundwaters quality from Brčko District BiH according to the content of these elements. The samples were collected from 61 groundwater sources (1580 samples) during five years (2004 – 2008) in clean polyethylene bottles. The concentrations of Fe and Mn in the investigated groundwaters were determined by flame atomic absorption spectrometry (FAAS). Our investigation showed that the range of iron concentrations in the analyzed waters was found to be rather wide (0.017 – 1.176 mg/L) and the average value was 0.203 mg/L, while median was 0.119 mg/L. The manganese content in the investigated samples of groundwaters was between 0.004 to 0.449 mg/L (the average value: 0.115 mg/L and median: 0.104 mg/L). To sum up, the obtained data provide evidence that the content of these metals in the studied groundwater supplies exceed the WHO limits. Furthermore, the analysis of groundwater chemistry data has shown that the undesirable Fe and Mn concentrations are a problem in groundwaters in Brčko District.

THE CHARACTERIZATION OF GROUNDWATERS FROM BRČKO DISTRIKT ACCORDING TO THE CHEMICAL COEFFICIENTS

KARAKTERIZACIJA PODZEMNIH VODA BRČKO DISTRIKTA NA TEMELJU KEMIJSKIH KOEFICIJENATA

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Groundwater is the main source used for drinking, irrigation and industrial purposes, and the evaluation of the groundwater quality is a relevant part of its safe usage. This work was focused on the characterization of groundwaters from Brčko Distrikt according to the chemical content and coefficients, which represent the ratios between water ingredients. The analysis of these compounds in 61 groundwater sources was conducted between 2004-2008, while the total hardness (Ca+Mg), Ca/Mg_{eq} ratio, SO_4^{2-}/Cl^-_{eq} ratio, corrosion coefficient (K_1) and sodium absorption ratio (SAR) were calculated. It was observed that the total hardness in the analyzed samples, expressed as mg/L $CaCO_3$, ranged from 67.88 to 378.58 (mean value: 182.09; median: 159.74), while the SO_4^{2-}/Cl^-_{eq} ratio was 0.14-5.98 (mean value: 1.50; median: 1.29). Furthermore, SAR varied in the investigated waters from 0.16 to 11.77, K_1 was lower than 0.2 and analyzed samples did not significantly mineralize (<500 mg/L minerals). According to the results of this study, the groundwaters of Brčko Distrikt could be classified as moderately hard water, calcium bicarbonate and chloride type, and non-corrosive. According to SAR 68.85% of all studied groundwaters belong to the class 0 and the class I (SAR <6), which makes this water source suitable for irrigation.

EVALUATION OF WATER QUALITY IN BRČKO DISTRICT BY WATER QUALITY INDEX

OCJENA KVALITETE VODA U BRČKO DISTRIKTU INDEKSOM KVALITETE VODE

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The scope of the present study was to evaluate the quality of groundwater resources in Brčko District, based on Water Quality Index (WQI). During the five years period (2004-2008) different measurements of various indicators of the water quality were conducted on 61 groundwater sources. The obtained results of nine different selected indicators (dissolved oxygen, total coliform bacteria (MPN coli/100 ml), pH, biochemical oxygen demand, temperature, total phosphate, nitrates, turbidity and mineralization) have been used for the WQI calculation in this region. The quality of the investigated waters represented by the median of all medium values WQI from all locations on the yearly level shows the constant quality for the period of research; the category "good" (WQI 73-84) was given. Beside this, the results have indicated that WQI of the mountain of Majevica was constant (81), while the other analyzed groundwaters oscillated in the quality (WQI 73-84). The presented research shows that application of the WQI method may contribute to the complete picture of the groundwater quality condition with the trend analysis and interpretation of results with descriptive quality indicator.

BIODIESEL – RESOURCES OF SLAVONIA & BARANJA

BIODIZEL – POTENCIJALI SLAVONIJE I BARANJE

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Republic of Croatia is on the verge of entering in the EU, which primarily makes certain adjustments, which is manifested in the fulfillment of environmental standards and requirements. Biodiesel as a renewable energy source, which can be manufactured from algae, vegetable oils and animal fats, and is biodegradable. In Croatia, most biodiesel are produced by rapeseeds, a crop which in past three years, has a positive tendency in representation of the cultivable land. It was monitored the trend of production in Croatia, with special emphasis on the production of biodiesel in Slavonia and Baranja. Considering the agroclimatic advantages that Slavonia and Baranja possess, it is possible to better exploit agricultural area, where the culture is grown for biodiesel production, in terms of yield and production thereof.

keywords: biodiesel, rapeseeds, production

DISPOSAL AND TREATMENT OF WASTE WATER IN VINKOVCI

ZBRINJAVANJE I OBRADA OTPADNIH VODA GRADA VINKOVCI

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Globalization, industralization and growing population of people are cause of a significant reduction of clean water on Earth, so many scientists and experts all over the world trying to make industrial processes less harmful to the environment. Such efforts usually involve the application of modern technology solutions in waste water processing. In addition to industry, significant amounts of wastewater and create settlements, where the physical, chemical and biological properties of these waters significantly changed, and the same, without treatment, can not reuse or discharge into the environment.
In the process of Croatian accession to the European Union, one of the most important and most expensive areas of harmonization is just the environment, whereby a significant portion relates to the regulations related to the treatment and disposal of wastewater.
Drainage system and construction of sewerage network in the town of Vinkovci began back in 1957th year, and in May 2005 the new plant was completed with the aim of treatment of municipal wastewater before releasing them into natural recipients - Bosut river. The process of wastewater treatment consists of two stages - mechanical and biological treatment. This paper will give a detailed process overview, while the analysis of the most important parameters will show the efficacy of the wastewater treatment process in Vinkovci town.

keywords: wastewater, primary and secondary treatment processes

LICHENS – BIOINDICATORS OF AIR QUALITY IN THE CITY OF OSIJEK

LIŠAJEVI – BIOINDIKATORI KAKVOĆE ZRAKA U GRADU OSIJEKU

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Lichens are symbiotic organisms between a fungus and a green alga or cyanobacterium.
Numerous studies confirmed lichen sensitivity to atmospheric pollutants. Thus, epiphytic lichens growing on trees are used as bioindicators for the air quality assessment in particular area. Epiphytic lichen flora was surveyed in the period 2004-2005 on seven sites in parks and alleys in the City of Osijek. The samples were collected from trees at a height up to 2 m. A total of 16 species, classified into 14 genera of lichenized fungi, were recorded. Foliose lichens dominates (81 %), followed by crustose (13 %) and fruticose lichens (6 %). The lichens were found growing on 25 tree species, and the most on: linden, maple, black locust, horse chestnut, birch, and plane. According to composition of the lichen flora and distribution of species, the air in the City of Osijek is estimated as medium to moderately polluted. Noticeably lower number of lichens was observed in tree alleys along the frequent city roads. Due to intake of dust and increased on-road emissions of nitrogen compounds, the trees are covered by nitrophilous lichens, resistent to higher eutrophication and tolerant to air pollution. More frequent occurence of fruticose lichens was observed on linden trees in alley along the Drava River, where the traffic impact is lower, and ecological conditions more favourable.

MULTIVARIATE LINEAR REGRESSION MODEL OF POLLUTION INDICATORS OF MUNICIPAL WASTEWATER WIDER AREA OF SPLIT

VIŠEVARIJANTNI LINEARNI MODEL POKAZATELJA ONEČIŠĆENJA KOMUNALNIH OTPADNIH VODA ŠIREG PODRUČJA GRADA SPLITA

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In this paper statistical analysis of measured parameters of pollution indicators of municipal wastewater which discharged into the natural recipient, sea, at locations from the wider area of Split, in the period 2004 to 2009 years was used. Based on the obtained experimental data statistical parameters were determined and multivariate linear regression model of pollution indicators was made.

The implementation of these analyses required the proceedings in the preliminary study for the selection of treatment technologies and making the project of device and a precondition for setting up the complex mathematical models that will enable an effective control and optimize the process of disposal and wastewater treatment. The obtained results show and explain the value movement of pollution indicators in relation to the maximum permissible concentration prescribed in the Regulations as well as some significant correlation of individual variables for a specified period.

Monitoring of the value of pollution indicators showed the constantly higher concentrations of o-phosphate (above 8 mg/L, maximum allowed concentration=1mg/L) and ammonia (above 45 mg/L, MAC=15mg/L) in wastewater. There has been made correlation of discharge parameters with the parameters of the sea analysis where the concentration of o-phosphate has been ranging from 0.021 to 0.036 mg/L.

INFLUENCE OF HEAVY METALS ON GROWTH OF *Legionella spp*. IN WATER SUPPLY SYSTEMS

UTJECAJ TEŠKIH METALA NA RAZVOJ INFEKCIJE IZAZVANE *Legionella spp*. U VODOVODNIM SUSTAVIMA

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This paper investigates the heavy metals content and the presence of *Legionella spp.* in water supply with the purpose of correlating their concentrations with presence of *Legionella spp.* and estimation of the associated public health risks.

Human activities and natural causes influence the formation of the bio-aerosols which when inhaled, create preconditions for infection. Chemical parameters like water hardness, free chlorine and heavy metals contribute to colonization of *Legionella spp*.

Based on the standard methods for detection of *Legionella spp*. and on determinations of heavy metals concentrations one can decide whether previous water treatment process has been successful. Otherwise, further interventions might be required for the protection of the human health. Furthermore this investigation provides the basis for design and subsequent scrutiny of pertinent chemical water treatment technologies.

The measurement of Fe, Mn, Zn, Cu, as well as Ca and Mg concentrations have been performed on samples collected in water supply systems within Split and Dalmatian County area. Their concentrations were determined by AA Spectrometry.

Based on the experimental results, the median of the Fe, Cu and Mn concentrations was found to be twice in the samples containing the *Legionella spp.* compared to other samples.

LABORATORY TESTS ON THE OXIDATION OF ARSENIC IN MODEL SOLUTIONS AND GROUNDWATER

LABORATORIJSKA ISPITIVANJA OKSIDACIJE ARSENA U MODELNIM OTOPINAMA I PODZEMNOJ VODI

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Contamination of water with arsenic is a problem worldwide and despite the availability of conventional methods for arsenic removal from water, efforts are made in order to develop new techniques to reduce costs and improve conventional methods what is necessary for the welfare of the population.
The technological process, which is conducted for the purpose of removing arsenic, has to be harmless compared to the standards for water, efficient, simple and has to achieve minimal residual arsenic content. Considering that As (III) form is very toxic and extremely difficult to remove, the subject of this study was to evaluate the results of different oxidizing agent for oxidation of As (III) to As (V) and to find optimal pH, contact time, as well as rational dosing of necessary chemicals to remove arsenic.
The success of the removal and oxidation of As (III) in the presence of potassium permanganate and Fenton reagent was examined in laboratory experiments on model solutions and groundwater and the best results were yielded with a Fenton reagent in concentrations of 1 mM H_2O_2 and 0.02 mM Fe^{2+}. The most favorable pH values for oxidation of arsenic (III) in the tested model solutions for both, $KMnO_4$ and H_2O_2/Fe^{2+} were 4.5 and 5.5.
This paper tries to contribute to long-term improvement of drinking water quality in the Osijek-Baranja County. Oxidative treatment of groundwater can be used to reduce arsenic toxicity and facilitate its removal from water.

WATER BRINGS LIFE

VODA DONOSI ŽIVOT

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Kopacki Rit area is well-preserved natural mosaic landscape which came under influence of two great rivers Danube and Drava. The parts of the swamp land and water, arranged mosaically as terrain elevations (beams), depression (ponds), lakes and channels, which came as a result of dynamics of flooding and drawdown of water in these two rivers. In order to preserve this natural phenomenon, it should be thoroughly familiar and regularly monitor the state of nature in it. Bearing in mind the importance of water for Kopacki Rit, Public institution independently, but in cooperation with other public or university institutions, constantly monitors the status of water in it, following factors that indicates the state. Abiotic factors are: level of ground and surface water, qualitative composition of surface water, sedimentation and chemical composition of the sediment, air temperature, soil and precipitation. Biotic factors which are constantly monitored are: the status of water birds, nesting of birds of prey and colonial birds, distribution of beaver population, ichthyofauna spatial distribution, frequency and composition of aquatic and wetland habitats. On this occasion. Public Institution will publish the results of monitoring.

THE METHODOLOGY FOR GREENHOUSE GAS EMISSION PROJECTIONS

METODOLOGIJA IZRADE PROJEKCIJA EMISIJA STAKLENIČKIH PLINOVA

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The average temperature of the earth's surface has risen by 0.74 °C since the late 1800s. It is expected to increase by another 1.8 °C to 4 °C by the year 2100, which will cause irreversible climate change. Therefore, it is necessary to undertake activities to reduce the predicted temperature increase. One of the fundamental steps, for each country which signed the Kyoto Protocol, is the development of methodology for greenhouse gases emissions projections. In this work, the development of methodology included three scenarios 'Scenario without measures', 'Scenario with measures' and 'Scenario with additional measures'. Based on past trends and current status of emissions, 'Scenario without measures' has been developed. 'Scenario with measures' included adopted and implemented policies and measures, while 'Scenario with additional measures' included the planned policies and measures. The methodology included three main steps. The first step referred to the collection of data from official publications and databases of relevant ministries and institutions. When creating the methodology within the framework of stage two, demographic, economic, resource, technology and non-climate policies has been taken into account. The third stage included the analysis of each scenario separately as well as comparison of scenarios. For the scenario that has proven to be sustainable, emission trends and key sources analysis has been made.

MONITORING OF NUTRIENTS IN SURFACE WATERS OF MEĐIMURJE COUNTY IN FIVE-YEAR PERIOD (2004–2008)

PRAĆENJE KONCENTRACIJE HRANJIVIH TVARI U POVRŠINSKIM VODAMA MEĐIMURSKE ŽUPANIJE U RAZDOBLJU OD 2004. – 2008. GODINE

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Results of determination of nutrients in surface waters of Međimurje County are showed in this study. Analyses carried out on 21 locations (18 brooks and 3 retentions) in period from 2004 till 2008 year. Except of determination of nutrients which include nitrates, nitrites, ammonium, total nitrogen and total phosphorus, there were carried out analyses of physical-chemical parameters, oxygen regime, heavy metals, organic compounds and some microbiological and biological parameters.

Water quality is defined by Directive of modifications and amendments of water classification directive, (N.N. 137/08). Tested waters were classified according to mentioned directive.

Concentrations of nutrients were determined by methods which are defined by regulation. The most methods are accredited in accordance with standard HRN/EN ISO IEC 17025. That means that methods are validated, they have estimated measurement uncertainty and they are checked by interlaboratory proficiency testing ($-2 \leq z \geq 2$).

Furthermore, during the five-year period values of every parameter were compared between themselves by using statistical tools and software Statistica for Windows 8.0.

ZINC REMOVAL FROM AQUEOUS SOLUTION BY PRECIPITATION AND COAGULATION/ FLOCCULATION

UKLANJANJE CINKA IZ VODENE OTOPINE PRECIPITACIJOM I KOAGULACIJOM/FLOKULACIJOM

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In this study, the precipitation and coagulation/flocculation were applied to remove zinc from aqueous solution. In order to optimise the conditions of their application, we have studied effect of pH and dosage of different coagulants. Experiments were performed using inorganic coagulant $FeCl_3$ and commercial organic polymeric coagulants 815 C and A 130 by standard JAR test procedure. Based on residual zinc concentration in supernatant solutions and settling velocity, the zinc removal efficiency has been determined.

Results show that efficient removal of zinc from aqueous solution can be performed by precipitation at pH=8.5. Coagulants A 130 and 815 C in optimum dose of 0.1 vol% enhanced settling velocity for two times compared to the experiment without coagulant. This is of great importance on the overall costs in practical application. Based on settling characteristic of suspension and Kynch theory, parameters of sedimentation process are calculated for conditions without and with optimal addition of coagulant.

TREATMENT OF THE WASTEWATER FROM WASHING PROCESS SAND FILTERS

OBRADA OTPADNE VODE NASTALE PRANJEM PROCESNIH PJEŠČANIH FILTRA

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In the process of the raw water treatment for the usage in petrochemical industry, one of the most important treatments is a process of filtration with the process sand filters. During the filtration process of the raw water besides of the treated raw water the product is also and wastewater. Wastewater resulting from the technological process of washing process sand filters. Wastewater resulting from the technological process of washing process sand filter is unsuitable for the further use, since it is contaminated with residual suspended matter and chemical compounds that are added in the process of the raw water clarification. To reduce the environmental impact of such discharge of waste water and to improve overall system processing of raw water, this paper presents the technological treatment of wastewater from washing process sand filters. Selected technological process with subsequent sedimentation of wastewater enables the full utilization of its returning back into the process stream. This paper also present a wastewater treatment system which consists of accepting sedimentation tank, pumps, pipelines and flocculator for the final acceptance of the wastewater. The treatment system of wastewater from washing process sand filters includes the wastewater from washing sand filters for the filtration of the clarified water after the process of clarification of the raw water, sand filters for the filtration of the cooling water and sand filters for filtration of clarified water prior to processing by ion decarbonisation. The overall technological process is efficiently sized to fully automatized process control. By the treatment of the wastewater from the washing of process sand filters are successfully continuously returned to the processing flow in the volume range of the wastewater from 80 m^3h^{-1} to 85 m^3h^{-1}.

keywords: filtration, sand filters, wastewater treatment

Susret mladih kemičara

Meeting of young chemists

ŽVAKAĆA GUMA I POLIMERI

Ljiljana Bečvardi, Mirjana Drakulić

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Žvakaća se guma sastoji od polimera kao gumi-baze i dodataka (šećeri, boje, arome, stabilizatori i dr.). Polimeri su visoko molekularne tvari građene od različitih molekula. Prema podrijetlu mogu biti prirodni i sintetski, različite strukture (ravnolančani i razgranati) što utječe na njihova svojstva.

Za izradbu žvakaćih guma prvo su rabljeni prirodni polimeri, prirodni kaučuk dobiven iz drveta Manilkara chicle. Danas se rabe mješavine prirodnih i sintetičkih polimera.

U radu je ispitivano koji su mogući polimeri u žvakaćoj gumi Hubba Bubba proizvođača Wrigley s okusom šumskog voća. Ispitivanje je provedeno depolimerizacijom, testovima gorenja, kemijskim analizama, te bubrenjem. Rezultatio analiza su pokazali da u sastavu gume nalaze se kaučuci, poliizopren, polibutadien i polistirenbutadien.

ŽVAKAĆA GUMA I LIMUNSKA KISELINA

Jelena Brdarić, Mirjana Drakulić

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Limunska kiselina je organska kiselina prisutna u mnogim vrstama voća. Uporaba limunske kiseline kao dodatka prehrambenim proizvodima je široka i raznolika.

Žvakaća se guma sastoji od gumene polimerne baze i dodataka šećera ili sladila, arome, boje i drugih dodataka kao što je limunska kiselina. Ona se u žvakaćoj gumi rabi kao regulator kiselosti i pojačivač okusa. Daje oštar, osvježavajući limunski okus, a pojačava i antioksidacijske učinke.

U radu je određivan udio limunske kiseline u žvakaćoj gumi Hubba Bubba s okusom šumskog voća i s okusom lubenice. Metoda određivanja limunske kiseline je kiselinsko-bazna titracija uz fenolftalein kao indikator.

EKSTRAKCIJA KOFEINA IZ KAVE

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Kofein je alkaloid, stimulans koji se nalazi u sjemenkama kave (*Coffea*). Zrno kave sadrži glikozide, polisaharide, lipide, proteine, antioksidanse, minerale i kofein. Sadržaj kofeina u zrnu kave može biti od 0,8 do 4 % ovisno o vrsti, uvjetima uzgoja, preradi i dr. Prema novijim istraživanjima uporabom umjerene količine kave, dvije do tri šalice kave dnevno (100 – 130 mg kafeina) može se smanjiti rizik od dijabetesa 2, Parkinsonove bolesti, raka debelog crijeva, ciroze jetre, a pomaže kod kontrole astme, glavobolje te poboljšava raspoloženje. Sjeme zelene kave prolazi različite faze tehnološkog procesa obrade u kojima dolazi do kemijskih i fizikalnih promijena.
U radu je provedena ekstrakcija kofeina iz Minas Franckove kave kuhanjem u vodi, a potom iz vodene otopine ekstrakcijom kloroformom.

ODREĐIVANJE NITRITA U SUHOMESNATIM PROIZVODIMA

Koštana Lukić, Đurđevka Pecikozić

Tehnička škola Nikole Tesle Vukovar, Blage Zadre 4, 32010 Vukovar, Hrvatska

Nitriti kalija i natrija se dodaju pri preradi mesa u svrhu razvoja i očuvanja boje, inhibicije mikroorganizama te nastanka karakteristične arome.

U ovom radu provedeno je određivanje sadržaja nitrita spektrofotometrijskom metodom u uzorku paštete, posebne pileće salame i šunke.

Dobiveni rezultati pokazali su da je sadržaj nitrita najviši u posebnoj pilećoj salami, zatim u pašteti, dok je u domaćoj šunki bio zanemarivo mali.

ODREĐIVANJE ŽELJEZA U TLU S HAWAIIA

Nikolina Živković, Đurđevka Pecikozić

Tehnička škola Nikole Tesle Vukovar, Blage Zadre 4, 32010 Vukovar, Hrvatska

Značajke vulkanskog materijala izbačenog iz unutrašnjosti na zemljinu površinu ovise o svojstvima magme iz koje je nastao. Uzorak tla crvenkasto smeđe boje s Hawaiia kvalitativno je analiziran i određeno je da sadrži Fe^{3+} i Al^{3+} iona. Izvršena je spektrofotometrijska analiza kojom je određen sadržaj Fe^{3+} iona i izražen u obliku Fe_2O_3.

Zaostali talog nakon obrade uzorka tla za spektrofotometrijsku analizu je SiO_2^+. Talog je analiziran gravimetrijskom metodom .
Dobiveni rezultati ukazuju da tlo Hawaiiskog otočja pripada tokovima bazaltne lave.

”JUNK FOOD”

Tomislav Zebec, Martina Popić, Marcela Konjevod, Vanja Baketa

Gimnazija Vukovar, Šamac 2, 32000 Vukovar, Hrvatska

Hrana je za čovjeka izvor tvari i energije. Današnji način života dovodi do sve većeg konzumiranja *brze* hrane koja je obično primamljiva i ukusna, ali što je s hranjivom vrijednošću te hrane? Podaci Hrvatskog zavoda za javno zdravstvo pokazuju da se Hrvatska ubraja u ”debele nacije” i zauzima 5. mjesto u Europi. Prekomjerna težina postala je ne samo estetski, nego i ozbiljni zdravstveni problem. Zabrinjavajuća je činjenica da je sve veći broj djece pretilo i s prekomjernom tjelesnom težinom.

U ovom radu istraženo je kako se hrane djeca u jednom vukovarskom vrtiću, osnovnoj i srednjoj školi.

Analiza mjesečnih i tjednih jelovnika vrtića i osnove škole pokazala je da se jelovnik u vrtićima sastavlja u suradnji sa zdravstvenim djelatnikom pri čemu se vodi računa o pravilnoj prehrani, dok osnovnoškolski više nalikuje ”fast foodu”. U Gimnaziji Vukovar proveli smo anketu među učenicima 1. i 4. razreda o njihovoj prehrani.

Rezultate ankete smo tabelarno i grafički obradili. Na osnovu provedenog istraživanja dani su prijedlozi za promjene prehrambenih navika i brige o vlastitom zdravlju (npr. edukacija roditelja, uzgoj eko voća i povrća u našoj školi, više pažnje posvetiti ovom problemu na web stranici škole, ...).

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