Podkarpacki Branch of the Polish Society of Food Technologists

Young Scientific Staff Section of Polish Society of Food Technologists

Food Chemistry Section of the Polish Chemical Society

Faculty of Biology and Agriculture University of Rzeszow

Book of abstracts

FOOD-QUALITY AND PERSPECTIVES

XX CONFERENCE OF YOUNG RESEARCHERS
-IVth INTERNATIONAL SESSION

14 – 15 of May 2015, Rzeszow

XX Scientific Session of the Young Scientific Staff of PTTŻ "Food - Quality and Perspectives", IVth International Session – „Food – Quality and Perspectives" organized in Rzeszow is a continuation of the annual meetings, which are aimed at the presentation of the scientific achievements of PhD students and young researchers as well as exchange of experience among both young and experienced scientific staff from Poland and from abroad.

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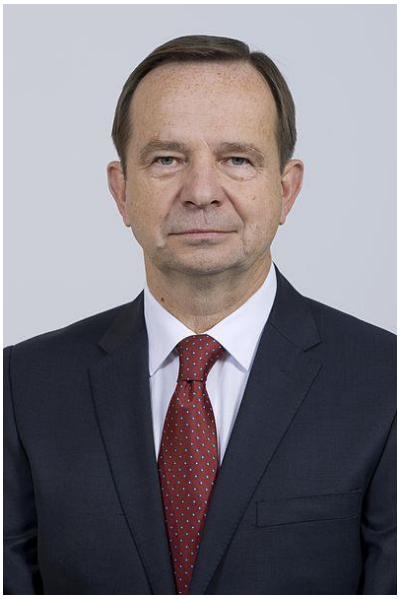

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Conference Program

13.05.2015

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14.05.2015

8.00 – 9.30 Rejestracja/Registration

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Chairpersons: Małgorzata Pawlos and Anton Nagy

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15.05.2015

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Chairpersons: Monika Przeor and Maciej Kluz

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11.50 – 12.00 **Oleksii Lyzak** JEDNOHYBRYDOWY SYSTEM IDENTYFIKACJI MIEJSC WIĄZANIA AKTYWATORA TRANSKRYPCJI SEF1 Z DNA U DROŻDŻY CANDIDA FAMATA ***/ONE-HYBRID SYSTEM FOR IDENTIFICATION OF DNA BINDING SITES OF Sef1 TRANSCRIPTIONAL ACTIVATOR OF Candida famata/***

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MAILLARD REACTION VS. QUALITY AND SAFETY OF FOOD

Zieliński Henryk
Division of Food Science, Institute of Animal Reproduction and Food Research of the Polish Academy of Sciences, Tuwima Street 10, P.O. Box 55,
10-748 Olsztyn, Poland

Processing is essential for producing foods which are microbiologically safe, have increased nutritional quality and reduced levels of potentially toxic compounds. Food processing fits with the European style of life, by increasing the shelf-life of products. In many food items, such as baked or roasted products, thermal treatment is indispensable for determining the specific nutritional and sensory properties, in particular texture, flavor and color.

Recent data have indicated that thermal treatment may induce the formation of health-promoting components however, may also lead to the formation of heat-induced contaminants. Among the various reactions occurring in heated foods, so called Maillard Reaction (MR) has a major role. The reaction's name is a little deceptive, because it's really an umbrella term for a number of reactions that can produce a complex range of products. The French chemist Louis-Camille Maillard was the first who described the reaction between amino acids and sugars in 1912. In 1973, American chemist John E Hodge published a mechanism for the different steps of the MR, categorizing its stages and identifying a range of the different products produced as a result of these. The MR terminates with the formation of brown nitrogenous polymers or melanoidins.

MR in foods is far more complex than in the human body due to: (1) presence of lipid, polyphenolics, vitamins (thiamine, ascorbic acid), metals; (2) range of food processing temperature/time combinations; (3) diversity of water activity and pH. The Maillard Reaction occurs between reducing sugars and amines at high temperatures and produces flavor, color, antioxidant products, toxic products and destroys nutrients (lysine). The desirable cconsequences of the MR in food include desirable flavors, brown color, formation of antioxidants with health-promoting activity: reducing agents, metal chelators, radical scavengers, formation of anticancerogens and antiallergic and antimicrobial compounds. In contrast, loss of protein biological value, darkening, decrease of digestibility and toxicity/mutagenicity are the undesirable cconsequences.

Recent work has provided new insights into the effect of heat processing and the MR on the safety and health promoting aspects of food. MR is also of fundamental importance in the flavour and colour of heat processed foods and beverages. A holistic research approach is needed so that as more knowledge is generated concerning the health impact of MRPs and work on the sensory attributes of the foods that contain them cannot be not forgotten.

Plenary lecture II

LOSSES AND WASTING OF FOOD AND POSSIBILITY OF ITS REDUCTION

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Plenary lecture III

MEAT TECHNOLOGY - ALTERNATIVE SOLUTION FOR MAINTAINING OF THE MEAT COLOR

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GENETIC CONTROL OF RIBOFLAVIN SYNTHESIS AND TRANSPORT IN FLAVINOGENIC YEASTS AND CONSTRUCTION OF THE ROBUST PRODUCERS OF RIBOFLAVIN AND FLAVIN NUCLEOTIDES IN THESE ORGANISMS

Sibirny Andriy A.
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Department of Biotechnology and Microbiology, University of Rzeszow, Cwiklinskiej Street 2, 35-601 Rzeszow, Poland
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Flavinogenic yeasts overproduce riboflavin under conditions of iron deficiency. This group includes pathogenic yeast *Candida albicans*, the most flavinogenic yeast *Candida flareri (C. famata)*, the model organism for studying the regulation of riboflavin synthesis *Pichia guilliermondii*, and some others. Eleven mutations have been identified in the yeast *P. guilliermondii*, which display either constitutive oversynthesis of riboflavin in iron-rich medium (*rib80, rib81, hit1, red1 – red6, yfh1, vma1*), or inversely, are unable to overproduce riboflavin under iron deprivation (*rib83 = sef1, rib84*). Iron deficiency and regulatory mutations cause transcription activation of the structural genes involved in riboflavin synthesis. Mutations leading to riboflavin oversynthesis in iron sufficient media lead to iron overaccumulation and oxidative stress, the last phenomenon apparently being the consequence of the strong drop in activities of catalase and superoxide dismutases. Most of the corresponding regulatory genes, with exception of *YFH1* (yeast frataxin homologue), *VMA1* (vacuolar ATPase) and *SEF1* (putative transcription factor), have not been cloned yet. It was found that point mutations, insertions or deletions in the gene *SEF1* coding for putative transcription factor block riboflavin oversynthesis in the *P. guilliermondii* wild-type strains, regulatory mutants *rib80* and *rib81* with constitutively derepressed riboflavin synthesis and in the *C. famata* industrial riboflavin producer dep8. Inversely, introduction of the additional copies of *SEF1* enhanced capacity of riboflavin production and strongly elevated stability of the strain dep8. The transcriptional regulation of *SEF1* gene in the *C. famata* wild-type and dep8 productive strains was studied.

Stable riboflavin overproducing strain *C. famata* AF-4 was isolated using classic mutagenesis and selection. Metabolic engineering involved introduction in genome of the additional copies of positive regulator *SEF1*, gene *IMH3* coding for IMP dehydrogenase, and two structural genes of riboflavin synthesis *RIB1* and *RIB7* coding for GTP cyclohydrolase and riboflavin synthase, respectively. Resulted strain was much more superior regarding riboflavin oversynthesis as compared to both riboflavin overproducers, dep8 and AF-4. Introduction into AF-4 strain of gene *FMN1* coding for riboflavin kinase, or additionally, gene *FAD1* coding for FAD synthetase, resulted in construction of the yeast strains capable of *de novo* oversynthesis of flavin nucleotides, FMN and FAD.

Riboflavin transport systems in the yeast *P. guilliermondii* were identified; two of them are involved in riboflavin uptake whereas another one is responsible for riboflavin excretion.

NEW METHOD FOR DETERMINING THE FRUIT HARVEST RIPENING (P.406446)

Bajcar Marcin, Saletnik Bogdan, Zardzewiały Miłosz, Drygaś Barbara,
Czernicka Maria, Puchalski Czesław, Zaguła Grzegorz, Zapałowska Anita
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Research about term harvest ripening of the fruit is quite a complicated subject. Several methods for determining the harvest ripening of climacteric fruits such as measurement of firmness, the overall content of the extract, starch content, the rate of respiration, as well as emitted ethylene evaluation. While non-climacterical fruits (not fulfilling the collective maturity phase) are identified as suitable for harvesting by evaluating the coloring. The first three mentioned basic measurement methods can be combined into a single, so-called Streiff index:

$$\frac{firmness\ (N)}{extract\ (\%) \times starch\ index}$$

Each of these characteristics, i.e.: identified starch assay, general extract (including sugars, tannins, vitamins, organic acids, etc.), as well as firmness, which correspond to converted from protopectin - pectin, indicates calorific value. Thus, the correlation between the maturity of the fruit, and the calorific value of the tested material provided a new, innovative evaluation test for harvest ripening fruit.

Sugars and their complex are largely responsible for calorific value of fruits, due to the content of proteins and fats in the dry mass of fruits are negligible. The caloric content of the fruit during ripening decreases as a result of the conversion of the water-insoluble starch into soluble monosaccharides, from 4200 kcal/g to 3750 kcal/g, respectively.

IDENTIFICATON OF MICROBIOTA AND PHYSICAL AND CHEMICAL PROPERTIES OF MEAD

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Mead, known also as a honey wine, is an alcoholic beverage made from diluted honey. Depending on honey-water ratio it can be called *półtorak* (one unit of honey, half unit of water), *dwójniak* (one unit of honey, one unit of water), *trójniak* (one unit of honey, two units of water) and *czwórniak* (one unit of honey, three units of water). Its alcohol content varies from 8% to 18%. For production natural honey of various botanical origin can be used. Although, mead is known and produced for centuries, currently its consumption is very little and it is rather forgotten among customers. Since 2008 it has protected designation of origin by European Union – Traditional Specialities Guaranteed.

New tools for investigating the origin of the product are needed to confirm its authenticity, it is also useful for traceability.

The aim of this study is to verify the hypothesis that origin of the product can be determined by microorganisms that are presented in product or by its physicochemical properties. Currently, there are no publications concerning correlation between microbiota and physicochemical properties.

HPLC-MS and electrophoresis were used to obtain fingerprint of every sample. The results were analyzed using chemometric methods, such as PCA (Principal Component Analysis).

Preliminary results show that this method can distinguish the samples not only by sugar content but also by origin.

PHYSICAL STABILITY OF FAT EMULSIONS STABILIZED BY CONCENTRATE OF PEA PROTEIN

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Plant proteins could be an alternative to replace animal proteins which is extensively used in food, pharmaceutical, and cosmetic products. Particularly, seed storage proteins could take up this function because of their emulsifying, film-forming and gelling properties. The most extensively studied plant protein for its functional properties is soy protein. However, the use of storage proteins of pea seeds in the food industry for the formulation of new food products is very interesting because of their free-GMO characteristic and good functional properties.

The aim of the study was determining the possibility of using pea protein as a stabilizer in high-fat emulsion used in the preparation of the microencapsulated fat powders. This study investigated the effect of fat type and carbohydrate component on droplet size distributions and stability of o/w emulsions with the addition of pea protein.

The material consisted of 8 kinds of o / w emulsion characterized by a dry matter content of 30%, and participation of the following components: pea protein concentrate - 2.2%, fat: canola or palm oil – 15.8% carbohydrate component: resistant maltodextrin, trehalose, polydextrose or oligofructose - 12%. Pre-emulsions were obtained by a rotor-stator system (Ultra-turrax IKA T18 Basic, Wilmington, USA). Emulsions were prepared in a high pressure homogenizer (Panda 2K; Niro Soavi, Italy). The stability of emulsions was determined with a Turbiscan Lab® Expert apparatus (Turbiscan Lab, Formulaction). A laser light diffraction instrument (CILAS 1190, France) was used for determination of oil droplet size of emulsions.

Pressure variant 60/20 MPa applied in two-stage homogenization enabled achieving satisfactorily small sizes of fat globules (< 10 μm) that ensured physical stability of emulsions, regardless of the type of fat and carbohydrate component. Homogeneity of all emulsions in terms of droplet size distribution did not change significantly during 4 days of storage, and thus there was no coalescence of oil droplets. Emulsions containing oligofructose characterized by the largest particles, regardless of the type of fat.

SELECTED RHEOLOGICAL PROPERTIES OF PEA PROTEIN - FAT EMULSIONS

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The main factors that affect emulsion viscosity include: degree of emulsion dispersion (usually fine-dispersion emulsions exhibit higher viscosity than coarse-dispersion emulsions), viscosity of individual phases of emulsion, and emulsion lifetime. High viscosity of the outer phase has a positive impact on emulsion stability. The latter is also increased by a small difference in density between phases and small size of droplets. Depending on the structure and content of the inner phase, the emulsion system may display the character of both Newtonian fluids or shear-thinning fluids, and viscoplastic or even viscoelastic systems.

Aim of the study was to determine the influence of the type of fat and carbohydrate component on the selected rheological properties of the emulsions stabilized by pea protein.

The material consisted of 12 kinds of o / w emulsion characterized by a dry matter content of 30%, and participation of the following components: 1) pea protein concentrate - 2.2%, 2) fat canola, palm oil or canola – palm fat – 15.8%, 3) carbohydrate component: resistant maltodextrin, trehalose, polydextrose or oligofructose - 12%. Pre-emulsions were obtained by a rotor-stator system (Ultra-turrax IKA T18 Basic, Wilmington, USA). Emulsions were prepared in a high pressure homogenizer (Panda 2K; Niro Soavi, Italy). Rheological measurements were carried out with a Brookfield DV-III V3.3 RV rotary viscometer (U.S.A.) at a temperature of 20 and 50 ^{o}C.

Investigated emulsions were shear-thinning non-Newtonian fluids in the examined range of shear rates regardless of the temperature. Type of fat and carbohydrate component affected the rheological properties of investigated emulsions. The highest apparent viscosity exhibited emulsions with the addition of canola fat and oligofructose as well as emulsions with palm fat or palm – canola fat and trehalose. The values of the flow behavior index n of investigated emulsions contained between 0.32 - 0.47, and higher values of the consistency coefficient K are received for emulsion with canola fat.

MINERAL-BINDING PEPTIDES OBTAINED BY ENZYMATIC HYDROLYSIS OF FOOD-DERIVED PROTEINS

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In recent years, many researchers were focused on obtaining functional peptides released by enzymatic hydrolysis of proteins. These peptides might exert antimicrobial, antioxidative, opioid, antihypertensive and immunomodulatory activities. Hydrolysis has been confirmed to improve biofunctionality, with the extent depending on the type of protease, type of substrate and hydrolysis time. The most popular enzymes used in the process are: pepsin, trypsin, chymotrypsin and enzymes derived from microorganisms or plants. An interesting bioactive trait of peptides is their ability to act as a chelating agents for iron, copper, zinc ions etc. Protein based mineral chelates may be an attractive alternative to dietary supplements because of their higher bioavailability, increased absorption and stability. Poor iron absorption from diet makes it necessary to introduce iron-fortified food sources. Reports usually describe the production of chelating peptides through the hydrolysis of milk proteins, particularly casein isolated from bovine, sheep or goat milk. Apart from casein, researchers are interested in various other food proteins as substrates for enzymatic hydrolysis. An increasing number of reports describe bioactive peptides released from many animal and plant proteins. Peptides obtained from sesame, shrimp, pulses (like: chickpea, Adzuki bean, soybean), beef, whey, sunflower, Allasca Pollock fish or porcine blood plasma proteins were found to possess mineral-binding properties. These peptides are also promising in prevention of diseases such as osteoporosis or anemia caused by deficiency of metals in human organism.

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EFFECT OF ETHANOL CONCENTRATION, EXTRACTION TIME AND TEMPERATURE ON THE RECOVERY OF PHENOLIC COMPOUNDS AND ANTIOXIDANT CAPACITY OF EXTRACTS FROM *ROSA RUGOSA* PETALS

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Roses belong to famous medicinal plants used in Polish folk medicine and pharmaceutical industry. Numerous phytochemical analyses demonstrated that they are a potential source of number of valuable substances with pharmacological properties. Interesting sources of valuable components are also rose petals which according to literature data contain numerous flavonoids (e.g. kaempferol, myricetin, quercetin glycosides), anthocyanins, carotenoids, essential oils, phenolic acids (e.g. gallic acid) and tannins. In order to extract all active substances from raw material it is compulsory to apply alcohol of appropriate concentration as well as to conduct the process of extraction within particular time.

The aim of the work was to determine the effect of the concentration of the solvent and process temperature on the content of phenolic compounds and antioxidant potential of received extracts. The scope of the work included the production of alcohol extracts from rose petals with the use of alcohol of various concentrations and different temperatures of process conduction.

The material constituted petals of *Rosa rugosa*, which were lyophilized and blended until the form of a powder was achieved. In order to receive the extract of phenolic compounds, the lyophilizes state was blended in the proportion of 1:10 with ethyl alcohol of different concentrations (25-95% *v/v)*. The whole was shaken in water bath in particular temperature (25-65^{o}C) by the constant amplitude. In planned experiments, the total time of extraction amounted to 60 min. In received extracts the basic chemical composition was determined, the content of total polyphenols (Folin-Ciocalteu's method) and antioxidative capacity with the use of DPPH radicals.

It has been stated that the concentration of ethanol as well as time and temperature of extraction have effect on the content of determined components in analyzed extracts. The application of the alcohol concentrations of 40% and 65% improved the effectiveness of extraction of phenolic compounds, whereas the extraction made with the use of 95% alcohol was less effective for these compounds. On the basis of obtained test results, it has been demonstrated that regardless of the concentration of alcohol and temperature, the process of extraction should last up to 10 min. The extension of the time of extraction up to 60 min was causing essential losses in the content of total polyphenols and deterioration of the antioxidant capacity of the extract.

A METHOD TO INCREASE THE STORAGE SUSTAINABILITY OF AMERICAN BLUEBERRY USING OZONE ATMOSPHERE

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American blueberry is becoming more and more popular among Polish growers, which in recent years resulted in an increase of the areas of this fruit plantation. However, the profit from production is closely linked with the period when the fruit quality during the storage can be maintained. Therefore, it is necessary to search for new, yet completely safe methods of storage, that do not cause an adverse effect on the quality of this precious fruit.

The aim of this study was to develop a method that utilizes the detoxifying properties of ozone to extend the storage time of blueberries *Vaccinium corymbosum L.* during cold storage.

The research material was obtained from plantations in the area of Raniżów in Subcarpathian province (southern Poland) on July. The prepackaged fruit were placed in two storage chambers. The experiment was carried on for 4 weeks in conditions of cold storage (4°C). Two test samples and two control samples were evaluated. The test samples were subjected to an air and ozone stream using an Korona 02/10 generator, ozone concentration was maintained at 8-10 ppm and the gas flow was 18 dm^3 / min for 30 minutes. The procedure was repeated every 12 hours, whereas the control sample was not treated with ozone. For the analysis only healthy fruit without visible signs of disease were selected. During the experiment, parameters such as sugar content, the degree of infestation of fruits by anthracnose and gray mold and mass losses were analyzed.

It has been found that the storage in ozone enriched atmosphere results in a complete elimination of gray mold and causes reduction of the total infestation by almost 50%. In addition, no negative impact of the ozone at the dosage used during the experiment on the stored material was observed. Moreover, the proposed method of cyclic ozonation is much more effective than single ozonation before submiting to storage and generates lower costs than continuous ozonation.

ANTIFUNGAL ACTIVITY OF THYME AND CLOVE ESSENTIAL OILS AGAINST TWO SPECIES OF THE BLACK *ASPERGILLI*

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Aspergillus niger, the most important member of *Aspergillus* subgenus *Circumdati* section *Nigri*, is primarily a plant pathogenic fungi responsible for deterioration of stored food material, as well as Aspergillus *tubingensis*, which includes species that morphologically resemble *Aspergillus niger*. Particular interest focused on the potential application of plant essential oils (EOs) and extracts from plants have recently been of great interest. Their possible use as natural additives emerged from a growing tendency to replace synthetic antimicrobial agents with natural ones and due to their antifungal and antibacterial properties.

The aim of this study was to evaluated antifungal activity of thyme and clove essential oils against two species of the black aspergilla: *Aspergillus niger* and *Aspergillus tubingesis* in vapor phase.

In vitro antifungal activity of essential oils against two species of the black aspergilla was evaluated by microatmosphere method and their ability to affect production of mycotoxins by thin-layer chromatography (TLC) method. Each fungus was inoculated in the center on Czapek Yeast Autolysate Agar (CYA) Ø 90 mm dishes. Dishes were incubated for fourteen days at 25 ± 1 °C (three replicates were used for each treatment). Diameters (Ø mm) of the growing colonies were measured at the 3rd, 7th, 11th and 14th day with a ruler. The essential oils able to inhibit each fungus (visible inhibition – non growth of fungus) were used in the following test. The minimum fungicidal concentration (MFC) of the essential oils with the most significant activity was determined by method of graded concentration of oils. Cultivation was carried out the same way as before. Data from both methods were evaluated statistically.

The best result were shown by *Thymus vulgaris* L MFC 10% (10/90; v/v) against *A. Niger* after 11th day of incubation and with MFC 20% (20/80; v/v) against *A. tubingensis* after all days of incubation. After 14 days of incubation with EOs (100%) with control sets, *A. niger* was screened for a production of mycotoxins – ochratoxin A (OTA). Result showed, that *A. niger* is not able to produce OTA. In a conclusion, volatile substances from tested essential oils in this work had a potential antifungal activity against *Aspergillus niger* and *A. tubingensis*, and they should find a practical application in food.

THE INVESTIGATION OF THE POSSIBLE USE OF ONION PREPARATIONS IN BAKING

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Food is being evaluated not only in terms of its nutritional value, but it is also expected to provide vast spectrum of properties. Some plants, such as onion, are very good resource of biologically active compounds, but parts of them are considered inedible waste. In these cases, extraction and microencapsulation might be a very useful method that helps to broaden the spectrum of use of some materials. Bread is a common food among most European countries. It is popular, highly consumed food. Addition of microencapsulated plant extracts may influence its technological properties and provide vast health benefits.

The aim of the study was to determine the effect of microcapsule preparation from onion husk on physico-chemical and organoleptic quality of bread. Additionally, the type of carrier used in microcapsules was judged in the context of efficiency and sensory properties of the final product.

Breads were prepared with wheat flour (type 500 – 0.5% ash content), 1.5% salt, 3% fresh yeast. The amount of additive was 0.4%, calculated taking into account onion husk preparation. The preparation was obtained by extraction with 80% methanol + NaHSO4 (0,1ml/l) and spray drying. Microcapsules with inulin or maltodextrin were acquired by spray drying of aqueous solutions of the onion husk preparation and carrier. The ratio of the preparation to the carrier was 1:3.

Doughs were kneaded in farinograph kneader until consistency of 300 FU was obtained. Doughs were bulk fermented and degassed twice after 60 and 90 minutes. Proofing took about 45 minutes. Doughs were divided after second degassing – the weight of pieces varied around 72 grams. Baking took 20 minutes at 230ºC. Breads mass and volume were determined. Hedonic sensory evaluation was carried out. Antioxidant activity was determined by ABTS, FRAP, DPPH methods. Total polyphenol content by Folin-Ciocalteu method was measured.

The addition of onion husk preparation, regardless of the form, changed the organoleptic properties of breads and their colour. The enriched bread was assessed organoleptically better than wheat bread, except for the aroma and taste parameters. Enriched breads were darker and had different colour than control bread. The addition of preparations influenced antioxidant activity. The use of onion husk preparation (regardless of the type) in baking, influences both technological and organoleptic properties of bread. It also highly increases breads' antioxidant activity, which is desired.

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COLOUR CHANGES DURING OSMOTIC DEHYDRATION OF APPLE TISSUE USING SUCROSE AND CONCENTRATED CHOKEBERRY JUICE AS OSMOTIC AGENTS

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Osmotic dehydration is one of the popular methods used in food preservation mainly because of its ability to yield sensory and nutritional properties similar to those of fresh fruit and vegetables. The aim of using chokeberry juice as osmotic agent was to enrich the apple tissue in natural nutrients and give attractive colour to the final product. Colour is one of the most important attributes of food products, since it influences the level of consumers' acceptance. Abnormal colours, especially those associated with spoilage or with deterioration in eating quality, cause the product to be rejected by the consumers. Therefore, many food producers try to make use of the psychological effect of colour to enhance their sales.

The aim of this study was to compare the colour of apple tissue osmotically dehydrated in sucrose or concentrated chokeberry juice solutions.

Apple cylinders of 10 mm diameter and 20 mm height were performed in a 60°Brix concentration of osmotic agents using different temperatures of solutions (from 30 to 60°C) and immersion time (from 0.5 to 6.0 h). Commission Internationale d'Eclairage (CIE) colour parameters of osmotic dehydration of apple were determined. A colorimeter was used to take measurement at five different points of each sample. Tristimulus values of $L^*a^*b^*$ were recorded directly from the colorimeter, where L^* value represents lightness, a^* represents redness and b^* represents yellowness. The change of colour was assessed on the basis of the difference saturation (C^*), tone (h^*) and total colour difference (ΔE).

The $L^*a^*b^*$ - values revealed that the colour of apple tissue depended on the type of osmotic agent. The obtained results revealed a decrease in yellowness (b^*) and in lightness (L^*) when temperature of sucrose concentrate was increased. Using concentrated chokeberry juice in the process of osmotic dehydration, as compared to the sucrose solution, resulted in a decrease in both lightness (L^*) and yellowness (b^*) as well as an increase in redness (a^*). Apple tissue osmotically dehydrated in concentrated chokeberry juice showed a significantly higher level of total colour difference (ΔE) than apple dehydrated in sucrose.

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MASS EXCHANGE DURING OSMOTIC DEHYDRATION OF APPLE TISSUE USING SUCROSE AND CONCENTRATED CHOKEBERRY JUICE AS OSMOTIC AGENTS

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Osmotic dehydration is a process which permits to obtain high quality foods with intermediate moisture content. In recent years, due to its potential to yield sensory and nutritional properties similar to those of fresh fruit and vegetables, osmotic dehydration has been used in preservation of these types of food. Thorough knowledge of dehydration kinetics and mass transfer mechanism is very important for understanding and controlling the process of osmotic dehydration and designing high quality osmodehydrated fruit products.

The aim of this study was to compare concentrated chokeberry juice and sucrose as osmotic agents for dehydration of apple tissue. In this study the influence of both solutions on weight reduction (WR), solid gain (SG) and water loss (WL), as well as on water activity and sugar concentration(°Brix) of the obtained extract were analyzed.

Osmotic dehydration of apple cylinders of 10 mm diameter and 20 mm height was performed in a 60°Brix concentration of osmotic agents using different temperatures of solutions (from 45 to 60°C) and immersion time (from 0.5 to 6.0 h) as independent process variables.

Mass transfer kinetics during osmotic dehydration were varied depending on the solution used. As compared to concentrated chokeberry juice using sucrose solution in the process of osmotic dehydration resulted in a higher level of water loss and solids gain. The highest water loss, about 5.4 g H_2O/g i.d.m, was observed in apples dehydrated in sucrose solution at 60°C for 360 min. It was observed that higher temperature of solutions and longer dehydration time, regardless of the type of solution, resulted in bigger changes in water and solids gain as well as higher loss of weight of the apple cylinders. Osmotic dehydration of apple in concentrated chokeberry juice and sucrose solution at 60°C and time extended to 360 min resulted in the largest increment of dry matter, to 0.9 and 1.2 g/g i.d.m., respectively. Chokeberry juice concentrate can be used as a substance to osmotic dehydration of apples. Mass exchange was similar to apples dehydrated in sucrose solution.

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COFFEE WITH CARDAMOM – IMPACT OF PHYTOCHEMICALS INTERACTIONS ON ANTIOXIDANT AND ANTI-*INFLAMMATORY IN VITRO* ACTIVITY

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In recent years, interest in plant- derived food additives has grown. Furthermore, many herbs and spices, usually used to flavor dishes, are an excellent source of phenolic compounds which have been reported to show good antioxidant activity. Cardamom used in this study as a coffee beverage supplements, affects not only its flavor and aroma, but also antioxidant properties of coffee, because is a source of bioactive compounds. Phenolic compounds in plant materials are closely associated with their antioxidant activity. They are also known to play an important role in stabilizing lipid peroxidation and to inhibit various types of oxidizing enzymes.

The aim of this study was to determine whether interactions between bioactive phytochemicals play a crucial role in the creation of the nutraceutical potential of coffee fortified with cardamom, and the importance of interaction with the food matrix and/or changes during simulated gastrointestinal digestion, that could cause significant differences in the relationship between the main bioactive compounds.

All samples: coffee, cardamom and their mixtures of showed abilities to scavenge free radicals and to inhibit lipoxygenase (LOX) activity. Both activities increased after simulated gastrointestinal digestion. In the mixture antiradical phytochemicals showed additive reaction– isoboles adopted the form of line. The water-extractable LOX inhibitors acted synergistically – the isobole curve was „concave". Interestingly, after digestion *in vitro* a slight antagonism in the action of LOX inhibitors and ability to scavenge free radicals was observed. The results show that the food matrix and/or its changes during digestion may play an important role in creating the biological properties.

THE EFFECT OF ULTRASOUND PRE-TREATMENT ON INFRARED-CONVECTIVE DRYING AND SELECTED PROPERTIES OF BEETROOT TISSUE

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Infrared-convective drying is a method of food preserving. It can be combined with ultrasound pre-treatment in order to improve mass and heat transfer during process. Moreover, ultrasound waves can facilitate extraction of food ingredients such as betalains pigments.

The aim of this study was to investigate the effect of ultrasound pre-treatment on the drying kinetics of beetroot tissue. The influence of ultrasound on the colour and betalains content were examined as well.

Beetroot tissue (var. Boro F1) was cut into slices with a diameter of 30 mm and a thickness of 5 mm. Afterwards, material was blanched or submitted to ultrasound with frequency of 21 kHz for 10, 20 and 30 minutes. After pre-treatment the samples were subjected to infrared-convective drying, using 70ºC, air velocity of 1.5 m/s and infrared lamps with power of 7.9 kW/m^2. The colour was examined with CIE L*a*b* system. The betalains content was investigated using a chemical method based on the pigments extraction and spectrophotometric measurement.

Ultrasound waves did not influence significantly on the drying time of beetroot tissue. However, ultrasound pre-treatment affected the substantial changes in the colour of dried beetroot slices. The lightness increased by 23, 31 and 35% for samples treated with ultrasound for 10, 20 and 30 minutes, respectively. The significant decrease of the red and yellow colour participation in relation to untreated material was observed as well. Dried beetroot pre-treated with ultrasound for 10 minutes obtained the substantially higher value of red pigment content by 14.3% in comparison to untreated dried samples. In the case of the yellow pigment, beetroot subjected to ultrasound for 10 and 20 minutes were characterized by significantly higher pigments content.

THE INFLUENCE OF ULTRASOUND WAVES ON BEETROOT TISSUE PROPERTIES

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Ultrasound application is very promising technique of pre-treatment in food technology due to its low heating effect. This method causes reduction of initial water content and modifies structure of vegetable tissue and, because of its non-thermal character, ultrasound waves can improve the quality of raw and dried materials.

The purpose of this work was to investigate the influence of ultrasound waves on selected properties of raw beetroot tissue. The mass changes, dry matter content and betalains content after ultrasound treatment were examined.

The experimental material was beetroot (var. Boro F1), which was cut into slices (diameter of 30 mm, thickness of 5 mm) and then blanched or subjected to ultrasound with frequency of 21 kHz for 10, 20 and 30 minutes. The dry matter content was investigated according to Polish norm, while the betalains content was examined using pigment extraction with a phosphate buffer (pH 6.5) and spectrophotometric measurement at the wavelength of 476, 538 and 600 nm.

The use of ultrasound caused the mass gain, while the blanching influenced on the weight loss of beetroot tissue. Ultrasound treatment significantly affected the decrease of dry matter content by 5-11% in relation to untreated samples. Moreover, the ultrasonic waves caused changes in the betalain pigments content. In comparison to untreated material the betalains content in beetroot treated with ultrasound for 20 minutes was substantially higher by 35 and 15% for the red and the yellow pigment, respectively. It may indicate that ultrasound waves facilitate pigment extraction from beetroot tissue.

EFFECT OF DIETARY SUPPLEMENTATION WITH RASPBERRY SEED OIL ON LIVER FUNCTIONS, INFLAMMATORY STATE AND LIPID METABOLISM IN RATS

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Raspberries are a rich source of nutrients and bioactive compounds that may beneficially affect human health. Most of raspberry-related studies have been focused thus far on the health effects of its juice and polyphenol extracts. During raspberry processing, however, many valuable compounds are wasted. For example, pomace and seeds are usually considered waste, but these components may be useful for nutritional purposes. Raspberry seeds contain approximately 23% of oil that is abundant in essential fatty acids. There is still a lack of nutritional experiments to assess potential benefits from the incorporation of raspberry seed oil into diets. Therefore, the aim of this study was to examine the effects of dietary supplementation with raspberry seed oil on the liver functions, inflammatory response, antioxidant status and lipid metabolism of healthy rats and rats with disorders induced by a high-fat and low-fiber diet.

Male Wistar rats were allocated to 4 groups of 8 animals each. Group C was fed a control diet that contained 7% lard, 1% rapeseed oil and 5% cellulose as the source of dietary fiber. Group HF was fed a high-fat/low-fiber diet that contained 22% fat, 0.5% cholesterol and 2% cellulose. The C+RO and HF+RO groups were fed the control and high-fat/low-fiber diet, respectively, containing 7% raspberry seed oil (RO), which was added in place of a proportion of lard. The RO was rich in linoleic and α-linolenic acids.

The RO supplementation decreased hepatic fat accumulation (30.1 vs. 23.3%; $P \leq 0.05$) as well as the plasma alanine and aspartate transaminase activities (43.4 and 157 vs. 25.6 and 115 U/L, respectively; $P \leq 0.02$), and it increased the hepatic glutathione to glutathione disulfide ratio (6.2 vs. 7.25 μmol/g; $P \leq 0.05$). In the blood plasma, dietary RO decreased the triglyceride concentration (2.07 vs. 0.99 mmol/L; $P=0.02$) and the atherogenic index value (0.250 vs. -0.062; $P=0.003$) in addition to the C-reactive protein and tumor necrosis factor-α concentrations (0.765 and 131.8 vs. 0.088 pg/mL and 86.5 ng/mL, respectively; $P \leq 0.05$). To conclude, raspberry seed oil improves lipid metabolism, reduces low-grade systemic inflammation and improves liver functions, however the extent of these beneficial effects may be less when the oil is supplemented with an unbalanced diet.

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THE EFFECT OF MARE'S MILK ON INTESTINAL PARAMETERS OF ALLERGIC OUTCOMES

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There are data indicated that mare's milk can be regarded as a good substitute of cow's milk in most children with severe IgE-mediated cow's milk allergy. Mare's milk could be considered as a one of the potential candidate for the creation a hypoallergenic formula, due to the fact that the homology between main cow's milk and mare's milk proteins is relatively low to other animal milks.

The present study was undertaken to investigate the role of mare's milk on modulation of intestinal parameters of allergic outcomes of BALB/c mice. The animals were evaluated immunologically in terms of both T helper type 1 (TNF-α) and T helper type 2 (IL-4) specific cytokines, inflammation process (MCP-1).

The BALB/c mice were randomly divided into four groups (*n*=8/group). Mice were given intra-peritoneal injections with mixture of β-lactoglobulin, α-casein and aluminum adjuvant. The mice were fed intragastrically for 23 days with raw mare's milk. Controls were immunized or sham immunized and fed or not with mare's milk. Small intestine was collected for determination of the expression (mRNA) of the inflammatory biomarkers: tumor necrosis factor α superfamily member 2 (TNFα), interleukin (IL)-4, monocyte chemoattractant protein 1 (MCP-1) with reverse transcription polymerase chain reaction (RT-PCR) method and gel electrophoresis.

Intestine is incessantly exposed to dietary antigens, which are need to be tolerated by the innate and adaptive immune systems to maintain homeostasis. Both sensitized group of animals and not sensitized group treated with mare's milk showed significant increased level of MCP-1 mRNA expression in comparison to not sensitized control group. The results indicated that any treatment did not influence on IL-4 expression in intestine. The TNF-α expression, which is a potent proinflamatory cytokine that induces intestinal permeability by altering the tight junctions between epithelial cells, was not modulated by mare's milk.

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ANTIBACTERIAL AND BACTERIOSTATIC PROPERTIES OF MARE'S AND COW'S MILK ON GROWTH OF SELECTED FECAL BACTERIA

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The similarity of mare's milk to breast milk makes it an interesting component of dairy beverages. Milk proteins composed of essential amino acids and important proteins have a function as an antimicrobial and immunomodulator. It was shown that the antimicrobial activity in mare's milk has the potential to protect against diseases as subclinical mastitis. Mare's milk contains a higher amount of lysozyme and lactoferrin than cow's milk.

The aim of the study was comparison the mare's and cow's milk in aspect of antibacterial and bacteriostatic potential on growth of selected fecal bacteria. The milks from cows and mares were obtained within 2-3 hours after milking. To assess the potential bacteriostatic and bactericidal properties of milks components, the growth of *Escherichia coli 30083, Enterococcus faecalis L, Enterococcus faecium T-208* on both milks was studied with two methods. Agar diffusion assay with cork borer was carried out. MacConkey Agar (212123, Merck) was used to assess the total number of E. coli. KEA (105222, Merck) was used to assess the total number of Enterococci. Petri dishes with bacteria (dilutions 10^{-2}, 10^{-3} ,10^{-4} ,10^{-5}) and milks in wholes (1 mL) were incubated 37ºC/24h. The border of wholes were analyzed. The submerged culture method was carried out. Mare's, cow's and hydrolyzed cow's milk as a control were inoculated with each strain of bacteria separately (10^4 CFU/mL) and incubated 37ºC/19h and 42h. After incubation the colonies were counted. The pH of the milk samples was measured electrometrically with pH meter.

The growth of examined bacteria on mare's and cow's milk were weaker than on hydrolyzed milk. The growth of *E. coli* and *E. faecium* on both studied milks was similar. The strain *E. faecalis* showed better growth on mare's milk. Despite the fact that mare's milk contain more antimicrobial compounds the antimicrobial activity of mare's and cow's milk was similar for *Escherichia coli* 30083, *Enterococcus faecalis* L, *Enterococcus faecium* T-208 strains. There were no differences in bacterial growth assessed by agar diffusion assay with cork borer.

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EFFECT OF EXTRACTION METHOD ON TOTAL POLUPHENOLS CONTENT AND ANTIOXIDANT ACTIVITY OF HERBS

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Herbal plants are becoming more and more popular, because of bioactive compounds content, which have precious properties on health. Extracts of the herb can provide valuable material to support on proper functioning of the human body.

The aim of the experiment was to study the effect of extraction methods (water and ethanol) selected herbs on total polyphenols content and antioxidant activity of obtained extracts.

Raw material used for the studies were dried herbs: basil, fenugreek, horsetail, lovage, marshmallow, nettle, rosemary and thyme purchased from the manufacturer. Herbs in powder form, were extracted by water and ethanol. Dry matter content was determined in the dry herbs (by drying method to constant weight), while in herbs extracts the total polyphenols content by Folin-Ciocalteu method and antioxidant activity by the $ABTS^+$, DPPH and FRAP assay were determined.

On the base of the results, significant differences in the antioxidant activity and the amount of extracted total polyphenols according to the method of extraction were found. Higher content of total polyphenols and antioxidant activity were observed using ethanol extraction method. Thyme ethanol extract, was characterized by the highest total polyphenols content (10335 mg GAE/100g), while the lowest-marshmallow (636 mg GAE/100g). After using the water extraction method, in the case of that herbs, total polyphenols content decrease in sequence, three times and twice. On the base of the $ABTS^+$ assay results, in ethanol extracts of herbs higher antioxidant activity was observed from 1.6 (basil) to 13.4 (horsetail) times as compared to water extracts. Also, the FRAP and DPPH assay results confirm the higher antioxidant activity of ethanol extracts of herbs than water extracts.

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THE INFLUENCE OF ROASTING DEGREE AND BREWING METHOD ON PROFILES OF VOLATILE COMPOUNDS OF COFFEE BREWS

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Brewed coffee is one of the most widely consumed beverages in the world. Coffee is appreciated for many attributes such as its stimulating qualities. Its pleasant taste and delightful aroma are considered as one of the most important characteristics of coffee brew. Roasted coffee aroma is very complex mixture of volatile compounds, which is the result of many factors like: plant variety, growing conditions, processing methods, roasting process, grinding size and brewing method. More than 800 volatile compounds with a wide variety of functional groups were identified to date. Because coffee aroma is a crucial factor in purchase decision it is important to understand its evolution and development during roasting and brewing.

The aim of this study was to evaluate specific changes in volatile content of coffee brews depending on coffee bean roasting process and coffee brewing method.

Green Arabica coffee beans from Brazil and Costa Rica were used. Green coffee beans were roasted to create light, medium and dark roasts. Ground coffee samples were prepared by grinding roasted and green coffee beans. For the preparation of brews Mocha and Chemex coffeemaker were applied.

Volatile aroma compounds were extracted from the headspace of coffee brews using HS-SPME technique. Qualitative changes in extracted aroma compounds were evaluated using GC-MS method. To figure out significant differences among coffee samples the Tukey's test with a level of significance of 95% was applied.

Arabica coffee brews were characterized by a acidic taste and intense aroma with rich body. Over 50 different volatile compounds were identified in the headspace of coffee brews. Among volatile compounds, furfural and its derivatives like: furfuryl alcohol, furfuryl acetate, 5-methyl furfural were found to be the major group. The concentrations of furans in analyzed coffee brews decreased with the intensity of roasting process.

THE USE OF HUMAN SERUM TO STUDY THE FOOD PRODUCTS IMMUNOREACTIVITY

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The European Union requirements to inform consumers about the presence of 14 allergens in food products were introduced in 2007. However, many other products which consumption causes the occurrence of allergic reactions were not included on that list and their presence does not have to be declared on the label. The occurrence of immunologic cross-reactivity between food products causes the necessity to control them in order to ensure consumer safety.

The aim of this study was to compare the capabilities of legume plants allergens detection with allergic patients sera and commercially available antibodies.

The tested material was broad bean, fermented broad bean, red bean and soybean sprouts. A single-stage one-hour extraction was carried out. 1 g of tested material was mixed with 10 ml of TBS pH 7.4 containing 1% Tween 20 and 0.4% Triton X-100. The extracts were centrifuged for 30 min (4°C, 5500xg) and the supernatants were used in further analysis.

Immunoreactivity of the extracts were analyzed by Western blot assay using human sera obtained from soy hypersensitive individuals and alkaline phosphatase-conjugated monoclonal anti-human IgE antibody (SIGMA A3076, dilution 1:1000) as a secondary antibody. The results were compared with those obtained with rabbit anti-soy polyclonal IgG antibody (SIGMA S2519, dilution 1:4000) and goat anti-rabbit IgG, alkaline phosphatase-conjugated antibody (SIGMA A3687, dilution 1:20000), used as the secondary one.

It was found that the rabbit anti-soy antibodies detected significantly more protein fractions than the used human serum. The human serum and rabbit anti-soy were polyclonal antibodies, i.e. mixture of antibodies produced by various B-cell clones. So each of them recognized different epitope of protein molecules. Despite the fact that human serum contains mixture of antibody, it recognized epitopes responsible for the induction of allergy in sensitive patients. Therefore, due to these properties, the use of human serum from sensitized individuals gives the most reliable results of food allergenicity determination.

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EFFECT OF EXTRACTION METHOD ON MILK-SPECIFIC ANTIBODIES CROSS-REACTIVITY WITH SOYBEAN PROTEINS

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Soybean is one of the major food allergens. It is introduced into the diet of children allergic to cow's milk as a special infant formula. However, 50% of these children are also allergic to soy. It has been shown that soy allergen cross-reactivity to allergens of cow's milk is associated with 50-70% amino acid sequence homology between these proteins.

The aim of this study was to investigate the effect of extraction methods on the occurrence of non-specific interactions between soy proteins and milk-specific antibodies.

The tested materials were skim milk powder, soy sprouts, raw and boiled soybeans. Milk proteins were extracted with the buffer A (40mM Tris-HCl pH 7.4, 1% Tween 20, 0.4% Triton-100, 280mM NaCl). Whereas, soy proteins were extracted with three different buffers: B (0,05M Tris-HCl pH 8.2), C (120mM Tris-HCl pH 7.4, 0.05% Tween 20, 4% SDS, 2% 2-ME), D (extraction buffer from Soybean ELISA kit - EuroClone EAE010096). The allergenic proteins were detected by three different rabbit polyclonal antibodies specific for: 1 - β-lactoglobulin (ABCAM ab112893, dilution 1:10000), 2 - casein (ABCAM ab166596, dilution 1:5000) and 3 - soy proteins (SIGMA S2519, dilution 1:4000). The goat anti-rabbit IgG conjugated with alkaline phosphatase (SIGMA A3687, dilution 1:20000) was used as secondary antibody. The checking of cross-reactivity was performed by Western Blot.

Antibody specific to the soy proteins did not cross-react with milk proteins, regardless of extraction method used to prepare milk extracts. While, antibodies specific for milk proteins (β-lactoglobulin and casein – 1 and 2) cross-reacted with soy proteins and positive results of these reactions were dependent on the applied method of protein extraction.

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RESISTANT STARCH FORMATION INDUCED BY PRESSURE-COOLING CYCLES AND PULLULANASE DEBRANCHING OF BUCKWHEAT STARCH

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Buckwheat starch shows susceptibility to enzymatic treatment what in turn may affect resistant starch (RS) formation upon that process. RS is a fraction of starch that cannot be assimilated in the human upper gastrointestinal tract and acts as a substrate for fermentation by the intestinal microbiota therefore providing health benefits. Combining high hydrostatic pressure (HHP) and enzymatic treatment may affect RS content. Furthermore, HHP inactivates the applied enzyme and reduces processing costs comparing to the traditional thermal processing.

The objective of the study was to obtain buckwheat starch preparations with high RS content induced by HHP and pullulanase debranching (PUN).

Buckwheat starch was isolated after grinding dehulled buckwheat achene. Basic chemical analyses of raw material were performed. Starch-water suspensions were subjected to HHP (200- 600 MPa / 3' / 20^{o}C) prior to pullulanase treatment (2, 6, 16h PUN). A total of three pressure-cooling* cycles (*at 4^{o}C / 24h) to each sample had been performed before rapid freezing and freeze-drying. RS content, microstructure (SEM), rheological and thermodynamic (DSC) properties were analyzed.

Microscopic analysis of starch preparations revealed that both pressure and pullulanase treatment led to changes in granules morphology. At early stage of processing, they appeared slightly damaged. Treatment at 600 MPa for 6 and 16h PUN affected starch melting resulting in network formation. Some differences in the network structure between preparations were found. The highest RS content was found for samples treated at 600 MPa after 6h PUN, whereas the lowest RS contents was observed at 200 MPa. Thermograms (DSC) of starch preparations manifested treatment-depended changes in the main thermodynamic parameters (melting temperature and enthalpy). Rheological analysis showed also a high impact of processing applied on the parameters studied (flow index).

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CHEMICAL COMPOSITION OF DRY CURED LOINS MADE FROM MEAT OF ZLOTNICKA WHITE PIGS

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Growing interest in traditional food has been observed in recent years. Foodstuff prepared with traditional methods, using old recipes, cultivated by local communities is considered to be healthy, tasty and untreated. Smoked meats and sausages are most frequently purchased by Polish consumers traditional products. Dry cured products are often made from meat obtained from native breeds, like Zlotnicka White pigs. Products made from these animals reared extensively acquire an unique and high quality.

The aim of this work was to evaluate the chemical composition of dry cured loins obtained from meat of Zlotnicka White pigs.

The study was carried out with 15 dry cured loins made from meat of Zlotnicka White pigs purchased from 3 different producers. Moisture, fat, protein and connective tissue content were measured using near-infrared spectroscopy (NIRS) by a NIRFlex N-500, Butchi Labortechnik AG apparatus. Salt content was determined by the Mohr method according to PN-73/A-82112. Statistical analyses were performed using Statistica 10.0 software.

All studied dry cured loins fulfill the requirements of Polish Norms. The chemical composition of loins was as follow: moisture content was 66.5%, protein content was 25.8%, fat content was 3.3%, salt content 4.7% and connective tissue 1.2%. The greatest variability was observed among fat content (V=62.2%), salt content (V=32.4%) and connective tissue (V=38.6%). Significant differences were also observed between manufacturers. Samples obtained from manufacturer “I” were characterized by the highest moisture and fat content (70.4% and 4.6% respectively) and the lowest protein (21.7%) and salt content (2.6%). Significantly higher protein content (27.6% and 26%) and salt content (5.1% and 5.4% respectively) were observed in loins obtained from two others manufacturers.

EFFECT OF WHEAT GENOTYPE ON THE SELECTED PHYSICAL PROPERTIES AND MILLING VALUE OF GRAIN

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In the world, for food purposes allocated is 70% of the wheat crops, while in Poland value is lower and it is approximately 47%. From grain used for food purposes, after milling process is obtained flour, which is the raw material for production of bread, pasta, etc. This process is influenced by many factors, specially by physical properties of wheat grain, which determine its technological suitability. Milling value of wheat grain is also strongly determined by its variety.

The aim of the study was to evaluate selected physical properties and milling value of wheat grain of different genotypes, and verify in which degree genotype affects them.

The research material was grain of 33 varieties of wheat of different genotypes: new varieties of common wheat (13) and old varieties (10), wheat of other genotypes: spelt (8 varieties), einkorn (1 variety), emmer (1 variety), from the production of 14 certified organic farms located in 8 Polish provinces and two plant breeding stations in Strzelce and Choryń. Grain derived from 2013 year of harvest. They were determined: mass of 1000 grains, grain test weight (PN-ISO 7971-2:1998) and uniformity, endosperm hardness of the individual kernels (UTM Instron 4301), flour yield (laboratory milling in Brabender ® Quadrumat Junior), total ash in grain and flour (PN-ISO 2171:1994) and milling efficiency index *K.* The results were statistically analyzed.

Studies have shown that wheat genotype significantly influenced on the physical properties and milling value of grain. New varieties of common wheat were characterized by highest weight of 1000 grains (40.2 – 51.5g). They were also characterized by the largest and least differentiated grain test weight and uniformity. The same was observed in case of flour yield - the highest average values were obtained for grain of common wheat new varieties (73.0%), the lowest (68.6%) for old varieties. Grain of other wheat genotypes: spelt, einkorn and emmer, had highest total ash content (2.03% d.m.), while in the case of white flour highest average ash content was found for the new varieties of common wheat (0.79% d.m.) Milling efficiency index *K* was relatively low for all studied grain samples, but the lowest average values of this parameter were obtained for grain of common wheat old varieties (92.4). The hardest endosperm had grain of common wheat new varieties (0.53 MPa).

VOLATILE COMPOUNDS PROFILING IN COLD PRESSED RAPESEED OIL OBTAINED FROM ROASTED RAPESEED

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Studies of the influence of technologic processing on the volatile profile of rapeseed oil can be based on an analysis of selected volatile compounds or on a no targeted analysis of the largest amount of volatile compounds. The aim of no targeted analysis is to select the volatile compounds that are characteristic for technological processes. Flavoromics is a term which recurs in the relevant literature with reference to untargeted analysis which enables evaluation of the relationship between the chemical composition of food and its flavour qualities.

The current presentation demonstrates the results of an analysis of the volatile compounds in cold pressed rapeseed oils obtained from two varieties of roasted rape seed (with different fatty acid content) at various temperatures (140, 160 and 180°C). Solid phase microextraction (SPME) was used for volatile compounds extraction. The samples were analysed by comprehensive two-dimensional gas chromatography with time of flight mass spectrometric detection (GCxGC-ToF MS). The obtained data were treated with PCA and LDA chemometrics tools. The aroma profile and sensory panel have been analysed in different experimental conditions (140, 160 and 180°C; variables: varieties, roasting temperatures, roasting time). The use of principal component analysis (PCA) and linear discrimination analysis (LDA) allowed for a selection of volatile compounds which are characteristic for cold pressed rapeseed oils obtained at different roasting temperatures.

OPTIMIZATION OF PRODUCTION OMEGA – 3 FATTY ACIDS BY MOULD *GALACTOMYCES GEOTRICHUM*

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In many countries the popularity of fish as food is very small although they are major source of very important for the organism fatty acids from omega-3 group. Therefore there is research being done in search of new sources of fatty acids omega-3 which could be used for functional foods production.

For the research there was *Galactomyces geotrichum* mould used, isolated from fried cottage cheese. Earlier studies have confirmed the ability of the strain for the production of fatty acids from the omega-3 group. To optimize the biosynthesis a series of cultures with various components in the medium was prepared. Based on the literature ingredients for the medium enrichment were selected and, after that, in a Design Expert 9.0 programme, a matrix with the content of each component in the medium variations was obtained.

100 ml of the medium in Erlenmeyer flask was inoculated by the mould. After 5 days the supernatant from the culture was evaporated and methylated. As internal standard to quantitative analysis methyl heptanoate was used. For fatty acid separation gas chromatograph from Thermo Scientific Trace 1300 was used. Retention time of obtained peaks in chromatogram was compared with retention times of omega-3 fatty acids standards.

Based on these results the best composition of the medium was chosen.

EFFECT OF PH AND THE CONCENTRATION OF HYDROGEN PEROXIDE ON THE STABILITY OF ANTHOCYANIN PIGMENTS ISOLATED FROM HIGHBUSH BLUEBERRIES *(VACCINIUM CORYMBOSUM L.)* – MODEL SYSTEMS

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Anthocyanins are an important group of natural pigments which can be found in fruits and vegetables industry. They are used primarily for colouring beverages, wines, ice creams, yogurts and jellies. These products have mainly red, blue or violet colour. Anthocyaninis are middling environment factors resistant pigments. Their colour and stability are conditioned primarily by the pH value of environment in which they are located and the presence of hydrogen peroxide.

The aim of this study was to determine the effect of pH value and concentration of hydrogen peroxide in model systems on the stability of anthocyanin pigments isolated from highbush blueberry fruits. Pigments were extracted with a solution of 80% methanol and then purified on the Amberlite adsorbent resin. Model systems with different pH value were prepared by dilution of final extract in citrate buffer at pH 3.0; 3.5; 4.0 and 4.5, while model systems with different concentrations of hydrogen peroxide were prepared by dilution of final extract in citrate buffer at pH 4.0 and then by adding the appropriate amount of hydrogen peroxide (30%) to obtain suitable concentrations of 0, 0.5, 1.0, 1.5 and 2.0 mg/100 ml. The final solutions were kept in 6^{o}C temperature without light for two months. The total content of anthocyanins was determined using a spectrophotometric method and the colour was measured using a colorimeter and a CIE L*a*b colour scale.

Studies showed that the stability of anthocyanin pigments depends on pH value, concentration of hydrogen peroxide and storage period. Pigments degradation grows with increasing pH value of environment. The smallest losses were observed in solution at pH 3.0 and the greatest losses were observed in solutions at pH 4.5. Content of total anthocyanins and colour of model solutions were mostly affected by hydrogen peroxide concentration. The smallest losses of pigments were observed in solution without hydrogen peroxide, while the greatest losses were observed in solutions at concentration of hydrogen peroxide 2.0 mg/100 ml. In the same time, pH value of environment has the least impact on content of total anthocyanins. The color of model solutions was affected by all the factors included in the experiment. The decrease in the value of the parameter a* in the solutions was low, which may indicate a mild process of degradation of anthocyanin pigments. High anthocyanins reactivity with hydrogen peroxide may indicate high antioxidant potential to free radicals.

THE EFFECT OF PROPOLIS ADDITION ON THE ANTIOXIDATIVE PROPERTIES OF HONEY

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Propolis is a complex substance rich in biologically active compounds such as phenolic compounds, including flavonoids and phenolic acids. Propolis exhibits antibacterial, antiviral, regenerating and anesthetic properties, and also stimulates the immune system.

The aim of this study was to evaluate the effect of the addition of propolis on the content of phenolic compounds, antioxidant and antiradical activity and reducing power multifloral honeys.

The research material was multifloral honeys and honeys enriched with propolis from three different apiaries from southern Poland. The total content of phenolic compounds was determined by reaction with Folin-Ciocalteu reagent, while flavonoids were measured with aluminum chloride. The total antioxidant activity was determined by reaction with ammonium molybdate, antiradical activity by reaction with a radical DPPH°, while reducing power by FRAP method.

On the basis of the results showed a significant increase in the content of phenolic compounds and flavonoids, antioxidant and antiradical activity and reducing power of honeys enriched with the addition of propolis compared to multifloral honeys. The total content of phenolic compounds ranged from 148.4 to 198.5 mg GAE/ 100 g instead of flavonoids from 101.7 to 135.5 mg GAE/ 100 g for honey containing propolis with an average content of flavonoids and phenolic compounds for honeys at the level respectively of 43.7 and 9.7 mg GAE/ 100 g of honey. A significant increase in the content of polyphenols, including flavonoids had a significant effect on the antioxidant and antiradical activity. Mean total antioxidant activity increased from 0.37 to 1.84 AU, while the antiradical activity from 15.8 to 84.37% for honeys supplemented with propolis. The significant increase in the average reduction power from 5.6 to 45.3 μM Fe (III) / 100 g for honey with propolis was also observed.

IN VITRO STUDY OF THE EFFECT OF *VISCUM ALBUM* ON FEMALE REPRODUCTION

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Viscum album (mistletoe) is a parasite that has been used for many years in traditional and alternative medicine. The pharmaceutical active substance has found wide use in the treatment of many diseases. The positive biological effect of mistletoe has become a key factor of anticancer, antimycobacterial, antiviral, secretory activity induction and immunomodulatory processes. It has become known to the general public by eliminating cytogenicity during chemotherapy and radiotherapy.

The aim of this study was to examine the effect of mistletoe extract on porcine ovarian granulosa cell at various concentrations (0.1; 1; 10; 100 and 1000 μg/ml) focusing on their secretory activity (17-β-estradiol and progesterone) and intracellular regulators of processes of proliferation (PCNA and cyclin B1) and apoptosis (caspase-3). ELISA (Enzyme-linked immunosorbent assay) was used to determine the steroid hormone 17-β-estradiol and progesterone. Immunocytochemistry was used for detection of markers PCNA, cyclin B1 and caspase-3.

After application of the extract during 24 h period we found significant stimulation ($P \leq 0.05$) of progesterone secretion by ovarian granulosa cells at the concentration 100 μg/ml (but not at 0.1; 1; 10 and 1000 μg/ml). On the other hand, the release of 17-β-estradiol by granulosa cells was not significantly affected by application of the extract. The presence of proliferative peptide cyclin B1 and PCNA was not affected by additions of extracts in any treatment group. Similarly, detection of caspase-3, an important marker of apoptosis, has not shown significant ($P \geq 0.05$) changes in any of the experimental groups as compared with the control group. Our findings show that *Viscum album* is able to induce a secretory activity of the ovarian granulosa cells in a dose-dependent manner. However, modulation of cellular processes (proliferation, apoptosis) was not confirmed in our *in vitro* study.

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EFFECT OF VIBRATIONS ON SELECTED VEGETABLES DURING HIGHWAY TRANSPORT

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Fruits and vegetables are important source of nutrients and vitamins in our diet. Production of fruits and vegetables is seasonal and depends on area. That makes it necessary to transport this products from production's area to places where they'll be consumed. Transport of fruits and vegetables can cause mechanical damage and reducing their quality. There are many factors which have impact on condition of fruits and vegetables during storage and transport: temperature, humidity, gas composition (controlled or modified atmosphere). These factors can provide to faster ripening or even spoilage. One of the important factor which can affect significant changes in fruit and vegetables during transport is vibration. It's well known that vibrations cause mechanical damage of transported fruits and vegetables. In this study the effect of vibration on chemical changes inside vegetables was determined.

The purpose of this research was to determine if chemical changes in selected vegetables are faster due to vibration during simulated transport.

In the experiment, vibrations were given to the vegetables from simulating machine. This simulator was operating with a vibration pattern obtained in previous test in real conditions on the road. The measured frequencies were as follows: 12Hz, 28Hz, 46Hz, 52Hz. In these research we use only 46Hz. Transport was simulated in constant temperature 8^{o}C. The boxes with vegetables were placed on vibration simulator as they would normally be loaded onto truck. They are vibrated for 60 minutes. Two techniques were used to gather data for chemical analysis of the vegetables: ascorbic acid content and browning as a oxidation potential using a spectrophotometer.

Vibration generated during highway transport effected on vegetables in different way. Due to their different chemical composition and their properties. Vibration can accelerate chemical changes associated with ripening.

THE EFFECT OF VITAMIN D SUPPLEMENTATION ON GLUCOSE AND INSULIN LEVELS AND THE HOMEOSTASIS MODEL ASSESSMENT OF INSULIN RESISTANCE IN OVERWEIGHT AND OBESE SUBJECTS: A SYSTEMATIC REVIEW WITH META-ANALYSIS

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Currently the role of vitamin D in the regulation of glucose and insulin homeostasis is highly investigated. Some studies showed that the vitamin D supplementation could influence insulin secretion and improve glucose metabolism.

The objective of this systematic review was to assess the effect of vitamin D supplementation on glucose and insulin levels and the Homeostasis Model Assessment of Insulin Resistance (HOMA-IR) index in overweight and obese subjects.

The search process was conducted using: PubMed, Scopus, Web of Knowledge, the Cochrane library and Embase databases. Nine randomized controlled trials were included in this systematic review. The analysed population consisted of 893 overweight and obese subjects with ages ranging from 9-75 years. Changes in the concentration of 25-hydroxycholecalciferol (25(OH)D), fasting glucose, insulin and the HOMA-IR index were assessed. A restricted maximum likelihood method was applied in the meta-regression analysis. To combine individual study results, a meta-analysis was performed.

The 25(OH)D levels indicated vitamin D deficiency. The vitamin D supplementation did not have a significant effect on glucose levels (differences: -0.164; 95%CI: -0.396-0.040; p=0.114), insulin concentrations (differences: -0.070; 95%CI: -0.252- 0.112; p=0.451) or the HOMA-IR index (difference: -0.128; 95%CI: -0.519-0.264; p=0.523). There was not association between the supplemented dose of vitamin D and mean differences in glucose (p=0.8398), insulin (p=0.5643) levels and the HOMA-IR index (p=0.7391). The meta-analysis showed that vitamin D supplementation has not effect on glucose and insulin homeostasis.

THE EVALUATION OF THE POSSIBILITY OF LAUNCHING NEW FRUIT AND VEGETABLE PRODUCTS FOR PEOPLE ENEGAGED IN QUALIFIED TOURISM ON THE MARKET

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The growing awareness of the society regarding the beneficial effect of sport as well as the willingness to challenge yourself and face extreme experiences leads people towards more and more non-standard forms of activity, among which qualified tourism can be found. During such an intensive physical effort tourists need a balanced diet adjusted to the kind of discipline and to the level of effort. Certain requirements must be met not only by the equipment but also food, which should be quick and easy to prepare as well as light enough to be taken on any expedition, keeping in mind that it is only a part of the equipment. The rapid development of the different disciplines of qualified tourism makes food producers search for new solutions which would enable to produce highly nutritious food at lower costs.

The aim of the study was to evaluate the possibility of launching new fruit and vegetable products on the market of food products for qualified tourists. The scope of the research included presenting the market offer concerning food products for qualified tourists, conducting a consumer survey on the needs and expectations for designed food among people actively engaged in qualified tourism and evaluating the possibility of launching new products to this segment of the food products.

The study was conducted on a group of 173 people actively involved in qualified tourism. An online questionnaire consisting of 24 detailed questions was used as a tool of research. The survey contained twenty closed-ended questions with one answer, three open-ended questions and one question matrix.

The survey revealed that the concept of food specially designed for qualified tourism is known for 69.4% of all respondents, but only 24.28% of them uses such products during their expeditions. Qualified tourists are interested in new products manufactured by another method rather than freeze drying. Obtained data indicates the necessity for searching new methods of producing highly nutritious food designed for a specific group of consumers.

THE EFFECT OF HEATING TECHNIQUE ON THE RHEOLOGICAL PROPERTIES AND THE SELECTED CHEMICAL COMPOSITION PARAMETERS OF PURÉE OF THREE VARIETIES OF PUMPKIN

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An attempt at finding the heating technique which would allow to manufacture pumpkin purée characterized by the highest retention of nutritious substances such as vitamin C and β-carotene as well as proper rheological properties was made. This research is an introduction to further studies aimed at obtaining powdered pumpkin purée constituting the final product designed for people engaged in qualified tourism, with particular emphasis on persons involved in mountain climbing.

The aim of the research was to investigate the effect of heating technique on the rheological properties and the selected chemical composition parameters of pumpkin purée

Six types of purée, which differed in the heating technique of the raw material, were produced. Water heating, steam heating, microwave heating and microwave heating preceded by ultrasounds were used before homogenization. Fresh pumpkins of the species *Cucurbita maxima* and of three varieties Ambar, Justynka and Bambino, were used as a research material. All the selected chemical composition parameters were measured in fresh pumpkins and pumpkin purées. Total soluble solids (ºBrix), pH, dry matter content, total carotenoids and vitamin C content were analyzed. Colour was determined with a colorimeter (Minolta, Model CR-300, Japan) using the CIELAB colour parameters - lightness (*L*), redness (*a*) and yellowness (*b*). Colour was expressed as the total colour difference (ΔE). Rheological measurements were carried out using a rotational rheometer RS150 Haake.

It was stated that the heating technique has an impact on the overall parameters of a pumpkin purées. It was proved that there is a relevant difference in total soluble solids, dry matter content, carotenoids and vitamin C content as well as colour between purées treated unconventional methods and those heated with water or steamed.

CONTAMINATION OF POLYCYCLIC AROMATIC HYDROCARBONS (PAHS) IN PRODUCTS FOR INFANTS AND YOUNG CHILDREN IN THE PODKARPACKIE REGION

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The presence of polycyclic aromatic hydrocarbons can be noted in many raw and processed food products. Food for infants and young children is counted among food for specific nutritional uses, whose raw materials and applied production technologies must provide proper nutritional value with maximum limitation of additives and contamination. In case of food for infants and young children the highest permissible level of benzo(a)pyrene and the sum of benzo(a)pyrene, benzo(a)anthracene, benzo(b)fluoranthene and chrysene is 1 μg per kg of the product.

The aim of this study was to determine the amount of benzo(a)pyrene and the sum of benzo(a)pyrene, benzo(a)anthracene, benzo(b)fluoranthene and chrysene in processed cereal-based foods for infants and young children as well as in preparations for initial and continued feeding of infants, including infant and child milk.

The research material includes gruel (milk-cereal and cereal with added fruit), which is commonly present in retail trade in the Podkarpackie region, as well as powdered infant and child milk. The analysis was conducted by involving the technique of high-performance liquid chromatography with fluorimetric detection (HPLC-FLD). This applied and accredited test method meets the criteria in accordance with the requirements of Commission Regulation (EU) No 836/2011.

In the group of preparations for initial and continued feeding of infants as well as food for young children, very similar values of PAHs content were observed. The assay of benzo(a)pyrene and the sum of benzo(a)pyrene, benzo(a)anthracene, benzo(b)fluoranthene and chrysene in all tested samples was well below the maximum levels set by the European Union. The study clearly indicates that the analyzed products for infants and young children, which are used in the Podkarpackie region, fully meet the requirements of food law of the European Union.

IDENTIFICATION OF GRAPE AND WINE YEASTS BY MALDI-TOF MS BIOTYPER

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The aim of this study was to isolate and identify yeast species from grapes and wine samples with MALDI-TOF MS Biotyper (Bruker Daltonics, Germany). In this study we used grapes and wines from four different grape cultivars (Rheinriesling, Welschriesling, Cabernet Sauvignon and Blue Frankish). Grape bunches collected aseptically into the plastic bags in the vineyard. After that, grapes were crushed and transferred into the 250 mL conical flasks and closed with fermentation plug. Crushed grapes were incubated at 18 ± 2°C for 3 days. Also wines were aseptically collected into 200 mL plastic bottles. Wines were storage at room temperature for 1 month. After incubation time we isolated only yeast from grape juice and wines. For isolation of yeasts we used three different cultivation media namely: Malt extract agar (MEA) with bromocresol green (Biomark, India), Wort agar (HiMedia, India) and Wild Yeast medium (HiMedia, India). Yeasts were incubated at 25 and 30°C for 3-5 days. Isolated species were identified with MALDI-TOF MS Biotyper. Samples were prepared with formic acid (70%) and absolute ethanol (99%) extraction method for final analysis. Samples were then processed by MALDI-TOF MS Biotyper with flex control and realtime classification software (Bruker Daltonics, Germany). 9 yeast species from grapes and 3 species from wine samples were identified. In grape juices *Candida valida, Candida stellata, Kloeckera apiculata, Kloeckera apis, Metschnikowia pulcherrima, Pichia terricola, Torulaspora delbrueckii, Aureobasidium pullulans* and *Rhodotorula glutinis were confirmed*. *Saccharomyces cerevisiae (*3 strains*)*, *Candida krusei* and *Dekkera bruxellensis* were isolated and identified from wines. Total, 14 yeasts, 3 *Candida spp.*, 2 *Kloeckera spp.*, 3 strains of *Saccharomyces cerevisiae* and 1 species from genus *Metschnikowia*, *Rhodotorula*, *Torulaspora*, *Pichia*, *Aureobasidium* and *Dekkera* were identified.

ENZYME-RESISTANT PREPARATIONS FROM POTATO STARCH FOR BEVERAGE INDUSTRY

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The increasing number of cases of civilization diseases leads to growing consumer interest in functional foods. On the other hand, food manufacturers want to encourage potential consumers by launching new, innovative products. Soluble fibre become very popular functional food ingredient. It finds a wide range of applications in the production of breads, cakes, dairy products, beverages, cereals, confectionery, snacks as well as dips, sauces and dressings.

The aim of present study was to obtain a soluble dietary fibre from starch by the application a nonconventional source of energy - microwave radiation - to thermolysis of starch.

Starch was sprayed with hydrochloric acid and citric acid, predried to a water content below 5% and then subjected to microwave radiation. Effect of microwave heating with different exposure time and various radiation level on physical and chemical properties of starch preparations was studied. Physico-chemical characteristics of samples including water solubility, water binding capacity, acidity, dextrose equivalent (DE) was examined. Total dietary fibre content in samples was determined by the official AOAC 991.43 method.

Novel starch preparations were characterized by good solubility in water (up to 70%), low DE (max. 2.52), slightly acidic pH of a 1% aqueous solutions (approx. 4.1), and total dietary fibre content reaching 25%.

CHANGES IN THE KEY PHYSICOCHEMICAL PARAMETERS OF SELECTED VARIETIES OF GREEN BEANS FROM ORGANIC FARMING DURING THE GROWING SEASON AND STORE

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Green beans is a kind of annual plants, belonging to the family Fabaceae. It has a lot of valuable proteins, a large amount of fiber, as well as vitamins and minerals. Green beans are also recommended for people with stomach hyperacidity, it has also a de-acidifying properties. A large part of bean products intended for human consumption, is subjected to processing operations during the growing season and store. Food processing technology treatments are aimed at: securing the health of raw materials, intermediates and products and making them available for consumption above. When these processes are unavoidable losses in the nutrition ingredients.

The scientific objective of this study was to analyze changes in the basic physico-chemical parameters during their growing season and store green beans from organic farming.

Material consisted of two varieties of green beans selected by the manufacturer as characteristic for the Polish market: Stanley and Excalibur At each stage of the experiment (immature, mature and stored beans) the chemical composition of the plant material using a thermo gravimetric analyzer (water content, ash and volatiles), the elemental analyzer CHNS Spec True and the calorie count using a bomb calorimeter were determined.

The nitrogen content of beans Stanley and Excalibur showed a decreasing trend in the various stages of maturity, from 3.35% observed in immature beans, following 3.14% for a mature beans to slightly above 3% for storage beans. Similar tendency for calorific value was observed. The average calorific value of the green bean (4144.75 cal/g) as compared with mature phase (4083.8 cal/g) and stored beans (4020.33 cal/g) were observed, Excalibur variety showed similar the calorie content as Stanley.. The percentage of volatiles in the bean, belonging to the variety Stanley and Excalibur, unlike the other parameters studied showed the increase in the course of beans maturation process. The highest level of volatile substances for full mature beans (2.96%) and the lowest for immature beans, (1.94%) was observed. In summary, the greatest quantity of the tested compounds level was present in the immature bean. During maturation their amounts decreased, with the exception of the content of volatiles.

FED-BATCH CULTIVATION OF *CANDIDA FAMATA* YEASTS - RIBOFLAVIN (VITAMIN B_2) PRODUCERS

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Riboflavin (vitamin B2) is an essential nutrition component serving as a precursor of coenzymes FMN and FAD that are involved mostly in reactions of oxidative metabolism. Riboflavin is produced in commercial scale and used in feed and food industries, as well as in medicine. It is manufactured for use as a vitamin for human and animal nutrition and as a food colorant, e.g. for soft drinks and yogurts.

Some microorganisms are able to overproduce riboflavin, ascomycete fungus *Ashbya gossypii*, yeast *Candida famata* and bacterium *Bacillus subtilis* are mainly used for the industrial production of this vitamin. The yeast *Candida famata* (*Candida flareri*) belongs to the group of so called "flavinogenic yeasts" which overproduce riboflavin under iron limitation. Recently, applying a combination of random mutagenesis as well as approaches of metabolic engineering, a riboflavin overproducing strain of *C. famata* was constructed.

The aim of our work was to optimize of cultivation conditions including the medium composition, aeration and other parameters favoring for maximal accumulation of riboflavin by the isolated recombinant *Candida famata* strain #91.

Yeasts *C. famata* strain #91were cultivated in OP-5m medium using Innova Lab Shaker (New Brunswick Scientific Co.) at 28°C with 250 rpm for 5 days. The addition of 1 % natural components (barley malt syrup, cane molasses, sugar beet syrup, manioc syrup, corn syrup, dactyl syrup, malt syrup with brown rice, wheat malt syrup, spelt malt syrup) to medium was used. The next step was directed to optimize riboflavin production in a 1.3 l laboratory glass fermentor (BioFlo®/CelliGen® 115, New Brunswick Scientific Co.). The batch operation mode was adopted to obtain a high cell density and high concentration of riboflavin.

The highest riboflavin accumulation in the shake flask experiments (2.24 g/l in 96 h) was obtained during cultivation in OP-5m medium supplemented with 1% spelt malt syrup. Fermentation of *C. famata* using optimization strategy under fed-batch cultivation conditions in fermentor allowed to achieve biomass production 54.15 mg dry weight/ml and riboflavin titer of 8.1 g/l after 108 h cultivation. Thus the optimization of the cultivation conditions led to a noticeable improvement in riboflavin production by the recombinant *C. famata strain #91*during fed-batch cultivation. Aeration has an important effect on riboflavin production. Addition of natural components to optimized medium OP5m can significantly influence to increase of riboflavin synthesis by recombinant *C. famata* yeasts.

BANANAS SURFACE MICROFLORA DETERMINED BY MALDI-TOF MS BIOTYPER

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Commercially available food is interesting source of different microorganisms. Nowadays we have almost non limited access to exotic fruits and vegetables. Bananas are high in nutritional value include, among others, potassium and magnesium, vitamin C, fiber and sugars that provide quick energy boost. During, growth, transport, storage and sale all they can gain a lot of different microorganisms.

The main objective of the study was to identify the microorganism determined on surface of commercially available banana by using MALDI-TOF MSBiotyper.

Six bananas was bought in one of supermarkets in Nitra (Slovakia). It were taken in to two plastic bags from bottom of the box and middle of bunch for minimize risk of contamination by microflora from human hands. Next stage was transfer microorganisms from surface of banana to agar media under laminar flow chamber. For this was used cotton swabs and three different medias: MRS media for lactic acid bacteria species (incubated at37 ºC for48-72 hours), nutrient agar (incubated at 30 ºC for 24- 48hours), malt extract agar for yeasts (incubated at 25 ºC for 3-5 days). After growth gained microorganisms was transplanted to fresh agar medias for its cleaning and incubated again. After growth of isolated cultures they was prepared for identification by MALDI-TOF MS Biotyper (BruckerDaltonics, Germany) and results of measuring was straight compared with database by software real time classification v3.1.

There was 18different species of microorganisms isolated and identified on banana's surface. Among them were 15 bacteria's and tree yeast species. Among bacteria's 60% (50% of all microorganisms) was gram positive: *Brachybacterium faecium*, *Bacillus pumilus*, *Microbacterium arborescens*, *Bacillus mycoides*, *Staphylococcus warneri*, *Staphylococcus epidermidis*, *Micrococcus luteus*, *Lactobacillus paracasei*, *Leuconostoc mesenteroides*. Gram negative bacteria's: *Burkholderia caledonica*, *Acinetobacter junii*, *Sphingomonas sp*.*Pantoea dispersa*, *Pseudomonas flavescens*, *Hafnia alvei constituted* 40% of found bacteria's and 33,3% of all microorganisms. Also some yeast's species was found *Candida krusei*, *Aureobasidium pullulans*, *rhodotorula glutinis* which was 16.6% of all microflora.

The results have been shown how wide spectrum of microorganisms we can find on commercially available food products. Also it have shown possibility of use new devices in laboratory work, which strongly reduces time of analysis.

AN ATTEMPT TO APPLICATION OF POTATO WASTEWATER AND GLYCEROL FOR THE PRODUCTION OF SCO BY THE YEAST *RHODOTORULA GLUTINIS*

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In recent years, researchers looking for new ways of disposing of industrial waste which, because of its composition, cannot be disposed of in natural conditions. There are high expectations of biotechnological processes, which not only allow to biodegrade products but also to obtain a new value-added products, for example lipid-rich yeast biomass (Single Cell Oil - SCO).

The aim of the study was to determine the ability of yeast *Rhodotorula glutinis* to grow and intracellular fat biosynthesis in media containing glycerol as the carbon source and potato wastewater as a source of nitrogen and minerals.

The study involved a strain yeast *Rhodotorula glutinis* LOCK 0051. Experimental media contained potato wastewater (PEPEES SA, Łomża) and glycerol (POCH., Poland) in quantities 5, 10, 15, 20 and 25% (w/v). Control medium was YPD and potato wastewater. During the 72 hours cultivation (200 rmp, 28^{o}C) biomass yield (weight method), glycerol (chemical method) and protein (Kjeldahl's method) concentration in experimental media and lipids content in yeast biomass (Soxhlet's method) were determined.

The test yeast strain *Rhodotorula glutinis* were able to grow and biosynthesis of intracellular lipids in media containing glycerol and potato wastewater. The highest yield of cell biomass (20.34 g d.w./L) was obtained in medium with potato wastewater and 5% of glycerol. The addition of glycerol to the culture medium at doses above 15% (w/v) significantly inhibited the growth of the test strain of yeast, but also induce biosynthesis of lipids. The highest content of intracellular fat (22.74 g/100 g d.w.) was obtained after 24 hours culture in medium supplemented with 25% glycerol. The highest volumetric productivity of microbial fat (1.95 g/L) was reached in the medium supplemented with 5% of glycerol after 72 hours. With increasing concentrations of glycerol (10, 15, 20 and 25%) volumetric productivity decreased, which was related to growth restriction. 72-hour process of yeast culture allowed partial biodegradation of waste. In medium containing 5% glycerol value of the COD was reduced by over 77%, glycerol content and protein concentration, respectively by 70 and 61%.

MALT QUALITY ACCORDING TO THE QUALITY OF THE BASIC RAW MATERIAL

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Malting barley is the main raw material for the production of high-quality malt, which is necessary for the quality beer production. On malting barley are imposed an extraordinary high quality requirements of breweries that are subjected to malt-houses and farmers. Barley growing areas in Slovak Republic have a decreasing tendency, which results in the emphasis on improving the effectiveness of cultivation and on meeting the needs of malting industry.

Aim of this study was to analyze essential quality parameters of malting barley respectively malt and based on measured results to evaluate the influence of locality and variety on quality of barley grain and also the impact of this raw material on the basic technological parameters of malt.

Samples of malting barley collected from 10 suppliers of different growing localities and malt samples produced from them were analyzed in this work. 4 barley varieties Malz, Kangoo, Signora and Levan. Many technological parameters were assessed in the samples of barley (first class grain, grain fall, bulk density of grain, crude protein content, starch content, etc.). After the malting process were evaluated technological parameters of malt quality (bulk density of malt, friability, malt extract content, wort turbidity, etc.). All determinations of barley and malt parameters were carried out according to the EBC recommended methods.

The achieved results showed quality differences between the suppliers in barley of the same variety and same crop year. A high first-class grain percentage was measured in the variety Malz from most suppliers, and only one sample dropped below 80 %. First-class grain percentage in variety Kangoo was above 90 % from 2 suppliers and only 71.5 % from one supplier. In varieties Signora and Levan were detected low levels of first-class grain percentage, as well as high levels of grain fall. The best chemical characteristics of technological quality were achieved with variety Malz, where the starch content was above 64 % from all suppliers and protein content reached values up to 11.5 % from 4 of 5 suppliers. On the other hand, the lowest starch (below 62 %) and highest crude protein content (above 13 %) of grain was measured at varieties Levan and Signora. As a result, this combination strongly influenced the malt extract content that was below 79%, which is from brewing´s perspective considered as low value.

On the basis of the obtained results, we can conclude that growing locality has a significant contribution to the formation of technological parameters of barley and the malt produced from it, and that it is also necessary to promote optimal barley production systems elaborated by scientific research base.

FOOD PRESERVATION USING AN ELECTRIC CURRENT

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Foodborne diseases are important causes of morbidity and economic loss. For that reason food industry is looking for new more effective methods of food preservation. The effect of electric field on bacteria has been studied for several decades. There are many different ways of applying electric energy for food pasteurization. These include e.g. ohmic heating, microwave heating, low electric field stimulation, high-voltage arc discharge, and high-intensity pulsed electric field (PEF) application.

The purpose of this study was to determine the possibility of using direct electric current as a new method for food preservation.

The antimicrobial activity of direct current (DC) applied via agar plates with sodium chloride (0; 0.5% w/v) was tested against *Yersinia enterocolitica* and *Staphylococcus aureus*. Plate diffusion test was used in this experiment. Completely gelled agar plates inoculated with 10^6 CFU/ml of bacteria cultures were treated by DC. Electrical current was passed from DC power source at three different milliampere (10, 20, 30 mA; ≥10V) for 2, 20 and 30 minutes. After applying DC, agar plates were incubated at 37 °C for 24 hours and then the diameter of the inhibition zone was measured. Moreover, antimicrobial activity of gelatine hydrosols (1%) with NaCl (0,1% w/v) exposed at 200 and 400 mA during 5 minutes was tested against *S. aureus*.

The results have shown that direct electric current inhibited the growth of *Y. enterocolitica* and *S. aureus*. The largest inhibition zone was observed for cultures exposed to the 30 mA for 30 minutes. Furthermore, the *S. aureus* population was reduced for about 1,60 log by gelatine hydrosols treated by DC of 400 mA.

The composites produced as a result of structuring hydrosols prepared on the basis of hydrocolloids of natural origin containing electrolytes which are exposed to direct electric current make it possible to manufacture innovative packaging materials (among others, edible protective covers, cases, casings) with new biophysiochemical properties thanks to which it is possible to ensure high quality, extend shelf life and decrease economic losses caused by food. The use of bioactive composites exposed to direct current in industry, e.g. in co-extrusion sausage coating process, is a new promising method for food preservation.

CHARACTERIZATION OF CROSS-LINKED CHITOSAN/ALGINATE COMPLEXES AS POTENTIAL CASINGS OF CO-EXTRUDED MEAT PRODUCTS

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Co-extrusion is a system that simultaneously extrudes a meat batter and casing material in continuous flow. Casing should be prepared from a carefully selected components which will allow to improve physicochemical properties of coated product, extend its shelf-life and ensure effective implementation in the production process. Possibility of creation food coatings with desired properties can be achieved through multicomponent system design. Because of anionic nature of alginate and cationic of chitosan, polyelectrolyte complex can occur under appropriate conditions as three-dimensional network.

The aim of this work was to develop and characterize polyelectrolyte material suitable as protecting casing for meat products, by cross-linking chitosan (CH) and sodium alginate (ALG) in a broad range of polymers ratios (R).

Polyelectrolyte complex solution was obtained by drop wise polycation solution (0,5% w/v chitosan solution) to polyanion solution (0,5% w/v sodium alginate solution) in nine different volume ratios: 3:5, 3:10, 3:15, 4:5, 4:10, 4:15, 5:5, 5:10 and 5:15 (v/v). Components were homogenized (IKA T18 basic, ULTRA TURRAX) for 1 min to achieve homogenous hydrosols. Solutions were structured on teflon plates in climate chamber (60% RH, 20°C, 48h). Rheological analysis, water solubility, contact angle and DMTA analysis were used to analyze obtained sodium alginate-chitosan hydrosols and their structured forms, films.

The obtained results showed that controlling of polymers ratio has changing cross-linking density, what influence on physicochemical properties of hydrosols and hydrogels. Different hydrosols composition affected their rheological properties. Due to the polyelectrolyte complexation material with greatly limited solubility (solubility ranged from 0.82% ± 0.78 to 54.56% ± 2.42, depending on sample polymers ratio) was achieved. The contact angle was found to be between 45 – 66° and clearly indicate the hydrophilic nature of all chitosan-alginate coatings. Accordingly to DMTA results, ion binding makes material more resistant to mechanical deformation compared to pure sodium alginate and chitosan. Flexibility of complexed coatings increased with polymer ratios (1.0 > 0.8 > 0.6) and was indicated by close to 0° phase angle and high storage modulus values. The obtained results confirmed potential of sodium alginate-chitosan polyelectrolyte complexes as natural protective coatings and packaging.

RHEOLOGICAL PROPERTIES OF SODIUM ALGINATE/SODIUM CASEINATE/TRANSGLUTAMINASE SOL-GEL SYSTEMS

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In recent years researchers have been paid much attention to natural occurring polymers use as an alternative for synthetic packaging materials. Casings used in food industry are usually obtained from an aqueous solutions of proteins and polysaccharides such as: collagen, cellulose or alginate. Due to their edibility and profitable production costs, food manufacturers are interested in innovative solutions, which will help to improve the physicochemical and biological properties of the currently used natural polymers.

The aim of this work was to characterize rheological properties of polysaccharide-protein complexes made from sodium alginate, sodium caseinate and transglutaminase of microbial origin.

Polysaccharide-protein solutions were obtained by mixing sodium alginate (ALG) solutions (0%, 0.6%, 1.2%) with sodium caseinate (KS) solutions (2%, 4%, 6%). Components were homogenized (IKA T18 basic, ULTRA TURRAX) for 1 min to achieve homogenous hydrosols. Transglutaminase (TG) (0, 5, 10 U/g protein) was added to sodium alginate-caseinate solutions 30 minutes before rheological measurements. The rheological properties of all ALG-KS-TG samples were determined using HAAKE RheoStress 6000 rheometer (Thermo Scientific, German). All test were performed using cone sensor (C60/1° Ti L) and measuring plate (TMP60 Steel 18/8). The recorded mechanical spectra included G' (storage modulus), G" (loss modulus), loss tangent (tan δ = G"/G') and η (viscosity) as a function of variable temperature 10°C - 80°C (heating rate = 1.2°C/min, fixed frequency = 0.1 Hz). Obtained data allowed determination of sol-gel phase transformation dynamics and resistance to syneresis of obtained complexes.

The obtained results showed that temperature of sol-gel phase transformation and time of its occurance since the enzyme introduction, indicates that the dynamics of the cross-linking reaction is the greatest at the maximum levels of TG and KS in the sample. Syneresis resistance of experimentally produced ALG-KS-TG biocomposites increases in proportion to the concentration of alginate in the sample.

CHEMICAL MODIFICATION OF CELLULOSE USING CYCLODEXTRIN DERIVATIVES

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Cyclodextrins are the cyclic oligosaccharides build by several anhydroglucose (AGU) units that are jointed together and form of a kind of cone. The most common used CD consist 6 to 8 AGU respectively. Described molecular structure involves the ability of CD's to form some inclusion complexes with many organic and inorganic moieties. The cone-like structure of CD results in the phenomenon of hydrophobic character of the inner space of this carbohydrate. Formation of the complex causes the increase in water solubility as well as decrease in volatility and sublimation tendency of small molecules. Nowadays, CD's complexes find a lot of application in both practical and laboratory aspects. According to molecular encapsulation mechanism they are applied on the field of stabilization of vitamins and flavor compounds in food, serve as a important in production of drugs with long realising time. They also find the important place in analytical chemistry, organic synthesis, cosmetics and agricultural.

The aim of this study was to investigate the possibilities of cellulose modification using reactive β-CD derivative i.e. a tosyl- and monochlorotriazyl-βderivatives. Modification of cellulose was performed on four different commercial fabrics by four different methods. Then the study on the properties of new materials obtained was done including the degree of modification and mechanical properties. Finally, a comparison of the two method of modification was performed.

Finally it was shown that investigated modification influence on properties of the fabric. The cyclodextrin molecules presented in material is able to complex some low molecular substances what may be useful in food industry by means of designing the new class of packaging material able to protect the food against environmental conditions or keep the flavor and aroma compounds longer than in conventional material.

AN ATTEMPT TO APPLICATION OF THE POTATO WASTEWATER AND GLYCEROL FOR PRODUCTION OF MICROBIAL PROTEIN BY FODDER YEAST *CANDIDA UTILIS*

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Production of yeast cell biomass can be a relatively inexpensive process because of the existing potential to utilize raw materials (so-called wastes) generated in various industries. Additionally, this approach helps to reduce significant amounts of waste and by-products from different technological processes that may cause a major problem for both the plant production and the natural environment. It also provides a possibility to obtain yeast biomass enriched in proteins, fat, vitamins, minerals and prebiotic polysaccharides.

The aim of this study was to determine the use of glycerol as a source of carbon and deproteinized potato wastewater as a source of nitrogen and mineral components in the production of biomass, using a strain of fodder yeast *Candida utilis* ATCC 9950.

The study involved a strain of fodder yeast *Candida utilis* ATCC 9950 that originated from the American Type Culture Collection. The culture of the studied yeast was run in two control media: YPD containing 2 g/L glucose, 2 g/L peptone and 1 g/L yeast extract, and in the medium including only potato wastewater. The experimental media included potato wastewater with varied amounts of glycerol addiction - 5, 10, 15, 20 and 25% (w/v) - as a source of carbon. The pH value in all media was established at 5.0. Deproteinized potato wastewater was obtained from the starch plant PEPEES SA in Łomża. This wastewater contained about 0.3% of directly reducing substances, constituting carbon source for the yeast, and 0.9% total protein being the source of nitrogen. During 72 hours cultivation (28°C, 200 rpm) following parameters were determined: biomass yield (by weight), the total protein content in the biomass and culture media (Kjeldahl's method) and glycerol concentration in the media (chemical method).

It was observed that *Candida utilis* yeasts were able to grow in the medium composed of potato wastewater and glycerol. Enrichment of wastewater with 5% glycerol addition guaranteed a high yield of the studied yeast biomass, even above 30 g d.w.·dm^{-3}, and the efficiency of protein biosynthesis was 12.2 g·dm^{-3}. It was also found that glycerol addition in higher concentrations (from 10 to 25%) inhibited the growth of the studied yeast strain. The production of *Candida utilis* yeast biomass during the submerged culture in medium with 5% glycerol addition showed partial utilization of glycerol and potato wastewater, which was demonstrated both by significant utilization of glycerol (83%) and nitrogen (51%) from the culture medium and through a high degree of COD index reduction (91%).

INFLUENCE OF CLARIFICATION OF ARONIA JUICE ON THE PHENOLIC COMPOUNDS AND ANTIOXIDANT ACTIVITY

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Aronia melanocarpa (black chokeberry) belongs to the *Rosaceae* family. Black chokeberry is a shrub native from North America, which is now also cultivated extensively in Europe. The juice of *A. melanocarpa* is known to contain high concentrations of polyphenols up to 7 g/l. The high content and the composition of the phenolic constituents of *A. melanocarpa* seems to be responsible for the wide range of its potential biological effects. It has been shown that the extract or the juice of *A. melanocarpa* has cardioprotective, gastroprotective, hepatoprotective, anti-diabetic, anti-inflammatory, anti-oxidative, anti-viral, anti-mutagenic, and anti-cancer activities. Difficult issue is the formation of turbidity and sediment during production and storage od clear chokeberry juices. One of the causes of these phenomena is the high content of polyphenolic compounds in chokeberry, which pass into the juice during pressing. For clarification of haze and sediment a plurality of auxiliaries such as gelatin, tannin, bentonite, diatomaceous earth and others are used.

The aim of the study was to select the optimal dose of clarifying agents and determine of their influence on the content of polyphenols and antioxidant capacity of chokeberry juice.

Material consisted of chokeberry juice and clarifying substances (gel, silica sol, bentonite) from Tymbark-MWS Sp. z.o.o. SKA. The content of polyphenols in chokeberry juice was determined by means of the ultra-performance liquid chromatography method. The content of antioxidant capacity was analyzed with ABTS and FRAP method.

The most favorable results were achieved by using the following configuration of clarifying agents gelatin-bentonite-silica sol. The use of the above order of addition of clarifying agents contributed to the best preservation of polyphenolic compounds and antioxidant capacity in chokeberry juice.

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THE INFLUENCE OF THE PREPARATION PROCESS OF POWDERED DRIED CRANBERRIES ON THE CONTENT OF POLYPHENOLS AND ANTIOXIDANT ACTIVITY

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Cranberry *(Vaccinium macrocarpon)* is a rich source of bioactive phenolic compounds with antiproliferative, antioxidant, antimicrobial, anti-inflammatory and anticarcinogenic activities. It contains large amounts of sugars, proanthocyanidins, flavonoids, organic acids, and also anthocyanins. Cranberry pomace is a byproduct of the cranberry juice processing industry composed of pulp, peel, seeds and stalks of the fruit obtained after the juice and water have been pressed from the fruit cranberry. Traditionally pomace has been used as an ingredient in animal feed; however, due to its poor nutritive value it is disposed into landfills causing considerable economic loss and environmental problems. Recently food technologists have developed a powder from cranberry waste, with this powder containing all the essential and branched chain amino acids, essential fatty acids, anthocyanins, phenolic, phytosterol, phospholipids, minerals, vitamins, and dietary fiber similar to cranberry concentrate.

The aim of the study was to evaluate the effect of the degree of fragmentation of the cranberry fruit (*Vaccinium macrocarpon* L.) cv. Pilgrim, on the chemical composition and antioxidant activity of fruit powders and lyophilized pomace and juices. In analyzed samples, the basic chemical composition, total polyphenolics and antioxidant activity were determined.

Material consisted of fruit cranberry ‘Pilgrim’ from horticultural farm in Wola Mysłowska, near Warsaw. In the fruits dry matter and titratable acidity according to PN norm were analyzed. The content of polyphenols in individual extracts was determined by means of the ultra-performance liquid chromatography method. The content of antioxidant capacity was analyzed with DPPH, ABTS, FRAP method. The content of sugar was analyzed with the HPLC-ELSD method.

The results indicated that the products obtained from cranberries were characterized by a high content of polyphenolic compounds and antioxidant capacity. The fragmentation degree of the raw material before pressing had a great impact on the yield of juice and residue amount in pomace. Large variations were obtained in percentages of sugars, acids and polyphenols in the pomaces and juices, depending on whether the whole fruits were pressed or crushed. These results suggest a beneficial effect of cranberry powder production from pomace obtained by whole fruit pressing.

ONE-HYBRID SYSTEM FOR IDENTIFICATION OF DNA BINDING SITES OF SEF1 TRANSCRIPTIONAL ACTIVATOR OF *CANDIDA FAMATA*

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Riboflavin (vitamin B2) is one of the most important vitamins required for human and animals. This vitamin is metabolic precursor of flavin nucleotides, FMN (flavin mononucleotide) and FAD (flavin adenine dinucleotide) involved as coenzymes in numerous enzymatic reactions, mostly of oxidative metabolism. Riboflavin deficiency causes retardation of growth, skin, nervous system and eye diseases. This compound is manufactured on a large scale for use in agriculture, medicine and food industry.

Although the riboflavin biosynthesis pathway is well studied it regulation is not known well. Only one regulatory gene *SEF1* was found in flavinogenic yeast *C. famata* so far. It takes part in positive regulation in riboflavin synthesis as additional copies of the gene leads to improvement of riboflavin production in *C. famata*.

Sef1p as well as characterized Gal4p belongs to zinc cluster proteins. They possess zinc finger of the Zn (II) 2Cys6-type involved in DNA binding and are typical transcriptional factors.

Results

One-hybrid system basing on *Saccharomyces cerevisiae* was used to identify DNA binding sites of Sef1. The strains BY4742 of *S. cerevisiae* with plasmid harboring *SEF1* gene of *C. famata* under the control of galactose-inducible *GAL1* promoter of *S. cerevisiae* and reporter plasmid bearing *LAC4* gene of *Kluyveromyces lactis* under control of *RIB1* and *SEF1* promoters of *C. famata* were constructed. Two shortened sequences of promoter *RIB1* lacking hypothetical Sef1 binding sites was used. β-Galactosidase assay was used for detection of the Sef1 binding capacity of the target sequences. Developed one-hybrid system is suitable for studying the interaction of Sef1 with targeted DNA sequences. Sef1 activates transcription of *RIB1* gene in heterologous host system. Truncation of *RIB1* promoter substantially decreases its activation. Sef1p directly interacts with own promoter providing evidence for Sef1 autoregulation.

THE ANALYSIS OF THE COLOUR OF SELECTED WHEAT VARIETIES BY MEANS OF DIGITAL IMAGE ANALYSIS METHOD

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Wheat is a cereal grain cultivated and consumed in the largest amount in Poland. Nowadays, common wheat, spelt and durum wheat are the most popular. However, there are certain difficulties in identifying individual varieties. The colour is one of the differentiating factors and its measurement using digital image analysis method is quick, reliable and inexpensive.

The aim of the studies conducted was to determine whether individual varieties of wheat differ among each other in terms of colour regarding the values of RGB and HSI model components.

Materials and methods

The material used in the study was the following varieties of common wheat grains: Belissa, Ostka Smolicka, Wydma and Zawisza; spelt grains: Schwabenkorn, Wirtas, Oberkulmer and SMH87 durum wheat grains.

The colour measurement was taken using the digital image analysis with version 3 of Nikon NIS- Elements Advanced Research. Pentium IV 3.2 Ghz, 1 GB Ram application and the 1280x1024- True Color mode image settings were used. Two point lighting of 150W intensity was used and the lens were installed at the height of 480mm. Mean values of components of the RGH and HSI models were calculated using the available software. There were 300 grains in each sample size.
The significance of differences was determined using Statistica software for the $p<0.05$ level of significance.

On the basis of the results obtained it was found that the parameter which differentiates the analysed varieties of wheat the most was Hue parameter for which statistically significant differences were not found only between Zawisza and Schwabenkorn varieties. The analysis of Red parameter value showed statistically significant differences between the varieties of common wheat, spelt and durum wheat. The parameter which differentiates the varieties of spelt wheat the most was Green parameter whereas in the case of common wheat it was Hue parameter. The analysis of the value of RGB and HSI model components for durum wheat demonstrated that it differs significantly from the common wheat and spelt wheat varieties in terms of HSI model components and Red parameter in RGB model.

THE INFLUENCE OF BARLEY FIBRE REACH IN β-GLUCAN ADDITION ON CANNED MEAT PRODUCT PROPERTIES

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β-glucan derived from cereals is non-starch polysaccharide, soluble dietary fiber, considered to be the greatest discovery in recent years. It is a linear homopolysaccharide composed of residues of D-glucopyranosyl joined by two bonds β-(1-4) and β-(1-3). It belongs to the group of bioactive components, due to the properties of reducing LDL cholesterol in the blood.

The aim of the study was to investigate the effect of the amount of addition barley fibre reach in β-glucan – Vitacel BG 300 (3 and 6%) and different meat fragmentation (homogenized and medium shredded) on canned meat product properties.

There were used following raw materials to produce batters: chilled chicken thigh muscles (grounded to 3 or 8 mm fragmentation) and pork jowl (grounded to 3 mm fragmentation). Moreover there were used water and additives as well: curing mixture, phosphates, sodium erythorbate, herbal and black peppers.

Ready batters were stuffed in cans, closed and pasteurized (till 70ºC in the coolest point of product). After thermal treatment products were chilled for 24 hours (4-6ºC). The following measurements were made on ready products: the size of thermal leakage, water activity with AcquaLab, colour parameters (L*a*b*) by reflection using Minolta CR 200 apparatus, texture profile analysis (TPA) by using ZWICKI 1120 testing machine, and sensory characteristic - scaling method (0-10 points scale).

The obtained results were subjected to statistical analysis by Statistica 10 using one-way ANOVA and Tukey test at $\alpha = 0,05$.

The results showed that the addition of fibre preparations Vitacel BG 300 at 3.0 and 6.0% levels impacted in the thermal drip in medium shredded products. Addition of BG 300 fibre to meat canned products change colour parameters L*a*b* as well as texture and sensory acceptability. Thanks to using barley fibre BG 300, which is rich in β-glucans, it is possible to acquire a product with a higher nutritional value, but it is still difficult because its influence on sensory characteristic.

QUALITATIVE ANALISYS OF THE WHEY PROTEINS COMPOSITIONS AFTER COLD GELATION

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Whey proteins (WP) are well known as food ingredients due to their high nutritional value and universal functional properties that include stabilization, emulsification, foaming and gelation. WP are globular proteins with molecular weights ranging from 14 to 1000 kDa composed of 60% β-lactoglobulin (β-Lg), 22% α-lactoalbumin (α-La), 5.5% bovine serum albumin (BSA), and 9% immunoglobulins (Ig). Food protein gels are commonly formed during heating. Heat-induced aggregation of WP occurs at temperatures above 70°C, leading to improvement in viscosity or gel formation. Cold gelation consists of two steps. In first step proteins are heating and cooling, in second cold-set gels are formed by changing the solvent characteristic for example in this study by gradual and slow acidification by addition of glucono-δ-lactone (GDL).

The aim of the study was to compare quality and quantity of proteins in solutions before and after cold gelation.

The experimental material were protein solutions prepared in different concentrations divided into two groups. The first group consisted of solutions, which are not treated with a coagulating agent while the latter solution, which was treated with three different portions of a coagulating agent. Prepared fractions were characterized by SDS-PAGE electrophoresis in Laemmli buffer using wide range protein marker 3-Colour Prestained marker: 11-245 kDa. Detection of proteins in polyacrylamide gels was performed using staining solution. Images of the prepared gels was done using a CCD LumiBis (DNR Bio-Imaging Systems), then the concentration of proteins in gels by densitometry were evaluated, which was based on a computer analysis of the electropherogram and compared the intensity of the bands derived from the model of a known concentration of the intensity of the bands studied.

Result of this work was to make 10 electropherograms of which 1 was a control sample containing milk proteins. Samples without addition of the coagulant contains typical whey protein clean fractions. The samples after the addition of different amounts of GDL characterized by weak stripes providing on the one hand, the low protein content of the solution and on the other by their large bonding to a gel.

SORPTION PROPERTIES OF SHORT-DOUGH BISCUITS

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The water condition in food is a very important aspect determining the physical, chemical and biological properties. To evaluate water state in food we can use the water sorption isotherms. The knowledge of the course of water vapor adsorption isotherms give us a lot of valuable information about food structure. Isotherms allows to determine the sensitivity of product for moisture and degree of water adsorption. Moreover they can predict changes which can occur during storage.

The aim of this work was to determine sorption properties of short-dough biscuits, in which wheat flour was replaced by chickpea flour (20, 40, 60, 80%). The scope of this study included analysis of sorption isotherms, which were measured in the environment showing the following water activities: 0, 0.113, 0.225, 0.329, 0.438, 0.529, 0.648, 0.753.

The analyzed material was composed of short-dough biscuits baked in laboratory conditions at 190℃ by 15 minutes in an industrial electric oven. The biscuits were composed of the following ingredients: wheat flour (type 550), chickpea flour, shortening, powdered sugar, baking powder and water. The static-desiccator method was applied to determine the sorption isotherms. All measurements were performed at 25℃, in two replicates. The water vapor adsorption isotherms of the biscuits were determined using BET, GAB, Peleg and Lewicki mathematical models.

It was found that the shape of water adsorption isotherms of short-dough biscuits were sigmoidal and were characterized by a II isotherm type according to the Brunauer's classification. The Peleg model was the best to describe the sorption isotherms of all biscuits.

RELATIONSHIP BETWEEN SELECTED PHYSICAL PROPERTIES OF REDUCED-CALORIE SHORT-DOUGH BISCUITS

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Sucrose is the main sugar which is used in short-dough biscuits formula. But high sugar content is connected with bigger risk of obesity, dental problems or high blood cholesterol. The sugar replacement commercially available allows us to obtain healthier and reduced-calorie short-dough biscuits.

The objective of this work was to investigate relationship between selected physical properties of reduced-calorie short-dough biscuits. The scope of this study included analysis of acoustic and mechanical properties, the density, colour, water activity and sensory evaluation of biscuits.

The research material constituted short-dough biscuits, containing: wheat flour (type 550), which was replaced by chickpea flour (in 20%), shortening, powdered sugar, sugar substitutes: polydextrose and inulin (40, 60% of replacement), egg yolk, baking powder and water. Texture properties of short dough biscuits were determined using penetration test in the Texture Analyzer TA-HDplus (Stable Micro Systems), at the constant speed of 0.3 $mm \cdot s^{-1}$ (6 mm diameter cylinder probe). During the test acoustic emission was being registered by the contact method (sensor 4381, Brüel&Kjær). The density of short-dough biscuits was determined by the helium Stereophycnometer (Quantachrome Instruments). Moreover, the colour of biscuits was recorded using CIE L*a*b* system (Konica Minolta, CM-5). The water activity (a_w) of biscuits was measured in an AquaLab (Model CX-2). The sensory evaluation was made by 50 consumers using the 5-point hedonic scale.

The addition of polydextrose caused stronger generation of acoustic emission (AE), while inulin caused damping of AE. Moreover, higher addition of water to formula of biscuits with inulin might influence on their acoustic properties. They also had the highest values of a_w and the highest density. Biscuits with 60% of inulin were characterized by the highest values of mechanical parameters (force and penetration work). What is more, it was observed that the sugar substitutes had significant impact on colour of biscuits. The analysis of sensory properties showed that the biscuits with 60% of inulin had the worst note in consumer evaluation, while biscuits with 40% participation of polydextrose and 40% of inulin obtained the highest overall rating.

ASSESSMENT OF BIOAVAILABILITY OF COMPOUNDS DURING DIGESTION *IN VITRO* OF YOGHURT ENRICHED WITH ANTHOCYANINS

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Anthocyanins are compounds, which show many interesting biological and pharmacological properties, but in human body they undergo metabolic transformation, which affects the level of this activity and the degree of their bioavailability. It has been proven that the anthocyanins are unstable and absorbed in a limited manner, and their absorption is dependent on the chemical structure.

The aim of this study was to compare the bioavailability of compounds during digestion *in vitro* of yoghurt enriched with acylated and non-acylated anthocyanins. Material for the study were the natural yoghurts enriched with acylated anthocyanins from purple carrot and non-acylated anthocyanins from cornelian cherry fruit. Yoghurts were enriched with 1% preparation of anthocyanins.

The study included two steps of digestion: in stomach and in small intestine. Simulated gastric digestion consisted of an incubation of samples for 2 h in the presence of pepsin, while simulated intestinal digestion of further incubation for 2.5 h in the presence of pancreatin and bile salt. In order to maintain the conditions that prevail in the organism, in addition to the enzymes, we used the appropriate pH and temperature. Additionally, the dialysis membrane was used to determine the bioavailability of the compounds. At all stages of digestion, we determined the qualitative and quantitative changes of anthocyanins by LC-MS and HPLC methods.

Obtained results show that individual anthocyanins were differently susceptible to degradation during digestion. The presence and type of functional groups in the molecules influences their stability. Among anthocyanins preparation from purple carrot, peonidin 3-xylosyl(feruloylglucosyl)galactoside showed the greatest stability and in the preparation from cornelian cherry fruit the most stable was pelargonidin 3-O-robinobioside.

The studies indicate that acylated anthocyanins showed greater stability than non-acylated ones. Both the type of aglycone and the type of sugar and phenolic acid attached to the molecules influences their stability and bioavailability.

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QUALITY EVALUATION OF HONEY ADULTERATED WITH APINVERT

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Honey is a valuable food product. Honey adulteration leads to quality degradation. Expensive and laborious analytical methods are available for identification of honey adulteration. However, it is still unclear if adulteration with inverted sugar syrups is detectable by regular analysis.

The aim of this study was to evaluate adulterated honey with commercial sugar syrup by rapid and economical analytical methods.

Natural acacia (A) and multifloral honey (M) were used as basic honey matrix for this experimental design. Twelve samples were prepared by addition in various proportions of Apinvert (commercial inverted sugar syrup) to each natural honey (6 samples for acacia honey and 6 for multifloral honey). Three blanks were used in this study: natural acacia honey (A1), natural multifloral honey (M1) and Apinvert (B). The adulterated samples were prepared with: 5% Apinvert (samples A2, M2); 10% Apinvert (A3, M3); 15% Apinvert (A4, M4); 20% Apinvert (A5, M5); 25% Apinvert (A6, M6). Humidity, pH, acidity and electrical conductivity (CE), hydroxymethylfurfural (HMF) content and diastase activity were evaluated for each sample in triplicate using the methods developed by International Honey Commission (2009).

Honey adulteration with inverted sugar syrup is common due to economical reasons. Although adulterated samples show slight modifications of physico-chemical parameters compared to natural samples (A1, M1), the values are not consistent enough for a laboratory to conclude that the product is adulterated. Humidity (17.2 – 19.4%); CE ~ 0.3 mS/cm; pH 3.7-4.6 and free acidity (min 27-49 mEq/kg) were all below the limit of EC 110/2001. Diastase activity of sample A6 (5.85 Shade units) and HMF of sample M6 (55.76mg/kg) were the only results which placed the samples outside the limits of EC 110/2001. Regular physico-chemical determinations for quality evaluation of honey are not enough to prove the authenticity of the product.

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THE EFFECT OF STORAGE ON THE CONTENT OF POLYPHENOLICS COMPOUNDS IN SNACKS

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Snacks belong to popular products characterized by different tastes, shapes and crunchy texture. In this group important place possess snacks obtained from pellets (extruded semi-finished products), which are expanding during frying in hot oil or baking. Due to the interest among consumers concerning the quality of snacks, raw materials of the nutritional as well as functional actions are looking for. The novel source of active substances could be coloured potato flour, which is rich in anthocyanins - polyphenol compounds of antioxidative properties. The content of polyphenolics found in food can be changed during storage.

The aim of this study was to investigate changes within the content of polyphenolic compounds and anthocyanins profile in fried snacks enriched with coloured potato flour.

The raw material for the preparation of snacks were pellets involving colored potato flour in the place of traditional potato grits present in the recipe. Coloured flour was obtained from 3 purple fleshed (Salad Blue, Blue Congo, Valfi) and 1 red fleshed potato varieties (Herbie 26). The control sample stated pellets with industrial potato grits. Snacks were stored in metalized bags under air atmosphere in the room temperature. The total polyphenols content was determined using the Folin-Ciocalteu colorimetric method, anthocyanins profile by HPLC and the anthocyanins identification was performed on LC-MS/MS.

Three months storage of snacks resulted in a decrease of total phenolics content in all studied samples. The biggest losses were observed in snacks produced with Herbie 26 and Valfi flours (about 39%) and the smallest in snacks enriched with Salad Blue potato flour (11.5%).There was observed a significant decrease in anthocyanin contents in snacks during 3 months of storage. The losses ranged from 6.5% (Blue Congo) to 28.7% (Herbie 26). The main colorant in snacks with purple fleshed potato flour was petunidin-2-p-coumarylrutinoside-5-glucoside and the losses of this compound ranged from 8.3% (Blue Congo) to 22.1% (Salad Blue). In snacks with red flour of Herbie 26 in recipe there was found pelargonidin–3-p-coumaorylrutinoside - 5- which losses amounted 37.7% after 3 months of storage.

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THE QUALITY CHANGES OF SNACKS MANUFACTURED WITH THE SHARE OF POTATO FLOUR FROM VARIETIES DIFFERING IN FLESH COLOUR

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Pellets snacks belong to popular food products, produced from semi-products pellets by frying in hot oil. The component of pellets are different starch containing materials, for example dried potatoes. Fried snacks contain from 18 to 30% of fat. Therefore researches are looking for natural substances which could stabilize fat stability in snacks during storage. Coloured potato flour rich in anthocyanins is promising raw material to manufacture snacks of improved quality. There is possible the increase of fat stability in snacks enriched with natural antioxidant compounds origin from coloured fleshed potatoes.

The aim of the study was to investigate changes of the quality of fat present in snacks enriched with dried potatoes of purple and red flesh at the time of 3 months of storage. Additionally, the purpose of the work was studying the changes of the content of total polyphenols and antioxidant activity of experimental snacks during storage.

The raw material for the preparation of snacks were pellets involving colored potato flour in the place of traditional potato grits present in the recipe. Coloured flour was obtained from 3 purple fleshed (Salad Blue, Blue Congo, Valfi) and 1 red fleshed potato varieties (Herbie 26). The control sample stated pellets with industrial potato grits. Total polyphenolics content was determined by Folin-Ciocalteu method, antioxidant activity using the Trolox equivalent antioxidant capacity (TEAC) with ABTS radicals. Peroxide value of fat extracted from snacks was determined according to AOAC standards (nr 965.33). Samples were packing in metalized bags under air conditions and stored in room temperature. The analysis were provided direct after frying of snacks and 1, 2 and 3 months of storage.

Peroxide value (PV) of fat contained in snack directly after frying was similar in all of studied samples. During storage there was observed PV increase in snacks independently on the origin of potato flour used for their production. The incorporation of coloured potato flour into fried snacks affected on the reduce of the intensity of fat oxidation. There was observed the slight decrease of antioxidant activity of snacks, but mainly in products enriched with Salad Blue and Herbie 26 flours and the decrease of total polyphenols content in all samples, particularly after the second month of storage.

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STUDY ON THE IMPACT OF TOASTING TIME ON ACRYLAMID CONTENT IN BREAD

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For most Polish consumer bread remains a fundamental part of everyday diet. Provides appropriate dose of energy and is a source of nutrients, among others protein, fiber, minerals and biologically active compounds. During the bread production takes a series of chemical reactions between free carbonyl group of reducing sugars and free amino group of amino acids, peptides or proteins. During baking in specified conditions may arise compounds potentially harmful to human health including acrylamide. Additional heat treatment including toasting may increase acrylamide content in bread thus increase the supply of potentially harmful substances to the human body.

The aim of this study was to compare the content of acrylamide in bread at different levels of toasting (toasting time). In addition, a comparison of acrylamide between types of bread (wheat and mixed) and examine the relationship between acrylamide content and water activity.

The study material consisted of 8 kind of toasted bread which were divided into 2 groups: wheat bread and mixed bread. Each type of bread were toasted at 5 different levels of toasting time set by using classical two-chamber kitchen toaster. Determine the content of acrylamide was performed using high performance liquid chromatography with a reverse phase (HPLC-RP).

Studies have shown that in each of the kinds of bread significant amounts of acrylamide were present. The toasting time (toasting level) has a statistically significant effect on the growth of acrylamide content in the tested bread. The statistically significant differences in the contents of acrylamide between types of bread were also shown - bread mixed acrylamide showed higher content than wheat bread. The statistical analysis revealed that there is a statistically significant correlation (negative) between the content of acrylamide and water activity at each level of toasting and each type of bread. Due to the potentially harmful effects of acrylamide on the human body becomes more reasonable wider consumer awareness that it is not negligible choice of the type and form of food intake.

CHARACTERISTIC OF THE RELATIONSHIP BETWEEN SENSORY QUALITY AND PROFILE OF VOLATILE COMPOUNDS OF TRADITIONAL POLISH CURED MEAT- PÓŁGĘSEK

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Półgęsek is Polish traditional product made from goose meat. It is registered in the national List of Traditional Products. In recent years, there has been a growing interest of consumers in traditional food. After the period of fascination for ready meals and fast food, more and more people believe that traditional food products have an exceptional sensory qualities.

The aim of this work was to characteristic the specific relationship between sensory quality and profile of volatile compounds of traditional Polish cured meat – *półgęsek*.

The research material was 21 commercial samples of półgęsek. Products came from the three different producers. To evaluate the sensory quality the QDQ method of profiling, in accordance with norm PN-ISO 4121:1988 was applied. Isolation of volatile compounds from the headspace was done with the use of Solid Phase Microextraction – SPME method. Results were elaborated with the use of statistical packaging STATISTICA version 10 (StatSoft, Inc. 2011) and Microsoft Excel 2007 program.

The results of sensory evaluation confirmed significant role of volatile compounds in creation of *półgęsek's* flavor and odour. Among studied odour attributes, the intensity of smoked meat aroma was rated best in products from each of the producers. Results of correlation between marked volatile compounds and attributes of sensory quality have shown that only 2-methyl-pyridine indicated statistically significant part in creation of smoked meat aroma. It is a compound of Pyridines group, which is characteristic compound of wood smoke. It is worth noting, that Thymol being an essential oil originating from added spices was negatively correlated with intesity of smoked meat's odor. It indicates the probability of concealing or eliminating the intensity of smoked meat aroma by adding spices. Similarly the situation looked like in case of flavor attributes. In this case, four volatile compounds have shown statistically significant correlation with intensity of smoked meat flavor. These were 2-methyl-pyridine, 2-furanmethanol, phenol, 2,3-dimethyl-2-cyclopenten-1-one and 3+4-methyl-phenol which are typical wood smoke compounds. Moreover, once again the essential oils originating from spices indicated negative correlation with differentiator of smoked meat's flavor. It was not only the thymol, but also α-pinene, an aroma compound originating probably from addition of cumin and cymene, which could have originated from rosemary. The addition of spices could so indicate the effect of eliminating the feeling of smoked meat flavor.

CHARACTERISTICS OF CHEMICAL COMPOSITION AND BIOACTIVE COMPOUNDS OF STRAWBERRY FRUIT (*FRAGARIA X ANANASSA*)

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Scientific reports have validated advantageous interaction between fruit consumption and prevention and treatment of chronic, noncommunicable diseases. Fruit are characterized by high content of polyphenolic compounds and high antioxidant activity. Furthermore, they stimulate insulin secretion, reduce blood glucose level, and lower blood pressure, serum cholesterol and triglycerides.

Strawberries (*Fragaria x ananassa*) are an important crop in temperate regions such as Poland. They are widely consumed fresh and in processed form. These attractive fruits are favored for their excellent taste and can be considered a very potent source of bioactive phenolic compounds.

The aim of this study was to assess chemical composition including polyphenols profile and antioxidant activity of strawberry fruit.

Research material consisted of different cultivars of strawberries (Rumba, Honeoye, Kimberlay, Pandora, Florence, Flair and Roxana). In the studied fruits the content of total polyphenols (anthocyanin, flavanol, flavonol, and phenolic acid) and polymeric procyanidins by the UPLC were determined. Total antioxidant activity by FRAP and ABTS methods was established. And also chemical parameters were determined, i.e. dry matter, soluble solid, titratable acidity, sugar content.

Conducted research has shown, that the major polyphenols groups of strawberries were flavan-3-ols > phenolic acids >anthocyanins>flavonols. The total polyphenols determined by UPLC method ranged from 9.52 g/100 g d.m. (Honey variety) to 5.98 g/100 g d.m. (in Rumba variety). The results confirm that high antioxidant potential, has been stimulated by polyphenolic compounds. The results clearly demonstrated that the values of the studied discriminants (the chemical composition and the content of bioactive compounds) were determined by the cultivars.

The study has indicated that the strawberries are an interesting material with a high pro-health potential, with the possibility of use in the prevention of lifestyle diseases.

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CONTENT OF BIOACTIVE COMPOUNDS AND ANTIOXIDANT ACTIVITY OF SOUR CHERRY SMOOTHIES

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Nowadays, there is a trend to design new fruit products with high health-promoting value. One such product is fruit cocktails (smoothies). Smoothies are mainly fruit-based products with a typical semi-liquid, smooth consistency that are prepared by mixing juice and fruits that were earlier ground to puree. Due to seasonal availability of fruits, it is interesting to determine whether fruit-derived products such as smoothies could also represent good sources of bioactive compounds.

The aim of this study was to assess the polyphenol content and antioxidant activity of sour cherries smoothies, obtained using of sour cherry puree enriched by apple or pear juice.

The production process included 3 main technological stages: juices was produced from apple and pear fruits; processing of sour cherry fruits into puree; mixing semi-products in proportions juices:puree as the proportion: 80:20; 50:50 and 20:80, additionally was analyzed as control sample: apple juice, pear juice and sour cherry puree (100%). Polyphenolic compounds were identified by LC-MS QTof and quantified by UPLC. Additionally, antioxidant activity by ORAC and FRAP methods was measured.

The compounds belonging to the following groups were identified in the examined smoothies: flavan-3-ols, flavonols, phenolic acid and anthocyanins. Depending on the composition of final product noted different content of polyphenols and also antioxidant activity. The highest antioxidant activity were identified for the smoothies with 20% pear juice – 3,97 mmol Trolox per 100g products, the lowest antioxidant activity, coctail with 80% apple juice in 100g of product – 1,69 mmol Trolox (ORAC). Furthermore, it was observed that the content of polyphenolic compounds was positively correlated with the antioxidant properties of the final product.

The newly designed products presented high content of bioactive compounds and antioxidant activity, so finally high nutritional value.

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ANTAGONISTIC ACTIVITY OF THE SELECTED *LACTOBACILLUS* STRAINS ISOLATED FROM FERMENTED CUCUMBER AND CABBAGE

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Lactobacillus strains and other lactic acid bacteria have been used traditionally in food industry as an effective method for extending time of storage of foodstuff by simple fermentation. The preservative effect of those bacteria is mainly due to the production of one or more active metabolites with antimicrobial properties, such as organic acids, hydrogen peroxide or bacteriocins.

The aim of the study was to evaluate the antimicrobial properties of *Lactobacillus* strains isolated from fermented cucumbers and cabbage, against selected strains of pathogenic and spoilage food microbiota.

The *Lactobacillus* strains were previously isolated from fermented cucumbers and cabbage (Zielińska et al., 2015) and were identified as *Lb. casei* (O12, O13, O16, O18), *Lb. plantarum* (O19, O20), *Lb. brevis* (O22, O24), *Lb. rhamnosus* K3 and *Lb. johnsonii* K4. The *Lactobacillus* strains were characterized for their antimicrobial properties relative to Gram positive (*B. subtilis* and *En. faecium) and* Gram negative *(Ps. fluorescens, E. coli, P. mirabilis and S. enteritidis)* indicator strains using the well diffusion method, and were screened for their H_2O_2 production ability. Tests included also two reference strains: *Lb. plantarum* 299v and *Lb. rhamnosus* GG.

Antagonistic activity of the culture of tested *Lactobacillus* strains was characterized by very high, high and medium against the indicator strains, with the greatest zones of inhibition for *E. coli* (11.19±1.98), and the smallest for *En. faecium* (6.97±1.9). It was found that almost all strains (excepting O20 and O24) were able to produce H_2O_2. The neutralized and treated with a catalase supernatant from the culture of the strains O13 and K3 exhibited slight (3.5±0.9) antagonistic activity against *E. coli*, whereas the supernatant of strains O12, O16, O20, K3 and K4 cultures exhibited antagonistic activity against *Ps. fluorescens* (3.5±0.8), in turn neutralized supernatant from culture of the strain O24 exhibited slight antagonistic activity against all indicator strains, which suggests the ability of these *Lactobacilus* strains to produce bacteriocins or bacteriocin-like substances. Antagonistic activity of the *Lactobacillus* strains isolated from fermented vegetables was comparable to that which exhibit probiotic microorganisms of human origin.

STUDIES ON PHYSICAL PROPERTIES OF STRUCTURED OIL AND PALM FAT

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Typical shortenings fats have solid consistency, which is due to high content of saturated fatty acids (SFA) or *trans*-isomers (TFA). These fats give desirable sensory characteristics of the products. International organizations such as EFSA and WHO recommend a maximum reduction of SFA and TFA consumption. Therefore it is necessary to develop new fat products based on vegetable oils rich in unsaturated fatty acids. However, the use of liquid oils in many products adversely affects the sensory properties and can cause oil migration from the product. To prevent this, it is necessary to add substances structuring oil.

The aim of the study was to analyze selected properties of fat product prepared from vegetable oil with addition of structuring substances.

Materials used for this work were structured oils (oleogels) obtained from high-oleic sunflower oil and 3% addition of oleogelators: monoacylglycerol (MAG) and waxes (candellila - CLX, carnauba - CRX, white beeswax - WBX, yellow beeswax - YBX and rice bran wax - RBX). The properties of obtained oleogels and palm fat were compared. Influence of the structuring substances addition on the properties of oleogels were tested by: determination of crystal size, viscosity, texture, color parameters in the CIELAB system, the crystallization time and the oil binding capacity by centrifugal separator method and a filtration method at 40°C.

The addition of waxes and monoacylglycerols to high oleic sunflower oil caused a gelatinization. Solid oleogel was not obtained only in the case of CRX addition. Oleogels with RBX and CLX were characterized by the densest crystals networks. The most similar to the palm fat in terms of microstructure and the crystal size was CLX oleogel. All manufactured products differed significantly in color and hardness compared to palm fat. In terms of apparent viscosity closest to the palm fat (379.4 mPa·s) was the RBX oleogel (412.4 mPa·s). Oil binding capacity determined by the centrifuge method was the largest for CLX and YBX, while in the filtration at 40°C method RBX was characterized by the smallest oil lose.

ANTIOXIDANT CAPACITY OF ORGANIC AND CONVENTIONAL CEREAL PRODUCTS

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Recent consumer interest in controlling and preventing chronic diseases through improved diet has promoted research on the bioactive components of agricultural products. Cereal are important agricultural and dietary commodity worldwide with known antioxidant properties. Organic farming is an alternative form of agriculture to conventional farming. Cereal products derive either from the processing of grain through one or more mechanical or chemical operations, or from the processing of flour, meal or starch. Milled products from cereals include flour and groats.

The aim of the study was to examine and compare the antioxidant capacity of selected commercial cereal products from conventional and organic farming.

Nine commercial cereal products (barley groats, semolina, millet, grits, rye flour- type 720, wheat flour- type 500, wheat flour- type 750, wheat flour- type 1850, corn flour) from conventional and organic farming were examined and compared for their antioxidant capacity. It entails in some case grinding of cereal products and in each case mixing with ABTS reagent, centrifugation and measure of the absorbance (λ= 734 nm).

In general there are differences in antioxidant capacity among analyzed conventional and organic cereal products. Organic cereal products have higher antioxidant capacity than conventional cereal products. The highest antioxidant capacity for both types of products have barley groats and the lowest wheat flour-type 500. These results indicate that readily available cereal products contain significant levels of antioxidants and may be an important source of dietary antioxidants.

CONTENT OF FREE PHENOLIC ACIDS IN GRAIN OF WINTER WHEAT

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Wheat is a major crop and an important component of the human diet, particularly in developing countries. Wheat varieties and cultivars are grown for particular characteristics that are suitable for specific products. Phenolic acids are derivatives of benzoic and cinnamic acids and are present in all cereals. There are two classes of phenolic acids: hydroxybenzoic acids and hydroxycinnamic acids. The phenolic acids reported in cereals occur in both free and bound forms. Free phenolic acids are located in the outer layer of the pericarp and are extracted using organic solvents.

The aim of the study was to examine and compare the content of free phenolic acids (FPA) in grain of winter wheat.

Individual grain samples of winter wheat (n=30 varieties) were collected at experimental stations of Plant Breeding and Acclimatization Institute—NRI. Extracts of each samples were mixing with Folin-Ciocalteu reagent and measuring of the absorbance (λ= 760 nm).

In general there are differences in content of free phenolic acids in grain of 30 winter wheat varieties. Variety, which had the highest content of free phenolic (FPA) acids was Naridana (588 mg/kg) and the lowest Markiza (522 mg/kg). The mean content of FPA for all analyzed samples was 557 mg/kg. These results indicate that different varieties of winter wheat differ in content of antioxidant compounds.

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OLIGO- AND POLYSACHARIDES' HEALTH-PROMOTING PROPERTIES

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Many scientific researches have confirmed the positive influence of fructooligosaccharides (FOS) on human's health. However, there are other oligo- and polysaccharides with a great potential for application in human nutrition. The new results have proven also the prebiotic properties of manno-oligosaccharides. Another polysaccharide which attracts the attention of scientists is β –glucan. This homopolymer of glucose, is a component of many plants, mushrooms and microorganism. β –glucan from oat and barley has the property of colon activity regulator and β –glucan from yeast and mushrooms plays a role in the immune system stimulation. Some fractions of this polysaccharide have a potential prebiotic application. β –glucan isolated from yeast can form aggregates with manno-oligosaccharides. It also forms the complex spatial structures of single or triple helix. Factors such as source, method of isolation, composition and structure influence the bioactivity of polysaccharides.

The aim of this work was firstly to find the source of biologically active β-glucan and develop the method of its isolation and purification. Secondly, it was to evaluate the prebiotic properties of obtained preparations, purified or aggregated with other polysaccharides and proteins.

The raw material for the isolation of β-glucan were yeast *Saccharomyces cerevisiae*, mushrooms *Pleurotus ostreatus*, and oatmeal. The polysaccharide was isolated with acid-alkali and enzymatic methods.

The prebiotic properties of β-glucan were evaluated with 11 strains of probiotic LAB grown on modified MRS medium, with β-glucan as the only source of carbon.

From among the preparations tested, only those from oatmeal were isolated with both acid-alkali and enzymatic methods, and also water soluble fraction from *Pleurotus ostreatus,* which have shown prebiotic properties. In the case of some tested strains, β-glucan intensified the growth of bacteria. Among the products of fermentation, there were some organic acids.

QUALITY AND PROCESSING SUITABILITY OF EWE'S MILK IN DIFFERENT STAGES OF LACTATION

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Milk and milk products are an essential group of food products, which are part of the daily diet. A preferred feature of ewe's milk is high dry matter content, in comparison to cow's milk, because it naturally contains more proteins and fat. Ewe's milk is mainly used for cheese production - the world famous French cheese Roquefort or Italian Pecorino. Poland is well known for oscypek, bundz and bryndza, cheese made of ewe's milk also.

The aim of this study was to evaluate the physicochemical parameters, hygienic quality and suitability for processing of organic ewe's milk obtained at different stages of lactation.

The research material was pooled ewe's milk purchased from the farm "Owcza zagroda" in Wyżne and collected three times in different stages of lactation: in May (I), June (II) and October (III). The general number of micro-organisms and the number of somatic cells were determined in IBC M/SCC (Bentley) semi-automatic counter. The chemical composition and freezing point were determined in Bentley B-150 milk composition analyzer. Potential acidity was determined by titration of 0.25N samples with standard solution of sodium hydroxide in presence of phenolphthalein as an indicator and active acidity (pH) was analyzed by the use of pH/conductivity meter CPC–505 (Elmetron) equipped with the OSH 12–00 electrode. Determination of fat content was performed according to Gerber's method and the density of milk was determined by areometric method. The obtained results were worked out statistically in the software Statistica v.10 with the use of one-way analysis of variance, and significance of differences between the averages was estimated with Tukey's test.

Ewe's milk was characterized by the total number of micro-organisms in the range of 253 334 (II) to 653 333 (III) CFU per 1 ml and a low level of somatic cells (from 94333 – stage II, to 210666 - stage III per 1 ml). Potential acidity of the milk was determined in the range of 8.13 °SH - stage II, to 10.93 °SH - stage III, and the pH was determined in the range of 6.64 to 6.91, respectively for the milk from II stage and III stage. Those values indicate on the freshness of sheep's milk. Correct freezing point (from -0.588 to -0.603 °C) and normal density of the milk indicate that there was no dilution of the tested material. During the lactation coarse clearly increase of the fat content in the ewe's milk (from 3.59% to 10.26%), proteins (from 4.58% to 8.06%) and the dry matter (from 13.76% to 22.78%) and decrease of the content of lactose (from 4.32% to 3.24%) were observed.

TRACE ELEMENT CONCENTRATIONS IN DIFFERENT POTATO VARIETIES FROM FERTILIZER APPLICATIONS

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In many European countries, potatoes represent main staple food and therefore consumption of tubers can substantially affect human dietary intake of many elements. These plants have characteristic taste, relatively low calorific value and composition of different bioactive compounds. Potato tubers contain about 1% of the macro- and microelements and their concentration depends on variety, soil type, used plant protection products, and the form of fertilization.

The aim of the study was to evaluate the impact of different forms of fertilization on the level of iron, copper, zinc, calcium, magnesium, sodium, potassium and manganese in the edible tubers of two potato varieties.

In this experiment, trace element concentrations were determined in the edible tubers of two potato varieties under various fertilizer applications (Asahi, Bio-Algen, Kelpak and Trifender) compared to control (without fertilization). The lyophilized samples, after mineralization were analyzed using atomic spectrometer Agilent 200 Series AA.

The study demonstrated the differences in the levels of the analyzed trace elements in the edible potato tuber both between different varieties and within the variety with various fertilizer applications, as compared to control samples (without fertilization).

EFFECT OF ESSENTIAL OILS ON ZEARALENONE REDUCTION UNDER *IN VITRO* CONDITIONS

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Zearalenone (ZEA) is a secondary metabolite biosynthesized mainly by *Fusarium graminearum* and *F. culmorum* and is present in cereals and cereal products. Because of the significant health hazard posed by ZEA to, both, humans and animals, many countries have implemented legal regulations specifying maximum acceptable levels of this compound in maize and small-grain cereals. The exposure risk to human is either directly through foods of plant origin (cereal grain) or indirectly through food of animal origin (kidney, liver, milk and eggs). It is very important to find an effective methods to reduce mycotoxins and improve the quality of plant materials.

The aim of this study was to confirm and optimize the reduction of the ZEA using essential oils as a decontamination factor with different doses of essential oils, incubation temperature and pH value.

Seven essential oils were used in the test: cinnamon leaf, cinnamon bark, white grapefruit, pink grapefruit, lemon, eucalyptus, and palmarosa oils. The experiment was based on the addition of various essential oils to the toxin solution under *in vitro* conditions. Qualitative and quantitative analysis of the ZEA was performed using HPLC method with fluorescence and photodiode detectors.

The experiment has confirmed the reduction of the ZEA concentration depend on temperature, pH and essential oil concentration.

THE KINETICS OF BACTERIA GROWTH FROM GENUS *PROPIONIBACTERIUM* IN WASTE SUBSTRATES OF AGRI-FOOD INDUSTRY

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The utilization of the waste products is a serious problem for food industry and the environment. Therefore the research are going for new solution of management industrial waste, e.g. potato pulp and apple pomace. The estimations for solving problems of utilization are in biotechnology which enables biodegradation of waste products with obtaining useful industrial metabolites (propionic acid, acetic acid).

The aim of the study was to compare the growth kinetics of different strains of propionic bacteria in the apple pomace and potato pulps.

The research used apple pomace and potato pulp which has been prepared in laboratory conditions. Culture media has been supplemented with biotin (0.0002 g/L), peptone (10 g/L), yeast extract (5 g/L), L-cysteine hydrochloride (0.4 g/L), potassium hydrogen phosphate (1.5 g/L) and dipotassium hydrogen phostate (2.5 g/L). The active acidity (pH) of the substrates has been set at 6.8-7 level. The culture have been grown in the Bioscreen C machine (OY Growth Curves AB LTD, Finland) during 60 h at 30˚C temperature. The broadband filter (λ = 420-580 nm) has been used for optical culture density measurement. Biological material were strains type: *Propionibacterium acidipropionici* (T122), *P. thoenii* (T117), *P. jensenii* (T 112, T127), *P. freundenreichii* (T82, T107). Based on the curves relating optical density and period of culture the adaptive phase, log phase and the specific of growth rate were set.

Using the apples pomace as substrate an increase have been showed for all tested strains, except *P. jensenii* T127. The highest specific growth have been observed in strains type *Propionibacterium acidipropionici* T122. Using potato pulp all of the types of strains (T82, T107, T112, T127) have been grown as well. The highest growth was observed for strains type *P. jensenii* T112.

Based on research we can say that there is a possibility to utilize apple pomace and potato pulp to obtain products of propionic metabolism.

THE EVALUATION OF COLD-PRESSED AND REFINED RAPESEED OIL STABILITY USING RANCIMAT AND PRESSURE DIFFERENTIAL SCANNING CALORIMETRY (PDSC) TEST

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Fats have a very important role in the human diet. Constitute a source of energy, fat-soluble vitamins, antioxidants and essential fatty acids. Increasing consumer awareness regarding healthy nutrition makes that vegetable oils are increasingly more popular, especially cold-pressed. One of the most valuable from nutritional point is rapeseed oil. However, the high content of polyunsaturated fatty acids causes that in oil during storage or heat treatment oxidation process takes place. The consequence of oil oxidation is deterioration of the quality and formation of compounds harmful to human health. In order to protect consumers against the consumption of dangerous products of oxidation there are many methods used to assess the oxidative stability of oils, among other rapid tests: Rancimat and PDSC.

The aim of this study was to determine the quality and oxidative stability of cold-pressed and refined rapeseed oil using Rancimat and pressure differential scanning calorimetry (PDSC) test.

The material consisted of ten rapeseed oils: five refined and five cold-pressed. Chemical analysis of oils was done by determining the acid (AV), peroxide (LOO) and anisidine value (LA). Also Totox indicator was calculated. Additionally color, fatty acid composition, content of tocopherols, heavy metals of tested oils were determined. Moreover sensory evaluation was performed. In addition, oxidative stability of tested oils in Rancimat test at 120^{o}C as well as PDSC test – at 120^{o}C and at 1400 kPa of oxygen were determined.

Analyzed oils were characterized by good quality. Refined oils compared to cold-pressed had lower AV (0,11 – 0,29 mg KOH/g) and PV (0,97 – 2,02 meq O_2/kg). Also refined oils were generally characterized by a higher oxidative stability in both Rancimat and PDSC test. Cold-pressed oils were characterized by a higher content of carotenoids, tocopherols and heavy metals. The biggest influence on oxidative stability of both refined and cold - pressed rapeseed oils associated with a content of polyunsaturated fatty acids and the content of secondary and primary oxidation products – Tototx indicator. Methods of assessing the oxidative stability were strongly correlated with cold – pressed and oils, respectively. The coefficient of determination R^2 for cold - pressed oils amounted 0.98 and 0.96 for refined.

OPTIMIZATION OF BIOACTIVE COMPOUNDS EXTRACTION PROCESS FROM LEAVES OF WHITE MULBERRY USING ULTRASONICATION

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Nowadays bioactive compounds become the most interesting components of plant material which are successfully used in functional food production. However acquisition of these components can be reduced by applying improper extraction techniques.

White mulberry leaves since ancient times have been used in the prevention of many diseases. It results from the wealth of bioactive components contained therein. Therefore, it can be used in the form of intermediate products (e.g. extracts) as part of prohealthy food products.

Ultrasonication process, due to their specific effect on tissues and cell walls affects on extraction level of bioactive ingredients from plant material.

The primary goal of the study was to determine effect of ultrasonication process of mulberry leaves on antioxidant activity by optimizing extraction process.

Basic materials were Polish mulberry leaves gathered in July, 2012 from plantation of Institute of Natural Fibres and Medicinal Plants. Fresh leaves were shredded and twisted and then divided into 5 parts (due to aging time: 0, 1, 2, 3, 4 hours of aging in piles of 10-15 cm). There was experience plan created by using *Design Expert*. Sonication process was carried out by using selected parameters with variables: time (1-30 mins), temperature (30-80^{o}C) and leaves weight (1–6 g). There were 20 experiences conducted. Total phenolics content, DPPH radical scavenging activity and ABTS cation radical inhibiting activity were measured in each aqueous extract of mulberry leaves.

Results showed that extraction process with ultrasounds keeps mulberry leaves rich in antioxidants. In conducted tests it was showed that the best in this case were extracts obtained from ~3.5 g of leaves sonicated for 30 mins in temperature 55^{o}C (variant 16th). Moreover *Design Expert* showed two other extracts as relevant in these three tests: ~3.5 g of leaves sonicated for 15.5 mins in temperature 55^{o}C (variant 17th) and ~6 g of leaves sonicated for 30 mins in temperature 80^{o}C (variant 15th). Despite the fact that ultrasonication process of mulberry leaves in water bath in laboratory scale was defined as gainful in the way of antioxidant activity, it could be difficult and expensive to transpose it to industrial scale.

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DETERMINATION OF CONTENT OF ANTIGLYCEMIC COMPOUNDS IN MULBERRY LEAVES USING LIQUID CHROMATOGRAPHY

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White mulberry is a tree which all morphological parts have been used in Far East Medicine for ages. All of them can be utilize as a sources of natural antioxidants and bioactive compounds. Previous studies showed that white mulberry leaves are rich in compounds responsible for reduction of blood glucose level after meal. 1-deoxynojirimycin is one of the most important alkaloids in this matter. Mulberry leaves having this sorbitol derivative can be valuable tool against lifestyle diseases.

The aim of the study was to develop method for determining 1-deoxynojirimycin in white mulberry leaves using high performance liquid chromatography.

The main materials in the study were mulberry leaves gathered from plantation of Institute of Natural Fibres and Medicinal Plants (Pętkowo, near Poznan, Poland) in July, 2012. After shredding and twisting fresh leaves were divided into 5 parts according to aging time: 0, 1, 2, 3, 4 hours of aging in piles of 10-15 cm.

The method of determination of 1-deoxynojirimycin was based on Kim et al. [2003] with modifications appropriate to the material and equipment.

Studies showed that leaves from Polish variety of white mulberry cultivated in moderate climate contain 1-deoxynojirimycin as well as Chinese one. There were observed differences in the amount of derivate between each leaves variants. Modifications used in the method course helped to adapt it to the tested material and laboratory options. It was found that mulberry leaves *Wielkolistna żółwińska* variety can be utilize as a relevant component of functional food products because of content of important antiglycemic compound.

The studies were supported by the EU Project No POIG 01.01.02-00-061/09 ‘New Bioactive Food with Designed Functional Properties’

THE INFLUENCE OF THE CONDITIONS STORAGE ON THE QUALITY OF CONCENTRATED JUICE OF CRANBERRY

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Cranberries have been marketed due to their high nutrient and antioxidant content and are often referred to as a "super food". Refrigeration is recommended for storage of most perishable fresh produce. Low temperature inhibits microbial growth, retards spoilage, and suppresses undesirable metabolic changes, therefore, maintains quality and extends storage life.

The objective of this study was to analyze fresh and pasteurized cranberry juices. The main destination of this project was to study the influence of storage conditions (temperature 20, 4 and -23^{o}C) on the quality of concentrated juices.

In particular categories of juices there were specified the basic parameters of the chemical composition as well as contents of selected biologically active compounds like polyphenols, anthocyanins, vitamin C. It were also specified the antioxidant capacity of the concentrate and basic parameters of L*, a*, b* color.

Based on conducted survey it was observed, that process of pasteurization and storage conditions had considerable impact on the changes in content of bioactive components and antioxidant capacity.

It was found that the concentrated cranberry juice stored at 20°C experienced the greatest losses of polyphenols (anthocyanins - 25%), vitamin C (38%) and antioxidant capacity (44%).

INFLUENCE OF RUTIN FORTIFICATION ON MAILLARD REACTION PRODUCT FORMATION AND ANTIOXIDANT CAPACITIES IN RYE-BUCKWHEAT GINGER CAKES

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The Maillard reaction (MR) is responsible for the development of color, taste and aroma of thermally treated food as well as decrease of nutritional value of final product. The progress of the reaction can be evaluated in the context of early (furosine), advanced carboxymethyllysine - CML, acrylamide - ACR and fluorescent intermediatory compounds) and final products (melanoidins) formation. However, the MR progress can be limited by polyphenols from natural sources having a high antioxidant potential.

The aim of this study was to find out the influence of rutin fortification on Maillard reaction product formation and antioxidant capacities in rye-buckwheat ginger cakes.

The cakes were formulated on rye flour substituted by flour from husked buckwheat or flour from roasted buckwheat groats at 30% level and by adding low and high amounts of rutin. Then the rutin, total flavonoids and available lysine contents were determined. The antioxidant capacity (AC) was measured by ABTS and photochemiluminescence methods whereas the MR products were determined by advanced HPLC methods.

Enrichment of rye-buckwheat ginger cakes with rutin improved their AC, showed protective effect on lysine blockage and stimulated MR progress to the melanoidins formation, thus supporting their contribution to the AC. In contrast, the loss of nutritional quality of rye-buckwheat ginger cakes with rutin was noted due to the formation of CML and fluorescent intermediatory compounds at the advanced stage of MR. Formation of a moderate level of ACR at the advanced stage of the MR was found, but no relationship with total flavonoids and rutin contents, as well as with AC of rye-buckwheat ginger cakes with rutin was noted. This study suggests that elaborated rye-buckwheat ginger cakes may be recommended for wider nutrition since daily consumption of 250 g of cakes enriched with high dose of rutin (125 mg per 250 g of cakes) may exert a prophylactic or therapeutically effect.

EVALUATION AND SCREENING OF EFFICIENT PROMOTERS IN *SHEWANELLA ONEIDENSIS* MR-1

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Hydrogen gas is used in the food industry for the saturation of fatty acids in the course of the margarine production process. Conventional methods of getting H_2 require the use of fossil fuels and the investment of great amounts of energy. Microbial hydrogen production represents a promising alternative. *Shewanella oneidensis* MR-1 is considered to be a potentially efficient hydrogen producer due to its unique respiratory capabilities. The intensive research of *S. oneidensis* demands the availability of molecular tools for its genetic manipulation. In particular efficient promoters are required to provide protein expression in this host. In current work we used β-galactosidase reporter system to assess activity of several *S. oneidensis* promoters of which one showed a very high constitutive activity (promoter of *S. oneidensis* transketolase gene, *tkt*). Also, we constructed genomic library of *S. oneidensis* and the most efficient promoter selected was identified as a promoter of gamma-glutamylputrescine oxidoreductase. However, β-galactosidase activity driven by this promoter was about 50% of the activity achieved under control of transketolase promoter. Also, we used SDS-PAGE to estimate the level of protein expression of β-galactosidase under control of *tkt* promoter in *S. oneidensis* MR-1 cells. The result of densitometric analysis revealed that the content of β-galactosidase is about 9% of the total cellular protein.

THE DEGRADATION OF STIGMASTERYL ESTERS DURING THERMO-OXIDATION IN MODEL SYSTEM

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The main food sources of plant sterols are vegetable oils, spreads, margarines, breads, cereals and vegetables. In the typical Western diet, the mean daily intake of plant sterols is about 300 mg, but can be as high as 600 mg in vegetarians. Plant sterols are the major part of the unsaponifiable fraction in most vegetable oils. Thermo-oxidation of phytosterols lead to degradation and formation of Phytosterol Oxidation Products (POP) with controversial biological effects. Currently ongoing worldwide research aimed to ascribe biological properties of phytosterol oxides. POP require specific investigation with the aim to minimize their formation and evaluate their effect on human health.

The main goal for this study was to establish the degree of stigmasteryl esters degradation during thermo-oxidation when thermally treated at temperatures simulating food storage and frying. Stigmasteryl esters were obtained by esterification of stigmasterol with stearic, oleic, linoleic and α-linolenic acids. The purity of obtained esters was evaluated by GC/MS. Quantitative changes of fatty acids and stigmasterol minority in the phytosteryl esters was evaluated by GC/MS and GC/FID.

Thermo-oxidation caused disintegration of stigmasteryl esters. The degree of degradation was directly affected by temperature, time and kind of fatty acid in stigmasteryl ester. After heating at 60°C and 180°C for 12 hours, respectively about 1% and 52% of stigmasteryl stearate, 1% and 45% of stigmasteryl oleate, 12% and 93% of stigmasteryl linolate, 15% and 97% of stigmasteryl α-linoleate were removed. Rates of acid and sterol degradation during heating varied. The stigmasteryl stearate, stearic acid was stable during heating at 60°C for 12 h and 180°C for 2 h, whereas losses of stigmasterol in theses samples were 1% and 18%, respectively. Degradation of unsaturated fatty acids was faster than sterol.

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PHYTOCHEMICAL CONTENT OF COLD-PRESSED SUNFLOWER, SESAME, SOYBEAN AND RAPESEED OILS

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Recently products labeled as "organic" and "safe food" becomes much more popular. In many European countries the market of organic and natural food has developed, which also includes cold-pressed oils. Changes in dietary trends caused increase in cold-pressed oils consumption. Sunflower, sesame, soybean and rapeseed are one of the most popular oilseeds worldwide. The production of these seed is huge and they are used for the extraction of oil for different utilizations as a food product and in the formulation of multiple cosmetic and pharmaceutical products.

The aim of this study was qualitative and quantitative identification of fatty acids, sterols and tocopherols contents in sunflower, sesame, soybean and rapeseed cold-pressed oils.

The analyses were performed on three different kind of each type of oil. In the study cold-pressed oils purchased in retail outlets in Poland in November 2014 were tested. All oils were purchased and analyzed within the recommended period of consumption. Fatty acid composition and phytosterols content were determined by GC/FID. Tocopherols content was tested by NP/HPLC/FL.

Soybean and sunflower had the biggest share of polyunsaturated fatty acids (57%), than sesame (45%) and rapeseed (35%). Although n-6 : n-3 fatty acids ratio in rapeseed oils (3:1) is the closer to recommended (2:1) while for sunflower is as high as 470:1. Sesame oil was the richest source of plant sterols (900mg/100g), than rapeseed (700mg/100g), sunflower (350mg/100g) and soybean (290mg/100g) oils. The average content of tocopherols in tested oils was the biggest in soybean oil (90mg/100g), than in sunflower (76mg/100g), rapeseed (54,5mg/100g) and sesame (43,5mg/100g) oils. The content of fatty acids, sterols and tocopherols in the same kind of oil were slightly different.

A STUDY OF THE CORRELATION BETWEEN CANOLOL CONTENT AND OXIDATIVE STABILITY OF *VIRGIN* RAPESEED OIL AS A FUNCTION OF SEEDS MICROWAVE PRETREATMENT

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Rapeseed contains more phenolic compounds than most of the other oilseed plants. The most significant of these are sinapic acid and its derivatives. Through decarboxylation of sinapic acid during the seeds thermal pretreatment canolol can be produced, described as a compound exhibiting strong antioxidant, anticarcinogenic, and antimutagenic properties. Thus rapeseed oil nutritional value may be enhanced by elevating the canolol content through thermal treatment of seeds prior to pressing.

The objectives of this research were (1) to evaluate the effect of the initial moisture content of rapeseed and microwave pretreatment time on tocopherols, plastochromanol-8 and canolol content in rapeseed oil, (2) to analyse the correlation between oxidative stability and minor components contents.

For each sample, 0.5 kg of whole rapeseed were adjusted to moisture contents of 7 and 9 %, and equilibrated at 0–4 °C for 24 h. Then individual sample sets were subjected to microwaving for 3 and 7 min under 800W. The oil was cold-pressed using screw-press (Farmet, Czech Republic). Rapeseed varieties used in the investigation (Bakara and Kana) were evaluated for tocopherols (α-, β-, γ-, δ-T homologue), plastochromanol-8, and canolol contents by NP-HPLC. Oxidative stability of oils was determined with the Rancimat test at 120 ºC.

Microwave pretreatment led to a constant increase of the canolol content, whereas only slight increase of tocopherol content was observed. Canolol contents increased with increasing microwave time and with decreasing initial moisture content of rapeseeds. When seeds initial moisture content was 7%, after 7 min of exposure the content of canolol in the samples increased drastically, the amount of which increased 48-fold (821.86 μg/g for Kana) and 92-fold (926.42 μg/g for Bakrara) in relation to control. However, when seeds were adjusted to moisture content of 9%, after 7 min exposure the canolol concentration was nearly 3-fold lower compared to seeds with 7% water content. Significant linear correlation have been found between the content of canolol and oxidative stability of oils (r^2=0.9632). The IP lengths prolongation from 3.64-4.09 h up to 11.52-12.75 h was observed.

THE INFLUENCE OF ADDITION ALPHA-AMYLASES OF DIFFERENT ORIGIN ON SELECTED WHEAT BREAD QUALITY INDICATORS

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Alpha-amylases are endo-amylases from the group of hydrolases that catalyze the hydrolysis of the α-1,4-glycosidic linkages starch. The result of their actions is creation of the short chain dextrin and small amounts of maltose. The amylolytic enzymes are added to the dough in order to improve the quality characteristics of the bread.

The aim of the study was to investigate the influence of various alpha-amylases addition on selected wheat bread quality indicators.

The research material were wheat bread received from the dough consistency of 350 jB. The dough was conducted using the direct method with the addition of alpha-amylase: mushroom - M4 (*Aspergillus oryzae*) and bacterial - GMS (*Bacillus sp.*). The enzyme were added as 3 doses (minimum, intermediate and maximum) according to the manufacturer's instructions. The control sample was bread without addition of enzymes. The obtained bread was determined according to: volume, moisture content, porosity and density of the crumb. Moreover, during the study an analysis of the bread crumb texture, evaluating hardness, gumminess, chewiness, cohesiveness, resilience, springiness was made. The results were analyzed according to the Tukey test at $\alpha = 0,05$ (Statistica 10.).

Bread with addition of the alpha-amylases, regardless of the used dose, had an increased volume as compared to the control sample. There was no significant effect of the addition of the alpha-amylase in the bread crumb moisture. The addition of alpha-amylase had a significant impact on increase in the porosity and a decrease in the mass of crumb as compared with the control sample. The highest porosity of the bread was noticed in bread with addition of the alpha-amylase GMS. The addition of alpha-amylase had a significant impact on the reduction of hardness, gumminess and chewiness of the bread crumb. There were no significant effect of the addition of alpha-amylase on cohesiveness, springiness and resilience of the bread crumb. The exception was bread with the addition of alpha-amylase GMS (minimum dose), which showed a significantly higher resilience of bread crumb and with the addition of alpha-amylase GMS (maximum dose) characterized by a significantly lower resilience of the crumb, as compared to other samples.

On the basis of the study it has been noticed that the addition of the alpha-amylase to the wheat dough positively influenced the volume of the bread and crumb quality characteristics (resilience, hardness, gumminess and chewiness).

INFLUENCE OF IRON FORTIFICATION DOSE ON DYNAMICS OF THE FERMENTATION PROCESS OF COW'S MILK BY USING *STREPTOCOCCUS THERMOPHILUS AND LACTOBACILLUS DELBRUECKII SUBSP. BULGARICUS*

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The amount of iron in the body of an adult ranges from 3.0 to 5.0 grams, which corresponds to an average of 60-70 mg/kg body weight. Two-thirds of the total pool of iron occurs in hemoglobin, and the remainder is located in myoglobin. The biggest iron deficiency concerns menstruating women and pregnant women. These deficiencies are largely the cause of the low absorbability of iron from animal products - approx. 20%, and even less from vegetable products - about 5%. Ingredients such as calcium or casein additionally reduce the availability of iron, forming with it insoluble iron complexes with phosphopeptide.

The aim of this study was to determine the effect of the applied dose of iron amino acid chelate on the dynamics in fermentation process of cow's milk by thermophilic cultures *Streptococcus thermophilus* and *Lactobacillus delbrueckii subsp. bulgaricus.*

The material was pasteurized cow's milk with a fat content of 2% (OSM Piątnica), concentrated skim milk powder in an amount of 3% (SM Gostyn). Milk was fortified with iron bisglycinate (OlimpLabs, Nagawczyna, Poland) in doses 0 (control sample), 5 and 10 mg Fe per 100 g of milk. Milk was inoculated with YC-X16 cultures (Chr. Hansen) and incubated at 45°C. After an hour titratable acidity (°SH) and active acidity was measured (pH-meter, CI 316 platinum electrode ERPt-13). The analysis was repeated after 2, 3, 4 hours from the start of incubation. Syneresis was determined after 4 hours of fermentation as the percentage leakage of whey.

No statistically significant differences between the pH of control yoghurts and the pH of fortified yoghurts (5 and 10 mg Fe) was proved. The highest active acidity was determined in yoghurts enriched with 5 mg Fe/100 g of milk after 4 hours of fermentation. The most intensive increase in total acidity, from 16.27°SH in the 1st hour of fermentation to 40.40°SH after 4 hours of fermentation, was observed in control yoghurts. There were found significant differences between the acidity of the control yoghurt and acidity of yoghurts fortified in iron in the form of bisglycinate after 3 and 4 hours of fermentation. Enriching yoghurt with 10 mg Fe decreased leakage of the whey by approx. 4% in comparison to the control yoghurts and demonstrated differences were statistically significant ($p \leq 0.05$).

SELECTED PROBIOTIC PROPERTIES OF THE LACTIC ACID BACTERIA STRAINS ISOLATED FROM RAW FERMENTED MEAT PRODUCTS

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Lactic acid bacteria are the most predominant microflora of fermented products. Scientific researches confirm that LAB strains isolated from spontaneously fermented food can exhibit potential probiotic properties. According to the FAO/WHO Report (2002) probiotics are “live microorganism which when administered in adequate amounts confer a health benefit on the host”. Probiotic strains candidates must be carefully examined. *In vitro* screening tests should be done as first.

The aim of a study was identification of *Lactobacillus* strains isolated from raw fermented meat products and examination of selected probiotic properties of bacteria according to FAO/WHO (2002).

LAB strains were isolated from raw fermented meat products. Molecular identification was carried out by amplification of 16S rDNA using specific primers. Survival of strains was performed in simulated gastrointestinal conditions. Safety assessment was performed examining antibiotic resistance using E-tests (bioMérieux) and specifying enzymatic profile using API ZYM (bioMérieux).

Strains were assigned to the species *Lactobacillus plantarum* (SCH2, BAL7) and *Lactobacillus brevis* (SCH5, SCH6, KŁ7). Further demonstrated that all of the strains are resistant to acidity and gastric enzymes in the simulated gastric juice and also resistant to high concentration of bile salts and enzymes in the simulated intestinal juice. Strains were resistant to gentamycin, streptomycin, vancomycin, ciprofloxacin and kanamycin. Susceptibility of strains was for ampicillin, tetracycline, chloramphenicol, penicillin and erythromycin. None of the strains produced harmful enzymes *β-glucuronidase* and *α-chymotrypsin*. All of the tested strains were found to be safe.

The *Lactobacillus* strains isolated from raw fermented meat products may possess a potential probiotic properties however, future studies are needed.

FRUIT STORAGE CONTAINER FOR EXTENSION OF FITNESS FOR CONSUMPTION (P.401126)

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The work includes the test of the comparative analysis of selected varieties of apple fruit, stored and treated with Earth's magnetic field.

Deprivation fruit external influence of the geomagnetic field will be carried out by placing the selected fruits in the prototype of pipe with Helmholzt windings.

The mechanism of action is based on offsetting resultant vector of Earth's magnetic field inside the coil through the induced vector directed opposite.

This type of approach to the process of storing, replacing traditional methods of extending the shelf life of fruit (e.g. fruit storage of gases in the atmosphere), is a new, innovative and forward-looking approach for extending the life of the plant material. The prerequisites for the possible success of the proposed method are extremely interesting observations presented by Balyavskaya (2004). This solution makes it possible to store fruit for a longer time without influence of an external magnetic field, which inhibits fruit respiration and limits evaporation of water and changes in other valuable nutrients in tissues of stored fruits and vegetables.

CONTENT OF PHENOLIC COMPOUND AND ANTIOXIDANT ACTIVITY OF SELECTED GRAPES (*VITIS VINIFERA* L.) CULTIVATED IN POLAND

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Vitis vinifera L. is dispersed as many cultivars worldwide. In Europe the best conditions for growth are in the Mediterranean countries. Berries are used for direct consumption (including dried as raisins), but mainly to prepare wine, juices, jellies, jams, tartaric acid and vinegar. From grapes seed is also pressed valuable oil.

Aim of study was to measure antioxidant activity and phenolic compound in different varieties of grapes growing in Poland. Three white (‘Jutrzenka’, ‘Solaris’ and ‘Riesling’) and three red (‘Rondo’, ‘Svenson Red’, ‘Rosler’) cultivars were tested.

The highest content of phenolic compounds measured by UPLC was lower in ‘Rosler’, than in ‘Solaris’ cultivar. ORAC assay show that tested red cultivars of grapes have higher antioxidant activity than white one. The values are as follows 15.5-32.4 mmol Trolox/ 100 g d.m. in white grapes and 52.0- 56.3 mmol Trolox/ 100 g d.m. in red.

The contents of the phenolic compounds and antioxidant activity strongly depended on cultivar as well as growing and weather conditions.

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CHANGES IN THE PHYSICOCHEMICAL PROPERTIES OF ALCOHOLIC BEVERAGES FROM APPLES AND QUINCES DURING FERMENTATION PROCESS

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Popularity of 'cider' type of alcoholic beverages is currently increasing in Poland. Ciders are refreshing, do not contain a lot of alcohol and in large extent preserved the properties of the fruit from which they are produced. Apples are typically sources for cider production, however quince characterized valuable chemical composition for this kind beverages. Additionally they contain biologically active compounds exhibiting antioxidant activity, vitamins, and mineral compounds. Due to the attractive taste apples are popular consumed in a raw or processed, but quinces fruit are usually eaten in the form of jams, liqueurs, wines and compotes.

The aim of the study was to determine changes in the physicochemical composition of cider from apples and quinces during and after fermentation process.

In the fresh juices, during fermentation and after 4 months cold storage, acidity, alcohol content and colour fruit was measured. Products made from quince were characterized by higher acidity and lower alcohol content compared to cider from apple. Quince alcoholic beverages characterized much more attractive color than apple cider.

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STUDY CONCERNING THE QUALITIES OF DIFFERENT TYPES OF HONEY FROM BIHOR COUNTY, ROMANIA

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Romania's beekeeping potential is very high. For Romanians beekeeping represents an ancient occupation being spread all over the country and this craft is transmitted from one generation to another since our ancestors the Dacians.

Honey is the first natural sweetener ever known by men. It is very flavored, with a great biological and caloric value (it contains sugars, vitamins and enzymes), and it's very often used as an ingredient in many manufactured foods. Honey has a medicinal purpose also, being used from ancient times for wound healing, different gastrointestinal affections and diseases. Nowadays it has been shown that honey has a good antibacterial efficacy against pathogenic bacteria. Honey also, is a good natural antioxidant.

The aim of this study was to underline the quality of different types of Romania honey from Bihor county area.

Four types of honey were studied: manna honey (also called blight honey or honeydew), polyfloral honey, acacia honey and linden honey (3 samples for each type of honey). pH and acidity of honey samples by automatic titration using Titrolyne Easy and Titroline Alpha10plus equipment (SCHOTT Instruments GmbH, Mainz, Germany) were determined. Brix was determinated using RE 40 Mettler Toledo refractometer. Hydroxymethylfurfural content was determinated using standard method and the results were shown as the average of a triplicate measurements. Sugar profile was determinated by HPLC-RID method described by Bogdanov et. al. using Shimadzu instrument. Concentrations of total phenolic and flavonoids were determinated using the original method adapted for honey.

Results showed that quality of tested honeys was superior. All studied samples meet well national and international regulations regarding honey quality and safety. The important sugar amount was showed by fructose and glucose. The differences between manna honey and the other types of honey was represented by the presence in high value of the sugar called melezitose (5,65). Acidity and pH represent few of main physical and chemical indicators that reflect the honey quality.

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BETALAINS PROFILE, CONTENT AND ANTIOXIDANT CAPACITY OF RED BEET ROOT ARE INFLUENCED BY GENOTYPE

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Betalains are water-soluble nitrogen-containing pigments, found in high concentrations in red beetroot. Betalains consist of two groups: red-violet betacyanins and yellow-orange betaxanthins. In additions to being colorful betalains have antimicrobial, antiviral, antioxidant, anti-inflemmatory and antitumoral activities.

The aim of the research was to determine the profile, content and antioxidant capacity in thirteen varieties of red beet root by means of HPLC-TOF-MS/MS.

The beet root varieties were grown in the experimental fields of the Research Institute of Vegetable Crops in Skierniewice, Poland. The beet roots obtained were purified and subsequently chopped into four parts. Two opposite pieces from each beet root were frozen together at -80ºC. After lyophilization the samples obtained were pulverized and stored at -80ºC until to analysis. Betalains were analyzed using micro-UHPLC system (LC200, Eksigent) coupled with TripleTOF 5600+ mass spectrometer (AB SCIEX, Canada). The antioxidant capacity (AC) was measured by four methods: ACW PCL, ACL PCL, ABTS and DPPH.

Compounds were identified by the means of a comparison of their retention time and MS spectra. In our study, the tissues of red beetroot contained thirty compounds, eighteen derivatives of betacyanins and twelve forms of betaxanthins. In the varieties of the beetroot the most popular batalains were betanin, isobetanin and 2,17-bidecarboxy-neobetanin with pseudomolecular ions at m/z 551.1452, 551.1496 and 462.1608 as well fragment ions at m/z 389.0996, 389.0981 and 300.1113, respectively. Betanin was a predominant compound in all studied beetroot varieties (42.7-52.1%) followed by isobetanin (15.0-20.4%) and 2,17-bidecarboxy-neobetanin (1.6-17.9%). The AC estimated by ACL PCL assay possessed the highest value (22.46-70.67 µmol Trolox/g dm), while AC determined by DPPH was characterized by the lowest potential (24.06-32.87 µmol Trolox/g dm). Antioxidant potential of red beetroot differed significantly across the varieties. In addition, the value of antioxidant properties of red beetroot varieties are correlated with their content of betalains.

METABOLIC ENGINEERING FOR IMPROVEMENT OF GLYCEROL PRODUCTION BY YEAST *SACCHAROMYCES CEREVISIAE*

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Glycerol (1,2,3-propanetriol) is used in cosmetic, paint, automotive, food, tobacco, pharmaceutical, pulp and paper, leather and textile industries. Chemical synthesis of glycerol from propylene or allyl alcohol is currently declined due to environmental concerns, so there is interest in development of microbial or yeast strains effectively converting cheap feedstocks (e.g. glucose) to glycerol. Facultative anaerobic yeast *Saccharomyces cerevisiae* can be a good platform for development of recombinant strains overproducing glycerol under low-aeration conditions. In *S. cerevisiae* glycerol is synthesized from dihydroxyacetone phosphate by the action of glycerol-3-phosphate dehydrogenase (Gpd1) and glycerol-3-phosphate phosphatase (Gpp2). Other road of dihydroxyacetone phosphate catabolism occurs by its isomerization to glyceraldehyde-3-phosphate with triose phosphate isomerase (Tpi1), resulting to ethanol formation.

It was shown that large amounts of glycerol accumulate *S. cerevisiae* mutants deleted in *TPI1* gene coding for triose phosphate isomerase, but such mutants fail to grow on glucose. Also recombinant strains with increased Gpd1 activity were characterized by increased glycerol production. We aimed to construct recombinant strains with increased Gpd1 and Gpp2 activities and reduced Tpi1 activity, providing growth on glucose and increased glycerol production.

Homologous recombination was used for partial substitution of *TPI1* gene promoter region with selective marker. Obtained strains contain 100, 50 or 25 base pairs of native *TPI1* gene promoter before *TPI1* ORF, and revealed corresponding sequential decreases in Tpi1 activity. Multicopy integration module was used for expression of hybrid *GPD1-GPP2* ORF (encoding artificial fusion of both enzymes) under the control of strong constitutive promoter of the alcohol dehydrogenase gene. Alcoholic fermentation of studied strains was performed on mineral medium containing 10% glucose as a Carbon source. Glycerol was measured with enzymatic kit (Biovision).

Recombinant *S. cerevisiae* strains with 50 or 25 bp version of *TPI1* promoter revealed up to 2 times increase in glycerol production as compared to the WT strain. Recombinant strains expressing *GPD1-GPP2* fusion produced approximately 4 times more glycerol than that of WT strain. Combination of both approaches resulted to 5-fold increase of glycerol production as compared to the WT strain.

THE EFFECT OF LYCOPENE ADDITION ON FATTY ACID PROFILE, CHOLESTEROL CONTENT AND OXIDATIVE STABILITY OF CURED TURKEY BREAST

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Meat products are not considered by nutritionists as a healthy option because of a high level of fat, cholesterol and salt. Lipids from poultry meat are more easily absorbed than from beef and pork. However, the oxidation of polyunsaturated fatty acids contribute to the deterioration of the quality of poultry meat. Therefore, more and more often immediately in the technological process uses natural antioxidants such as lycopene.

The aim of this study was to determine the effect of lycopene addition during curing of turkey meat on fatty acid profile, total cholesterol content and oxidative stability of finished products.

The analysed material comprised of 64 turkey breast muscles, of which 16 samples (RBM) were immediately transported to a laboratory analysis. The next 16 muscles (UBM) were subjected to heat treatment (baking + grilling) in the convection steam oven. The remaining 32 muscles previously were cured (for 3 days) in two types of curing mixture without (CBM) and with the addition of tomato peel extract (CBM+Lyc), standardized for 5% lycopene content. Then both CBM and CBM+Lyc muscles were baked and grilled under identical conditions as for UBM products. In the all samples, the fatty acid profile, total cholesterol content and the value of TBARS were determined.

The obtained data show that the chilled muscles characterized by the lowest amount of total cholesterol (64.60 mg/100 g) and the value of TBARS (0.35 mg MDA/kg of meat). It has been found that the heat treatment caused an increase in cholesterol and malondialdehyde content in the finished products (mean 7.41 mg/100 g and 1.9 mg MDA/kg). Statistical analysis demonstrated that the RBM samples characterized by the lowest level of saturated (36.85%) and monounsaturated (35.48%) fatty acid and the highest unsaturated (63.15%) and polyunsaturated (27.67%) fatty acids. The addition of lycopene during curing contributed to reduction content of the SFA, OFA acids and to increase the share of UFA, DFA acids, ratio DFA/OFA and UFA/SFA. It was noted that all finished products were characterized by a similar average content of MUFA and PUFA, which was respectively 39.99 and 19.63%. By comparing the experimental groups demonstrated that the ratio of PUFA n-6/n-3 was the lowest ($p \leq 0.01$) in RBM muscles and it was 2.32.However, in the finished products, there was no statistical differences within this parameter (mean 3.09). It can be concluded that lycopene does not show a clear effect on the total cholesterol and oxidative stability of fats, but it improves the fatty acid profile.

INFLUENCE OF BREWING PARAMETERS ON THE CONTENT OF SELECTED POLYPHENOLS IN GREEN AND BLACK TEA INFUSIONS

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Tea, made of leaves of *Camelia sinensis* plant, is one of the most widely consumed beverage in the world. The manufacturing process causes fresh green leaves to be convert to different commercial made including green tea (not fermented) and black tea (fermented tea). Interest in tea is not only due to its sensory properties, but also the health benefits, such as antioxidant effects, reducing the risk of cancer and anti-obesity properties. These beneficial effects has been mainly attributed to purine alkaloids and polyphenols such as catechins.

The purpose of the study was to analyze the influence of brewing parameters (time and temperature) on the content of selected polyphenols in green and black commercial tea infusions.

Research material consisted of two black and two green commercial teas in paper tea bags. The sample of 0.5 g of tea was extracted with 100 ml of water in 100º and 60ºC for black tea, 90º and 60ºC for green tea. Time of extraction was 2, 5 and 10 minutes for each temperature. Two catechins: (+) catechin, (-) epicatechin, gallic acid, chlorogenic acid and caffeine were examined. The standard solution and tea samples were filtered through a 0.45 µm nylon filter before HPLC analysis. A Shimadzu high-performance liquid chromatography (HPLC) system with diode array detector (DAD) was used for quantitative analysis. A Kinetex (Phenomenex) C18 column (5 µm, 4.6 x 150 mm) was used for chromatographic separation at 30ºC. The mobile phase consist of methanol (A) and 3% acetic acid in water (B) using in gradient program of 98% (B) in 0-2 min, 98-85% in 2-25 min, 85-65% in 25-40 min, 65-10% in 40-55 min. The solvent flow rate was 0.6 ml/min. The Tukey's test was used to establish the significance differences among samples at the 95% significance level.

Content of polyphenols increased slightly with brewing time in green and in black tea. There were more polyphenols in infusions brewed in 100ºC for black and 90ºC for green teas than in 60ºC. Caffeine content decreased slightly in black teas during the brewing time and increased slightly in green teas.

EFFECT OF QUANTITIES OF USED ADDITIVES AND MAGNESIUM FORTIFICATION ON THE QUALITY OF PEACH YOGURTS DURING THE COLD STORAGE

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The organoleptic characteristics of the fermented milk drinks is extremely crucial for the consumers therefore they are so often modified by adding fresh fruit, candied fruit, candied pulp, jams and other food additives.

A material for the study was pasteurised cow's milk with 2% fat content. For manufacturing yoghurts were used YC-X 16 starter strains (Chr. Hansen). Yoghurts were fortified with magnesium chloride hexahydrate (Chempur). Milk was enriched in dry matter by the addition of skim milk powder (S.M. Gostyń). Fruit pulp was served as a flavour additive (Zentis Polska Sp.z.o.o.). A system of the experiment included: A (12% peach additive and 2% addition of powdered milk); B (12% peach additive); C (12% peach additive, 2% addition of powdered milk and 15 mg of magnesium/100 mL); D (15% peach additive). Fermentation was conducted for 4.5 hours in disposable containers with lids (100 ml) in temperature of 43°C. The assessment of the influence of addition on active and potential acidity, syneresis (%), texture and sensory characteristic (1-9 points scale) was conducted after 1 day, 7 days, 14 days and 21 days of cold storage. From the obtained results an average and standard deviation were estimated in the software Statistica programme version 10.

Active acidity of all experimental groups successively increased throughout the entire period of storage. Increasing an amount of the peach flavouring from 12% to 15% resulted in decreasing of the total acidity by about 1ºSH, which maintains during a whole period of the storage. The highest syneresis was noted in the yoghurts with the flavour additive of 12% and 15% on the first day of storage. The yoghurts with a flavour additive of 15% were assessed by the evaluators as the best on 1, 14 and 21 day of cold storage. According to the sensory panel the best consistency had yoghurts enriched with magnesium on 1, 7 and 21 day of storage. The most characteristic colour was determined in the yoghurts with 15 % flavour additive. On each day of the experiment sensory panel indicated a group of the yoghurts enriched with magnesium as the fermented beverages with the most intensive milky - creamy taste. The highest hardness (> 2.6 N) and gumminess were found in yoghurts enriched in milk power. Whereas a prolongation of the storage time to 21 days decreased gumminess of the peach yoghurts.

SHORT CHAIN FATTY ACID DERIVED FROM BUTTERMILK- BASED PRODUCTS MODULATE CACO-2 CELL METABOLISM

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Cows' milk allergy (CMA) is recognized as a frequent disorder, in progression of allergic diseases in humans life. Therefore, the mainstream of CMA treatment is self-oral immunotherapy focused on the intake of increasing amount of products, like fermented beverages, until achieve the immune tolerance toward milk allergens. The beneficial role of diet supplementation with fermented dairy products is known for many years and also provides the new therapeutic approach for people suffering from allergic diseases. The favourable composition and health-promoting properties of buttermilk has been extensively studied. Lactic acid fermentation process can have a double beneficial effect, both through probiotic activity of lactic acid bacteria (LAB) strains as well as the modulating effect of their biogenic metabolites. All this components improve gut barrier integrity, stimulate the development of tolerance to antigens and work suppressive on intestinal inflammatory response.

The main aim of this study was to determine the influence of SCFA provided with buttermilk-based beverages on the metabolism and immunological response of enterocyte model (Caco-2 cells).

Based on buttermilk (A- *L. casei*- LCY, B- *L. bulgaricus*-151) fermented products were subjected to simulated two-step, gastro-duodenal digestion and the content and profile of SCFA was determined with RP-HPLC-PDA method. Caco-2 (DSMZ, Braunschweig, Germany) cell line was used as a model of human gut epithelial cells. Cells were treated with digested product and after the incubation the expression of metabolic and immunological markers were evaluated by the RT-PCR method.

Buttermilk derived products revealed different composition and content of SCFA. The significant differences were observed in butyric, propionic and lactic acids that can induce different pathways of cell response. Visible implications on expression of such innate immunological factors as NFκB, IL-8, IL-1β-R, TLR-2 and 4 and DR5 was observed. Different immunological pathways were induced and caused various metabolic effects that may result favorable reaction of epithelium. Buttermilk based products exhibit beneficial effects however further studies on living organisms are required.

ANTIOXIDATIVE POTENTIAL OF ULTRASOUND AND STEAM BLANCHED MICROWAVE-CONVECTIVE DRIED PARSLEY LEAVES

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Ultrasound (US) is a non-thermal technology applied prior to dehydration in order to modify food's microstructure and thus accelerate the drying. For this purpose, the food industry commonly utilizes the thermal pre-drying treatment – blanching. Recent studies show that ultrasound technique has a potential to replace the blanching. However, the chemical composition changes affected by US are strongly associated with the type of treated material and drying conditions.

The objective of the research was to evaluate antioxidant capacity and polyphenolic content in microwave-convective dried parsley leaves affected by ultrasound and stream blanching pre-treatments.

Parsley leaves were subjected to ultrasonication (US) carried out for 20 min (21 kHz, 300 W). The material was immersed directly in tap water (20±1°C, material/water ratio: 1/40). Steam blanching was conducted over boiling water for 3 sec. following by dipping in tap water for 20 min. The treated parsley was dried in microwave-convective dryer at different microwave power (100-300 W) and air temperature (20-40°C). The total polyphenolic content (TPC) and the antioxidant capacity with DPPH free radical were determined.

The lowest total phenolic content was noted in blanched sample dried at 40°C and 200 W and equalled of 19.7 mg/g d.m. Decrease of temperature to 30°C guaranteed the highest TPC in steamed parsley (27.9 mg/g d.m.). Generally, when drying was set at 20 and 40°C in most cases the scavenging activity and polyphenolic content were not altered by sonication and blanching, compared with untreated dried parsley. The TPC in blanched samples was higher to 29% compared with intact leaves dried at 30°C. However, under these conditions, the worst antioxidant ability was observed for all samples. The antioxidant potential was linked with drying conditions and pre-treatment and therefore these variables must be taken into account for each product separately.

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NUTRITIONAL STATUS AND THE LEVEL OF C-REACTIVE PROTEIN

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Chronic inflammation plays an important role in the development of many diseases such as cardiovascular diseases, type 2 diabetes, metabolic syndrome. One of the best studied and most reproducible inflammatory marker is C-reactive protein. Studies indicate that nutritional status parameters such as body weight, BMI, WHR are correlated with the level of CRP.

The aim of the study was to evaluate the relationship between nutritional status and the level of C-reactive protein in patients aged 45+.

The study involved 57 women and 57 men aged 45+. Nutritional status was estimated on the basis of anthropometric measurements (body weight, BMI, waist and hip circumferences, WHR, skinfolds thickness, percentage of body fat- %FM) and lipid profile parameters. Was also measured levels of C-reactive protein (CRP) in serum. The evaluation of the relationship between the nutritional status indicators and CRP level were made by linear regression analysis using the STATISTICA10 programme by StatSoft.

It was showed that a significant percentage of men and women were overweight or obese diagnosed on the basis of BMI and %FM. Rating distribution of adipose tissue by WHR and waist circumference released alarming data. Both men and women had elevated waist circumference, abdominal obesity based on WHR was diagnosed in 34% of men and 68% women. It has been shown that CRP correlated with body weight, the thickness of the triceps skinfold, subscapular skinfold, suprailiac skinfold, the sum of the thickness of 4 skinfolds, waist and hip circumference and %FM, but only in women. The data confirm that the concentration of CRP in the blood is determined by nutritional status parameters.

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THE IMPACT OF DIET ON CRP LEVEL IN ADULTS

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Chronic inflammation plays an important role in the pathogenesis of atherosclerosis - a key factor in the development of cardiovascular diseases. Chronic inflammation correlates also with the risk of type 2 diabetes and metabolic syndrome components. Literature data indicate a relationship between CRP and various dietary factors, suggesting that inflammation can be modified by diet.

The aim of this study was to evaluate the relationship between diet composition and the level of C-reactive protein in adults.

The study included 114 individuals, mean age 57.7 and 57.3 years for women and men respectively. 7-day dietary record was used to evaluate diet. The energy value and nutrient content were assessed using computer program "Dietetyk" by JuMaR. The level of CRP in the serum of patients was also measured. To determine the relationship between the nutrients in the daily food rations of patients and CRP level linear regression analysis was used.

The study showed no association between the consumption of nutrients and the level of C-reactive protein in the group of women, men and the entire population. The limitation of this study may be due to the small studied population. On the other hand, data indicates that the dietary patterns rather than individual nutrients evaluation in relation to an inflammatory reaction should lead to better results. The study is a preliminary analysis of the PhD project. It is planned to carry out a comprehensive assessment of diet on CRP.

This study was partly financed by grants to young researchers and PhD students of the Food Sciences and Nutrition Department of the Poznan University of Life Sciences in 2014 no: 507.786.64

PHYSICO-CHEMICAL CHARACTERISTIC OF CLOUDY STRAWBERRY JUICES

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Strawberries (*Fragaria x ananassa* Duch.) are popular dessert fruits. They are rich source of polyphenols (including ellagitannins), ascorbic acid, folate, pectins and minerals. More and more studies have demonstrated various cardiovascular, antiproliferative, and neurologic benefits associated with the consumption of strawberries. Because of high biological value and convenient form, cloudy strawberry juices can be particularly useful in the prevention of civilization diseases. Therefore, the important is to better know the chemical composition and physical properties of these products.

The aim of the study was the physico-chemical characteristic of cloudy juices from 7 strawberry cultivars.

Cloudy juices from 7 strawberry cultivars (‘Flair’, ‘Florence’, ‘Honeoye’, ‘Kimberlay’, ‘Roxana’, ‘Rumba’, ‘Pandora’) were analyzed in physical (viscosity, NTU, color parameters) and chemical aspect (UPLC analysis of polyphenols content, antioxidant activity- FRAP and ABTS tests).

Strawberry juices were characterized by an attractive color, stable turbidity (from 38.52 to 63.41% NTU) and high viscosity (from 25.2 to 116.4 mPas), which decided on their high quality for fruit processing point of view. They were a rich source of polyphenols compounds, including anthocyanins (cyanidin and pelargonidin glycosides) and ellagic acid derivatives. Cloudy products from ‘Pandora’ and ‘Florence’ cvs. had the highest antioxidant potential.

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FACTORS INFLUENCING ON THE BIOLOGICALLY VALUE OF CLOUDY JUICES FROM APPLE

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Apples (*Malus domestica* Borkh.) are processed into a variety of products, mainly in the form of clear juice. In Europe it's a highly-consumed product, in second place after orange juice. Despite this, clear juice is not a valuable source of bioactive substances (especially polyphenols) compared to cloudy product. Many research suggests, that a diet rich in apples may reduce the risk of diseases, like overweight and obesity, cardiovascular diseases or cancer. It has an impact on the situation on the fruit market, including juices products. According to the popularity of apple among consumers and market position of NFC juices, the continue of the research about possibilities of use a different apple cultivars for processing is warranted.

The aim of the study was to characterize the polyphenolic profile, antioxidant potential and residual pectinmethylesterase acitivity (PME) of cloudy apple juices according to fruit cultivar.

Cloudy products from 6 apple cultivars were analyzed in respect of qualitative and quantitative profile of polyphenols (UPLC/ UPLC-MS), antioxidant potential (ABTS and FRAP methods) and % of residual PME activity.

In juices flavan-3-ols (5), dihydrochalcones (2), phenolic acids (3), flavonols (5) and anthocyan (1) were identified. Total polyphenols content ranged from 686.63 mg/L ('Gloster') to 988.63 mg/L ('Alwa'). Antioxidant potential values, measured by ABTS and FRAP tests, were the highest in the case of 'Alwa' and 'Fiesta' juices, respectively (0.73 and 0.67 mmol Trolox/100 mL). The thermal treatment of juices did not make a complete inactivation of PME. Taking into account the % of residual enzyme activity, the pasteurization was most effective in the case of 'Fiesta' and 'Pinova' juices (13% and 14% of the initial activity).

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THE EFFECT OF STORAGE TIME ON QUALITY OF STERILIZED MEAT PATES CONTAINING OSTRICH LIVER

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Pates are one of the most popular meat product produced by meat, fat and liver with addition of spices and another additives. Alternative raw material in relation to chicken or pork liver can be ostrich liver, which is characterized by favorable fatty acid profile in particular the PUFA/SFA and n-6/n-3 ratio.

The aim of the study was to determine the effect of storage time on quality of sterilized meat pates containing ostrich liver from different feeding groups.

Pates were produced from chicken thigh muscle (50%), jowl (30%), chicken and ostrich liver (20%) with addition of spices and another additives. Ostrich liver originated from animals from three different feeding groups (control, with linseed supplementation and linseed with lucerne supplementation). Pates were sterilized (121°C; 45 min), chilled and stored (4°C) for 0, 3, 6 and 9 months. In pates color parameters (CIE L*, a*, b*), penetration force, the amount of thermal leakage (%), chemical composition, fatty acid profile and cholesterol content were determined. Also a sensory evaluation was conducted.

Pates containing ostrich liver have lower water and higher protein content compared to pates with chicken liver. There was no significant differences in fat content between pates.

After 9 months of storage pates are brighter and less red ($P<0.05$). Storage time increase the penetration force and decrease the amount of thermal leakage. Total cholesterol content was lower after storage ($P<0.05$). There was no significant differences in ∑SFA, ∑MUFA and ∑PUFA content during storage. However, storage time increase n-6/n-3 ratio and decrease PUFA/SFA ratio ($P<0.05$). There was no significant differences in taste and overall desirability in sensory evaluation of pates during storage. Pates containing ostrich liver originated from animals with linseed and lucerne diet supplementation have lower value of L* and b* color parameter and higher water content compared to control group. There was no significant differences in quality parameters between pates containing chicken liver and pates with ostrich liver.

Results indicate that ostrich liver can be successfully used in pates production and the storage time influence the quality of this products.

THE USE OF OPTICAL MICROSCOPE WITH PHASE CONTRAST EXTENDED TO MEASUREMENTS OF CRYSTAL SUGAR POMADE

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Sugar pomade is a confectionery consisting mainly of potato syrup, sugar and water or milk. Properly carried out the production process favors the formation of the desired pomade small crystals. One of the possible variants of this raw material quality control is to measure the size of the crystals by optical microscopy extended by a phase plate and an annular aperture to form an optical system called phase contrast.

The aim of the study was to determine the possibility of using an optical microscope with phase contrast for measuring the size of the sugar crystals in pomade used in confectionery.

The main objective of this study was to use an optical microscope series MB-800 (OPTA-TECH) extended by phase contrast system for measuring the size of the crystals of sugar pomade. Measurements were made on pomades, produced from rafined and white sugar. Attempts pomades applied to a glass slide and smear performed. The observation was made using a magnification of x400 and x1000 while taking pictures with a camera 3MP sCMOS microscopic interacting with computer software OptaView IS. After prior calibration and image processing system with microscopic observation measurements sugar crystal size.

On the basis of microscopic observation, the captured images and processing them, it becomes possible to distinguish the boundary between the crystals and the background pomades sugar formulation, which gives the possibility to make reliable measurements of crystal sugar pomade. The results of crystal size does not exceed 20μ which provide high-quality intermediate. The rapid measurement of crystal size and low cost apparatus can help to optimize the conditions of the manufacturing process *in situ*.

MICROSCOPIC FUNGI AND THEIR METABOLITES IN EGGS

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In recent years there has been a growing trend of eating eggs, therefore it is necessary to ensure proper, the required quality of the raw material both at the stage of production, distribution and storage. Next to the pathogenic bacteria, eggs microflora include also microscopic fungi as *Cladosporium, Penicillium, Fusarium, Mucor, Alternaria, Candida*. The presence of microflora may provoke the possibility of mycotoxin contamination of eggs because among microscopic fungi, the part of eggs microflora forming toxinogenic strains are also observed.

The aim of this study was to assess the possibility of the occurrence of mycotoxins in table eggs.

Microscopic fungi were found on the surface of the shells, but there are also data about the contamination of table eggs by molds. In another studies (Szablewski et al., 2010) the concentration of ergosterol as the indicator of the presence of microscopic fungi were analyzed. The studied material consisted of dehydrated white of egg coming from mulch farming. In the analyzed material the presence of mold were revealed. Similar results were obtained in the tests (Nowaczewski et al., 2011) conducted on pheasant eggs.

Most of the known toxins forming microscopic fungi are present on the plant material, so the aspect of mycotoxins in animal products is according to the current state of the secondary issues. The method of maintaining hens and egg distribution conditions are essential factors of development of microscopic fungi. The presence of microscopic fungi may indicate the possibility of contamination of the contents of eggs mycotoxins.

SOLUBILITY OF ASPARTAME AND ACESULFAME K IN WATER SOLUTIONS

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Solubility phenomena are very important issue in many industrial applications including food technology, pharmacy and chemistry. Modern trends in nutrition, require restrictions on the use of sucrose as a sweetener. Sucrose is going to be replaced by other compounds with lower nutritional energy, glycemic response etc. In many cases solubility of saccharose substitutes in comments solvents are poor or not defined strictly. It is a case in which concentrates of drinks or liquids are in use.

Presented study focuses on solubility phenomena of aspartame as well as acesulfame K in water solutions. Analysis of soluble fraction of aspartame and acesulfame K was performed using HPLC system.

Results were described using two different solubility models i.e. Buchowski-Ksiazczak as well as modified Apelblat models. The applicability of both models was checked using the root-mean-square deviation (RMSD).

THE VERIFICATION OF ACCELERATED SHELF-LIFE TESTS IN DRIED FRUITS

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The determination of food products shelf life is a long process especially regarding dried food. Food producers are still searching for accelerated methods which could help with the evaluation of expiration period. High temperature is the most common factor used to accelerate adverse changes in stored dried products. It causes the reduction in time and cost of launching a new product on the market.

The objective of this research was to evaluate the influence of storage time and temperature on the anthocyanins content and colour in freeze-dried cherries and lingberries. Monitoring of storage enables the verification accelerated shelf life tests as tools to predict shelf life in dried fruits.

Frozen fruits were placed in a shock freezer at the temperature of about -40°C to obtain the fruit temperature of -38°C. Then, samples were dried at the temperature of 20°C and the pressure of 63 Pa for 24 hours. After that, the fruits were packed in opaque PET/Met/PE plastic bags with removing 95% of air. Packaged samples were stored in incubators without light exposure at three different temperatures 25, 35 and 45°C. Dry matter content, colour and anthocyanins content analyses were conducted in the raw material before storage as well as after 1, 2, 5, and 8 months of storage.

Storage resulted in significant colour change of freeze-dried cherries and lingberries, particularly of those stored at higher temperatures. In most cases dried fruits were darker and had reduced a* values and chroma. Both temperature and storage time had a significant effect on the colour change in dried fruits. Anthocyanins are very unstable compounds at elevated temperatures. After 39 weeks of storage at 35 and 45°C virtually all anthocyanins in freeze-dried fruit were degraded. Anthocyanins were most stable at 25°C and their content did not decrease during the 8 weeks of storage. Both temperature and storage time had a significant impact on the content of pigments in the dried fruits.

It was noticed that time and temperature of storage had a significant influence on colour and content of anthocyanins. The conducted research also proved that accelerated shelf life test is not a suitable method to predict shelf life of dried fruit products.

REDUCING ACTIVITY OF PHENOLIC ACIDS AND FLAVONOIDS EVALUATED BY SPECTROPHOTOMETRIC AND ELECTROCHEMICAL METHODS

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Phenolic acids and flavonoids behave as antioxidants in a variety of ways, including direct trapping of reactive oxygen species, inhibition of enzymes responsible for production of superoxide anion radicals and chelation of transition metals involved in processes forming radicals. In recent years a rising number of methods have been proposed for the evaluation of reducing activity based on different electrochemical techniques (CV, DPV). The main advantage of CV is its capability for rapidly observing the total redox behavior over a wide potential range without the necessity of measuring the specific antioxidant activity of each component alone. Also, it could be an attractive alternative to spectrophotometric assays to determine reducing activity of antioxidants and total phenolics.

This study shows possibility of applying cyclic voltammetry (CV) to electrochemical characterization of phenolic acids and flavonoids and to establish the correlation between reducing activity deduced from cyclic voltammograms with those obtained by spectrophotometric assays.

The studied antioxidants include a representative compounds from phenolic acids, flavones, flavonols, flavanons, flavanoles, anthocyanins and dihydrochalcones. Reducing activity was measured by Fe(II)-FZ assay according to Berker et al. [1], $DPPH^{\bullet}$ method according to Brand-Williams et al. [2] and by CV according to Zieliński et al. [3].

The following parameters were taken into account based on the cyclic voltammograms of analyzed compounds: first oxidation peak potential ($E_{p,a}$) and the area below the anodic current waveform (total charge Q). At present, it is well known that low potential $E_{p,a}$ and large total charge Q are related with high reducing activity. In this study, the reducing activity of the investigated, structurally different phenolic acids and flavonoids, evaluated by Fe(II)-FZ assay was negatively correlated with oxidation potential $E_{p,a}$ ($r = -0.87$) and positively correlated with the total charge Q ($r = 0.72$). However, the reducing activity provided by $DPPH^{\bullet}$ assay was positively correlated with the total charge Q ($r = 0.78$) and negatively correlated with the $E_{p,a}$ ($r = -0.80$). In conclusion, the reducing activity of studied antioxidants evaluated by cyclic voltammetry technique was highly correlated with those obtained by spectrophotometric assays.

[1] Berker K.I. *et al.* (2010) *Anal. Methods* 2: 1770-1778. [2] Brand-Williams *et al.* (1995) *Lebensm.-Wiss. U.-Technol.* 28: 25-30. [3] Zieliński H. *et al.* (2012) *Food Chem.* 130: 1089-1104.

THE HEALTH VALUE OF VARIETAL HONEY PRODUCED IN PODKARPACIE REGION

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Honey is a respected and popular food product in all parts of the world due to its taste as well as nutritional and therapeutic properties. They are mainly related to the presence of many biologically active compounds as well as macro and micronutrients. Moreover, honey high antioxidant and antibacterial activity which is conditioned by the presence of enzymes and vitamins, but most of all phenolics compounds and flavonoids.

The aim of the study was to evaluate the quality of varietal honeys produces in Podkarpacie region. Study involved the content of the necessary elements as well as antioxidant activity.

Samples of varietal honey (n=100) produced in apiaries located in Podkarpacie region in 2013 were tested. For the content of the necessary elements ICP-OES method using Thermo iCAP 6500 spectrophotometer with prior microwave mineralization was applied. For antioxidant activity assessment FRAP and TPC tests were used.

The study of the mineral composition performed by ICP-OES have shown that honeys from Podkarpacie are a source of essential macro- and micronutrients : potassium (mean 1274.97 mg/kg), calcium (85.17 mg/kg), magnesium (39.88 mg/kg), manganese (3.24 mg/kg), iron (3.08 mg/kg) and zinc (1.64 mg/kg). The highest content of macro and micronutrients was found in dark honeys as honeydew and buckwheat, whereas the lowest in light honeys as rape and goldenrod. Moreover, very low level of heavy metals in tested honeys were determined (on average 0.02; 0.07 and 0.35 mg/kg for Cd, Pb and Ni, respectively), and any of them did not exceed the current limit. Studies of antioxidant activity using FRAP test have shown that tested honeys were characterized by high antioxidant activity (from 236.01 for rape to 2450.56 µmol of trolox/kg for buckwheat honey), which was positively correlated with TPC test (r= 0.865).

It has been shown that dark honeys produced in Podkarpacie region have a higher mineral content and stronger antioxidant properties than light honey. Moreover, all tested honeys were characterized by high quality and its regular consumption can help to improve the condition and health, as well as prevent the development of many lifestyle diseases.

Study was financed by the project "The role of element interactions in bioavailability reduction of heavy metal in human food chain" (UE founds)

RED CABBAGE ANTHOCYANINS: PROFILE, VARIETAL VARIABILITY, ANTIOXIDANT PROPERTIES, FOOD PROCESSING IMPACT, BIOAVAILABILITY

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Red cabbage is rich in a number of bioactive substances, including anthocyanins. Numerous studies have suggested that anthocyanin present in plant food products have protective potential against chronic degenerative diseases but mechanisms of this action are not completely explained. However, to exhibit positive effects, anthocyanin have to enter the human systemic circulation and next reach the site of action. From the physiological and the nutritional point of view, the knowledge about the chemical structures and the full profile of red cabbages anthocyanins, the impact of red cabbage processing on anthocyanins as well as bioavailability of red cabbage anthocyanins are very important as it may help to predict biological activity of these compounds.

The anthocyanins profile of red cabbage consisting of twenty derivatives of cyanidin glucosides was described by means of HPLC-DAD-MS/MS. The base structure of anthocyanins was cyanidin-3-diglucoside-5-glucoside. Their glucoside residues were nonacylated, monoacylated and diacylated. Among the seven isolated and purified red cabbage anthocyanins, cyanidin-3-diglucoside-5-glucoside diacylated with sinapic acid showed the highest radical-scavenging activities.

In regards to anthocyanins profile, content and antioxidant activity of red cabbage varieties the content of anthocyanins varied significantly in plants grown in two different years. In addition, the vegetation period length was demonstrated to affect the anthocyanins profile. The extract of red cabbages scavenged radicals and their antiradical potential differed significantly across the varieties. Moreover, red cabbage antioxidant capacity was positively and significantly correlated with anthocyanins content.

Fermentation, storage and stewing affected concentration and profile of red cabbage anthocyanins. Anthocyanins content was reduced by fermentation and stewing of red cabbage. The intensity of anthocyanins degradation during storage depended on the process length. Derivatives of cyanidin-3-diglucoside-5-glucoside acylated with sinapic acid were characterized by the highest losses. In addition, fresh red cabbage had stronger antioxidant capacity compared to fermented, stored and stewed red cabbage.

In a randomized crossover study, after consumption of fresh and fermented red cabbage, the analyses of anthocyanins in blood and urine samples by HPLC-MS/MS and plasma antioxidant capacity by PCL assay were conducted. The anthocyanins ingested were present in physiological fluids in form of 32 metabolites (native, methylated, glucuronided, sulfated). Among cyanidin metabolites identified, methylated forms were predominant. Bioavailability of anthocyanin from fresh red cabbage was higher than from fermented red cabbage. After fresh cabbage consumption, volunteers plasma showed higher antioxidant capacity than after fermented cabbage intake.

In conclusion, fresh red cabbages are the richest and the best source of bioavailable anthocyanins which show a strong antioxidative potential, what may be important in biological point of view.

THE INFLUENCE OF PULSED ELECTRIC FIELD OR CONTACT ULTRASOUND TREATMENT ON THE BIOACTIVE COMPOUNDS CONCENTRATION AND THERMAL PROPERTIES OF THE PLANT TISSUE

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Pulsed electric field (PEF) and ultrasounds (US) are considered to be one of the most important non-thermal food processing methods, even though their mechanism of influence on the biological cells is different. PEF treatment leads to the electroporation, i.e. electrically induced perforation of the cell membrane. In turn, subjecting the biological material to US is connected with so called 'sponge effect'. However, the knowledge about the properties of the materials, especially solid-like samples, which are processed by these techniques is limited.

Therefore, the aim of this study was to analyze the influence of pulsed electric field or contact ultrasound treatment on the bioactive compounds concentration of the plant material.

Apple and carrot samples were used in the investigation. PEF was delivered to the samples in a form of exponential shaped pulses with following parameters: E=1.85-5 kV/cm; 0-100 pulses; Ws=1.13-80 kJ/kg; f=0.5 Hz. In turn, contact sonication lasted from 0 to 30 minutes. After the treatment the relative total carotenoids content (rTCC) in carrots, total polyphenols content (TPC) and antioxidant activity (EC50) in apples were measured. In order to assess the thermal properties of the material thermal conductivity, thermal diffusivity and volumetric heat capacity were determined.

The rTCC varied from 74.7 to 111.3% for PEF treated samples and from 97.7 to 103.6% for US treated samples in comparison to the intact material. What is worth emphasizing the US treatment increased the TPC up to 76.9% whereas the PEF application resulted in even higher increase which was equal to 85.8% when compared to the untreated apple samples. Analogous results were observed in the case of free radical scavenging activity. Thermal properties of the PEF and US treated material were different. However, the course of these alterations depended on both the method and the parameters of treatment.

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ELECTRICAL CONDUCTIVITY MEASUREMENT AS A TOOL TO ASSESS THE COURSE OF THE FREEZING/THAWING AND QUALITY OF FREEZE-THAWED PLANT MATERIAL

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The kinetics of freezing/thawing and quality of freeze-thawed materials depend on many factors which are linked to the processing method, features of the raw material and the pretreatment conditions. Therefore, it could be stated that there exist a need to develop a tool which could be helpful in the analysis of the course of the freezing process and the quality of freeze-thawed material. Measurement of electrical properties of the tissue, which are related with the integrity of the intercellular structure of the material, could provide a helpful data in both freezing process evaluation and optimization.

The aim of this work was to analyze the dependence between the electrical conductivity and some parameters linked to the kinetics of freezing/thawing and physical parameters of freeze-thawed plant tissue.

Apple, carrot and potato samples were used in the investigation. Plant material was frozen by the means of air-freezing (-20°C), shock-air-freezing (-20 and -40°C) and immersion freezing (-20°) and thawed at the room temperature (free convection). After such processing the electrical conductivity, dry matter content and the mass loss were determined.

The shortest total freezing time was noticed for the shock-air-freezing method regardless the processed raw material. Thawing lasted at least two times longer than freezing and the longest total thawing time was observed in the case carrot frozen by the means of shock-air-freezing at -40°C. Freezing and thawing generally reduced the dry matter content up to 26.1%. Furthermore, the lowest value of mass loss after thawing was observed for the immersion freezing method regardless the type of the plant tissue. All thawed samples exhibited higher electrical conductivity than the unfrozen, raw tissues. The value of this parameter was even 6.78 times higher in the case of freeze-thawed potato frozen by the means of air-freezing (-20°C). Cluster analysis showed that the electrical conductivity can be aggregated in the same group with the dry matter content, phase transition time during freezing, phase transition time during thawing and total thawing time.

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THE INFLUENCE OF HYDROTHERMAL TREATMENTS ON THE CHOSEN PROPERTIES OF ACETYLATED STARCH

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Native potato starch is often modified with physical, chemical and enzymatic methods which can obtain certain physico-chemical properties suitable for the particular mode of utilization. There have been constantly searching new application for this polymer. This is possible through the use of multiple modifications.

The aim of the study was to determine the effects of annealing on properties of acetylated potato starch with varying degrees of esterification.

Aqueous suspension of potato starch was separate by sedimentation according to the size of granules. Large fraction of potato starch granules (D4/3>61 μm) was used. The native starch preparations was acetylated with various doses of acetic acid (6, 5, 13 or 26 cm^3 per 100g dry weight) and then annealed in an aqueous suspension for 24 hours at about 1°C lower than the onset temperature of gelatinisation. For the determination of the starch granules laser particle size analyzer was used. The degree of substitution, swelling power, temperature and enthalpy of gelatinization based on thermal characteristics using differential scanning calorimeter (DSC) as well as flow curves of 5% pastes using oscillating–rotational viscometer were determined.

The degree of substitutions of acetylated starch ranged from 0.05 to 0.18 and was the higher, the higher was the dose of acetic acid anhydride used for the acetylation. Swelling power after acetylation was higher than native potato starch (1,47g/g) and increased with degree of starch esterification (8.3 to 8.5 g/g). Annealing process led to an increase of swelling power to a maximum of 13g/g. In comparison to the temperature of native starch gelatinization (59.1°C), the esterification process caused its gradual decrease (44.9°C - 53.8°C) depending on starch substitution degree. After annealing this temperature was increased to a level in the range of 59.3 - 66.2°C. Enthalpy of gelatinization of potato starch was 14.95 J/g. Esterification caused a slight decrease in the value of this parameter (10.9 - 12.3J/g). Annealing resulted in a significant reduction in the heat necessary for gelatinization of starch and was the lower, the higher was degree of esterification (4.4 - 6.1J/g). Based on flow curves and determined parameters of Ostwald de Waele and Casson models, acetylation of native potato starch led to a reduction in viscosity of the pastes ($K=0.6 – 0.8$ Pas·s^n and $\eta_c=1.6 - 2.1$ Pa) compared to native starch ($K=2.9$ Pas·s^n and $\eta_c=7.1$ Pa). In the case of annealed starch viscosity decreased with increasing dose acetic anhydride used for the esterification ($K=0.7 - 1.6$ Pas · s^n, $\eta_c=1.7 - 4.1$ Pa).

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CHIA (*SALVIA HISPANICA L*.) SEEDS USE IN WHEAT BREAD PRODUCTION

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In the last decade of the twentieth century chia was re-discovered by scientists and farmers because of its nutritional and functional properties. Chia is characterized by a high content of protein of good biological value, dietary fiber and fat. It contains also natural antioxidants, vitamins (B group, E and A) and minerals (calcium, magnesium, phosphorus, copper, zinc, iron).

The protein content of chia is higher than the traditionally grown cereals such as wheat, corn, rice, oats, barley or amaranth. The lipid fraction contains unsaturated fatty acids (PUFA): omega-3 - linolenic acid and omega-6 - linoleic acid.

The aim of this research was to evaluate the impact of chia seeds on the quality properties of wheat bread. The research material was wheat flour type 750 incorporated with milled chia seeds. The content of chia in the achieved flour samples was from 5 to 25%. The control sample was wheat flour without the addition of chia.

The dough and bread prepared by a single-phase method was executed according to the Biskupski's method. The samples used in the research were mark with the following designations: total protein and amylographic traits. Designations performed on bread**:** overbake, volume of bread baked of 100 grams, porosity of the crumb according to 8-points Dalmann scale, crumb and crust color on the basis of discriminants L *, a *, b *, organoleptic evaluation of bread using a 9-point hedonic scale verbal.

The results obtained showed that the increasing content of chia positively impacted total protein content, overbake, porosity of the crumb, the decreased amount of red color of the crumb and dietary fiber content. The increasing content of chia caused initial gelatinization temperature, brightness of crust and crumb, the amount of red color of crust and the amount of yellow color of crust and crumb to decrease. The maximum level of the additive of chia seeds in the wheat bread, giving tasty and accepted by the consumer in terms of appearance and color of the bread, was an 15% supplementation.

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QUALITATIVE ANALYSIS OF THE ISOTONIC DRINKS ENRICHED WITH MICROENCAPSULATED EXTRACT OF FLAVONOLS

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Isotonic drinks contain mainly digestible sugars (sucrose, glucose and fructose), and minerals such as sodium, magnesium, potassium and calcium. Their purpose is to maintain in the body a balance of fluids (water, electrolytes), which are excreted in sweat during intense effort. The increasing share of these products in the structure of production and growth of consumption of isotonic drinks, new methods are looked for, which are designed to make this product group more attractive. Microencapsulation is a chance to enrich the isotonic drinks in biologically active compounds. This process can protect polyphenols against harmful effects of oxygen, increases the resistance of these compounds to technological factors such as high temperature and pH, and neutralizes the unpleasant taste and odor.

The aim of this study was to determine qualitative properties of isotonic drinks enriched with non-encapsulated and microencapsulated flavonols extract from onion husk.

The flavonols preparation was obtained by extraction. Microencapsulation process was carried out by spray drying. Maltodextrin (8 DE) and inulin Ortafi HPX were used as coating materials. Inlet temperature of drying chamber was 150°C. The ratio of preparation to coating material was 1:5. The concentration of the preparation in 1 ml of drink was 0.5 mg, concentration of the microcapsules was 2.5 mg/mL. The quantitative and qualitative composition of isotonic drinks was determined by the LC-MS/HPLC method. The color in reflected light was measured using the CIE*L*a*b** scale. The total polyphenols content, antioxidant activity (ABTS, DPPH, FRAP) were measured in the isotonic drinks. The sensory evaluation was performed using a 5-point hedonic scale. General appearance was assessed by linear scale method.

Use of the coating materials has improved the color of isotonic drinks. Drinks with the addition of microcapsules showed the higher value of parameter *L** (brightness) and the lowest the *b** index value. The coating material neutralized undesirable, intense aroma of polyphenolic compounds. Isotonic drinks with addition of microcapsules received the highest organoleptic acceptance and more attractive general appearance than non-encapsulated extract. Q-4'-glucoside and quercetin occurred in drinks in the largest quantities. Microencapsulation of polyphenols gives chance to use them as bioactive additives health enhancing foods.

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EFFECTS OF PRE-SOWING MAGNETIC STIMULATION ON THE GROWTH, DEVELOPMENT AND CHANGES IN PHYSICOCHEMICAL PROPERTIES IN SUGAR BEET SEEDLINGS

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The magnetic field is a physical factor to improve germination and development of plants. The laboratory experiment was conducted to determine the effect of pre-sowing magnetic field stimulation on the ability of growth and development as well as changes in the physicochemical properties of sugar beet seedlings. The magnetic field of low frequency f=50 Hz, B = 10, 20, 40 mT, exposure time t = 60 seconds was used. In the rest of the experiment the results were compared with a control group, taking into account changes in the basic physical and chemical properties of beet seedlings. The observations carried out during the experiment focused on the growth of plants and determining the basic composition of micro- and macronutrients in the emerging plants.

The study explicitly demonstrated the effects of pre-sowing stimulation applied to the planting material of 10 selected cultivars of sugar beet on physicochemical properties of the emerging seedlings. Most significantly, 40mT magnetic field of 50Hz frequency impacted the tendency of the examined seedlings to accumulate basic macro- and microelements; the results were also manifested in lower content of total ash. Importantly, the reduced accumulation of harmful elements such as: Al, Cd, Cr, Ni, Pb, Zn was observed which may be of particular importance in a situation when seeds are planted in soil contaminated by industry, fertilizers or crop protection agents. Due to, pre-stimulation of seeds can provide interesting alternative to the previously known methods of preventing heavy metals accumulation, such as liming or soil ionization which are very expensive and may lead to changes in the structure, pH and other starvation related soil conditions. On the other hand pre-stimulation, without interfering with the soil structure and properties, prevents accumulation of heavy metals which are a major hazard for people and animals. Additionally, observed faster pace of seed germination following magnetic stimulation suggests another agrtechnical advantage, the possibility to achieve faster germination rate favors a better crops.

STUDIES ON THE USE OF STEVIOL GLYCOSIDES IN THE PRODUCTION OF PRO-HEALTHY REDUCED FAT SALAD DRESSING-TYPE EMULSIONS

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Saturated fatty acids, sugar, salt and cholesterol are the main components which should be limited in food. Their excessive intake leads to obesity epidemic, coronary heart disease, diabetes and cancer. To inhibit these negative trends, the action should be taken to reduce the intake of the above mentioned components.

The aim of this study was to obtain salad dressing-type emulsions with increased nutritional value: without cholesterol, with the addition of inulin and steviol glycosides as a fat and sugar substitute, respectively.

Four types of salad dressing-type emulsions were compared in the study. The control variant contained 1% of egg yolk, 18.46 % of refined rapeseed oil and 3.3 % of sugar. As an egg yolk replacer there was used milk proteins. 6.46% of fat was replaced by inulin HORTIMEX ORAFTI HPX. The addition of steviol glycosides TATE & LYLE TASTEVA was on the level 0.11% (the difference in sugar content was supplemented by oligofructose HORTIMEX ORAFTI P95 in an amount of 3.19%). To determine the influence of used additives, the quality of salad dressing-type emulsions was determined by: pH measurement, apparent viscosity, stability of salad dressings, color components L*a*b* and sensory analysis. Obtained results were statistically analyzed.

The steviol glycosides can be used as a total sugar replacer in the production of pro-healthy reduced fat salad dressing-type emulsions. In the opinion of consumers, sugar substitute alleviated the sensation of sour taste of salad dressings-types emulsions, while not significantly affected the taste. The addition of inulin and steviol glycosides visible caused the eye darkening of color and a slight increase in the apparent viscosity.

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