4 th International Conference on Quality and Safety in Food Production Chain

Department of Animal Products
Technology and Quality Management
Wrocław University of Environmental and Life Sciences

Polish Food Technologists' Society

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Ladies and Gentlemen,

The process of globalisation poses new challenges related to the development of knowledge on food technology in the aspect of the competitiveness of food industry. Harmonisation of research with the demands of innovation technologies and dissemination of the results in the system of education in order to boost economic development become the most important issues.

Food science is a wide spectrum of knowledge covering fundamental and applied sciences. Food processing technologies are based on the latest scientific achievements and are closely integrated with the food legal regulations. The knowledge of the technological process is not enough to manufacture a product. The knowledge of biological principles governing the production of materials to be processed is equally important. Thus, food production requires monitoring of processes in all production chain "from field to table".

Production of food is a complex and long chain of biological, chemical, physical, economic and psycho-sociological processes. It is also strongly conditioned by many religions. It is, however, a key existential element of mankind and all economic and political activities must be subordinated to the idea of the quality of life, sustainable development and, first of all, to the basic existence needs of the humans.

The development of knowledge-based economy and knowledge-based society require more engagement of the universities in the life of local communities. Besides realising the primary mission of producing and disseminating knowledge, the universities of today are also the main source of expert knowledge in many fields. Higher education institutions can and must be the places of dialogue and exchanges of experience between scientists and society.

The Wroclaw University of Environmental and Life Sciences is actively involved in the activities promoting the quality and safety of food in the food production chain and it participates in all national and European initiatives. One of the forms of such activity is organisation of international conferences.

The first International Conference in the cycle of "Food Quality and Safety" was held in the year 2000. The present, fourth conference in the cycle, has been divided into five sections, that is:

Session I. Food preservation and packaging systems
Session II. New technologies and methods for the improvement of food products, nutraceuticals and biomedical preparations
Session III. Food analytics
Session IV. Information and education systems in building consumer awareness
Session V. Safety systems in food production chain.

All five subject areas are in line with recent trends observed all over the globe. All of them are of great interest of the world markets, since they deal with food quality and safety, let alone, manufacturing of novel products, such as nutraceuticals and biomedical preparations.

There is an increasing need for new developments in education and transfer of knowledge from research to practical applications. The countries which keep pace with the transfer of knowledge, by introducing new elements to the study curricula and focus their attention on innovation and entrepreneurship, are highly competitive on the world markets. Nowadays, it is crucial to include all aspects of food quality and safety in the entire agri-business chain.

The objective of this conference is to highlight the most recent tendencies in food products technologies, with special regard to the innovation and development of new products emerging on the market. We also hope that this conference will be a platform for exchanging ideas of good practice, beneficial to the researchers, manufactures and food consumers.

The organizers of the conference would like to wish all participants effective discussion, constructive debate and pleasant time during your stay at this university and in our beautiful City of Wrocław, the capital of Lower Silesia.

Prof. Dr. hab. Tedeusz Trziszka
Chairman of the Conference Organizing Committee

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Hanna M. Baranowska, Ryszard Rezler

WATER BINDING IN STARCH-FAT GELS INVESTIGATED BY LOW-FIELD NMR

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The presented study discusses relaxation investigations of potato and wheat starches with addition of hardened plant fats. The selected fats differed with regard to their content of fatty acids. The examined starch-fat gels were prepared from a mixture of: 5 g starch, 95 g water and 1 g fat. Experimental mixtures were boiled for 60 minutes and then placed in measuring test tubes. Measurements were carried out 24 hours after the preparation of samples.

Investigations were performed by using a pulse nuclear magnetic resonance (NMR) spectrometer operating at 30 MHz frequency. Spin-lattice (T_1) and spin-spin (T_2) relaxation times were measured. Using values of these parameters mean correlation times of the molecule rotation movement in the gel were calculated.

Both polymers differed with regard to the contents of amylose and amylopectin. Potato starch, which contains more amylose, forms gels which bind water considerably weaker. The addition of each fat decreases values of both relaxation times. This means restriction of water molecule mobility in the system. The applied fats contain, primarily, saturated fatty acids: $C_{16:0}$ and $C_{18:0}$ as well as unsaturated fatty acids: $C_{18:1}$ and $C_{18:2}$. The remaining fatty acids constitute from 8% to 3% of the composition.

Spin-lattice and spin-spin relaxation times decreased together with the increase in the concentration of the four main fat constituents in potato starch gels. A reverse correlation was observed in wheat starch gels. In addition, it should be stressed that in the case of wheat starch gels, the recorded relaxation times were shorter, which indicates better water binding and restriction of mobility. Calculations of the mean correlation time in individual systems showed that fat added to wheat starch caused a distinct increase in the value of the mean correlation time. The longest correlation time was determined when the added fat contained the highest quantities of unsaturated fatty acids ($C_{18:1}$ – 49% and $C_{18:2}$ – 13%) in comparison with the remaining fats. Simultaneously, this system contained the smallest amounts of saturated fatty acids ($C_{16:0}$ 26% and $C_{18:0}$ 4%) in comparison with the remaining two systems. In the case of potato starch gels, which contain distinctly more amylose, the impact of fat addition on the molecular dynamics was significantly smaller.

The analysis of the obtained results indicates that fats interacting with starch exerted influence on quantitative and qualitative water binding as well as on the molecular dynamics of water molecules in gels.

Key words: starch, fat, gel

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Maria Balcerek

EVALUATION OF THE EFFECT OF ARGINASE AND UREASE ACTIVITIES IN SELECTED STRAINS OF WINE YEAST ON THE PRODUCTION OF ETHYL CARBAMATE

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Ethyl carbamate (EC), referred to as urethane, is a natural component of fermented foodstuffs and alcoholic beverages. Nevertheless, due to its carcinogenic effects in humans, maximum allowable levels of EC are limited.

The study was aimed at evaluating the enzymatic capacity of selected strains of wine yeast *S. cerevisiae* for the production of arginase (EC 3.5.3.1) and urease (EC 3.5.1.5) as well as their effect on the production of ethyl carbamate in aronia mashes.

The experimental material were strains of wine yeast: *Syrena, Tokay, Burgund, Bordeaux, Steinberg,* originating from the Pure Cultures Collection of the Institute of Fermentation Technology and Microbiology, Technical University of Łódź, and *Saccharomyces bayanus* yeast by Prochimica Varese SRL company (Italy). Distillery fruit mashes were prepared from aronia fruit (*Aronia melanocarpa* Elliot).

Under conditions of alcoholic fermentation, the highest activities of arginase (9.355 U/mg protein) and urease (0.569 U/mg protein) were observed for the strain *Steinberg*. The lowest activities of urease (0.192 U/mg protein) and arginase (1.416 U/mg protein), were determined for *Tokay* and *Bordeaux*, respectively. The concentration of ethyl carbamate in after-fermentation liquids was at a similar level, lower than 0.01 mg/L.

The chromatographic analysis of raw spirits, obtained from fermented aronia mashes, indicated differences in the contents of ethyl carbamate depending on the strain of yeast applied in the process. Urethane concentration in tested samples ranged between <0.01 mg/l spirit 40% (v/v) in distillate obtained by *Steinberg* strain and 1.35 mg/l spirit 40% (v/v) in ones produced by *Burgund*.

Key words: enzymatic capacity, fermentation, ethyl carbomate, fruit spirits

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Wojciech Barszczewski, Zbigniew Lazar, Ewa Walczak, Michał Piegza, Małgorzata Robak

MOLECULAR IDENTIFICATION AND DIFFERENTIATION OF YEASTS OCCURING IN FERMENTED FOOD

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Yeasts species identification and their differentiation on strain level is a very accurate method based on molecular biology techniques. One of its advantages is low unit price. In the Department of Biotechnology and Food Microbiology a technique based on RFLP-PCR rDNA and microsatellite RAPD was developed [Barszczewski and Robak 2006, Robak et al. 2005, Walczak et al. 2007]. This technique allows quick and effecitve identification and differentiation of yeasts strains occuring in fermented food.

I this study we have investigated by molecular techniques yeasts species naturally occuring in fermented cabbage, cucumbers and vegetable`s salades. We have included new data in WEPABAZ, department`s database of yeasts molecular profile suitable for identification and differentiations. Finally, more data could help to identify wider range of yeasts isolates from food and some patogenic species as well.

Subject of this study was yeasts isolated from fermented cucumbers (41 strains), cabbage (19 strains), vegetable`s salades (15 strains), soil (7 strains), tropical vegetables (6 strains) and type or reference strains (8). Using API 32C identification method, the isolates were classified as: *Saccharomyces cerevisiae* (21)*, Candida lipolytica* (13)*, C. holmii* (5), *C. utilis* (10)*, C. pelliculosa* (11)*, C. guilliermondi* (10)*, C. famata* (6)*, C. lusitaniae* (2), *C. sake* (1)*, Pichia ohmerii* (3)*, P. etchellsii* (3), *Cryptococcus albidus* (1), *Rhodotorula glutinis* (1), *Geotrichum sp* (1). Molecular identification was performed using restriction analysis with enzymes: *Hae*III, *Msp*I, *Scr*FI of amplified fragments of NS3-ITS4 of ribosomal RNA genes (rDNA). Differentiation of yeast`s isolates was performed using RAPD method with (GTG)5, (GACA)4, (GAC)5, M13 microsatellite primers. In some cases additional primers OPA-01, OPA-09 i OPB-01 were used.

Most of strains isolated from fermented cucumbers was identified as *C. lipolytica*. The same strains analyzed by PCR-RFLP rDNA showed 100% of identity each other but only 56% of identity compared to reference *Yarrowia lipolytica* strains included in WEPABAZ. It was proved, that *MspI* restriction profiles of analyzed strains were identical. RAPD analysis with 4 primers allowed to clasify *Y. lipolytica* isolates with 83–98% of identity. Similar situation was observed in fermented vegetables salades. Analyzed *S. cerevisiae* strains showed

45–47% of identity with *Saccharomyces sensu stricto* and 68–97% of identity among group. Species affiliation was confirmed by two-stage analysis based on RFLP-PCR rDNA.

For example, restriction profiles of strain No 7.IV compared to restriction profiles of references strains from WEPABAZ showed 47% identity to group No III – containing *Schizosaccharomyces pombe* and *Schizosaccharomyces japonicus*. Second step of this analysis showed 100% of identity of strain No 7.IV to *S. japonicus* one of two candidates in the group No III of WEPABAZ.

As a result of this study we developed commercially available service of identification and yeasts differentiation. Details are available on web page: http://wnoz.up.wroc.pl/wnoz/katmikr/Elementy%20strony.htm

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Key words: fermented food, molecular identyfication

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Andrzej Bartkowiak

TRENDS IN DEVELOPMENT OF PROECOLOGICAL MATERIALS FOR FOOD PACKAGING

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Nowadays consumer demand for more convenient, fresher, and better-tasting food is driving the need for better and more functional packaging. At the same time, consumers are also seeking packaging that is recyclable and environmentally friendly, where waste regulations in EU and other countries are putting increasing demands on the packaging industry to develop new ecological materials which are also degradable at the end of their service life.

Instead of relying on oil-based packaging materials, many domestic and EU funded research programs looked at packaging that can be made with natural polymers such as cellulose, proteins, starch, sugars, fatty acids and novel biodegradable polymers such as PLA. In most cases the goal is to produce packages that are combustible, compostable, renewable and carbon-dioxide neutral.

Nowadays industry, both packaging and food oriented, is looking for novel packaging materials which combine at least two very important added values: biobased and smart with appropriate functional properties. In addition to the specific mechanical properties related to type of selected package, such materials must have also the adequate permeability to water vapor and oxygen. The gas barrier requirements of the packaging depend upon the products characteristics and the intended end-use application.

During this presentation the latest results related to novel proecological materials mainly based on biodegradable polymers including cellulose and synthetic polymers such as PLA will be presented. This presentation will focus on the results of some recent EU projects as well as on information from scientific literature.

Over the last ten years many companies have developed a number of sustainable technologies that apparently meet the above goals whilst maintaining product integrity, value and desirability. In the future both, producers and consumers with help of novel eco-oriented regulations will decided which of this novel materials and packaging technologies will win this important and fascinating race.

Key words: proecological materials, biodegradable polymers, food pacaging

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PROTEOLYTIC PROPERTIES OF *BACILLUS CEREUS*

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Level of N-acetylneuraminic acid (also known as sialic acid), which is an ingredient of κ – casein can be an indication of milk proteolysis. As a result of proteolytic enzymes affecting binding between 105th and 106th aminoacid of κ – casein and the following hydrolysis, sugars like galactose, galactosamine, and N-acetylneuraminic acid are released.

Bacillus cereus is a species which is present in raw milk. Because of the fact that they are spore-forming bacteria, they get to UHT milk and dairy products. Psychrotrophic strains of this species cause defects in UHT milk, even when refrigeration cycle is kept well.

The aim of the study was to determine the development of proteolysis when affected by *Bacillus cereus* in milk stored in temperatures of 4°, 6°, 8°, 10°, 15°, 30°C and 43°C. Investigational material was psychrotrophic strains of *B. cereus* isolated from raw milk. The measure of milk proteolysis was the amount of sialic acid. What was additionally observed was changes of amount of *B. cereus* in milk and milk acidity.

Strong proteolytic features of *B. cereus* were confirmed during research. *B. cereus* displayed the highest proteolytic activity in temperatures of 10°C and 15°C. A lower proteolytic activity was observed in 30°C (which is an optimal temperature for the species to grow) and in 43°C. What was not demonstrated was a correlation between a general amount of *B. cereus* and the content of sialic acid in milk. Initial growth and then reduction of sialic acid was observed in milk stored in temperatures 10–43°C, which was most probably caused by the use of this compound by vegetative cells of *B. cereus*.

It has been found out that strains of *B. cereus* which ferment lactose cause changes in milk leading to creation of curd with simultaneous rise of acidity. In raw milk, there are strains of *B. cereus* able to germinate and grow in temperatures from 4 to 8°C.

Key words: milk, proteolytic properties, *Bacillus cereus*

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**Anita Blija, Imants Skrupskis, Valda Kozule,
Gita Krumina-Zemture, Teodors Blija**

CHANGES OF BEAVER MEAT QUALITY DURING MEAL PREPARATION

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The article focuses on the analysis of the possibility of using beaver meat in catering enterprise.

The dynamics of changes related sensory and microbiological indicators has been studied in compliance with the standard methods.

The technological process of preparation of beaver meat meal includes the following critical control points: the preparation of raw material – disjointing of carcass; storage of disjointed meat before it is thermally processed; thermally processing and serving. Cooking, braising and boiling are choosing as thermal processing methods. The following temperature conditions during the meal preparation process and also in the production premises have to be strictly observed to avoid the changes in the quality of a product: in cutting premises the temperature shall not exceed +12°C; in meat forming premises +10°C and in the storage chamber prior to the thermal processing the temperature shall not exceed +2°C. The maximum permitted storage period of a semi-finished food before thermal processing is 2 hours.

Having been achieved without representing the sides concerned, the results of the independent studies can serve as guidelines for the producers in catering enterprise and consumers of beaver meat, ensuring that products meeting criteria of harmlessness only reach the food market.

Key words: meat quality, sensory indicators, microbiological indicators

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Józef Błażewicz[1], Marek Liszewski[2], Agnieszka Zembold-Guła[1], Łukasz Szwed[1], A. Dawidowicz[3]

INFLUENCE OF BARLEY GRAIN VARIETY ON PROGRESS IN MALTING

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Variety of brewing barley grain is a guarantee of quality of malt, wort and, in great deal, beer. Variety homogenous of grain is one of the most important factors affecting technological value of brewing barley grain. The variety affects enzymatic potential of grain in the process of malting and mashing of malt in brew house. This causes difference in brewing usability of varieties. Commonly only those qualified as a group of brewing guarantee good quality of malt. Those varieties are low-protein and mostly high cropping. Frequent problem is choosing the best variety, which is most stable in variable cultivation conditions.

Aim of this study was to determine influence of variety properties of spring and winter barleys in the course of differentiating cultivating, agro-technical and technological conditions on yield, properties of grain and Pilzner type malts.

Material was:

Brewing barley grain of different varieties from 2004–2008 vegetation seasons, originating from Agricultural Research Station in Pawłowice, which conducts research in Post-registration Variety Testing System (PDO)

Brewing barley grain of different varieties sampled from raw material shipments from region of Lower Silesia, prepared for processing in malt house.

In the course of long term experiments with micro-malting of brewing barley grain it was proved that usage of Bishop formula in initial qualification of grain, and Molina – Cano method in detailed evaluation of obtained malts and worts allows optimalization of malting process in the course of improvement and introduction to cultivation more and more brewing barley grain varieties.

Key words: barley variety, extract content, malt, wort, normal wastage, germination time

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Józef Błażewicz[1], Marek Liszewski[2], Agnieszka Zembold-Guła[1], Łukasz Szwed[1], A. Dawidowicz[3]

MOLINA – CANO METHOD AS INDICATOR OF BARLEY GRAIN MALTING USABILITY

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Quality factor Q by Molina-Cano was developed on demand of European Brewery Convention (EBC) as a tool to estimate usability of respective grain varieties for brewing. In cultivation it is used to evaluate brewing value of respective varieties and lineages of barley. During construction of complex factor of barley brewing value, the factor of inheritage was used as a selection criteria of strongest genotype dependant technological properties.

Aim of this study was to determine influence of varieties properties, vegetation seasons and technological factors on Q quality factor.

Material was:

– Brewing barley grain of different varieties from 2004–2008 vegetation seasons, originating from Agricultural Research Station in Pawłowice, which conducts research in Post-registration Variety Testing System (PDO).
– Brewing barley grain of different varieties sampled from raw material shipments from region of Lower Silesia, prepared for processing in malt house.
– Brewing barley grain of winter barleys Actrice and Babette varieties, brewing barley grain of spring barleys: Poet, Troon, Laila, Jersey, which in case of varieties Poet and Troon were cultivated in region of Lower Silesia.

In the course of long-term experiments with Molina - Cano method in evaluation of barley grain malting usability it was proved that the method is very accurate in classification of barley varieties, as well as estimate influence of various factors (agrotechnical and technological) on properties of malts and worts.

Key words: barley grain, varieties, Molina–Cano method, malt, wort

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Józef Błażewicz[1], Łukasz Szwed[1], Agnieszka Zembold-Guła

PRODUCTS OF MAIZE MILLING IN TECHNOLOGY OF WORT PRODUCTION

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The brew house can produce not only beer worts, but also malt worts, which are valuable raw materials in many branches of food industry.

The aim of this work was the estimation how varying factors are influencing mashing yield of Pilzen type malts with the addition of raw grain during laboratory congress mashing.

Varying factors were: dose of fine maize grits or maize grits in range of 40 to 80% of grist, gelatinization of raw materials or its absence, usage or lack of usage of enzymatic preparations: Termamyl S.C., Ceremix 6XMG or Ceremix PlusMG, granulation level of raw materials – maize grits: 500–1250 μm; fine maize grits: 250–750 μm.

In the course of experiment the following parameters were determined: time of mash saccharification, time of flow, volume and mass of worts, as well as extract yield. Additionally the mashing yield was calculated. The data was compared to values obtained for Pilzen type malt worts.

The enzymatic preparation Termamyl SC, used in course of gelatinization of fine maize grits and maize grits, increased the mashing yield and also significantly shortened the saccharification time, as well as time of flow. The highest mashing yield was achieved with gelatinization of raw materials in the presence of Termamyl SC preparation, or mashing of ungelatinized fine maize grits or maize grits in the presence of Ceremix 6XMG or Ceremix Plus MG. Addition of raw materials in range of 40 to 80% of grist gives worts with good time of flow, with similar volume and mass, while raw material contribution exceeding 50% of grist cause over normative lengthening of mash saccharification time. Mashing yield of worts with 40–80% contribution of raw material is similar, which proves incomplete utilization of extractive substances in mashed mass. The difference in level of granulation of maize grits, and fine maize grits in small degree influences final yield.

Key words: unmalted materials (grain, syrups, maize), enzymes, gelatinization, efficiency, extract content.

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Łukasz Bobak, Wiesław Kopeć, Małgorzata Korzeniowska, Michał Korzycki, Tadeusz Trziszka

APPLICATION OF MEMBRANE FILTRATION TO RECEIVE SOLUTIONS ENRICHED WITH CYSTATIN FROM EGG WHITE

Department of Animal Products Technology and Quality Management, Wrocław University of Environmental and Life Sciences

The objective of the study was the evaluation of the possibility of membrane techniques application for receiving solutions enriched with cystatin – cysteine proteinases inhibitor from hen's egg white. Raw material used in the study was egg white separated from yolk and shell. Eggs were collected from 30–45 weeks of age Lohmann Brown layers kept in battery system. Birds were fed with standard fodder with an addition of commercial premixes. Eggs were collected between 3 to 5 days after laying and kept in chilling conditions until analyses. Obtained egg white was filtered due to chalase, shell membranes and shells remaining removal. Membrane feed was prepared by diluting of homogenous egg white with 150 mM sodium chloride solution in volumetric relation of 1 to 4. Microfiltration was carried out on filtration module consisting of membrane made from polypropylene (PP) tubes. Membrane was characterized by the nominal porosity of 0.2 μm and active membrane area of 0.24 m^2. Membrane feed was input into filtration membrane module using peristaltic pomp with elastic rotor (FIP). Transmembrane pressure (TMP) was adjusted to 0.05 MPa using regulatory inverter of feeding pomp. In order to limit the biologically active substances loss during filtration simultaneous diafiltration process was applied. Filtration was performed as one step operation (up to 100% of added solution was obtained in permeate) or two step process including microfiltration up to 50% of solution volume in permeate followed by the addition of the same volume of NaCl solution to retentate. The process was continued up to the same volume of final permeate was obtained in permeate fraction. Collected filtrates were then subjected to protein content and cystatin activity analyses expressed as the ability to papain inhibition. Results collected in the study revealed that there is possibility of recovery the 50% of active inhibitor. Moreover, significant increase in a specific activity of cystatin was observed in relation to raw material.

Key words: cystatin, egg white, membrane technique

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INFLUENCE OF THE SEASON OF THE YEAR ON THE CHEMICAL COMPOSITION OF PSE, NORMAL AND DFD CHICKEN BREAST MUSCLES[2]

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Wrocław University of Environmental and Life Sciences
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The aim of the presented study was to analyse the chemical composition of normal, pale soft exudative (PSE) and dark firm dry (DFD) chicken breast muscles in different seasions of the year (autumn, winter, spring, summer). In two different experiments, breast muscles after 3 and 24 h post mortem were obtained from the chicken carcass. Then muscles were classified as normal, PSE and DFD according to colour parameter L* (lightness) and pH value. Specific L* value and pH were assumed at the level of L*>53; pH<5.7 for PSE, 48<L*<53; 5.7<pH<6.1 for normal and L*<48;pH>6.1 for DFD meat. All slaughter as well as post slaughter operations were performed at commercial conditions in Adros Co. in Dobrzyca. The experiment was replicated twice in each seasons of the year. Chicken breasts muscles were subjected to water content analysis (drying sample in an oven set at 105°C for 24 hours) according to PN–ISO 1442:2000, as well as proteins content measured by the reference Kiejdahl method according to PN-75/A– 04018, fat using Soxhlet method according to PN–ISO 1444:2000 and WHC (water holding capacity) by method described by Grau & Hamm (1953) with the modification of Szmańko (1986). The results of the study revealed that the chicken breast muscles were characterized by lowest water content in the winter (about 75%) and the highest in the summer (about 77%). In case of analysis carried out in summer the results of water content were correlated with the lowest protein content of about 23%. The smallest variations within the whole period were observed in fat content, which ranged from 1.2% to 1.4%. The lowest water holding capacity was analysed in chicken breast muscle during the summer season (60–62%), whereas the highest in autumn (72–74%).

Key words: dricken breast muscles, water holding capacity, chemical composition of meat

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Robert Bodkowski[1], Bożena Patkowska-Sokoła[1], Zygmunt Usydus[2], Wojciech Zawadzki[3], Marzena Janczak[1]

THE STUDY ON A POSSIBILITY OF AN APPLICATION OF FISH OIL ENRICHED IN BIOACTIVE FATTY ACIDS EPA AND DHA IN A REDUCTION OF BLOOD LIPID INDICES

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The possibility of an application of oil from Atlantic mackerel enriched in omega-3 acids (mainly EPA and DHA) in a lowering of blood lipid indices was assessed in the study.

Raw mackerel oil was subjected to enrichment process using modified by the authors method of complexing with urea. The content of saturated fatty acids (SFA) decreased significantly from 28.9 to 0.3% in an obtained concentrate, while the content of omega-3 and EPA + DHA acids increased significantly from 35.5 to 90.4%, and from 23.9 to 70.7%, respectively. Obtained concentration of EPA and DHA acids is about 2.5 – fold higher comparing to capsulated diet supplements available on a market. As a result of complexing with urea process, also a ratio of omega-3 / omega-6 increased significantly in fish oil (from 6.7 to 13.3).

In the 2nd part of the study, fish oil enriched in omega-3 acids was given to rats, and its influence on blood lipid indices was assessed. Research material consisted in 80 homozygous rats of Wistar strain, that were divided into 4 groups, 20 individuals in each.

- group I – control (only loose fodder Labofeed),
- group II – loose fodder + an addition of pork lard in amount 7.5 g/head/day for 3 weeks,
- group III – loose fodder + an addition of pork lard in amount 7.5 g/head/day for 3 weeks, and at the same time (preventively) 1 ml/head/day of fish oil enriched in ω-3 acids,
- group IV – loose fodder + an addition of pork lard in amount 7.5 g/head/day for 3 weeks, and after a discontinuation of lard, 1 ml/head/day of fish oil enriched in ω-3 acids for 3 weeks.

At a day of beginning, and after the end of the experiment blood was collected from all rats. The content of triglycerides, total cholesterol and its LDL fraction were determined using an enzymatic colorimetric test.

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Comparing to the control group (I), an addition of pork lard (group II) caused an increase in a content of all lipid indices of blood of rats. Content of triglycerides increased of 77%, total cholesterol of 46%, while LDL cholesterol of 120% (highly significant differences). In turn, an application of fish oil enriched in omega-3 acids in a preventive (group III) and therapeutic (group IV) form, caused a decrease of triglycerides of 26 and 20%, total cholesterol of 19 and 16%, and LDL cholesterol fraction of 68 and 81%, respectively (differences highly significant statistically) comparing to group II (with elevated level of lipid indices).

Key words: fish, bioactive fatty acids

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MICROBIOLOGICAL QUALITY IN THE SELECTED INSTANT SOUP CONCENTRATES

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The aim of this work was the assessment of microbiological quality of the selected instant soup concentrates. Research material was six selected instant soup concentrates: chicken soup with noodles, red borscht, Polish rye soup with croutons, tomato soup with noodles, mushroom cream soup with croutons, boletus cream soup with croutons of four national producers (A, B, C, D). The scope of research included the markings of: total number of microorganisms in 1 g, E.coli bacteria in 0,01 g, Salmonella bacteria in 25g, amount of mould and yeast in 1 g, spores of anaerobic bacteria reducing the amount of sulfites in 0,01 g, according to methodics included in to Polish and International Standard.

On the base of received results of the research we can tell that the highest total number of microorganisms was marked in the boletus cream soup with croutons (A) – $2,6x10^5$ CFU/g. Among the examined soups, only the boletus cream soup with croutons (A) didn't meet the requirement of the norm.

The presence of the E.coli bacteria was not found in 17 out of the 18 tested instant soups. The boletus cream soup with croutons (A) was the exception. It was soiled microbiologically by the E.coli bacteria that was present in 0,01 g of the investigated product.

In the researched instant soups of four producers, didn't regarded presence of Salmonella bacteria.

There were spores of anaerobic bacteria in the amount of 0,01 g in four of the examined soups. There were as follow: Polish rye soup with croutons (B, D); tomato soup with noodles (C, D).

The highest quantity of yeast was marked in the tomato soup with noodles (D) – $5,5x10^1$ CFU/g . In the other soups the quantity of yeast was smaller than 10 per 1g of the investigated material.

In the examined soups there wasn't any over of the level of mould allowed in the Polish legislation.

Key words: soup concentrates, microbiological quality

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**Tomasz Boruczkowski, Hanna Boruczkowska,
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MEASUREMENT OF BIOMASE CONCENTRATION WITH USE OF MICROSCOPY IMAGE ANALYSING SOFTWARE

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It is aimed to the shortening the time which is necessary to the realization of various analyses in the fermentation industry. It is used the progress in the science among others to the improvement of the methods of the calculation of micro-organisms, because traditional methods require them devotions the large quantity of work and time the most often.

The qualification of the usefulness of the computer analysis of microscopic images to the sign of the dry mass of the yeast was the aim of the work. After propagating the biomass of the yeast Saccharomyces cerevisiae Safethanol 3035, the preparation of yeast slurry designed to more far investigations and suitable thinning her, the content of the dry mass of the yeast was measured three methods: the weight, spectrophotometric and with use of software for the computer analysis of the microscopic images - ImageJ. The results were subjected the statistical analysis with STATISTICA 8. It was calculated: average, standard deviation, variance, the minimum and the maximum for the quantity of the yeasts, the surface of the yeasts and area occupied through the yeasts and the coefficients of the correlation were calculated. Equations were also fit: linear, square and logarithmic and the corresponding coefficients of the correlation were calculated. The absolute error was calculated moreover in the aim of the qualification of accuracy of executed measurements and also relative error was calculated enabling the comparison of the errors of various methods.

It was affirmed in the result of conducted investigations that the determination of the dry mass of the yeast is possible with using software for the computer analysis of the microscopic images.

Key words: biomass *Saccharomyces cerevisiae*, computer analysis, microscopic images

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EFFECT OF FORAGES IN INTENSIVE FATTENING OF LAMBS ON FATTY ACID PROFILE OF INTRAMUSCULAR AND DEPOT FAT

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The effect of forage and breed origin of lambs on the fatty acid profile of intramuscular fat in m. longissimus lumborum (LLF) and depot fat (SCF) above this muscle was investigated. The study was carried out in two replications on 36 Kołuda sheep (KS) and Ile de France × KS (If×KS) ram-lambs fattened intensively to 32-37 kg body weight. Lambs were fed ad libitum with the same concentrate mixture and different roughage supplements: grass hay in group C (control), field forage fed in a sheep house in group F, and pasture grazing (4 h/day) in group P. The intake of basic nutrients in the groups was similar, with a higher PUFA intake in groups F and P compared to group C by 20.2 and 14.0%, respectively.

Both treatment factors had different effects on the fatty acid profile of LLF and SCF fat. In the case of LLF fat, the composition of fatty acids was found to deteriorate in lambs receiving forages compared to lambs from group C. More pronounced differences were obtained for lambs grazed on pasture (P), which had a higher content of LLF fat (2.31 and 1.90% in P and C respectively, $P \leq 0,05$), a higher proportion of SFA (42.1 vs. 39.6%, $P \leq 0,01$), a similar proportion of MUFA, and a lower proportion of PUFA (10.4 vs. 12.5%, $P \leq 0,05$). With similar content of depot fat (an average of 4.00 mm over ribs), changes in the FA composition of SCF fat in relation to group C were observed in F lambs. Compared to C lambs, SCF of F and P lambs contained less SFA (5.16% vs. 46.8 $P \leq 0,01$ and 49.3%) and more MUFA (41.8% vs. 45.6 $P \leq 0,01$ and 43.6%), with a similar proportion of PUFA, and higher CLA content in group P (by 17.8%).

The crossing of KS with Ile de France meat rams did not result in differences in LLF fat content (2.07% on average), with a generally unfavourable effect on FA composition and health quality parameters calculated on this basis. LLF of If×KS lambs, compared to KS lambs, contained more SFA (41.7 vs. 39.9%, $P \leq 0,01$) and less PUFA (10.4 vs. 12.3%, $P \leq 0,05$), with a similar proportion of MUFA. With a tendency towards greater content of depot fat in If×KS compared to KS animals (by 11.7%), a higher proportion of MUFA in their SCF (44.7 vs. 42.5%, $P \leq 0,05$), similar proportions of SFA and PUFA (including CLA) and generally more favourable parameters of health quality were found.

In summary, the present study showed generally unfavourable effects of forage on the intensitivity of fattening of lambs and the crossbreeding scheme used on the composition of fatty acids in intramuscular fat and parameters of health quality calculated on this basis, with a tendency towards a favourable effect of these two factors on the lipid profile of depot fat.

Key words: fatty acids profile, intramuscular fat, lamb

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Anna Bzducha-Wróbel, Mieczysław W. Obiedziński

EFFECT OF *LACTOBACILLUS CASEI* ON FATTY ACIDS IN MODELS OF RIPENING CHEESE SLURRY

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The study followed the changes in fatty acid profile in models of cheese slurry inoculated with *Lactobacillus casei* DN – 114001. The control slurry were prepared only with starter cultures of the fermentation process – *Lactococcus lactis* subsp. *lactis* (R-603*)*. Models were submitted for ripening at 14 °C during 8 weeks.

The concentration of individual fatty acids in glyceride fraction, as also the free fatty acids (FFA) content after SPE – NH_2 fractionation and methylation were investigated using GC - MS.

Ripening process resulted in increase in the levels of palmitic and oleic acid in gliceride fraction, respectively from 31.8 to 32.6 g / 100 g fat and 18.6 to 19.1 g / 100 of fat. Also the content of stearic acid showed the increasing tendency but it was not statistically important alteration ($\alpha = 0.05$). At the same time the levels of linoleic and linolenic acid slightly decreased. In probiotic models the content of conjugated linoleic acid (18:2 *cis* – 9, *trans* – 11) was statistically higher at the end of ripening time, 530 mg / g fat, comparing with the 450 mg / 100 g fat at the beginning. CLA changes were not correlated with linoleic and linolenic acids. Positive correlation was noticed in case of CLA and oleic acid (r = 0,587), while negative dependence with pH changes (r = - 0.568).

After 8 weeks of ripening the concentration of FFA amounted to over 1300 [mg / 100 g of fat] and was about 2.5 times higher in models with *Lactobacillus casei* comparing with control slurry. The predominant free fatty acids were palmitic and stearic (over 360 mg / 100 g fat) while the individual concentration of miristic, oleic and butyric acids averaged 100 mg / g fat. The content of free linoleic, linoleic and CLA fatty acids was respectively 19.0; 7.7 and 7.6 mg / 100 g fat.

Key words: *Lactobacillus casei*, model of ripening cheeses, fatty acids, CLA

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J. Calik

EVALUATION OF EGG QUALITY ACCORDING TO HEN ORIGIN AND AGE

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The aim of the study was to determine the effect of age and origin of laying hens on the quality of table eggs. The study involved eggs from Rhode Island Red (K-44, K-66), Rhode Island White (A-22, A-88), Barred Rock (P-11) and New Hampshire (N-11) layers kept at the Pedigree Breeding Farm in Duszniki. Hens were kept in a 3-tier battery of cages and fed ad libitum complete diets throughout the production period. At 33 and 53 weeks of age, 30 eggs were randomly taken from the hens of each population for quality assessment using QCS-II electronic device (TSS). The parameters analysed were egg weight (g), shell colour (%), height of dense albumen (mm), Haugh units, yolk colour (pts), shell weight (g), shell thickness (μm) and shell density (mg/cm^2). Shell strength (N) was measured using an EGG Crusher, and total cholesterol content of yolks (10 from each group) was determined using the Washburn and Nix method. The results obtained were subjected to analysis of variance and significant differences were determined using Duncan's test.

During the observations, the mean egg weight increased by over 3.0 g in line K-44 and P-11 and by about 1.5 g in the other lines. In all the populations, the increase in egg weight was paralleled by a significant increase in shell and yolk weight. The strongest shell (34.59 N) was characteristic of the eggs laid by K-44 hens aged 33 weeks. At the same time, the shells of these eggs were thickest (364 μm) and the eggs had greatest shell density (83.99 mg/cm^2). All the lines were characterized by good parameters of egg freshness (albumen height and Haugh units), which were found to deteriorate with advancing age of the hens. Genetically determined differences were found in the colour intensity of eggshells (30.07 – 43.43%), which tended to become lighter in colour as hens grew older (33.00 – 45.21%). Throughout the egg production period A-88 hens (8.93 and 8.73 pts) laid eggs with darkest yolks, which was confirmed statistically. The lowest score for yolk colour was found in A-22 hens (7.90 and 8.13 pts) at both 33 and 53 weeks of age. Total cholesterol concentration (mg/g) in yolks of hens aged 33 and 53 weeks ranged from 14.49 to 15.04 and from 14.56 to 14.87, respectively. The mean concentration of yolk cholesterol did not differ significantly between individual lines, with the lowest cholesterol content per g of yolk found in N-11 and A-88 hens (about 14.5 mg/g). In K-44, K-66, A-22 and A-88 hens, yolk cholesterol tended to decrease in 53-week-old layers compared to young hens at peak egg production. An opposite tendency was found in lines N-11 and P-11, in which cholesterol content increased slightly

with advancing age of the hens. Eggs laid by the hens of these lines were characterized by good quality parameters. This especially concerned traits such as height of thick albumen, Haugh units and shell strength. In addition, it was confirmed that many egg and shell quality traits change with the age of hens.

Key words: laying hens, age, egg quality

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J. Calik

EFFECT OF AGE OF ASTRA S LAYING HENS ON EGGSHELL QUALITY

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Hen productivity has improved considerably thanks to the use of modern methods of breeding, nutrition and veterinary prevention. Breeders have to pay more and more attention to improving egg quality traits as a result of increasing intensification of egg production. Shell quality is determined by several interrelated parameters including shell weight, thickness, breaking strength, deformation and shape, and specific weight of egg. It is estimated that approx. 6-8% of all eggs produced in a year are broken in a poultry house during collection or transportation. This loss is even greater at the end of the egg production period, especially in the cage system, which reduces the profitability of egg production. Many publications have shown that shell quality traits are affected by several factors such as layer origin, feeding, veterinary prevention and management conditions.

The aim of the study was to determine the effect of age of Astra S layers on eggshell quality. Eggs from 96 Astra S commercial layers, kept in a 3-tier battery of Big Dutchman individual cages, were investigated. Hens were fed *ad libitum* standard diets – a pre-layer diet from 18 weeks of age followed by a DJ complete diet. Shell quality was evaluated at 24, 32, 44, 56 and 64 weeks of age. Eggs were weighed on an electronic balance with an accuracy of 0.01 g, and analysed for shell quality traits. An Instron 5542 device was used to determine shell strength and deformation under a 1kG and 2kG load applied on the long axis of the egg. Maximum shell deformation at breaking was also determined. In addition, shell weight (g), thickness (μm) and density (mg/cm^2) was determined using an electronic device for egg quality evaluation (EQM, Technical Service & Supplies). The results obtained were subjected to analysis of variance and significant differences were determined using Duncan's test.

During the observations, egg weight increased from 51,9 g in layers aged 24 weeks to 65,9 g in 64-week-old hens. As the size increased eggs became more elongated, as shown by lower shape index. A statistically significant increase in the weight of eggs laid by hens was also observed to 44 weeks of age. In the next test periods, egg weight stabilized. The increase in egg weight was accompanied by increased shell weight and reduced shell percentage, which was confirmed statistically. The strongest (4.33 kG) and least deforming shells under a load of 1 kG (47,29 μm) and 2 kG (86,62 μm) was characteristic of eggs laid by 24-week-old hens and this tendency persisted to 32 weeks of age. At the same time, the shells of these eggs were thickest (371 μm) and the eggs were characterized by the densest shell (80,16 mg/

cm^2) and the most elastic deformity measured at breaking (184,40 μm). In the next tests, shell strength gradually decreased to 2,80 kG at 64 weeks of age. The significant weakening of shell strength was paralleled by the increased value of shell deformation at 1 kG (55,59 μm) and 2 kG (95,47 μm), reduced thickness (349 μm) and lower shell density (75,79 mg/cm^2).

It is concluded from the results obtained that the eggs laid by commercial Astra S hens are characterized by good quality parameters of the shell, and many shell quality traits change with the age of hens.

Key words: laying hens, age, shell quality

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Renata Cegielska-Radziejewska, Grzegorz Leśnierowski, Tomasz Szablewski, Jacek Kijowski

ANTIBACTERIAL ACTIVITY OF LYSOZYME DEPENDING ON DIMER CONTENT

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Lysozyme is an enzyme (14400 Da) found in almost all secretions, systemic fluids and tissues of human and animal organisms. However, the primary and extremely rich source of lysozyme is hen egg white, in which it accounts for approx. 3.5% total protein content. Antibacterial activity of lysozyme pertains mainly to Gram-positive bacteria, which is connected with the structure of the cell wall. Analyses showed that production of modified lysozyme preparations, containing – apart from monomer – also other, polymeric forms of the enzyme, makes it possible to extend the scope of its antibacterial activity to include also Gram-negative bacteria.

The aim of the study was to determine the antibacterial activity of lysozyme preparations depending on the amount of dimer. Analyses were conducted in the model system on samples with a specific amount of dimer (0–100%). Antibacterial activity was assessed using the disc-diffusion method on agar medium in relation to bacteria *Micrococcus luteus* and *Pseudomonas fluorescens*.

Results indicate that antibacterial activity of lysozyme in the investigated system is dependent both on the type of bacteria and the percentage of dimer in the mixture. The dependence between dimer content in the tested preparation was shown both for Gram (+) bacteria *Micrococcus luteus* and Gram (-) *Pseudomonas fluorescens.* In case of *Micrococcus luteus* growth inhibition zones were observed to decrease with the reduction in the percentage content of dimer. An opposite dependence was shown for bacteria *Pseudomonas fluorescens*. Further studies are required to confirm reported results and to evaluate properties of preparations in relation to selected Gram (-) bacteria.

Evaluation of the antibacterial action of lysozyme with the use oft his method shows that there is a dependence between dimer content in the preparation and its antibacterial activity. Analyses need to be extended to include different bacterial strains, especially Gram (-). This paper concerns a narrow stage of investigations conducted within the framework of research of the authors' project, the State Committee for Scientific Research no. 2P06T00926, on modification of lysozyme and evaluation of its antibacterial action.

Key words: lysozyme, antibacterial acitvity, modofication

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DETECTION OF EGG YOLK IN LIQUID EGG WHITE USING MID-INFRARED SPECTROSCOPY COUPLED WITH CHEMOMETRICS

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The objective of this study was to examine the feasibility of using mid-infrared spectroscopy (MIR) to determine potential contamination of egg yolk in liquid egg white products, which may influence their functional properties. Egg samples with known concentrations of egg yolk in egg white ranging from 0–100% (w/w) were prepared and analyzed using a Fourier transform infrared spectrometer with ATR-sampling accessory. Principal component analysis (PCA) of the spectral data showed clear clustering of samples according to storage duration (1, 7 or 15 days) as well as yolk content (≤10%, 10–50% and > 50% w/w yolk in white). Partial least squares (PLS) regression analysis resulted in a prediction model with r = 0.99 and RMSEP = 4.5, revealing the possibility of using MIR as a rapid tool for semi-quantitative estimation of contamination levels of egg yolk in liquid egg white products.

Key words: egg, egg products, mid-infrared spectroscopy

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Anna Chojnacka, Grzegorz Kiełbowicz, Witold Gładkowski, CzesławWawrzeńczyk

ENZYME-CATALYZED ENRICHMENT OF EGG-YOLK PHOSPHATIDYLCHOLINE WITH LINOLEIC ACID FROM NATURAL SOURCES

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Phospholipids (PLs) are widely used as emulsifiers in foods, pharmaceutical and cosmetic products. Commercially available PLs are isolated mainly from soybean oil or sunflower oil but they can also be obtained from egg-yolk. Comparing to PLs from plant sources lecithin from egg-yolk contains mainly saturated fatty acids and there are less contents of polyunsaturated fatty acids (12% of 18:2 and 3% of 20:4).

Modified phospholipids enriched in PUFA could have much better surface active properties and nutritional value than the original compounds.

Modification of phospholipids can be performed by chemical catalysts as well as by enzymatic methods. There are many reports about incorporation of commercially available acids, such as EPA, DHA, CLA in lipase-catalyzed acidolysis process mainly into the soya lecithin. From an economical point of view it is preferable to use the vegetable oils as the cheap, natural sources of desired acids.

To obtain modified phosphatidylcholine (PC) as food additive, we decided to carry out lipase-catalyzed interesterfication reaction between PC and sunflower oil. This oil is rich in unsaturated fatty acids and among them linoleic acid (18:2, *n-6* PUFA) predominates (75%). Three different lipases were investigated as biocatalysts in the interesterification processes: Lipozyme RM IM (lipase from *Rhizomucor miehei*), Lipozyme TL IM (lipase from *Thermomyces lanuginosa*) and Novozym 435 (*Candida antarctica* lipase B). Considering the regioselectivity of the enzymes used, we expected to incorporate linoleic acid in the *sn*-1 position of PC. This acid occurs naturally in *sn*-2 position, so our experiment would cause the considerable enrichment of PC with this acid.

Key words: egg-yolk, linoleic acid, enzymes

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Marta Ciecierska, Mieczysław Obiedziński

DETERMINATION OF POLYCYCLIC AROMATIC HYDROCARBONS IN INFANT FORMULAE, FOLLOW-ON FORMULAE AND BABY FOODS BY GC-MS

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The study was carried out on commercially available infant formulae, follow-on formulae and baby foods for young children and their contamination by PAHs. From the group of infant formulae and follow-on formulae, the material investigated were two brands of milk, together with infant milk and follow-on milk. From the group of baby foods for young children, three kinds of dinners and three kinds of soups of two well-known producers were taken for the research.

The purpose of the study was to determine the content of 4 compounds from the group of light PAHs listed by EPA and 15 PAHs listed by The Scientific Committee on Food in the above-mentioned products.

Methodology consisted of fat extraction, PAHs isolation using gel permeation chromatography (GPC) and PAHs determination by gas chromatography coupled with mass spectrometry (GC-MS).

Similar quality profiles of PAHs were found in infant formulae and follow-on formulae, as well as in the baby foods. In infant milk and follow-on milk 4 light PAHs (phenanthrene, anthracene, fluoranthene and pyrene) constituted 100% of summary content of PAHs, while in the case of baby foods mean content of light PAHs was about 90%. Total content of 19 PAHs ranged from 0.33 to 6.52 µg/kg. The highest content of 15 PAHs was equal to 0.89 µg/kg, however for the majority of products any of 15 PAHs were not detected. Benzo[a]pyrene was only detected in two kinds of soups, however at the level which was much lower than the maximum tolerable limit stated for these group of products (1 µg/kg) in Commission Regulation (EC) No. 1881/2006 of 19 December 2006.

Key words: polycyclic aromatic hydrocarbons, baby food

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Marta Ciecierska, Mieczysław Obiedziński

CONTAMINATION OF RAW AND ROASTED ARABICA COFFEES BY POLYCYCLIC AROMATIC HYDROCARBONS DETERMINED APPLYING GC-MS

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Warsaw University of Life Sciences

The study was carried out on raw and roasted Arabica coffees (Coffea arabica) imported from 5 different countries (Brazil, Peru, Ethiopia, Indonesia, Tanzania). The coffee beans were roasted in the temperature ranged from 125 to 135°C by using the electrical heating system.

The purpose of the research was to study contamination of the above-mentioned natural Arabica coffees by 19 PAHs, including 4 PAHs from the group of light PAHs listed by EPA and 15 genotoxic PAHs listed by The Scientific Committee on Food. Important issue was to define influence of roasting process on PAHs level in the final product.

Methodology applied for this study consisted of fat extraction, extract's clean up using silica gel column, PAHs isolation from fat matrix by gel permeation chromatography (GPC) and qualitative and quantitative PAHs determination by gas chromatography coupled with mass spectrometry (GC-MS).

The level of 19 PAHs content in raw Arabica coffees ranged from 7.49 to 58.63 μg/kg, whereas in roasted coffees the PAHs concentration varied from 5.35 to 14.43 μg/kg. Moreover, it was statistically confirmed that contamination of roasted coffees was significantly lower in comparison with their raw equivalents. It was therefore proved that the applied mild parameters of roasting results in a relatively low level of contamination and even have substantial impact on reducing the level of PAHs contamination in the final product. It was also stated that in raw coffees 4 light PAHs (phenanthrene, anthracene, fluoranthene and pyrene) represented 90–97% of all determined polyarenes, whereas in roasted coffees 75–96%.

Key words: arabica coffee polycyclic aromatic hydrocarbons

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A COMPARISON OF PAHS AND PCBS CONTENT IN HONEY, RAPESEED BLOSSOM AND SOIL

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The aim of this study was to estimate the content of toxic organic compounds in honey harvested from villages Pęczerzyno and Przybysław (West Pomeranian Province, Poland). The study comprised analysis of polychlorinated biphenyls (PCBs) and polycyclic aromatic hydrocarbons (PAHs) in six varieties of honey. Additionally, in case of rapeseed honey, the compounds were determined in rapeseed inflorescences collected after the flowering period and in soil samples from the rapeseed fields.

The analysis was performed by gas chromatography (GC) coupled with mass spectrometry (MS) on a GC-MS (HP 6890/5973) apparatus. The study revealed that the vicinity of Pęczerzyno was more polluted, which was evidenced by higher levels of PAHs and PCBs in both soils and rapeseed blossoms.

In the soil from Pęczerzyno, the most abundant PCB congener was PCB 138 amounting to 0.119 ng/g dry weight (ng/g d.w.), while the most abundant PAH was benzo[a]pyrene (BaP) amounting to 1642 ng/g d.w. PCB content in the six varieties of honey examined was low. Σ15PCBs averaged 0.07 ng/g wet weight (ng/g w.w.), and only in the rapeseed honey from Przybysław it amounted to 0.12 ng/g w.w.

In spite of literature reports informing about high contamination of some honey and honey products with PAHs, the examined honey samples had very low content of these compounds. However, correlations were observed between the levels of soil or blossom contamination and PAH levels in the rapeseed honey. Higher PAH content was observed in the rapeseed honey from Pęczerzyno, that contained 66.1 ng/g w.w. of Σ23PAHs, including 0.24 ng/g w.w. of BaP.

Key words: honey, toxic organic compounds

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HEADSPACE PROFILING USING MS-BASED ELECTRONIC NOSE FOR DISCRIMINATION OF BUCKWHEAT HONEY VARIETIES

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Honey is a sweet product provided by bees. Thanks to its high nutritive value as well as for its unique sensory characteristics honey has become very popular among candies amateurs, cooks, and nutritions. Nowadays, hundreds of honey types are produced all over the world each of them having specific character determined by its botanical and geographical origins. Great popularity among consumers and relatively simple composition seem to make honey exceptionally prone to potential frauds. Thus, it is important to provide fast, effective, and reliable means for honey authenticity evaluation.

Over the past 20 years a wide range of papers have been published devoted to discrimination between various honey types based on their chemical, physical, and/or biological properties. Techniques such as pollen counting and identification, ash, acidity, electrical conductivity, and pH measurements as well as metal content analysis have been applied. Recently, gas chromatography (GC) and mass spectrometry (MS) have gained widespread attention as a time-saving and reliable tool for evaluation of honey volatile compounds. Several attempts have been made to distinguish between honey types of different botanical and/or geographical origins on the basis of their headspace composition assessment. Electronic noses seem to be very useful and popular tool for food volatiles analysis. A promising alternative for traditional instruments are MS-based electronic noses. They are said to have many advantages over their predecessors eg. a wider range of "sensors" available (each of *m/z* value analysed) as well as greater robustness and reproducibility.

The aim of the present study was to assess availability of headspace profiling for characterization of buckwheat honey varieties of different origins and propose a sort of MS-based electronic nose for studying honey headspace composition. An object of the study was six buckwheat honey varieties available on Polish market. Headspace analysis was performed by means of solid-phase microextraction (SPME) and gas chromatography coupled with mass spectrometry (GC/MS). DVB/CAR/PDMS fibre was used. The data obtained were processed in two different ways. First, a traditional GC data analysis ie. chromatographic peaks evaluation and identification of headspace compounds on the basis of their mass spectra, was applied in order to evaluate chemical composition of honeys headspace. 54 volatile

compounds were identified including aldehydes, furans, fatty acids, and esters. Components present in at least 4 samples studied were retained for further statistical analysis. In a second approach, average-integrated mass spectra in range 17.5-32.5 min were collected and ions present in at least 83% of the samples were retained resulting in individual honeys headspace fingerprints. The two data matrixes obtained (12 × 25 for the first approach, and 12 × 158 for the second one) were subjected to principal component analysis (PCA) using *Statistica 8.0*. For a chromatographic approach, the first two principal components (PCs) explained 67.6% and allowed grouping of the samples according to their origins with some intermingling observed. Adding the third PC (12.2% of the total variance explained) gave no noticeable separation improvement. For a mass spectrometric approach, the first two PCs accounted for 70,8% of the total variance and tended to group honey samples by their origins but again, some overlapping was noticed. Including the third PC (8,5% of the total variance explained) improved grouping.

Headspace profiling was shown to be useful in differentiation of various buckwheat honeys and MS-based electronic nose using SPME-GC/MS technique was proposed as a fast and effective tool for characterizing buckwheat honey varieties on the basis of their volatile fraction analysis.

Key words: honey, ms-based electronic nose, buckwheat honey

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COLOUR CHANGES OF FREEZE-DRIED STRAWBERRIES OSMOTICALLY DEHYDRATED BEFORE DRYING

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Food colour is very important and often determines product acceptation by consumer. To reduce unbeneficial changes it is necessary to modify drying method. One from the manners is osmotic dehydration, which consist in water removing from the plant tissue with simultaneous penetration of the osmotic solution.

The aim of this work was to analyze the effect of osmotic dehydration, type of osmotic solution and freezing on colour changes of freeze-dried strawberries.

Fresh and frozen Senga Sengana strawberries were dehydrated in osmotic solutions with water activity about 0.9 (sucrose solution 61.5% and glucose solution 49.2%), at temperature 30°C by 3 hours under atmospheric pressure in dynamic conditions. Osmotically dehydrated fruit were frozen and freeze-dried at the temperature of heating shelves 30ºC by 24 hours.

For received dried fruit colour changes were determined.

The colour changes for the surface of freeze-dried strawberries were determined in CIE L^* a^* b^* agreement in ten repetitions. The values of colour indicators were also determined: saturation index (SI) and hue angle (H).

Osmotic dehydration in glucose and sucrose solution for fresh strawberries caused significant decrease in saturation index (SI) in comparison to fruit without osmotic pre-treatment. It was shown that type of osmotic solution isn't important.

Also for frozen strawberries osmotically dehydrated, significant decrease in saturation index was shown in comparison to fruit without osmotic pre-treatment. Type of osmotic solution has significant influence on the value of colour indicators for fruit osmotically dehydrated.

Storage of osmotically dehydrated before frozen fruit caused increase in saturation index in comparison to strawberries osmotically dehydrated in fresh state, with the exception of fruit osmotically dehydrated in glucose solution. For those strawberries there was decrease of investigated index after long storage time.

Key words: strawberries, freeze-drying, osmotic dehydration, colour

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THE ASSURANCE OF QUALITY AND SAFETY OF FOOD PRODUCTION ON THE EXAMPLE OF MEAT AND MEAT PRODUCTS

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Consumers safety is one of the most important and priority task in food chain management. Despite the efforts making by participants in the food chain, it is absolutely impossible to eliminate the risk connected with the food safety hazard. That is why all operators of the food chain supply on all production stages, processing and the distribution inside companies controlled by them, should assure that the food quality satisfy the sanitary-hygienic requirements. For this purpose companies of food branch must be possessed the effective system of identification for own food suppliers of food products or fodder, breeding animals and other different substances, which could be the component of final food products. The identification of risk sources by traceability system allows to reduce the range of potential occurrence of the hazard among the other participants of food supply chain. This fact allows to eliminate the risk of the supplying dangerous food which could harmful for consumers' health.

The aim of this paper was to present the food safety assurance system of the food production on the example of the chosen meat production plant and the functioning of traceability system of meat and their products.

The practical aspects of fulfillment of the traceability systems in reference to meat was in this work presented. Functioning of the own McDonald's corporation system – MAAP (McDonald's Agricultural Assurance Program) in this paper was also discussed. This program was created in the purpose of possess the archives of all components of products offered in restaurants, as well as for monitoring the established corporate` standards. Furthermore the realization of traceability system for chicken and beef meat at this corporation was presented. It should be emphasized, that the great effort in this corporation is focused on assurance quality and food safety system of produced food in suppliers deliver of the semi-finished articles to McDonald's restaurants. The system of quality and food safety of production at this corporation is based in majority on the semi-finished suppliers.

Moreover, in this paper the proprieties of functioning of food products traceability in other meat processing plant was analyzed. The practical solutions of testing of the traceabi-

lity system on the example of beef and pork meat products in the chosen meat processing plants were presented. It was shown, that traceability system of the product in the studied meat processing plant was effective and it makes possible the effective removal of the product from the market, in case of any hazard.

The analysis of the efficiency of traceability system in the chosen meat processing plant showed that this system is the most important in the assurance of food safety. Traceability system correctly introduced in plants gives many possibilities of monitoring the quality of products, but the first of all allows removal rapidly and efficiently the article from the market in the case of any hazard. In the presented plant the simulation of product removal, which could occurred in the hazard for the consumer health, as well as product incompatible with the quality requirements, was carried out. This simulation showed also, that traceability system in this plant works efficiently and allows effectively for removal the dangerous product from the market. Analysis of the product`s 'way' in the plant gives a possibility to recognize the causes of the hazard. The localization of the source of the mistake allows to avoid the duplication of this mistake in the future, as well as allows to correct all actions to lead of the appearance of this problem.

Key words: quality meat, meat products, safety of food production

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NEW GENERATION FOOD PRODUCTS QUALITY AND SAFETY ASPECTS IN LITHUANIA

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The production and consumption of food, which satisfying the requirements of health nutrition – like fruits and vegetables, some products rich in nutrients fibres, mineral substances and vitamins – is too small in dynamic progress of Lithuania food industry. On the other hand some compounds, even particularly in small concentrations, which are stable during all chain of food manufacture, could influence positive or negative on human health. Because of that the necessary of control food quality is very important. For that purpose government legitimate some acts inducement to organic farming and manufacturing of exceptional quality of agriculture and food products as well as Lithuania integrated in to the activity of European Technology Platform "Food for life".

The group of scientist of Lithuanian University of Agriculture have been done some experiments with new generation of food products. They were focused to the requirements of public and local food manufacturing, what would allow to prognosticate, control and regulation of food processing chain as well as to make a convenience of raw materials possibilities creating safe and new generation food products.

For the attainment of promote the natural processing technologies for healthy food with maximum exploitation of raw materials, it was evaluated some qualitative indexes of oily pumpkins, Jerusalem artichoke and sprouted seeds as food additives. The amount of amino acids, fatty acids, microorganisms and the influence of detoxification have been evaluated in food manufacturing chain. As has been stated the tubers of Jerusalem artichoke (*Helianthus tuberosus* L.), the pulp and especially the seeds of pumpkin's (*Cucurbita pepo* L.) could be the source of amino acids, with dominating arginine, leucine and glutamine, while germinated seeds – nonessential amino acids. Characterising protein quality, the ratio between nonessential amino acids with total amino acids was higher compare to those with other research results.

The specific conditions for germination of seeds (enlarged moisture and temperature) increase the risk of mycological contamination. *Micromycetes*, *Aspergillus*, *Penicillium*, *Alternaria*, *Fusarium* genus dominated in no sprouted and sprouted seeds, independent on breed and sprouting technology. The micromycet impurity of germinated seeds of all disinfecting agents (extract of grapefruit seeds, hydrogen peroxide, aminolevulinic acid) as well as biophotonic technology significant reduced the risk.

Key words: new food products, safety of food oil pumpkin, microfungi, wheat

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ASSESSMENT OF SHELF-LIFE OF MEAT PACKED IN VARIOUS PROTECTIVE ATMOSPHERES USING LYSOZYME

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The objective of this research was to evaluate the impact of different protective atmospheres, with or without the addition of lysozyme, which were used to pack swine *longissimus* muscles kept in cold store conditions for the period of up to 3 weeks.

The employed atmospheres comprised: vacuum, modified atmosphere with carbon oxide (MAP-CO) and with oxygen (MAP–O_2). The evaluation of the shelf life of packed meat was performed on the basis of microbiological examination determining the total number of aerobic bacteria, *Enterobacteriaceae* familia bacteria, enterococci as well as lactic acid bacteria (LAB). Measurements of muscle centrifugal drip protein hydrophobicity were employed as a method allowing to compare microbiological state of the meat.

It was found that the applied atmospheres did not differ with regard to the degree of the aerobic microorganisms development in the stored meat. The application of vacuum or MAP–O_2 was found as a best way to inhibit the development of LAB. Samples with the addition of lysozyme were characterised by a slower development of microorganisms than samples without its addition only in the case of samples packed in MAP–O_2 and stored for 21 days. The storage time exerted a significant influence on the hydrophobicity. It was lower in vacuum conditions than when protective gases were applied. The inclusion of lysozyme resulted in the increase of hydrophobicity.

Key words: meat packed, protective atmospheres, lysozyme

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REAL-TIME QUANTITATIVE PCR ASSAY FOR THE DIRECT DETECTION AND QUANTITATION OF GOAT'S MILK ADULTERATION WITH COW'S MILK

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Food adulteration becomes more common in food industry. High rate of food production and it's growing costs incline some food manufacturers to substitute expensive ingredients by cheaper or more available ones. Also inappropriate or inaccurate cleaning of technological equipment may effect introduction of undeclared ingredient into the final product.

In the past different methods for species identification were developed. These methods were based either on protein or fat analysis. Although the methods work well for raw samples analysis, they are significantly less sensitive in heat- or pressure-treated material, mainly due to protein denaturation and/or oxidation of fatty acids making the detection of species in processed sample more complicated.

In comparison to proteins and lipides DNA is a more stable molecule and easily withstands the processing conditions such as high temperature, pressure and chemical treatment. Therefore nowadays it becomes the molecule of choice for quick and accurate food analysis.

The real-time PCR is highly sensitive system allowing quantitation of starting DNA amount.

In this study a real-time PCR assay with an unspecific DNA-binding dye, i.e. SYBR Green was developed for quantitation of cow`s milk addition in the goat`s milk. For this reason, two sets of primers were used. BosD-for and BosD-rev were designed for cow's-specific mitochondrial DNA regions. The specificity of the Bos primers was evaluated on the DNA from pure cow milk, mixtures of cow and goat milk and pure goat milk and shown to produce a 300-bp amplicon only in the presence of cow`s milk DNA.

In order to normalize a total amount of DNA in the samples Uni-for and Uni-rev primer pair was designed. These primers target conserved regions in mitochondrial genomes of cow

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and goat, producing a 184-bp amplicon from the DNA of both species. Real-time PCR efficiency was determined for Bos and Uni primers and was shown to be comparable. Usefulness of Uni primers was tested on an array on DNA isolated from a series of 5-fold dilutions of 50% cow milk in goat milk, demonstrating that the results are not influenced by the yield of DNA. Results of quantitative PCR performed on DNA from four different preparations show high reproducibility of the test.

Key words: goat's milk, cow's milk, PCR

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THE COMPARISON OF FATTY ACIDS CONTENT IN ARABICA COFFEE BEANS DERIVED FROM FIVE DIFFERENT COUNTRIES

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The study was carried out on Arabica coffee beans that were grown in five different countries: Brazil, Costa Rica, Columbia, Guatemala, Ethiopia. Green beans, beans after first crack and beans ready to use were analyzed. Thermal procedure was performed using roasting equipment (PROBAT). In the beginning of roasting process coffee beans were kept in temperature of 190°C for 20 minutes and then in 210°C for 3 minutes. During the process coffee beans were constantly mixed. After the second cracking the temperature was increased about 20°C and heating has finished within 3 minutes.

The purpose of the study was to find the differences between fatty acid content in coffee beans derived from five different countries. The investigations included also showing the effect on fatty acid content of roasting process.

Fatty acid profile in all investigated coffee beans was very similar. The polyunsaturated fatty acids, representing about 42 to 51 per cent of the total acids, were composed of linolic and linolenic acids. Coffee fat contained only one monounsaturated fatty acid, it was oleic acid and it content was between 6–11% of the total acids. The saturated fatty acids consist mainly of palmitic and stearic acids, but small amounts of arachidic and behenoic acids were also present.

All investigated coffee samples before roasting characterized similar content of palmitic, stearic, oleic and linoleic acids, only content of arachidic, behenoic and linoleic fatty acids were different in coffees that had been grown in different country. The roasting process effected on increasing the content of total and particular fatty acid content in 100g of coffee sample, it was caused by decreasing water content during the process.

Key words: fatty acids, arabica coffee

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INFLUENCE OF SELENIUM YEAST SUPPLEMENTATION ON THE CONCENTRATION OF SELENIUM IN EGGS AND TISSUES OF LAYING HENS

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The study included 48 laying hens of Tetra SL line. The birds were randomly divided into 4 groups (12 birds in each). All groups were kept in a battery system. Group C – control group fed commercial laying hens feed mixture "DJ"which contents of 0,20 mg Se/kg ;group E – experimental group fed "DJ"mixture supplemented of 3% humic-aluminosilicate preparation (P-pd) which contents of 3,21 mg Se/kg mainly coming from Se-yeast (FZN-P Biochefa, Poland). Total intake in Group C was 26 µg/hen/day and group E was 39 µg/hen/day. The experiment lasted 6 weeks for all groups.

The study was conducted to evaluate the influence of selenium yeast supplementation on concentration of selenium in eggs, tissues and organs of laying hens.

The measurement of Se concentration in eggs included: egg shell, white, yolk, whole egg and contents of the egg (white + yolk).

The contents of Se in tissues was determined into taken samples from a pectoral muscle and a femoral muscle, and also from organs segments from a liver, brain and kidneys. In the laboratory the material for the analysis firstly was subjected to the homogenization and mineralization and to the measurement of Se contents. The samples for examinations were mineralized on wet by concentrated nitric acid in microwave furnace of the MD-2100 type, CEM corporation. Identification of the contents of selenium in the biological material was conducted by the method of atomic absorption spectrometry (AAS). The method of hydride generation system with the use of attachment FIAS 200 and the spectrometer of the atomic absorption Elmer 1100, made by Perkin, was used to the measurement of selenium contents.

Between groups C and E the contents of Se in egg shell, yolk and whole egg was statistical significant difference. The group E had a higher level of these elements, the maximum was in yolk (0,388 mg/kg).The average contents of Se in the whole egg in the group E was 15% higher in the comparison with the control group. In the muscles no significant differences in Se level between groups was observed. However, in the organs the highest increase of

selenium level was recorded in the brain, kidneys and liver. In the investigation it was proved that the Se from selenium yeast, which is a component of P-pd preparation, has a good bio-availability.

Key words: selenium, supplementation, egg, tissues

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PROTEOLYTIC CHANGES IN COMMERCIAL YOGHURT DURING STORAGE

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In the last several years there has been a significant development of both production and consumption of fermented milk products due to their attractive organoleptic features, high nutritional value, and probiotic and pro-healthy influence on humans. It is known that during production, but also during storage of those drinks there are many biochemical processes caused by microbes. Literature sources confirm that lactic acid fermentation bacteria show different activity in protein decomposition, but there is very little published information about how these processes go while the fermented milk products are in storage. Because of that, it has been found necessary to observe proteoiytic changes in commercial yoghurts while in storage in different temperatures.

The investigation material was commercial yoghurts available in Warsaw market, stored in temperatures 6°, 10° and 15°C up to 5 weeks. Determination of proteolytic activity of the studied products was done with spectrofotometric method with TNBS acid (2,4,6 – Trinitrobenzenesulfonic acid solution) which reacts with free amino groups.

The conducted study showed that while the commercial fermented milk drinks were in storage for 5 weeks in temperatures of 6° and 10°C there were no significant proteolytic changes. The content of free glycine, as a indicator of proteolytic changes in yoghurts, rose slightly during storage. In case of yoghurts stored in temperature of 15°C the content of glycine after a week of storage was higher than in yoghurts stored in 6°C and 10 °C, but after 3 weeks the amount was similar to the first week of storage. The content of aminoacids in fermented milk drinks depends on their release and assimilation by bacteria. The content of particular aminoacids depends mainly on the level in which they are used by microbes, so those aminoacids which are used by bacteria to grow and ferment are mustered in lesser amounts. The result of this work is one of the possibilities to consider in search for the answer to a question: in what range and direction do the proteolytic changes happen during storage of milk products and how do those changes affect their shelf life.

Key words: yoghurt, proteolytic changes, storage

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OCCURENCE OF *ENTEROBACTER SAKAZAKII* IN COMMERCIAL SPICES AND HERBS

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Enterobacter sakazakii, in the past known as *Aerobacter cloacae,* is considered to be a new pathogen present in food. *E. sakazakii* belongs to the family of *Enterobacteriacea;* it is a Gram-minus, not spore-forming, mobile, anaerobic bacilli. Growth of *E. sakazakii* is possible in temperatures from 5 to 47°C, but the optimal temperature for it to grow is between 37 and 43°C. *E. sakazakii* can be isolated from many food products like UHT milk, milk powder, cheese, meat, crop products, vegetables, spices and herbs.

The aim of the this study was to determine a microbiological quality and the occurrence of *E. sakazakii* in spices and dried herbs. The investigation material was 33 different samples from different producers. What was determined in studied samples was a total bacteria count (TBC) [PCA, Merck, cat nr 1.05463, 30°C/72h] and presence of *E. sakazakii* according to PKN – ISO/TS 22964.

TBC in the investigated products fluctuated between $1{,}5x10^2$ and $7{,}9x10^5$ cfu/g, and in 40% of samples this amount was more than 10^4cfu/g. *E. sakazakii* was found in 6 out of 33 (18%) studied samples of spices and herbs (dried Provencal herbs, estragon, dried basil, parsley). Moreover, in case of basil and marjoram, *Klebsiella pneumoniae* was found – which, like *E. sakazakii*, is a disease producing agent. The presence of those microbes in food products can be a menace to potential consumers.

Key words: *Enterobacter sakazakii*, food products

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Wioletta Drożdż, Tomasz Boruczkowski, Ewa Tomaszewska-Ciosk, Hanna Boruczkowska, Ewa Zdybel

EXTRUDED STARCH AS A CARRIER FOR YEAST CELLS IMMOBILIZATION IN ETHANOL FERMENTATION PROCESS

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The aim of the work was immobilizing the Saccharomyces cerevisiae yeast cells in the extruded starch and the qualification of propriety and the usefulness of this type of carrier in the process of alcoholic fermentation. Experiment were executed in two stages: the first had on the aim checking if the lock of the yeast cells happened inside the matrix of the carrier, second stage related to the semi-continuous fermentation in which apply the fresh carrier with immobilized yeast cells and study the course of fermentation in three variants of the initial concentration of glucose in wort: 40 g/l, 100 g/l, 150 g/l.

In extruded starch being micro-organisms carrier water absorption and mechanical proprieties was measured. Additionally the working of amylolitic enzymes on extruded starch was investigated after finishing the process of fermentation. As a basic criteria of the results of fermentation processes was admited: the quantity of produced ethanol in g/l during fermentation, the content of the remaining sugar in wort and the coefficient of ethanolic efficiency ratio $Y_{P/S}$. It was affirmed in the result of investigations that the efficiency of fermentation depended on the concentration of glucose in wort – it was reached the best near the initial concentration of glucose 100 g/l and 150 g/l applying the fresh carrier with immobilized yeast cells. Both in the process of periodical fermentation and semi-continuous fermentation with the same sugar concentration in wort the approximate values of dissolubility and the absorption of the carrier were almost the same. Comparing the various concentration of the sugar in wort in semi-continuous fermentation the highest values of solubility and water holding capacity were noted down in case of carrier used in fermentation with 4% of the sugar concentration in wort. The solubility of the carrier grew up and his water holding capacity decreased with the outflow of the time of semi-continuous fermentation.

Carrier used in fermentation with 15% of the sugar concentration in wort characterized the best strength proprieties. This carrier was the most resistant on the compression strength and was characterized by the largest resilience.

Key words: starch, cell immobilization, ethanol fermentation process

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Wioletta Drożdż, Tomasz Boruczkowski, Ewa Tomaszewska-Ciosk, Ewa Zdybel, Hanna Boruczkowska

STUDY PROPERTIES OF EXTRUDED STARCH ENCAPSULATED FOR THEIR USE IN THE IMMOBILIZATION OF YEAST CELLS

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The qualification of the property of extruded starch used as the carrier to immobilizing the Saccharomyces cerevisiae yeast cells was the aim of the work.

The influence of the time of keeping in yeast slurry and the time of storage on the change of his propriety was examined after producing the carrier.

In carriers it was measured: solubility in the temperature 80°C, water holding capacity (practical and theoretical), susceptibility on the working of amylolytic enzymes and mechanical properties: compression strength and resilience.

The time of keeping the carrier in yeast slurry and storage influenced the change of his property indeed. The carrier increased his solubility, susceptibility on the working of amylolytic enzymes and compression strength with the growth of the time of keeping it in yeast slurry, however the carrier underwent the decrease his theoretical and practical water holding capacity and resilience. In the comparison with the carrier kept in water, the carrier kept in yeast slurry was characterizing higher solubility, susceptibility on the working of amylolytic enzymes, compression strength and lower theoretical and practical water holding capacity. The changes of these properties intensified during storage of the carrier in the temperature 5°C. In the next weeks of storage, carrier increased his solubility and susceptibility on the working of enzymes and decrease his theoretical and practical water holding capacity. Time of storage of the carrier in the temperature 5°C influenced his mechanical properties unfavorably.

Key words: extruded starch, *Saccharomyces cerevisiae*

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Beata Drużynska, Elwira Worobiej, Rafał Wolosiak

CONTENT OF SOME SELECTED BIOLOGICALLY ACTIVE COMPOUNDS IN THE EXTRACTS OF DRIED PLUMS AND THEIR ANTIOXIDANT PROPERTIES

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The objective of this research was to determine the content of some selected biologically active compounds in the extracts produced of dried plums and their antioxidative properties.

The research material was two kinds of dried plums coming straight from the different producers from Chile and one from USA. Preparation were obtained by the extraction with a 70% acetone solution.

The value of dry mass was determinated in dried fruit whereas in the extracts the contents of total polyphenols (result calculated into gallic acid) by Folin method, catechins (result calculated into (-)epicatechin) by Swain and Hillis method, vitamin C, and total carotenoids. Antioxidant properties of extracts were investigated using $DPPH^{\bullet}$ radicals and $ABTS^{+\bullet}$ cation radicals; the ability of those extracts to chelate iron ions was also determinated.

The contents of total polyphenols in extracts of dried plums was aligned and it amount to app. 700 mg/100 g d.m. Differentiated contents of vitamin C was determinated (from 5.9 to 3.3 mg/100 g d.m.) and similar contents of carotenoids was investigated (app. 0.9 mg/100 g d.m.).

Antioxidant properties of dried plums extracts were marked with three methods. Their ability to deactivate stabile $DPPH^{\bullet}$ radicals has been examined, deactivation cation radicals $ABTS^{+\bullet}$ and chelating iron ions (II) activity. All the extracts showed antioxidant activities towards $DPPH^{\bullet}$ radicals (app. 51%), $ABTS^{+\bullet}$ (30–48%) as well as the ability to chelate iron ions (45-85%). Based on the results obtained, it was concluded that dried plums were a valuable, but still underestimated source of food compounds appearing important for human organisms.

Key words: biologically active, prunes antioxidant capacity

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NUTRITIONAL VALUE AND QUALITY OF ORGANIC FOOD

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Intensification of agricultural production, which is associated with excessive mineral fertilization and use of pesticides, has a direct impact on the quality of food delivered by conventional farming. An alternative method is organic farming, whose aim is the production of high-quality food while maintaining traditional methods of plant growing and animal husbandry, without the use of synthetic fertilizers, pesticides, growth regulators, and fodder additives. It is commonly believed that this food has high nutritional value and contains only a small number of contaminants compared to food produced by conventional methods. But does organic food really have a higher nutritional value and quality?

To answer this question, a review was made of the literature from the last 18 years on the nutritional value and the amount of contaminants in plant and animal food sources produced by organic and conventional methods.

The conclusion of the review was that, generally speaking, organic food was not more nutrient-rich than conventional food. The overall content of carbohydrate in tomatoes and peppers, starch in potatoes, and vitamin C in most organically grown vegetables was significantly increased. There were major differences in the amount of micronutrients and macronutrients in agricultural produce from both types of cultivation. The research found lower amounts of nitrates (V) in potatoes and selected kinds of vegetables from organic farming.

In milk and milk products from organic farms there was typically a higher content of the total polyunsaturated fatty acids, conjugated linoleic acid, α- linolenic acid, vaccenic acid, tocopherol, and β- carotene, and a lower content of monounsaturated fatty acids and linoleic acid.

Due to different results of tests on the amount of contaminants, such as heavy metals, pesticides, and mycotoxins, we cannot unequivocally state that organic food is safer than conventional food.

Key words: nutritional value, quality, organic food

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EVALUATION OF SOME NEW SOUS VIDE PROCESSED CHICKEN AND VEGETABLE PRODUCTS

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Consumer demand for fresh tasting, preservative free, ready-to-eat convenience meals with high dietary value require development of new minimal processing technologies such as minimally processed, ready-to-eat, extended shelf-life refrigerated foods, which include *sous vide* processed food products. *Sous vide* processing relies mainly on a mild heat-treatment and chilled storage of vacuum packed products. The *sous vide* process is a pasteurization step that reduces bacterial load but is not sufficient to make the food shelf-stable although it provides extended shelf life to the product.

The aim of this study was to develop new ready-to-eat *sous vide* processed products made from poultry meat and vegetables.

The process involved preparation of the raw materials, vacuum packing of the products in the plastic shrink film (thickness 60 μm) pouches, sous vide processing and chilling. Sliced raw chicken was combined with fresh shredded vegetables (carrots, bell pepper, onions, garlic, and celery), some fruits (sea buckthorn, orange) and spices (pepper, parsley, dill, and others) in various proportions. Each sample containing chicken portion in size of 130 grams and mix of various vegetables was vacuum packed in a chamber type machine MULTIVAC A 300/16 and heat treated in a water bath "Clifton Food Range" at temperatures between 70 and 80 ºC for 40 to 50 minutes. After heat treatment the samples were chilled and stored in Commercial Freezer/Cooler ELCOLD at +4.0±0.5ºC until sensory evaluation of the product.

Results indicate that *sous vide* cooking resulted in acceptable sensory quality (taste, aroma, texture, and appearance) and improved storage stability of new products compared with the conventionally prepared chicken products. Sensory analysis allowed developing the suitable recipes for new products. Taste of s*ous vide* processed sliced chicken with certain vegetable mix was excellent, texture and tenderness was milder, softer and more juicy therefore the ready-to-eat chicken was more acceptable than conventionally prepared product. In future more extensive studies would be needed to evaluate safety issues related to use of s*ous vide* technology for the preparation of specific ready-to-eat chicken and vegetable product as a function of added ingredients, storage time-temperature and heat processing conditions.

Key words: chicken, vegetables, s*ous vide,* sensory properties

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DEHYDRATION OF ROSEMARY BY A COMBINATION OF CONVECTIVE AND VACUUM-MICROWAVE DRYING

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Rosemary herb was dehydrated by convective drying and by a combined method consisting of convective pre-drying followed by vacuum-microwave finish-drying. Pre-dried samples with moisture content levels of 60, 30 and 15% were finish-dried by vacuum-microwave method (VM) at microwave power 360 W. Pre-dried samples with moisture content 30% were also VM finish-dried at microwave power 240 and 480 W. In the result of combined drying the following moisture content levels of dried rosemary herb were obtained: close to 0, 7 and 15%. The drying kinetics was derived by mass losses measuring of rosemary herb with previously estimated moisture content. The temperature of VM dehydrated herb samples was measured with infrared thermometer just after taking them out from a drying chamber. The absolute pressure in the chamber revolving at 6 rev/min was from 4 to 6 kPa.

Microbial analyses included total count of aerobic mesophilic bacteria, yeast and moulds, and coliforms. Microbial floras of dried herb were counted on media under characteristic conditions for each group.

The free-radical scavenging activity was determined by ABTS radical cation decolorization assay and total phenolic compounds by Folin-Ciocialteu'a methods. The analysis were carried out on a UV-VIS spectrophotometer.

The drying kinetics of rosemary dehydrated with the convective method was described using linear function up to a critical point characterized by moisture content of 2.17 kg kg^{-1} db and exponential function beyond that point. The vacuum-microwave finish-drying had an exponential character. The study revealed that application of microwaves at lowered pressure significantly reduced the time of drying.

The increase in temperature of VM dried samples was observed until the critical point. Beyond that point the sample's temperature decreased. The highest temperature was found

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for samples VM finish-dried with the highest wattage and samples pre-dried with convective method until 60% of moisture content. The lowest temperature was stated for samples VM finish dried with the lowest wattage and samples pre-dried with convective method until 15% of moisture content.

Experimental data showed that decreasing in moisture content decreased the counts of bacteria and in most cases increased the counts of yeast. However, the lowest level of microbes was found for samples pre-dried to 15% and then VM finish-dried at 360 W. *Coli* microorganism presence in dried samples was not detected.

Decreasing in moisture content generally decreased the total phenolics contents and increased the free-radical scavenging activity. The different behaviour of rosemary in the course of drying can be effected by the Maillard reaction, which creates various products of higher antioxidant power than their precursors. The VM treated samples exhibited higher phenolics contents and antioxidant potential as compared with convective dried ones, particularly when pre-dried until 15% and then VM finish dried at 360 W.

Key words: vacuum-microwave drying, rosemary herb

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THE COMPARISON OF ANTIOXIDANT PROPERTIES OF GREEN AND BLACK LEAF TEAS

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The aim of this work was the comparison of antioxidant properties of chosen leaf teas of well known brand which are present and recognized on polish market from many years. In this study four black and four green teas derived from two producers were analyzed. The dry leafs and the water tea extracts were tested by the sensory analysis. The quality of tea were measured also by the contents of dry mass, water extract, caffeine, contamination, share of tea dust and stalk. The antioxidant power of teas was determined by scavenging effects on the DPPH (α,α – diphenyl – β – picrylhydrazyl) radical.

Basing on the result of the sensory analysis of dry leafs it was stayed that the aroma, appearance and color were typical in all tested teas. The sensory analysis of the tea extracts confirmed high quality of analyzed tea. All teas were free from artificial colorants and contamination, had low content of tea dust and stalks and high of the water extracts. Green teas were characterized by higher content of caffeine (ca 4 g/100 g dry mass) in comparison with black teas (ca 3 g/100 g dry mass).

All of tested teas were characterized by good antioxidant properties but the activity of their water extract was differentiated. The highest scavenging effects on the DPPH radical had green tea made by the first company, lower black teas and the lowest green teas made by the second company. This study has shown that black teas can have higher scavenging effects than green teas. It was also confirmed that teaflavins, which arise during fermentation of tea leafs, had the same antioxidant properties that catechins from green tea. It was also stayed that the antioxidant properties are also determined by the composition of polifenols in teas of the same species, which is dependant on the age of tea leafs, way of harvest, climate of tea-growing, and the conditions of tea storage.

Key words: antioxidant properties, leaf tea

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RESEARCH REGARDING THE INFLUENCE OF BIOTECHNOLOGICAL FACTORS IN MERLOT WINE COMPOSITION

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Romanian viticulture has some specific features which distinguishes it from others. They leave their mark on the wine variety that can be obtained but also on the products variety based on grapes and wines. The favorable conditions for producing the Romanian high quality wines are proven by the scientific data, by the demands for Romanian wines on the international market and by the successful results obtained in worldwide contests.

Superior quality red wines are very praised at present by the competent consumers due to the complex chemical composition and to the specific organoleptic features. They are appreciated by physicians and nutritionists for the benefic influence they have on human health through the increased content in poliphenols, mineral salts, organic and mineral acids as well as other substances.

Among other sorts of successful kinds of black grapes for obtaining superior quality red wines such as Cabernet Sauvignon, Feteasca neagra and Pinot noir there is also the Merlot type which is original from Medoc, France.

Biotechnology is a modem science that requires the help of the enzymes, microorganisms, environmental factors in order to obtain new food sources as well as for improving technological processes.

Key words: merlot wine, chemical composition, biotechnological factors

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UV DESINFECTION AS A MEASURE TO ENSURE SUITABLE AIR HYGIENE IN FOOD PRODUCTION

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The research was carried out at the meat plant. Selected area is production minced meat, where the production hygiene, including the hygiene of air is especially important because of the nature the product. The hall has an area of about 85m^2 and 300m^3 cubature.

The hall is equipped with machines to produce the ice, mill-mixed and formed-packing products. The finish product is packed under vacuum. To the test were set 6 points located at the hall on different heights from the floor, and the various points including the entrances and nearby equipment.

Studies were retrieved using sedimentation method – time of descent was 15 minutes, in six points, by 12h – at 3h in order to explore the amount of micro-organisms at the time of production. Inoculation conducted in towards a total number of micro-organisms and the total number of mold. Incubation carried accredited laboratory.

Analysis was carried out in two replications – before installing the UV lamp and 7 weeks after using the UV lamp E2000S produced by SterilSystems(built shielded filaments and ventilator forced-air). The lamp worked without interruption because it was safe (not create a hazard) to workers.

The results were a statistical test using the Fisher LSD test.

The experience showed a statistically significant reduction in air pollution in meat factory after the installation of UV lamp.

Key words: UV desinfection, air hygiene, production, minced meat

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Ewa Gornowicz, Lidia Lewko

THE EFFECT OF BROILER CHICKEN ORIGIN AND PARENT STOCK AGE ON PERFORMANCE TRAITS IN LIVE BIRDS, SLAUGHTER AND MEAT YIELD AND ITS QUALITY

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The purpose of study was the comparison of performance traits, slaughter and meat yield of broiler chickens from parent stock strains at the following age: 26 to 28, 36 to 38 and 46 to 48 weeks. The experimental material comprised Cobb 500, Hybro G+ and Ross 308 meat hybrids since all three predominate on the Polish poultry market.

To eliminate the effects of environmental and nutritional factors on meat quality the rearing of birds and their slaughter and processing procedures were conducted under the same conditions for the three groups of hybrids used. The following traits were examined: slaughter and meat yield, quality and physicochemical traits of breast and leg muscles and sensory traits of raw muscles.

No effects of the age of parent stock of meat type birds on the performance traits of broiler chickens were noted, *i.e.* final body weight and rearing economic effectiveness index. However, the studied experimental factor affected the product yield parameters and broiler meat quality. With the age of parent stock hens the slaughter yield was increasing (difference up to 5.22%). More favorable values of meat quality traits were observed being proportional the higher age of the parent stock birds – better by 0.77% meat yield, lower peritoneal fat content by 0.31%, lower pH value after 15 minutes and 24 h postmortem, higher protein content by 0.92% on average. Those values were followed by higher scores of the sensory evaluation of muscles by 0.40 point on average.

Broiler chickens from parent stock at 46 to 48 weeks of age were found to have physical and sensory traits of breast and high muscles on a high level, which indicated their very good quality. The noted differences among the three examined groups of broiler chicken hybrids, concerning performance traits and carcass and meat quality were statistically significant at $p \leq 0.05$, thus demonstrating that the main modifying factor was bird origin.

The examined Cobb 500, Hybro G+ and Ross 308 meat type chicken hybrids being used in the commercial production of broiler meat in Poland do not present a uniform material.

Key words: broiler chicken, quality, meat

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Ewa Gornowicz, Lidia Lewko, Grzegorz Szukalski

COMPARATIVE EXAMINATION OF MEAT SENSORY TRAITS IN FIVE CONSERVATIVE STRAINS OF DUCKS

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The local poultry breeds are an excellent material for studies on the history of farm animal evolution as it was reported by Książkiewicz (2002) in his studies in many fields of poultry genetics. Selected quality traits of duck meat have not been examined to such extent as in the case land fowl.

The purpose of study conducted in 2008 was the determination of sensory traits in meat of selected strains of duck conservative populations (P-8, P-9, P-33, K-2 and synthetic LsA). Those strains have been kept in the water fowl genetic resources farm located in Dworzyska (National Research Institute of Animal Production-Experimental Farm Ltd Co. in Dworzyska).

Breast and leg muscles from 16 birds (8♂ and 8♀) of particular groups were taken for sensory evaluation. The sensory analysis was conducted on chilled carcase parts and the following traits were taken into consideration (external appearance, fatness, colour, odour and total impression). The sensory panel comprised five trained persons. A score of 1 to 5 points was used in the evaluation (Ziołecki, 1988).

The overall appearance of the breast muscles varied significantly at $p \leq 0.05$ among strains from 4.28 (K-2) to 4.89 (P-3, LsA). That trait was by 0.17 point lower in males that in females, on average. Breast muscles of LsA females were given the highest scores (5.0). The total score of breast muscles from both sexes (4.79) was noted in LsA bird strain. Significantly ($p \leq 0.05$) lowest scores *i.e.* 4.60 for the same trait were found in P-8 strain. In the case of meat odour and fatness no statistically significant differences were observed. However, in those quality traits considerable coefficients of variation were observed (from 15.8 to 19.6%).

In the total evaluation of leg muscles (♂+♀) the LsA strain showed the highest quality traits, *i.e* for appearance (4.64), odour (4.67), fatness (4.42), colour (4.75) and the total quality scores (4.62). Leg muscles of LsA females demonstrated the highest scores for overall appearance (4.67), fatness (4.56) and total quality scores 4.64. In the case of colour and odour of meat the scores were found to be on the level for duck groups examined.

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In general, the sensory traits of muscles in male birds were scored higher that those in female ducks and were as follows no average: odour 0.02; fatness 0.09; colour 0.1 and in total 0.01 point. The observed difference were statistically non significant.

Significant correlation was noted between the overall muscle appearance and the total score; the muscle odour and fatness; and between muscle odour and the overall appearance.

The observed differences in the sensory traits of breast and leg muscles of ducks from particular conservative strains studied can indicate that those populations can be utilized in the agro-turistic farms, as members in mini-zoo expositions as well as in preparation of meals having attractive sensory traits for consumers. The population of LsA concerns in particular.

Key words: meat sensory, ducks, fat

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Justyna Górna

THE RESULTS OF QMS AND HACCP IMPLEMENTATION IN THE OPINION OF THE EMPLOYEES OF STRAUSS CAFE POLAND COFFEE ROASTING PLANT

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The target of conducted research was to canvass opinions of blue and white collar staff on the subject of QMS and HACCP systems implementation results in the coffee roasting plant STRAUSS CAFE POLAND Ltd in Swadzim near Poznań. The surveyed organization has implemented an integrated quality management system based on the requirements of ISO 9001:2000 standard and HACCP system. During the research the company has been adapting to the ISO 22000:2005 standard. A sample of respondents was chosen randomly on the basis of quota sampling. Samples from management staff was collected separately from production workers samples.

The respondents (both managers and production workers) have indicated, that the improvement of an image of the company in the branch is a positive result of QMS implementation (QMS managers – 67%, QMS workers – 90%). This can have a reflection in the behaviour of clients, who express growth in the satisfaction from products. More over they feel that the company adjust greatly to their requirements, than before the implementation. Amongst the mostly chosen merits of HACCP system, similarly to merits of QMS, the improvement of image of the company (HACCP m – 92%, HACCP w – 75%) was pointed out. In the opinion of respondents a great advantage of HACCP system is the increase in the products and service quality (HACCP m – 75%, HACCP w – 85%).

Apart from the merits of systems implementation, which are functioning as an Integrated Quality Management System, the surveyed staff notice negative effects. The highest percentage of management respondents pointed out the increase of bureaucracy (QMS 58%, HACCP 50%), and the lowest percentage indicated the decrease in work productivity (QMS 8%, HACCP 0%) and efficiency (QMS 0%, HACCP 8%). The production staff has given similar answers related to the negative effects of systems implementation. The production workers emphasize significantly the increase of bureaucracy (QMS 60%, HACCP 40%).

Summing up, both groups of employees indicated in similar scale, that the increase of bureaucracy is a negative result of implementation of the above mentioned systems. On the other hand the improvement of image of the company and increase in the products and service quality were pointed out as positive results of implementation. On the basis of the results it can be noticed, that both management and production staff have similar point of view on

the functioning management systems. However each of this group attach greater value to the system, which they have contact with during their everyday activities. For management staff the quality management system is more important, with which they work in the offices, complying with the rules and conducting the processes in proper way. Whereas HACCP is a system within the framework of which the production staff conduct their everyday tasks at their workplace.

Key words: staff assessment, HACCP, QMS

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COMPOSITION OF AROMA COMPOUNDS IN BLACK-CURRANT AND RASPBERRY JUICES WITH HYDROLYSED OAT FLAKES SOLUBLE FRACTION ADDITIVE

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Oats and oat flakes are significant in human diet. Oats provide proteins with higher ratio of irreplaceable amino acids over replaceable amino acids. In comparison to other cereals, oats contain considerably more lipids and dominating fatty acids are linoleic acid and oleic acid, and significant amount of compounds with antioxidant activity. Preparation of drinks using oat flakes soluble fraction and fruit juices such as raspberry and black currant juices could provide bioactive compounds both from oats and juices.

The aim of the current research was to determine aroma compounds in drinks made from black-currant and raspberry juices with hydrolyzed oat flakes soluble fraction additive.

Oat flakes with the content of moisture equaling to 9.8%, water and enzyme *Ceremix Plus MG* were used for the preparation of oat flake hydrolysate – at enzyme optimum temperature 65°C, duration of fermentation 20–25 min. The hydrolysed oat flakes soluble fraction was used for drink preparation combining it with black-currant and raspberries juices produced at the Latvia State Institute of Fruit Growing. Aroma compounds were extracted using headspace autosampler Turbomatrix (PerkinElmer). For the analysis of volatile aroma compounds, a PerkinElmer Clarus 500 GC/MS equipped with a capillary column Elite-Wax ETR (60 m x 0.25 mm i.d.; DF 0.25 μm) was used. Compounds were identified by comparison of their mass spectra with mass spectral library Nist98 and retention times of the standards.

Results showed that the main aroma compound of hydrolyzed oat flakes soluble fraction was hexanal. In raspberry juice main aroma compounds were ketones (2-heptanone, 2-pentanone), whereas in blackcurrant juice mainly terpenes were detected (α-pinene, ocimene, 4-carene). The main volatile compounds found in black-currant and raspberry juices with hydrolysed oat flakes soluble fraction additive were the ones indentified in juices without additive.

Key words: black-currant, raspberry juice, aroma compound

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THE ANTIMICROBIAL ACTIVITY OF THE HEN'S EGGSHELL PROTEIN EXTRACTS

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The eggshell is a complex, multifunctional biomineral composed of calcium carbonate mineral phase and an organic phase of lipids and proteins. It is a physically barrier against microbials directed against the developing embryo. An important role in the embryo protection may also play proteins with antimicrobial properties. C-type lectin-like proteins are the major components of the calcified eggshell. Proteins specific for egg-white like: lysozyme, ovoalbumin and conalbumin have been also detected in eggshell.

The aim of this study was to investigate the antimicrobial activity of eggshell protein extracts obtained by urea, chloric acid, acetic acid and ethanol treatment of hen's eggs. All extracts were dialyzed against water and then lyophylized. Protein extracts were analyzed in size-exclusion chromatography on Zorbax GF- 250 column (HPLC). Antimicrobial activity was evaluated against: *Escherichia coli PCM 2560, Yersinia enterocolitica, Salmonella enteritidis, Salmonella typhimurium, Listeria monocytognes, Enterococcus faecalis* bacteria. Furtermore different *Bacillus species* like*: B. subtilis B172, B. cereus B 3p, B. laterosporum B 6, B. cereus B 512, B. subtilis B3* were tested.

Proteins with molecular masses ranged from 11 to 17 kDa (lysozyme, ovocleidin-17); from 32 to 39 kDa (ovocalyxin-32, ovocalyxin-36) and proteins from 42 to 48 kDa (ovoalbumin) were detected in protein extracts. However different percentage concentration in extracts of these proteins were observed. All of analyzed protein extracts had different impact on tested bacteria. *B. subtilis B 172, B. laterosporum B6 B. cereus B 3p* and *B. subtilis B3* were the most sensitive to the chloric acid protein extract. The growth of both *B. laterosporum B6* and *B. cereus B3p* was less inhibited in the presence of urea protein extract than chloric acid protein extract. Ethanol protein extract showed weak antimicrobial activity against *B. laterosporum B6*. None the protein extracts had antimicrobial effect on: *Escherichia coli PCM 2560, Yersinia enterocolitica, Salmonella enteritidis, Salmonella typhimurium, Listeria monocytognes* and *Enterococcus faecalis* bacteria.

Key words: eggshell, antimicrobial activity, ovocleidin-17, DPPH

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PALYTOKSYN – ORIGIN, OCCURENCE AND DANGERS

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Palytoxin belongs to group of the most toxic substance in the world. Places occurrence of palytoxin are very limited. The first note about this toxin comes from the 1838 and talks about red-seaweed of death from Hana. Inhabitants from Hana used to this seaweeds to smear on the spear points, to make them fatal.

Those algae are *Ostreopis siamensis* and palitoxin is metabolic of them. We can found the palytoxin only in one type of coral- *Palythoa Toxica,* but in very small concentration. A lot of *Palythoa* species is keep in aquariums, but those don't produce palytoxin. Her complicate structure is built with 71 stereogenic centers. In 1971 the group of professor Daisuke Uemura on Uniwersity Nagoa isolated palytoxin from *Palythoa Toxica* .Next, in 1994 the group of professor Yoshito Kishi from Harvard University completed synthetic structure of palytoxin. This experiment is up to this days one of the most important scientific events. The molecular weight of palytoxin ($C_{129}H_{223}N_3O_{54}$) is 2680,13g/mol and structural formula is:

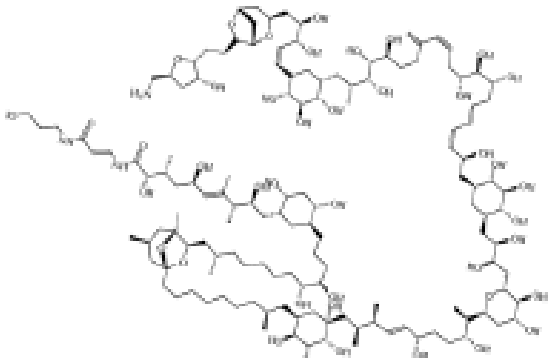

Fig. 1. Structural formula of palytoxin

Mechanism of toxic activity palytoxin was prompt many times, but short time ago was exactly described. Palytoxin blocks Na^+ and K^+ channels in cell membranes. Palytoxin is an inhibitor and targets the sodium-potassium pump protein by binding to the molecule such

that the molecule is locked in a position where it allows passive transport sodium and potassium ions. The most sensitive for palytoxin is myocardium and it reduces diameters of blood vessels in heart and lungs. Different effect toxic active of palytoxin can be hemolysis and destruction of red blood cells. Typical symptoms of palytoxin poisoning are: angina-chest pains, asthma-breathing difficulties, tachycardia and unstable blood pressure. The onset of symptoms is rapid, and death usually follows just minutes after. Palytoxin is considered to be one of the most toxic non-peptide substances causing death in humans by cardiac arrest at dose of 1,5 µg/kg of body mass**.** Antidotes are drugs widening of blood vessels if are inject into the heart immediately following exposure. The most effective are papverine and isosorbide nitrate. In case to expect danger protection against poisoning can be inject dose of hydrocortisone one hour before intoxication.

Key words: palytoxin, toxic substance

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Eugenia Grześkowiak, Andrzej Borys, Piotr Janiszewski, Karol Borzuta, Dariusz Lisiak, Jerzy Strzelecki

STUDIES ON MEAT QUALITY AND PROCESS ABILITY OF MEAT IN PIGS OF WHITE BREEDS AND CROSSES WITH DUROC AND PIETRAIN

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Meat quality is closely related with pig breeds and their genetic predisposition. The Duroc breed is considered to be resistant to stress, characterized by typical meat marbling and it is used in crossing with breeds with high leanness, e.g. Pietrain.

The aim of the study was to determine the slaughter value, as well as meat quality and processability of fatteners being two- and three-way crosses with a share of Duroc and Pietrain genes in their genotype.

The experimental material comprised 50 carcasses of fatteners coming from crossing Polish White Landrace sows with Polish Large White boars (PLxPLW), as well as crosses of the Polish White Landrace breeds with Duroc x Pietrain boars – PLx(DxP). Leanness and backfat thickness were measured at five points on warm left half-carcasses. Cooled carcasses were divided into sub-primal cuts. Values of pH at 45 min and 24h after slaughter (pH_{45} and pH_{24}) and electrical conductivity (EC_{24}) were measured in the longissimus dorsi muscle *(m.LD)*. In the lumbar part of m.LD the following parameters were determined: basic chemical composition, natural drip, WHC, thermal drip and colour, determining parameters L,*a*,b*. Raw smoked loin was prepared from the thoracic part of m.LD following the traditional technology. Sensory examination of cooked meat and smoked loin was conducted in a 5-point scale determining aroma, juiciness, tenderness and flavour.

An advantageous effect of three-way crossing on slaughter value in comparison to two-way crossing was confirmed. In PLx(DxP) fatteners leanness was recorded to be by 2.32% higher, while a lower subcutaneous fatness was found, especially in ham in points KI, KII and KIII and over the last rib. In the analyzed pig population no carcasses with PSE meat ($pH_{45} \leq 5.8$) and DFD ($pH_{24} > 6.3$) were found. Muscle LD in PLxPLW fatteners in relation to PLx(DxP) fatteners was characterized by a lower fat content (1.53 and 2.52%, respectively), natural drip higher by 2.3% and a slightly darker colour. Cooked meat and smoked loin received in both groups on average over 4 points for evaluated attributes. Good tenderness of smoked loin was also confirmed by the results of instrumental measurements (shear force of approx. 47 N).

Key words: meat quality, pig, slaughter value

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Eugenia Grześkowiak, Dariusz Lisiak, Andrzej Borys, Karol Borzuta, Jerzy Strzelecki

A STUDY ON THE EFFECT OF PORCINE CARCASS LEANNESS AND WEIGHT ON INTRAMUSCULAR FATNESS GRADE IN SELECTED HAM, SHOULDER AND LOIN MUSCLES

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Intramuscular fat constitutes an important meat quality attribute, considered to be highly desirable both by the meat processing industry and consumers. It has an advantageous effect on tenderness, flavour and juiciness; moreover, it also reduces losses during thermal processing.

The aim of the study was to determine marbling in six selected muscles depending on porcine carcass weight and muscling.

The experimental material consisted of 130 carcasses of fatteners from commercial purchase. Three groups of carcasses differing in weight were identified, i.e. group I up to 70 kg, group II 70.1 to 90 kg, group III over 90 kg, together with 6 groups differing in meat content in individual classes (classes: S,E,U,R,O,P). Leanness was measured using an IM-3 apparatus.

During dissection marbling was assessed in six selected muscles, i.e. *m. biceps femoris (BF), m semimembranosus (SEM)*, *m. quadriceps femoris (QF), m. triceps brachii (TB),gluteus medius (GM)* and *m. longissimus dorsi (LD).* Fatness grade of muscles was determined following Canadian and American standards using a 5-point scale (1 points – slight fatness, 5 points – considerable fatness). Among evaluated groups of fatteners significantly higher fatness was recorded in muscles of carcasses weighing over 90 kg, while it was markedly lower in carcasses of less than 70 kg. Bigger marbling was observed in *m. glutens medius* and *biceps femoris,* lower in *m. quadriceps femoris* (3.14, 2.93 and 2.06 points, respectively). Evaluated muscles were characterized by comparable marbling in carcasses with higher leanness, i.e. in classes S,E,U (1.68 to 2.01 points), and differed significantly from carcasses with lower leanness. In muscles of classes O and P similar intramuscular fatness was found. Highly significant correlations were shown between marbling of analyzed muscles. Higher values of correlation coefficients were recorded between SEM and BF, QF and LD muscles ($r = 0.677^{*}$ to 0.751^{**}), while lower between m. GM and the other muscles.

Based on conducted analyses a significant effect was shown between weight and leanness of carcasses on the degree of intramuscular fatness in these muscles.

Key words: porcine carcass, meat quality

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THE VIABILITY OF NATURAL MICROFLORA OF ARONIA AND HONEY BLUEBERRY AFTER THERMAL TREATMENT WITH USING ENBIOJET FLOW PASTEURIZER

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Polyphenols are widely distributed in plants, such as fruits, vegetables, tea, olive oil, tobacco and so on. As a large group of bioactive chemicals, they have diverse biological functions. Their antioxidant activity can be used for producing health-promoting food product. Some polyphenolic constituents are sensitive to high temperature. Therefore determination conditions of thermal preservation such products is very important.

In this study, two fruit juices obtained from aronia (*Aronia melanocarpa*) and honey blueberry (*Lonicera edulis*) that are rich sources of anthocyanins, were used to examine the inactivation of microorganisms with using ENBIOJET Flow Pasteurizer. This device exploits the patented technology enabling swift and direct microwave energy transfer to the flowing medium which reduces the length of the sterilization process to seconds only and eliminates the undesired effect of substance sticking like it is in traditional heat exchanger's walls.

The aronia and honey blueberry juices were heated at the temperature in the range of 90–135°C for 2s. The number of microorganisms in samples before (control) and after pasteurization was determined. It was shown that just after treatment at 90°C the living cells were not detected in 1 ml of juices from the population of 100 cells/ml unpasteurized samples.

Key words: *Aronia melanocarpa*, *Lonicera edulis*, anthocyanins, inactivation of microorganisms

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THE PRESERVATION OF ARONIA AND HONEY BLUEBERRY BIOACTIVE PHYTOCHEMICALS DURING STERILIZATION OF JUICES WITH ENBIOJET FLOW PASTEURIZER

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Two recent decades marked the rise of a new approach to control of civilization diseases emphasizing rather prophylaxis, including the one involving dietary means (chemoprevention), as opposed to treatment (chemotherapy). The dietary prevention is associated mainly with the presence of bioactive phytochemicals, therefore it will be required from modern food processing technologies that such compounds are not lost.

In this study, two fruit juices obtained from aronia (*Aronia melanocarpa*) and honey blue--berry (*Lonicera edulis*) that are rich sources of anthocyanins, were used to examine the preservation of plant phytocomplexes upon sterilization with ENBIOJET Flow Pasteurizer. This device exploits the patented technology enabling swift and direct microwave energy transfer to the flowing medium which reduces the length of the pasteurization process to seconds only and eliminates the undesired effect of substance sticking to the exchanger's walls.

The parameters examined included total antioxidant activity, changes in TLC profiles of antioxidants, the quantitative determinations of anthocyanins by HPLC, as well as carbohydrate structure stability with FT-IR technique. The results were compared with those obtained for the same batch of juices submitted to classic thermal processing. The determinations are still in progress, however, first results suggest that sterilization with ENBIOJET Flow Pasteurizer is highly conservative as regards bioactive phytochemicals found in aronia and honey blueberry.

Key words: *Aronia melanocarpa*, *Lonicera edulis*, antioxidant activity, phytochemical found

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THE INFLUENCE OF THE *IN VITRO* DIGESTION PROCESS CONDITIONS ON THE PHENOLIC COMPOUNDS OF WINE

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The research presented in this thesis aimed at the observation of changes occurring during the in vitro digestion process of selected wines in a model of the gastrointestinal tract. The study was supposed to illustrate the character of changes concerning the polyphenols compounds during the process of digestion. Wines: red grape and white grape were selected for our investigations.

The digestion tract model, which comprises 3 compartments: stomach, small intestine and large intestine, was used for controlling and regulating the environment in which digestion processes occurred. In the each compartment of the model the total amount of phenolic compounds (Folin-Ciocalteu Reagent) quality and quantitative compounds – HPLC/MS methods, antoxidant $ABTS^{\bullet+}$ (mg Trolox) activity and changes in microbial composition have been investigated during the digestion .

The highest rate of the compounds of polyphenols character was found in red grape wine. Before the *in vitro* digestion the quantity of the polyphenolic compounds was 282 in the latter when in white grape wine – 54 mg/ml.

As a result of the wine digestion process, it was found out that the content of the analyzed polyphenols was reduced irrespective of the wine type. However, during the large intestine phase the highest content of phenolic compounds and antioxidative activity was noticed in red grape wine – 52 mg/ml as well as 160 mg Tx/g of the product.

After finishing the process of digestion an impeding effect of the red grape win on *E. coli* was noted. It was recorded that the initial value of 2,99 cfu/ml of this bacteria increased only up to 3,68 cfu/ml in the red grape wine. It is worth mentioning that no influence was recorded in other kind of wine by selected microorganisms.

Key words: intestinal microflora, polyphenols, antioxidantive activity, wine

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THE CONTENT OF BIOACTIVE COMPOUNDS IN PICKLED RED PEPPER FROM ORGANIC AND CONVENTIONAL CULTIVATION

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The most important rule of the organic agriculture is plant production without mineral fertilizers and pesticides. The natural fertilizers as manure, compost, also green manure are widely used. For plant protection are use natural insect predators and different plants extracts. The sweet red pepper is a good source of vitamin C, flavonoids, especially rutin, also carotenoids: capsorubin, capsantin, beta-carotene and lutein. Some experiments indicated that fruit and vegetable from organic production contained more antioxidant compounds as flavonols, carotenoids also vitamin C, but some not. In Poland vegetable processing has a long tradition and it is a good method to enhance the keeping quality as well as diet diversity. Every method of vegetable processing has a negative impact on the bioactive substances content. The organic vegetables contained more such compounds in comparison to the conventional ones, therefore it could be assumed that pickled vegetables will also contain more antioxidant compounds despite the processing. The aim of this study was to prove this hypothesis.

Three cultivars of sweet red pepper (Roberta, Spartacus and Berceo) from organic and conventional cultivation have been used in the experiment. The red pepper fruits were cultivated in certified organic and conventional private farms located in Mazovia region. The red pepper fruits were collected in the same stage of maturity in the organic and conventional farms. The processing was the first step of the work (preparing the pickled red pepper) and after that the pieces of pickled peppers were freeze-dried (to keep their quality) and chemically analyzed. The content of dry matter, vitamin C, flavonols and carotenoids has been determined.

The obtained results showed that organic pickled red pepper fruits contained more vitamin C, rutin, phenolic acids, beta-carotene and lutein, also more dry matter in comparison to the conventional ones.

Key words: bioactive compounds, red pepper, organic agriculture

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THE INFLUENCE OF THE PASTEURIZATION ON THE NUTRITIONAL VALUE OF CARROT JUICE FROM ORGANIC AND CONVENTIONAL PRODUCTION

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A carrot juice is a product rich in many bioactive compounds such as beta-carotene, lutein, phenolic acids, vitamin C. Therefore carrot juice is an important product in a preventive nutrition. According to many researchers vegetables from organic production and their products contain more beneficial nutrients than conventional vegetables. However the results in this field are not fully consistent. The research has been established to solve the rising doubts. The aim of that investigation was to determine the pasteurization influence on the level of nutritional compounds in the juices made of organic and conventional carrots.

Two varieties of carrots from organic and conventional system have been chosen to study: Flacoro and Perfekcja. The samples of the roots have been selected in the same time and passed on to the juice production. Then the chemical analyzis of the carrot juices have been conducted (two times) in a fresh juice and after pasteurization process. There were: dry matter, beta-carotene, lutein, vitamin C, phenolic acids, organic acids, total sugars and reducing sugars determined.

The collected data indicated that fresh organic carrot juice had higher level of organic acids, dry mass and reducing sugars. Simultaneously conventional juice contained more total sugars, phenolic acids and vitamin C. The agricultural system used had no influence on beta-carotene and lutein levels in the carrot juice.

After pasteurization it was found that organic juices made of Flacoro variety had more dry matter and total sugars, but organic juices made of Perfekcja variety had more reducing sugars and organic acids. In the samples of conventional juices, all parameters measured were higher for Perfekcja variety. The mean results after pasteurization indicated that organic juices contained more total sugars than conventional ones. Simultaneously the highest level of dry matter, reducing sugars and organic acids was observed in the conventional juices' samples.

Key words: carrot juice, bioactive compounds, pasteurization

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IMPACT OF M-CALPAIN GENE ON THE CULINARY QUALITY OF CATTLE MEAT

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The objective of the performed investigations was to assess the influence of the μ-calpain gene on traits associated with meat quality. The experimental material comprised the thoracic and psoas *longissimus* muscle (*m. longissimus thoracis et lumborum*) of bulls slaughtered at the age of 6 to 12 months. The experimental muscle was cut out from the carcass 24 hours after slaughter, vacuum packed and stored in cold room for the period of 10 days. Meat culinary quality parameters included: colour, juiciness and tenderness were evaluated. The first two of the above parameters were assessed employing sensory methods, whereas the third one – using both sensory methods and the Warner-Bratzler shear device. Genotype evaluation was conducted with the assistance of the PCR-RFLP reaction.

The highest score for colour (9 points out of 10) of the examined raw material was recorded for μ-calpain gene homozygotes (CC and TT). The performed sensory estimation of meat juiciness and tenderness revealed that the best quality raw material was obtained from heterozygote. The only exception concerned results of juiciness assessment 48 hours after ageing storage. Scores obtained for juiciness of meat correlated with its content of intramuscular fat. Higher fat contents corresponded to better juiciness of the raw material. A statistically significant influence of the μ-calpain gene was determined in the case of all the analysed parameters of sensory assessment (colour, juiciness and tenderness) in the 96th hour of cold storage of the raw material as well as for the fat contained in it.

Meat tenderness assessment using the Warner-Bratler shear device reflected the sensory estimation of this parameter, as the lowest cutting value and, at the same time, the best tenderness was determined for the μ-calpain gene heterozygote. For this parameter, no statistically significant differences between the genotypes of the analysed gene were observed.

The performed experiments allowed to determine a significant impact of the μ-calpain gene on traits associated with meat culinary quality in the 96th hour of its ripening storage. The highest quality of this raw material was found in the case of the heterozygote of the analysed gene.

Key words: cattle meat, meat tenderness, cullinary meat

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SLAUGHTER VALUE AND QUALITY OF CULINARY MEAT FROM DUAL PURPOSE AND BEEF TYPE CATTLE USED IN POLAND

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The aim of the paper was the comparison of slaughter value and muscle properties of dual-purpose cattle most common in Poland with that of beef type, from which high quality culinary meat is obtained. Four breeds were compared: two of them were dual-purpose type i.e. Holstein-Fresian of Black and White variety and Polish Red and the other two – of beef type i.e. Limousine and Hereford.

The authors discussed factors influencing cattle slaughter value and muscle properties, i.e. the impact of the utility type, gender, age, feeding systems as well as maturation rate of animals. The slaughter value was presented using the dressing percentage and the content of main components in the carcass i.e. the muscle tissue, fat and bones. The tissue composition of analysed cattle breeds and the share of main cuts in their carcasses were presented.

Higher daily gains of beef type or dual-purpose breeds are connected with a higher number of muscle fibers (hyperplasia) and also with a bigger size of their diameter (hypertrophy). These phenomena are accompanied by increased lightness of meat colour what is the result of changes in the muscle fibers metabolism and the proportion of myosin heavy chains (MHC) of the I, IIa and IIx type.

Observed differences in the slaughter value existed not only between breeds, but also inside them indicating the need for further improvement of animal selection and deeper analysis of factors influencing it. It was stated that the amount of culinary meat obtained from carcasses may be increased not only through the selection of corresponding genotypes, but also through the modification of the system of carcass cutting.

The performed analysis of the slaughter value emphasizes special significance of the domestic Polish Red cattle also as a breed for production of good quality meat similar to beef cattle breeds.

Key words: slaughter value, cattle meat, beef meat

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EVALUATION OF PORK TENDERISATION PROCESS USING IEF AND 2DE

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Meat tenderisation process is closely connected with protein changes, especially myofibrillar proteins. However, changes occurring in the sarcoplasmic fraction can also to some extent reflect changes related to meat tenderness. The aim of this study was to assess relationships between protein changes of the centrifugal drip from pork and its tenderness.

The experimental material was the *longissimus lumborum and thoracis* muscle derived from 24 pigs of a known genotype. They were slaughtered at the weight of about 110 kg. Rearing and feeding conditions were the same for the whole group of pigs, which were selected from the total number of 165 animals. The selection of samples was carried out on the basis of measurement of the shear force value which pointed them to four different models of the tenderisation process. Samples collected for analyses included meat of normal quality (RFN) which was evaluated on the basis of pH_1 and pH_2 (24 hr) measurements as well as electrical conductivity measured 1,5 (PE1) and 24 (PE2) hours after slaughter

Isoelectrofocusing (IEF) and two-dimensional electrophoresis (2DE) analyses were conducted on the proteins of centrifugal drip collected 48 and 144 hours after slaughter. At the same time were performed measurements of the shear force of meat.

It was found on the basis of the obtained results that the proportion of the protein centrifugal drip characterised by the isoelectric point ranging from 6.1÷7.2 decreased together with the meat tenderisation process. Employing the technique of two-dimensional electrophoresis, six large spots were identified which were designated as C_{2D} (3700 kDa and 4 IP), M_{2D} (148÷153 kDa and 4÷6 IP), F_{2D} (25÷30 kDa and 8 IP), K_{2D} (90–95 kDa, 4 pI), I_{2D} (71 kDa, 4pI) and L_{2D} (42 kDa and 4÷7 IP) proteins whose intensity changes correlated significantly with the tenderisation process. The canonical correlation coefficient between the shear force values 48 and 144 hours after slaughter and the content of the above proteins determined on gels at the above terms amounted to $C_R = 0.9514^{**}$. It means that meat tenderness can be described with considerable precision employing the assessment of protein changes using 2DE. However, since the speed and extent of these changes depend on processes of glycolysis, a more comprehensive tenderness assessment of meat 48 and 144 hours after slaughter can be achieved by combining observations of glycolysis and proteolysis. The obtained high canoni-

cal correlation coefficient (C_R = 0.9555**) confirms that making simultaneous allowances for proteolysis and glycolysis indicators makes it possible to present more accurately the results of meat tenderisation 48 and 144 hours after slaughter.

Key words: pig meat, meat tenderness, isoelectrofocusing, electrophoresis

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STUDY ON SLAUGHTER VALUE AND SOME MEAT QUALITY TRAITS IN PIGS OBTAINED FROM CROSSING NAIMA AND PBZ SOWS WITH DUROC BOARS

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The aim of this study was to compare slaughter value and some meat quality traits in pigs obtained from crossing of Naima and PBZ sows with Duroc boars. Investigations were carried out on 40 fatteners which were obtained from crossing of Naima sows (n = 28) and PBZ (n = 12) with Duroc boars.

Fatteners from both groups were characterized by almost the same meatiness and thickness of fat in 5 different carcass points, but these fatteners, which came from PBZ sows were relative heavier than from another group. There were no carcasses within investigated groups with PSE meat, however the average pH value in Naima x PBZ group was a little bit lower than in the other group.

Carcasses of PBZ x Duroc group were characterized by a higher content of ham and loin in compare to the Naima x Duroc group.

There were no significantly differences in most investigated quality traits of meat between both groups. Only water content was significantly higher in PBZ x Duroc group, however the value of WHC and cook losses were a little bit higher in pigs obtained from crossing PBZ x Duroc. Results of sensory evaluation of cook and smoked loins confirmed good meat quality of the examined groups. The smoked meat obtained from crossing Naima x Duroc was significant more acceptable of compensation and desirability color.

The results of this study shoved that there were no significant differences between investigated groups in the more study quality traits.

Key words: meat quality, pig, slaughter value

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MICROBES, TAINTS AND OFF-FLAVORS

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Microorganisms play an important role in food technology. They contribute to flavor of fermented products, playing crucial role in beer, wine flavor formation, in dairy products as well as in fermented sausages, to name only few. However, microorganisms in foods can also form volatile compounds that are indicators of their presence and cause formation of off-flavors.

Due to, in many instances, their very low odor thresholds, compounds of microbial origin causing off flavors pose a serious challenge for analytical chemists. Methods used for their detection and quantitation should have detection limits lower than odor thresholds of analyzed compounds. In the process of analysis, pre-concentration and selective detection are of special importance.

Examples of microorganisms responsible for specific off-flavors in various food products will be discussed with the emphasis on the approaches for off-flavors detection and quantitation using gas chromatography and hyphenated techniques.

Key words: microorganisms, food technology

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ANALYSIS OF VARIOUS BREEDS OF PIGS AND WILD BOARS HEALTH STATUS AND MEAT NUTRIONAL VALUE

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The purpose of the study was to determine health status of different commercial breeds of pigs and wild boars in Lithuania, to establish microbiology of guts and to analyse nutritional value and physico-chemical composition of meat. Blood samples for morphological and biochemical investigation and microbiology analyses of guts were taken in slaughterhouses. The amount of GL was twice as higher in different genotypes of pigs than in the blood of wild boars. The amount of TG in all breeds of pigs was by 17.3% higher than in the blood of wild boars. The most intensive protein metabolism and erythropoiesis was defined in Yorkshire. The most intensive processes of oxidation were found in Large white pigs, when they were grown under Lithuanian conditions. The breed of pigs effected the variety of blood protein, erythrocytes and triglycerides. Meat quality parameters of all the breeds of pigs investigated (Lithuanian white, Landrace, Yorkshire, Large white) and wild boars were different. The meat of wild boars contained by 0.5-1.3% higher amount of intramuscular fat, it was darker, cooking loss was lower and except from Landrace, tended to be softer. The breed of pigs effected meat color L* – by 46.8%, redness a* – by 88.0%, yellowness b* – by 57.6%, rigidity – by 40.1%, the amount of intramuscular fat – by 61.1% and the amount of ash – by 45.3%. The ratio of lactobacillus, enterobacteria, enterococcus and yeast tended to remain similar in the colon of pigs and wild boars. However, the bacterial count in wild boars was from 18.9% to 29.1% lower than in the colon of pigs. Count of lactobacillus positively correlated with enterobacteria and enterococcus and negatively – with yeast as in pigs fat – by 61.1% and the amount of ash – by 45.3%.

Key words: pigs, wild boars, blood, meat, gut microbiology

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A VACCINATION AGAINST PIGS MYCOPLASMAL PNEUMONIA INFLUENCE ON THE PORK QUALITY AND QUANTITATIVE PROPERTIES

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Pig respiratory disease is the most important problem in pig producing countries. Vaccination is an important strategy for controlling Mycoplasmal pneumonia. The objective of this study was to evaluate the vaccination against pigs Mycoplasmal pneumoniae influence on the pork quality and quantitative traits. A Mycoplasma hyopneumoniae single dose Respisure One® vaccine was tested in 10 piglets for its effects on the carcass yield%, musculus longissimus dorsi area, feed input MJ, overweight per 120 days and meat chemical and physical properties. The other group of 10 piglets was left unvaccinated as a control. The experiments have shown that overweight per 120 days ($p < 0.001$) were obtained significantly higher in the vaccinated pigs. The carcass yield%, musculus longissimus dorsi area and feed input MJ differences were not statisticaly significant between vaccinated and unvaccinated pigs.

Our data showed that meat lightness L* ($p < 0.05$) and drip loss% ($p < 0.001$) were significantly higher in the vaccinated pigs. Whereas, meat shear force kg/cm^2 ($p < 0.05$) was significantly higher in the unvaccinated pigs. It indicated, that shear force of meat increased that drip loss% increased in the meat.

In this study, dispersive analysis (ANOVA) were calculated for effects of vaccination against pigs Mycoplasmal pneumoniae on the pork quality and quantitative traits. Dispersive analysis (ANOVA) showed statisticaly significant of vaccination influence for the carcass yield% ($p < 0.01$), drip loss% ($p < 0.001$), meat shear force kg/cm^2 ($p < 0.05$) and ash% ($p < 0.01$).

We concluded that vaccination against pigs Mycoplasmal pneumonia has positive effects on overweight per 120 days, meat lightness L* and negative effects on meat drip loss%. According dispersive analysis (ANOVA) vaccination statisticaly significant effected on carcass yield%, drip loss%, meat shear force kg/cm^2 and ash%.

Key words: Mycoplasmal pneumonia, pigs, vaccine, quantitative traits, meat quality

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EFFECT OF USING SUNFLOWER'S CAKE AND LINSEEDS AND VITAMIN E SUPPLEMENTATION ON FATTY ACID PROFILE OF INTRAMUSCULAR AND DEPOT FAT IN FATTENED LAMBS

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The aim of the study was to determine the effect of sunflower's cake and linseeds, and vitamin E supplementation on fatty acid profile of intramuscular fat in *m. longissimus lumborum* (LLF) and depot fat (SCF) above this muscle. Subjects were 18 Kołuda sheep (KS) and Ile de France × KS (If×KS) ram-lambs (3 groups per 6 animals, 50% KS and If×KS). Lambs were fattened intensively to 32-37 kg of body weight with *ad libitum* concentrates and grass hay supplement. The control group (C) was fed a diet based as a cereal components (>50%) and rapeseed meal (RM; 20%). In two experimental groups, ground wheat and RM were replaced with sunflower cake and linseeds: 23.5 and 5%, respectively (group SCL), with additional supplementation of vitamin E (Polfamix E – 0.2%) used in group SCL+E.

Investigated diets did not differ concerning protein, N-free extractives and ash content. SCL diets contained 11.0% more fibre and twice as much fat compared to C diets (8.75 vs. 4.31% in DM), with a 73% lower SFA content and a 6.5 and 30% higher UFA and PUFA content, respectively. The high proportion of PUFA in the fat of SCL diets resulted from the increased content of C18:3 and 18:2 acids and a lower content of C16:1 and C18:1 acids. In the diets consumed by SCL lambs, the content of PUFA was about 2.5 times higher (including 4.5 times as much 18:3 and twice as much 18:2 acids).

The effect of feeding sunflower cake and linseeds and supplementation vitamin E on fatty acid content of LLF fat in the fattened lambs was observed. With a similar total SFA content, the fat of SCL and SCL+E lambs contained less MUFA (39.6 and 42.2% vs. 46.9%) and more PUFA (18.8 and 15.2% vs. 10.7%) compared to the fat of C lambs. In the group supplemented with vitamin E (SCL+E), FA profile was characterized by smaller changes than in SCL group and lower fat content of the analysed muscle in relation to C and SCL groups (2.25% vs. 2.82 and 3.05%).

A positive effect of feeding oil components was also found for the fatty acid profile of depot fat. Compared to C lambs, SCF fat of MSL and MSL+E lambs had a lower content of saturated acids C16:0 and C17:0 (20.37 and 1.26% vs. 25.47 and 2.10%, $P \leq 0{,}01$), and a higher content of C18:0 (24.45 vs. 18.79%). Both experimental groups were characterized

by a lower MUFA content (35.72 vs. 43.59%, P≤0,01), resulting mainly from the lower content of the dominant C18:1 n9 acid (26.54 vs. 37.53%, P≤0,01). The depot fat of SCL lambs contained almost 2.5 times as much PUFA compared to C lambs (9.28 vs. 3.84%, P≤0,01), which was due to the 2.5 and 3 times higher content of 18:2 and 18:3 acids, respectively. The SCF fat of SCL lambs also contained more CLA (0.58 vs. 0.39%, P≤0,05).

Breed origin of the lambs did not have a large effect on the fatty acid profile of intramuscular and depot fat.

The results obtained show that the health quality of lamb meat can be positively modified by using sunflower cake and linseeds in fattening diets. The addition of vitamin E weakened the beneficial effect of feeding with the oil components studied on the fatty acid profile of intramuscular fat, with no effects in the case of depot fat.

Key words: fatty acid profile, intramuscular fat, lamb

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Joanna Kawa-Rygielska

ETHANOL FERMENTATION OF EXTRUDED RAW MATERIAL WITH NONCONVENTIONAL YEAST

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The aim of the work was the assessment of the effect of extrusion on potato starch ability of hydrolysis and fermentation by *Schwaniomyces occidentalis* ATCC 48086 yeast.

Biological material was *Schwaniomyces occidentalis* ATCC 48086 yeast strain originating from American type Culture Collection (Rockville,USA). This strain possesses amylolytic enzymes: α–amylase, glucoamylase and enzymes hydrolyzing α–1,6 glycoside bonds. *Schwanniomyces occidentalis* ATCC strain was stored and activated on YM medium.

The material for investigation was potato starch subjected to the process of extrusion in different temperature conditions. Control sample involved not extruded starch.

The process of extrusion of potato starch featuring 25% moisture was conducted in AEV 650 single – thread worm extruder produced by Brabender firm at the temperatures: 60°C, 120°C and 180°C.

Fermentation tests with the examined yeast participation were done in conical flasks of 250 ml capacity containing 100 ml of appropriate fermentation medium. The latter one involved mash containing 4% of potato starch extruded in already mentioned temperatures, enriched in mineral salts: $MgSO_4x7H_2O$, $(NH_4)_2SO_4$, KH_2PO_4, $CaCl_2$. Control sample was the medium containing not extruded potato starch. In the samples there were not used any amylolytic enzymes. Fermentation process was carried out at the temperature of 30°C.

The process of extrusion at the temperature of 120°C and 180°C increased potato starch susceptibility to the effect of α–amylase and glucoamylase produced by *Schwanniomyces occidentalis ATCC 48086* yeast strain and it did improve final effects of potato starch fermentation.

It was recorded that as the temperature of extrusion increased both the speed of starch hydrolysis and the dynamics of ethanol fermentation did also increase to reach the highest ethanol yield from potato starch extruded at 120°C. The amount of ethanol obtained in the course of fermentation of starch extruded at 120°C was twice higher in comparison to the amount of ethanol provided by fermentation of not extruded starch. Extrusion of potato starch carried out at the temperature of 60°C did not effect on the improvement of final results of ethanol fermentation.

Key words: potato starch, ethanol fermentation, extrusion

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MICROBIOLOGICAL QUALITY OF RAW MATERIALS FOR ETHANOL PRODUCTION

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The aim of the study was the assessment of the influence of raw material microbiological quality on the course and final results of maize mashes ethanol fermentation with distillery yeast.

The material for investigation was maize grain of different quality: maize KB, maize A, maize B. In the examined raw material there were assessed dry matter concentration and starch concentration. The results obtained were the basis for calculating fermentation yield. Determination of microflora existing on maize grain was done according to de Tempe method. All kinds of fungi isolated from the grain were identified, regarding their species. The analysed maize grain was used for ethanol production. Maize mash of 20% raw material concentration was prepared using a non-pressure starch release method. Fermentation was conducted at 30ºC using cultured distillery yeast of *Saccharomyces cerevisia* Ethanol Red. Dynamics of fermentation, practical ethanol yield and physiological condition of yeast cells were used as criteria for the assessment of fermentation activity.

Starch content in the grains amounted from 64,7 to 68,5%.The maize grain KB and A did not show any external sings of decay. The symptoms of contamination became visible only for maize grain B. Maize grain A was infected with: *Penicyllium notatum, Rizopus arrhizus, Fusarium oxysporum, Nigrospora oryze, Trichoderma harzianum and Aspergillus flavus.* The amount of fungi isolated from maize A was 65 j.t.k. The number of fungi isolated from maize B was 3-4 times higher than in the other case. Grain B was contaminated by fungi: *Aspergillus flavus, Penicyllium notatum, Rizopus arrhizus, Fusarium oxysporum, Fusarium culmorum*, *Fusarium avenaceum* and *Trichoderma harzianum*. The maize KB was the control sample.

It was observed that the microbiological quality of the material used for fermentation influenced the results of ethanol fermentation. The lowest practical ethanol yield in relation to theoretical one was observed for fermentation of the substrate prepared from maize grain B. In this case the yeasts needed more time to adapt to fermentation medium and were more sensitive to environmental conditions. The yeast were characterised by the lowest activity during fermentation. The process of fermentation of all mashes were over after ca. 3 days

(ca. 72 h). The degree of carbohydrates consumption was very high, over 99% in all samples. Physiological condition of yeast after fermentation of lower quality material (maize B) was significantly worse than in control samples (maize KB).

Key words: ethanol fermentation, microbiological quality

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Małgorzata Kaźmierska, Marek Nowak, Tadeusz Trziszka

MARKET BEHAVIOUR OF THE WROCŁAW CONSUMERS OF ENRICHED EGGS

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The study presents the results of the analysis of the preferences of consumers of eggs enriched with n-3 fatty acids. The factors deciding about the purchase of that type of eggs and the level of consumers' knowledge about the influence of fatty acids on human organism were analysed. The study was conducted in Wrocław. In the period from November 2008 to January 2009, 215 inhabitants of the city were interviewed directly using questionnaires.

A large group of respondents who purchase eggs for their households buys eggs enriched with polyenic acids. It results from the fact that the consumers pay more and more attention to the composition of food products and to their nutritional value. The results have also showed that over 50% of the persons who were interviewed paid attention to the pro-health qualities and the price of eggs enriched with omega-3 acids. It may be assumed that the products which were more expensive were perceived as products of better quality and higher nutritional value. The fashion for "healthy" life-style and "healthy" food influenced the decisions to buy enriched eggs as well.

Based on the analysis of the results, it may be concluded that enriched eggs are gaining popularity among consumers and their consumption will continue increasing in the future. The analysis has also confirmed that the consumers' knowledge about eggs enriched with omega-3 acids is still at a low level and needs to be improved.

Key words: enriched eggs, market analysis, consumer preferences, Wrocław

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PASTA PROPERTIES MADE WITH EGGS ENRICHED WITH POLYUNSATURATED FATTY ACIDS

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The aim of this work was to compare pasta properties made with standard eggs and enriched with omega-3 and omega-6 fatty acids.

Pasta dough was produced from commercial wheat flour (type 750) and water (Group I); wheat flour (type 750) and standard eggs (Group II)/ enriched eggs (Group III) in number of 8 for every kg of flour. Dough was mixed in press Dolly Mini P3 (La Monferrina) and extruded in spaghetti shape. Fresh pasta was dried at room temperature for 24h.

Quality of pasta was described by cooking properties (minimal cooking time, cooking loss and cooking weight index). The color of pasta was determined by Minolta Chroma Meter CR-200b based on L* and b* values in CIE L*a*b* system. The strength of pasta was determined by Instron 5566 in 3- point bending test. The process of fat extraction in the experimental dried material was conducted according to Folch (1957), using methylene chloride and methanol (2:1). After methylation (14% BF3 in ethanol), the analysis of fatty acid profile was performed in a gas chromatograph with a spectroscopy mass detector (Agilent 6890N Series, 5973 MS Detector). The separation of fatty acids was carried out in a column HP-88 (100 m x 0.25 mm I.D. x 0.2 mm).

The results were statistically verified by applying a one-way analysis of variance (Group of pasta). The means were computed using Duncan´s Multiple Range Test at the significance level of 0.95.

Pasta with enriched eggs (Group III) was characterised by higher L* value (73.61) and cooking loss (6.02%) than pasta made with normal (Group I) or without eggs (Group II). The addition of standard eggs during pasta formulation resulted in the highest b* value (12.71).

Using of eggs in pasta production increased the cooking weight index from 2.57 (without eggs) to 2.80 (standard eggs) and 2.70 (enriched eggs). However, a decrease in the pasta strength (Group II and III) was observed as a result of use of eggs in pasta.

Pasta prepared only from wheat flour contained significantly less MUFA in lipids fraction (22.0%) comparison to Group II (36.44%) and Group III (38.07%). As it was expected, addition of enriched eggs to pasta resulted in increasing of n-3 PUFA level in lipids fraction,

especially DHA (1.72%). Pasta formulated from wheat flour, which is rich in linoleic acid (C18:2) and alpha-linolenic acid (C18:3), was characterised by high level of those components (47.51% and 6.01%, respectively). Significantly lower level of C18:2 acid was analysed in pasta prepared with the addition of eggs, either standard (28.06%) or enriched in PUFA (23.71%). Regarding C18:3 fatty acid lower amount (2.19%) was observed when pasta was manufactured with standard eggs, however pasta prepared with the addition of enriched eggs was characterised by similar level (5.07%) as in control pasta.

Results collected in the study showed that ratio n-6/n-3 PUFA in pasta from the experimental groups (Group I, Group II and Group III) equaled 8.0; 10.4 and 3.5, respectively.

It can be concluded, that enriched eggs may be utilised in pasta production.

Key words: pasta, polyunsaturated fatty acids, egg

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Grzegorz Kiełbowicz, Witold Gładkowski, Anna Chojnacka, Czesław Wawrzeńczyk

PRODUCTION AND ANALYSIS OF 1-ACYL LPC AND 2-ACYL LPC FROM EGG YOLK

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Lysophospholipids are the class of compounds which are the products of enzymatic regioselective hydrolysis of phospholipids. Among them the lysophosphatidylcholine (LPC) is the most common. Hydrolysis of PC with phospholipase A_2 (PLA_2) yields 1-acyl LPC and hydrolysis with phospholipase A_1 (PLA_1) or 1,3-specific lipase yields 2-acyl LPC.

Formation of lyso-PC in egg-yolk significantly improves the emulsification properties, heat stability and viscosity of egg yolk products. These properties are especially useful in hot food applications, therefore enzyme-catalyzed production of lyso-PC has been applied in industry by some companies like Degussa, Central Soya or Cereol. Another process in which enzymatic production of LPC is applied is refining of vegetable oils, in which the key step is oil-degumming.

Lysophospholipids are also important intermediates in the synthesis of phospholipids with modified fatty acid composition. In this two-step procedure PC is first hydrolyzed to LPC an then the esterification of free hydroxyl group with the defined fatty acid is carried out. The common problem of these syntheses is possible acyl migration between two positions of glycerol backbone. Therefore it is very important to elaborate methods of identification of 1-acyl LPC and 2-acyl LPC.

In this report we present the results of HPLC analysis together with FA composition of 1-acyl LPC and 2-acyl LPC obtained by us by egg yolk treatment with the use of phospholipase A_2 or by ethanolysis of pure PC isolated from egg-yolk by lipase from *Mucor miehei*, respectively. We also present chromatographic method of separation of 1-acyl LPC possessing different fatty acid in *sn*-1 position.

Key words: egg yolk, HPLC analysis

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EVALUATION OF *SOUS VIDE* TREATED OSTRICH MEAT QUALITY DURING STORAGE

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Introduction. Commercial breeding of ostrich is a new direction in Latvian agriculture. Ostrich meat is lean, tasty, healthy, and a highly nutritious red meat. The global demand for ostrich meat has escalated with the international trend towards **healthier eating, as it is virtually fat free and low in calories and cholesterol but very rich in protein.** The offered range on the existing ostrich meat market includes prime fresh or frozen fillet, steak, goulash, minced meat, sausages, and kebabs, marinated and spice sprinkled products, smoked fillet and a variety of cold deli meats. Nowadays consumers demand refrigerated convenient meals, processed using a mild heat treatment. This demand has led to a growth in the application of *Sous vide* and cook-chill processing technologies to extend the shelf life maintainig the quality of raw materials.

Methods. Fresh ostrich meat breed in local farms was used. It was marinated for 12 hours. A Sous vide packaging technology was used. Each sample size of 250 grams was vacuum packed in shrink film pouch with thickness 60 μm and heat treated in water bath "Clifton Food Range" at temperatures of 80 and 90ºC for 45 to 60 minutes. After heat treatment the samples were chilled and stored in Commercial Freezer/Cooler ELCOLD at +4.0±0.5ºC. Physical-and-chemical (texture, cooking losses, pH, moisture content, $a_{w,}$ and colour) and microbiological analyses were ascertained on 0, 21st and 35th days of storage. During the storage time microbial growth of total mesophylic anaerobic bacteria was controlled.

Results. Results indicate that flavor and its intensity of *Sous vide* treated ostrich meat was excellent, texture and tenderness milder and softer therefore the ready-to-eat ostrich was more acceptable than conventionally cooked or roasted prepared as a "ham" product. Cooking losses decreased in average by 27 to 30%. The biological value (vitamin content, amino acids) was higher than for traditionally roasted meats. No microbial growth was ascertained at the examined storage time.

Key words: ostrich meat, *Sous vide* packaging technology

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COMPARISON OF FATTY ACIDS PROFILE IN THE GOAT'S AND SHEEP'S MILK

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Fats are an essential element of human nourishment. They perform energetic and reserve functions and moreover they are solvents for many important vitamins (A, D, E, K). The content of individual fractions of fatty acids affects its healing properties. Unsaturated fatty acids matter greatly in the man diet because of their exogenous nature. A comparative test of the profile of fatty acids of the goat's and sheep's milk was the aim of executed tests with particular concideration of the content of saturated (SFA) and unsaturated (UFA) fatty acids, including: polyunsaturated (PUFA), monounsaturated (MUFA), desirable hypocholesterolemic (DFA), objectionable hypocholesterolemic (OFA) fatty acids, eicosapentaenoic (EPA), docosahexaenoic (DHA) acids.

Sheep's and goat's milk constituted the experimental material, which was produced by 30 heads in every group of animals. Collective samples of seep's and goat's milk were taken during morning milking, in six periods of lactation, from the beginning of May till the end of September, every 30 days. Animals were held in conditions of the ecological breeding and during the entire period of lactation they were in the pasture, and pasture green forage exclusively constituted their food. The tests of higher fatty acids were carried out with method of the gas chromatography (the CP-WAX 58 column, 25 m) and the fat in the milk was set with Ekomilk apparatus. A statistical analysis of data was carried out with help of single-factor analysis of variance, with the use of Statistica 6 package.

On the basis of data analysis presented in the Table 1, it can be stated that sheep's milk, compared with goat's milk, was characteirsed by over twice as high fat content but at the same time it had 86.7%higher amount of SFA and almost three times as high amount of UFA, thereby PUFA, MUFA, PUFA 6 and 3 and DFA and only 79.3% OFA ($p>0.01$). Also more beneficial relations of individual groups of fatty acids ($p>0.01$) were stated in the sheep's milk, except for PUFA6:PUFA3, which, even though was at low level, developed more favourably in the goat's milk ($p>0.01$).

Table 1

Content of groups fatty acids in sheep's and goat's milk

Characteristics	Content in 100 g of milk (g)		SEM
	goat	sheep	
N	6	6	
Zawartość tłuszczu (%)	4.22[A]	8.96[A]	0.771
SFA	3.16[A]	5.90[A]	0.449
UFA	0.95[A]	2.66[A]	0.282
W tym: PUFA	0.16[A]	0.45[A]	0.048
MUFA	0.78[A]	2.21[A]	0.235
PUFA6	0.095[A]	0.240[A]	0.024
PUFA3	0.068[A]	0.211[A]	0.024
EPA	0.003[A]	0.017[A]	0.003
DHA	0.002[A]	0.015[A]	0.002
DFA	1.34[A]	3.62[A]	0.372
OFA	2.76[A]	4.95[A]	0.367
UFA/SFA	0.298[A]	0.450[A]	0.029
DFA/OFA	0.492[A]	0.733[A]	0.050
MUFA/SFA	0.246[A]	0.375[A]	0.024
PUFA/SFA	0.052[A]	0.076[A]	0.004
PUFA6/PUFA3	1.44[a]	1.15[a]	0.070

A – statistic differences essentials at p>0.01; a – statistic differences essentials at p>0.05

Summary and conclusion: to sum up it can be stated that sheep's milk indicates more beneficial healing properties, on account of much higher content of unsaturated fatty acids as well their proportion to saturated fatty acids, than the goat's milk.

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Key words: fatty acids, goat's milk, sheep's milk

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Wiesław Kopeć, Małgorzata Korzeniowska, Łukasz Bobak, Michał Korzycki, Monika Wilgusz

MODIFICATION OF SENSORY PROPERTIES OF POULTRY BROTH USING MEMBRANE TECHNIQUE

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The aim of the study was an attempt to modify the flavorant composition of volatile fraction of chicken hydrolysate using membrane microfiltration. Chicken broth was the experimental material for the study. Microfiltration was carried out on ceramic membrane at the transmembrane pressure of 0.05 MPa. Diluted chicken broth, fraction after 20% of total volume of membrane feed was filtered and final concentrate were then subjected for sensory profiling of the most typical taste and odour traits, as well as volatile compounds, mainly aldehydes, were evaluated using SPME chromatography analysis (GC/MS). The results of the study showed that microfiltration process positively influenced the taste of chicken broth. Final concentrate was characterised by high intensity of meaty and brothy taste, and low intensity of bitter taste. Filtration improved also odour profile of final concentrate, i.e. higher intensity of meaty odour was evaluated. SPME analysis of volatile compounds revealed that chicken broth was characterized by high content of hexanal and low of higher aldehydes. Microfiltration process increased the level of hexanal up to 24% in concentrate, however filtrate fraction was characterized by significantly lower content of this constituent. It can be concluded that microfiltration process can be used for further purification of chicken meat extracts.

Key words: chicken broth, microfiltration, sensory profiling, volatile compounds

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Monika Kordowska-Wiater[1], Iwona Pomorska[1], Dariusz Stasiak[2]

APPLICATION OF ULTRASOUNDS FOR ELIMINATION OF SELECTED GRAM-POSITIVE PATHOGENIC BACTERIA CONTAMINATING POULTRY CARCASSES

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Ultrasounds are the object of intensive research of food technologists, because they can eliminate microorganisms from products and so they can be used as method of food preservation. They are able to inactivate bacteria and deagglomerate bacterial clusters or flocs through a number of physical, mechanical and chemical effects arising from acoustic cavitation. Their bactericidal effect on pathogens and spoilage microbes was investigated on different food e.g. milk, whole eggs, meat and also on laboratory broths.

The purpose of the study was to investigate ultrasounds effect on two pathogenic, gram-positive bacteria: *Staphylococcus aureus* and *Bacillus cereus* that are the reason of some gastrointestinal efforts. Because there is a drive towards the use of sonication as an adjunct to other techniques, simultaneous effect of ultrasound and lactic acid was examined.

The chicken wings obtained from Indykpol (Lublin, Poland) were contaminated with these two bacteria separately. Ultrasound treatment (frequency 40 kHz and intensity 2 $W \cdot cm^{-2}$) was conducted in distilled water or 0,8%, 2,4% and 4% ($v \cdot v^{-1}$) lactic acid aqueous solutions in ultrasonic bath (Polsonic). Three periods of samples sonication: 5, 10 and 15 min were used. The sonicated samples were compared with parallel, untreated samples. Smears from wings were taken and serial decimal dilutions were prepared. Plate counting technique was used to count colony forming units. Baird-Parker and Mossel agars were used for *S. aureus* and *B. cereus* isolation, respectively. The samples of aliquots were also analyzed by the same method to determine the presence of living bacteria in reaction environment.

It was observed that lactic acid stimulated sonobiological phenomena in cell membranes and decreased its vital functions and caused the death of investigated bacteria. The most bactericidal effect on *S. aureus* was obtained in 2,4% ($v \cdot v^{-1}$) lactic acid during 15 min of sonication. Reduction of cocci of 3,57 logarithmic cycles from $cfu \bullet cm^{-2}$ was obtained. During sonication period of 5 and 10 min in 2,4% or 4% ($v \cdot v^{-1}$) lactic acid solution reduction on the level 2,62–2,78 log $cfu \cdot cm^{-2}$ was observed. Sonication in 0,8% ($v \cdot v^{-1}$) lactic acid solution for 10 min was effective in total elimination of *B. cereus* cells from chicken wings, so it was no need to use more concentrated acid solution or longer action. Synergistic effect was much more effective than action of lactic acid and ultrasound separately. It was shown that *S. aureus* was more resistant on the low frequency and medium intensity ultrasound than vegetative cells of *B. cereus*.

Key words: ultrasound, *S. aureus*, *B. aereus*, food preservation, poultry

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Małgorzata Korzeniowska, Wiesław Kopeć, Łukasz Bobak, Michał Korzycki, Joanna Mucik

MODIFICATION OF CHEMICAL COMPOSITION OF POULTRY BROTH USING MEMBRANE TECHNIQUE

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Chicken broths are meat extracts concentrates produced by heat treatment of poultry meat or more often poultry by-products, such as breast frames, bone residues after mechanical deboning and/or lower quality whole carcasses. Broths are also manufactured from protein hydrolysates obtained after an enzymatic or chemical process. Chemical composition of the broth is strongly affected by different technological factors like time of cooking and/or kind of acidulants used for partially hydrolyzed poultry meat extracts. The aim of the study was an attempt to modify the chemical composition of chicken concentrated hydrolysate to lowering hydroxyproline and fat content using membrane microfiltration. Material used in the study was broth obtained from chicken raw materials by enzymatic hydrolysis. Dissolved broths were then applied to microfiltration modules (ceramic Al2O3 membrane, pores 3–5 μm, porosity 35%, diameter 20 mm, active area 0.06 m^2, trans membrane pressure 0.05 MPa) for membrane separation process. Filtrate samples after 20%, 40%, 60%, 80% of total feed volume filtration were collected. Analyses of dry matter, total nitrogen, protein, fat and hydroxyproline contents were performed in the feed, filtrate fractions and retentate.

The results of the study showed that microfiltration process was not effective for modification of chicken broth composition if was conducted up to filtrate all added to feed water (80%) because of high looses of broth constituents. But if process was performed up to filtrate 20% of added water lowering of fat content in chicken broth can be obtained. In opposite to that hydroxyproline content in broth (showing share of gelatine in total protein) after microfiltration process was not lowered in both operation e.g. carried out up to filtrate of 20 or 80% of added water.

Key words: chicken broth, membrane techniques, chemical composition

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NUTRITIVE VALUE OF MEAT FROM BROILERS FED WITH FODDER CONTAINING DIFFERENT LEVEL OF DRIED DISTILLERS GRAINS WITH SOLUBLES (DDGS)

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Chemical composition, besides the physical traits, is one of the basic indicator of nutritive value of meat. The objective of the study was the effect of feeding broilers with DDGS on chemical composition of meat.

Experiment was performed on 224 Ross 308 broiler chickens (108 male and 116 female) housed for 6 weeks. Birds were divided in four groups for 56 each. From 1 to 14 days of living chickens were fed with starter balanced fodder. Following from day 15 to 35 grower mixture was served to all experimental birds. Chickens belong to group I, considered as control, were fed with standard fodder. To birds from group -II -III and -IV standard mixture with the addition of respectively 5%, 10% and 15% of DDGS (dried distillers grains with solubles, which was obtained during production of bioethanol from corn) was given. Finally, from day 36 up to slaughter time chickens were fed with finisher balanced fodder. Birds of all groups were reared indoors, under controlled environment; drinking water and feeds were provided *ad libitum*.

From each experimental groups five roosters and five hens were selected for slaughter in 6 weeks of living. Birds were characterized by similar body weight average for specific gender in every experimental group. All chemical analyses were performed on chicken breast muscles excised from carcasses chilled at 4ºC for 18 hours. Chemical composition of meat was analysed according to AOAC (1990) methods.

Results collected in the study showed significant effect of different level of DDGS added to chicken fodder on protein, lipids and cholesterol contents in meat. The highest protein content (23.8 g/100g) was analysed for breast meat collected form birds fed with the addition

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of 10% of DDGS. The lowest protein content (23.0 g/100g), significantly different ($P<0.05$) from previously discussed, was analysed for meat obtained from chickens fed with fodder contained 5% of DDGS. Significant differences ($P<0.05$) were also observed between the highest and the lowest lipids content in meat; respectively obtained from group fed with 15% of DDGS (3.4 g/100g) and with fodder containing 5% of DDGS (2.2 g/100g). Regarding cholesterol content in meat, the highest level of this constituent (130.7 mg/100g) was analysed for breast muscles excised from chicken carcasses when supplemented with 10% of DDGS. Significantly lower ($P<0.05$) cholesterol content was observed in meat from control birds (121.3 mg/100g). There were no significant differences in dry matter content between meat from all experimental groups. Average dry matter content ranged from 26.2 g/100g for chicken fed with 10% of added DDGS to 26.6 g/100g for meat obtained from control birds as well as fed with 15% of DDGS in fodder.

It can be concluded that the addition of more than 10% of DDGS (dried distillers grains with solubles) to fodder resulted in higher protein content as well as higher lipids and cholesterol levels in chicken breast muscles.

Key words: nutritive value, broilers, meat quality

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Jarosław Kowalik, Adriana Łobacz, Anna S. Tarczyńska, Stefan Ziajka

RISK ASSESSMENT OF *LISTERIA MONOCYTOGENES* GROWTH IN TVAROG CHEESE

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Risk assessment is a systematic process of identification and evaluation of hazards resulting from microbiological contaminations. Predictive microbiology is a tool for risk assessment, which is useful for identification and understanding microorganisms (also pathogens) ecology in food. The reaction of microorganisms to the environment can be presented in the form of predictive models.

The aim of the present study was to investigate the behaviour of *Listeria monocytogenes* 38 in tvarog cheese during storage in the temperature range of 3–15°C for 21 days. Traditional plate count method was used to determine the number of microorganisms.

The growth of *L. monocytogenes* 38 in tvarog was presented in the form of growth curves generated in DMFit software package (Baranyi model) and the time-temperature summary model (second order polynomial). Results of analyses were compared with data predicted in Growth Predictor (GP), which describes microorganisms behaviour in modified culture media.

Results obtained from studies in tvarog differ from those obtained from microbiological media. These data suggests that prognostic models, which can be useful to estimate microbiological quality, should be created for each type of the food product.

Key words: tvarog cheese, *Listeria monocytogenes*, microbiological quality

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Jolanta Kowalska, J. Bartoszczyk

THE APPLICATION OF GAS CHROMATOGRAPHY TO THE SPECIFICATION OF THE INFLUENCE OF RAW MATERIAL CONTENT CHANGE AND AGGLOMERATION PROCESS ON THE CONTENT OF VOLATILE COMPOUNDS IN COCOA DRINK

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An increase in the interest for food which is simple and quick to prepare, including instant products, has been observed among consumers. The quality, that is the organoleptic properties, is the first factor judged by the consumer while choosing a product. What is crucial then is the appearance, color, shape, wrapping, as well as the odor, which should be pleasant, sensible and characteristic of a given product.

A cocoa bean can be found in the considerable range of tastes and scents. Over 480 different odor compounds from about 20 different chemical compounds have been identified so far. This makes the cocoa aroma one of the most complicated aroma compositions. The aroma profile of cocoa pulp is a complex combination of the used raw material and of the kind of its processing.

The aim of the research was the analysis of the influence of the raw material content change, the agglomeration process as well as the storage time on the content of volatile compounds in cocoa drinks powder. Basic composition of mixture contained 10% of cocoa and 90% of sugar. Composition was changed by replacing partially or entirely sugar with other raw material – maltodextrine, powder milk and/or whey.

The analysis of volatile compounds was conducted by means of the GC/MS method. It was preceded by the incubation of the examined material at 50 degrees Celsius in 20 minutes time. The percentage distribution of the particular volatile compounds in the entire profile was calculated on the basis of the area under the chart. The analysis of volatile compounds in examined products was conducted directly after their receiving as well as after storage.

Among volatile compounds found in examined products 14 of them were predominating. However, only two were present in all the mixtures and agglomerated products: acetic acid and 2,3-butanodiol. As a result of agglomeration process a decrease in the content of acetic acid was observed. Moreover, whereas the amount of non-sugar constituents in the mixtures rose, the content of acetic acid in agglomerated products rose as well, however, these values were still lower in reference to the corresponding mixtures.

Among compounds which were predominating in mixtures and in their agglomerated products after the storage time, 3 of them were also present in initial analysis. These were acetic acid, 2,3-butanodiol and isovaleric acid. Their behavior was similar to that before storage, but differences between mixtures and their agglomerated products were a little smaller. Furthermore, whereas the number of raw materials used to replace sugar rose in the agglomerated products, the content of benzoic aldehyde decreased.

On the basis of the received results, it was proved that that the raw material content change, the agglomeration process and storage had a statistically crucial influence on the content of volatile compounds.

Key words: cocoa drink, gas chromatography, agglomeration process

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STRUCTURE ANALYSIS OF OSMOTICALLY DEHYDRATED APPLES

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The aim of this work was analysis of changes in the structure of osmotically dehydrated apples in sucrose solution. Samples of apple tissue in the form of 10 mm cubes were subjected to osmotic dehydration in sucrose solution (40, 50 and 61.5%) at temperature 30, 50 and 60°C for 180 minutes. A course of the osmotic process was observed on the basis of water loss, weight reduction, solid gain, changes in water content and dry matter content as well as water activity of samples, as a function of time.

The microscopic structure of raw and dehydrated apples was analysed on the basis of photographs made using scanning microscopy. The degree of changes in the structure of apple tissue depended on conditions of osmotic dehydration process. The smallest tissue damages was observed osmotic dehydration in 40% sucrose solution. Osmotic dehydration affects size and shape of cells, and in consequence also the intercellular spaces. Reduction in shape factor of cells and displacement of its range towards smaller values took place. Osmotic dehydration of apples in sucrose solution caused decreasing of cells number with shape factor between 0.7–0.8. When in raw tissue there were 59% cells from this range, in apple tissue dehydrated during 60 minutes there were 6–27% of this cells, depends on process parameters. Simultaneously number of cells with shape factor smaller than 0.7 increased during the process. Longer time of osmotic treatment led to recovery of cells shape, depending on process conditions. The shape factor of the intercellular spaces of dehydrated apples also was reduced, compared with the tissue not subjected to dehydration. Share of intercellular spaces with circumference larger than 1000 μm increased on average, about 15% in comparison with raw tissue. The circumference, maximum and minimum Feret diameter of cells showed changeability during the osmotic dehydration of apples, and direction of these changes depended on the process parameters.

Key words: osmotic dehydration, apples, microscopic structure, shape factor

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T. Kovalczuk

GC- AND GCXGC-TOF MS – A RECENT CHALLENGE IN FOOD ANALYSIS AND STRATEGY TO GET ACCURATE RESULTS IN COMPLEX SAMPLES

Leco Polska Sp. z o.o.

The techniques of fast gas chromatography and comprehensive two-dimensional gas chromatography (GCxGC) have attained a lot attention in recent years and many practical applications have been reported. The enormously high acquisition speed of TOF and its ability to accurately describe narrow chromatographic peaks match well to the needs of the above techniques. Therefore TOF MS is recently the detector of choice, where mass spectral identification is desirable after fast or comprehensive 2D GC separation. Coupling of GCxGC with TOF-MS detection for the analysis of complex real-life samples will be discussed in the presented contribution, especially focusing on the determination of pesticides and other types of environmental pollutants in food.

Key words: food analysis, gas chromatography

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THE POSSIBILITY OF WHOLE EGG REDUCTION IN SPONGE CAKE PREPARED WITH DIFFERENT ADDITIVES

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The amount of added whole egg affects the cost of baked products such as sponge cakes. It can be reduced by substitution of egg components by cheaper substances but the functionality of cake mixtures should be achieved. The aim of the study was to recognize the possibility of reduction by 20% of whole egg addition to model sponge cake produced with wheat flour. Eggs were replaced by water, whey proteins, mono/diglicerides, maltodextrines, potato starch and/or wheat flour was partially substituted by corn flour (25%). Sponge cakes were prepared at laboratory conditions by mixing (Hobart equipment) selected ingredients. Baking process was performed in electric oven at 180ºC for 48 minutes. The cake volume and colour parameters of the crumb were determined. In addition to that sensory analysis including colour and appearance of the cake crust, colour, structure and porosity of crumb, and taste and odour of fresh cake was carried out. According to the results collected in the study replacement of the amount of added whole egg by 20% with water did not effect cake volume but lowered some texture/quality attributes and slightly increased lightness of cake crumb. The most effective additive in sponge cake mixtures with reduced whole egg by 20% was maltodextrine causing increase in cake volume and improve crumb structure. Addition of whey proteins increased lightness and decreased yellowness of the cake. The substitution of 25% of wheat with corn flour without lowering of whole egg addition resulted in higher yellowness and lower lightness. In addition to that sensory analysis revealed that colour of crust and crumb as well as crumb structure were improved. It can be concluded that whole egg addition in sponge cake formulations could be lowered by 20% without significant decrease in cake volume but some quality characteristics of final product are dropped. To achieve proper colour and texture of the final product maltodextrins should be added.

Key words: sponge cake, egg replacement, maltodextrins

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EFFECT OF DIFFERENT HEAT TREATMENT METHODS ON THE QUALITY PROPERTIES OF PORK

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The aim of the study was to compare the effect of used heat treatment methods on some quality properties of pork. The experimental material included ham muscles cut out form half-carcasses of fatteners born from sows of Polish Landrace (P.L.) breed matted with a cross-breed boar (pietrain x duroc). Material under investigation was divided into two parts (about 370 g each one) and put into baking tin (sample A) or into special nylon baking foil (sample B). Hams thermal treatment was carried out in electric roaster in 170°C for the period of 1,5 h until they were light brown (until the inside temperature reached 90°C). In order to characterize technological efficient and quality of roasted hams, the authors determined: yield of the roasting process, basic chemical components, colour changes, texture parameters, volatile profile and carried out the sensory evaluation of final products.

The results of the performed investigations provided information about differences occurring between samples of ham after two different heat treatment methods. The obtained results pointed to advantageous dietetic and sensory properties of hams roasted with special foil. The results of sensory evaluation confirmed that method of heat treatment have a strong impact on quality traits. Samples A were characterized by more favorable overall acceptability and colour (4,3 and 4,4 points) but samples B were more tenderness (4,0 points). The analysis of volatile components also revealed the influence of used methods on flavor of roasted hams. Meat samples after heat treatment in nylon foil were more aromatic than those roasted in baking tin.

Key words: heat treatment, ham muscles

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J. Krawczyk

EGG QUALITY OF MESSA 45 HENS UNDER EXTENSIVE REARING CONDITIONS

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For many years, a relatively large group of Polish consumers have been interested in buying eggs of hens raised in small flocks, on free range, and under rough backyard conditions, where layers receive farm-produced feed such as whole grains or ground cereals mixed with potatoes. Consumers think of this rearing system as similar to organic and believe that eggs produced under this system are more flavoursome compared to the intensive system and show health-promoting properties (Sokołowicz et al., 2008).

The aim of the study was to determine the effect of the backyard production system of laying hens on selected quality traits of their eggs.

The study was conducted between September 2006 and May 2007 (20–56 weeks of age). Eggs from the commercial hybrids of Polish-bred Messa 45 hens were investigated. Group I (50 birds) was raised in the backyard system with a free range of about 20 m^2/layer. They received farm-produced feed, one-third of which were boiled potatoes mixed with wheat and maize bran, and two-thirds were whole wheat grains containing only 12.08% of crude protein. Group II (control, 60 birds) was kept on litter in a confinement poultry house at a density of 5 birds/m^2. They were kept under environmentally controlled conditions and fed *ad libitum* complete layer diet containing 18.2% crude protein.

Thirty eggs from each group were taken from hens twice: at 32 and 56 weeks of age (November and May).

Differences in egg quality traits were greater in relation to hen age compared to the rearing system. However, the second evaluation at 56 weeks showed a greater number of significant differences in this respect between rearing systems compared to the first evaluation, which showed that the time spent by layers in different conditions was of critical importance.

The present study shows that the eggs of backyard layers had better parameters of freshness and vitamin A but some physical parameters of eggs and eggshells deteriorated. Backyard eggs were characterized by lower total weight and yolk weight, slightly higher cholesterol level in yolk and thinner eggshells with lower crushing strength. This suggests that to obtain good quality eggs under rough backyard conditions, layers should be fed complete diets or at least farm-produced feeds supplemented with high-protein and mineral components, because hens are unable to make up for the deficiency on free range.

Key words: egg quality, physical parameters, chemical parameters

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J. Krawczyk, J. Calik

MEAT QUALITY OF SUSSEX HENS RAISED UNDER BACKYARD CONDITIONS

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Studies with broiler chicken meat have shown that the short period of growth has a negative effect on many meat quality traits. Under the intensive production system, the meat of light laying hens reared for 12 months is used mainly in processing plants as a component of cured meats and meat products, because the meat obtained is hard and thermal treatment takes much longer than for the commonly used meat of broiler chickens. In the backyard system, which enjoys considerable popularity in Poland, hens are used to produce both eggs and meat. Medium-heavy hens such as RIR or Sussex are recommended for this production system.

The aim of the study was to determine the effect of backyard (ChP) and intensive (ChI) production systems of Sussex hens (S-66) included in the genetic resources conservation programme in Poland, on selected technological parameters of their meat.

ChI layers were fed complete standard diets and ChP layers received farm-produced fodders (cereal grains and potatoes). Analysis was performed on carcasses, giblets and breast and leg muscles of 56-week-old Sussex hens. The samples were taken from five birds representing each management system. Muscle acidity was determined 15 min and 24 h postmortem using a CyberScan 10 pH meter. Thermal loss and drip loss after 24 h of cooling were determined in addition to muscle colour, which was analysed using a Minolta reflectance spectrophotometer

The management system had a significant effect on differences in body weight and most carcass quality traits analysed. The mean body weight before slaughter was 1840 g in ChP hens and 2071 g in ChI hens ($P<0.05$). After 24 h of cooling, significantly greater weight losses were found for the carcasses of ChP compared to ChI hens ($P<0.05$). ChP carcasses were also characterized by significantly lower body weight and dressing percentage and lower fatness, with a high variation coefficient ($v>15\%$) for these traits ($P<0.05$ or $P<0.01$). Compared to ChI carcasses, ChP carcasses had a significantly higher proportion of giblets ($P<0.01$).

There were no significant differences due to different management systems in pH of breast and leg muscles, drip loss from breast and leg muscles, thermal loss and water holding capacity. However, better water holding capacity was characteristic of breast muscles from backyard hens. An opposite relationship was found for leg muscles. The leg muscles of confinement hens were characterized by lower drip loss and lower thermal loss. Differences were

found between the groups in muscle colour. ChP carcasses had a significantly lighter colour, lower redness and higher yellowness compared to ChI carcasses, but with large intragroup variation the differences were not significant. Breast muscles of ChP hens were characterized by significantly higher redness (a*) and yellowness (b*) compared to the muscles of ChI hens.

The present study showed statistically significant differences for many meat quality traits between the intensive and backyard systems. These differences were mainly due to differences in layer nutrition.

Key words: meat quality, broiler chicken, intensive system, backyard system

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J. Krawczyk [1], Z. Sokołowicz[2]

CONSUMER BEHAVIOUR AND COMPETITIVENESS OF POLISH EGG PRODUCTION

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Polish legislation, harmonized with EU legislation, has ensured the traceability of production, obligating egg producers to mark eggs. This expensive undertaking will offer a chance for egg producers to eliminate cages from layer production in favour of alternative welfare improvement systems, because it is mandatory to provide a production system symbol when marking eggs.

The aim of the study was to determine the level of consumer knowledge on information that is obligatorily placed on egg shells and egg packaging. The study was carried out by means of the questionnaire method among 564 adults from Rzeszów in 2007. Consumers showed alarmingly low knowledge of the code printed on the egg shells, which contains layer housing system, country of origin and the identification number of the production site, assigned by veterinary authority. Almost 60% of the respondents are unable to read the information conveyed by the code stamped on the eggshell, while others (about 20%) can most often read the country of origin only. Over 50% of the respondents are interested in the management conditions of the hens that laid the eggs. Among the consumers interested in the hen housing system, preference is given to backyard keeping in small farms (about 60%) and rearing on organic farms (18%). The most important factor determining the purchase of eggs from a given rearing system is the consumers' conviction that such eggs have better taste (47%) or show health-promoting value (about 20%). In general, consumers distinguish between two hen rearing and egg production systems: intensive and small-flock (organic or backyard, often associated with ecological). In the intensive system, consumers pay no attention to the hen management system (cage or litter).

The present study showed that consumers fail to use information given on egg shells. The choice of eggs from a given farming system is determined by habit and the consumers' conviction that eggs from extensive systems are of better quality. There is an urgent need to educate people in this regard, because the low level of public knowledge is a threat to the competitiveness of domestic egg production and discourages producers from eliminating cages, which are allowed in the present form until the end of 2011. All the chicken production systems recommended by the European Union as an alternative to cages increase production costs, which should be covered by consumers who pay proportionately higher prices for eggs

from welfare-friendly systems. Considering the inadequate knowledge and indifference of consumers, farms that keep layers in the litter system may no longer be profitable. Following the European example, consumers should be educated by both consumer organizations and egg producer groups. The data from the Central Statistical Office in Poland shows that food accounts for 47.7% of expenses in the group of lowest-income households and only 26.3% in highest-income households and concern the costs of buying expensive foods having special dietetic and taste value. It can therefore be assumed that the increased standard of living will be paralleled by the increasing demand on hen eggs from extensive farming systems, but this requires promotion.

Key words: egg production, consumer behaviour, mark eggs

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QUALITY OF EGGS FROM POLISH NATIVE HENS RAISED UNDER FREE-RANGE CONDITIONS

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The aim of the study was to evaluate the effect of housing system on the quality of eggs from native breeds of hens.

Eggs from Greenleg Partridge (Z11) and Yellowleg Partridge hens (Ż33), kept in different housing systems, were investigated. After a period of rearing under identical environmental and feeding conditions for hens of both breeds, layers of each breed were randomly assigned at 18 weeks of age to one of 2 groups: 60 layers of each breed were kept on litter in a windowless poultry house at a stocking density of 5 birds/m^2 without outdoor access, and 60 layers were raised on litter with outdoor access.

Thirty eggs from hens of each breed and group were collected at 44 weeks of age. The eggs were analysed for the level of higher fatty acids, vitamin A and E content and yolk cholesterol level.

It was found that the protein content of albumen from the eggs of free-range Greenleg Partridge hens was greater compared to the eggs of Greenleg Partridge hens kept without outdoor access, whereas in free-range Yellowleg Partridge hens the egg protein level was smaller compared to the indoor confinement system.

The effect of housing system on cholesterol level was only confirmed for Greenleg Partridge hens.

Eggs from Greenleg Partridge hens raised with outdoor access were characterized by greater vitamin A content compared to the eggs of confined hens, whereas differences in the yolk vitamin A content of eggs from Yellowleg Partridge hens between confined and free-range hens were not significant.

The vitamin E content of eggs from Greenleg Partridge and Yellowleg Partridge hens raised with outdoor access was 56.7% and 49.1% lower compared to the eggs from confined layers.

The yolk level of saturated acids was not affected by the housing system in any of the breeds.

Housing system had an effect on the level of linoleic (C18:1), linolenic (C18:2) and γ linoleic acids (γ C18) in Z11 hens.

Key words: quality eggs, egg production

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CHARACTERIZATION OF AROMA COMPOUNDS IN MEDICAL PLANT GROWN LATVIAN

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In the last years, interest in plant medicines has increased world wide and the use of medical plants has been playing a significant role in maintaining human health. Traditionally in Latvia for medical purposes different herbs, for example, chamomile, marigold etc. are used. Large numbers of components of essential oils interact with physiological systems and valuable properties of these compounds have been established.

The aim of research was to investigate composition of volatile aroma compounds in medical plants grown in Latvia.

Chamomile *Matricaria chamomilla* L., St. John's wort *Hypericum perforatum* L., marigold *Calendula officinalis* L., motherwort *Leonurus cardiaca* L., yarrow *Achillea millefolium* L. were harvested in 2008, air dried (at 30±2°C temperature) and stored in sealed non-transparable bags until analysis. Volatile aroma compounds were extracted using headspace autosampler Turbomatrix (PerkinElmer). For the analysis of volatile aroma compounds, a PerkinElmer Clarus 500 GC/MS equipped with capillary column Elite-Wax ETR (60 m x 0.25 mm i.d.; DF 0.25 μm).was used. Compounds were identified by comparison of their mass spectra with mass spectral library Nist98 and retention times of the standards.

In the headspace of medical plants aroma compounds belonging to different chemical classes were detected: monoterpenes, oxygenated monoterpenes, sesquiterpenes, alcohols, aromatic compounds. The main aroma compounds of investigated medical plants were as follows: in chamomile *E*-β-farnesene, in St. John's wort - nonane, 2,6-dimetylheptane, α-pinene, in marigold α-pinene, myrcene, in motherwort α-pinene, β-pinene and in yarrow – α-pinene, 1,8-cineole. The highest amount of total identified aroma compounds were detected in St. John's wort and marigold.

Key words: aroma compounds, plant medicines

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M. Krzywdzińska-Bartkowiak

ANALYSIS OF THE STRUCTURE OF FINELY COMMINUTED MEAT BATTERS AND PROCESSED MEAT PRODUCTS PRODUCED WITH DIFFERENT ROTATIONAL SPEED OF CHOPPER KNIVES AND BOWL

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The aim of the study was to determine the structure of meat batters, depending on the applied comminution method, using histochemical methods in combination with the computer image analysis system. The investigations were conducted on finely comminuted meat batters and processed meat products. In the experiment four variants were applied of rotational speed of chopper knives and bowl: 1500/10 rpm^{-1}, 1500/20 rpm^{-1} , 3000/10 rpm^{-1} and 3000/20 rpm^{-1}. Results of investigations presented in this study, based on the measurements of dimensions of fat globules and collagen fibers in finely comminuted meat batters and meat products produced from these batters with the use of the computer image analysis system confirmed the suitability of this method to assess the quality of meat-fat emulsion and the final product produced from this emulsion. Obtained images of the microstructure of batters and processed meat products made it possible to identify the investigated objects (fat globules and collagen fibres), while MultiScan software made it possible to characterize changes in their primary geometric parameters. Computer image analysis showed that rotational speed of chopper knives and bowl had a statistically significant effect on the comminution of chopper meat batters. Moreover, it made it possible to determine the optimum rotational speed of the chopper knives and bowl, i.e. 3000/20 rpm^{-1}.

Key words: structure of meat, computer image analysis

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EFFECT OF FATTY EXCHANGE ON NUTRITIONS VALUE AND STABLE OF MODIFIED PÂTÉ

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More and more popularity enjoy the low-energy food (fats content reduced), which determine the new trend in proper nutrition. Many products of meat industry contain significant fat quantities, which is energy and taste carrier. One of these foodstuffs are pâté, pertained to delicatessen hastlets products.

Nowadays consumer market expect from food manufactures the requirements on higher level for nutritional value and food quality (mainly sensory). It is found that requirement for food products, characterized by fats low content, carbohydrates, salt and additional chemical substances, is increase. However fats elimination or replacement recently is making technological difficulties. Fatty materials has significant influence on creation functional products attributes, such as texture, emulsion creation, juiciness and deliciousness characteristic.

The vegetable additions (oat, pea) influence on sensory evaluation, nutritional value and stability of pâté, was investigated described.

The "mazowiecki" pâté and modification (use by oat or pea), were the materials under investigation. The pâté in the industrial conditions with the manufacturing recipe (patent), were produced. It's found that the pâté modification contributed to increasing the nutritional value. Additionally storage time (12 months temperature 8–10^0C), hasn't influence on decrease the pâté sensory quality.

Key words: nutrition value, food quality, low-energy food

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**Alicja Z. Kucharska, Anna Sokół-Łętowska,
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ESTIMATION OF CHEMICAL COMPOSITION AND COLOR OF CORNELIAN CHERRY COMPOTES

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Fruits of cornelian cherry (*Cornus mas* L.) are the valuable source of active compounds, as vitamin C, polyphenols or anthocyanins responsible for the red color. Thanks to their attractive chemical composition and intensive color, fruits of cornelian cherry may be processed into various products, as liqueurs, juices, jams, pure and compotes (stewed fruits). Depending on the variety, processing, and storage, chemical composition and color of cornelian cherry products may be very diverse.

The purpose of this work was to estimate the chemical composition, antioxidant activity and color of cornelian cherry compotes after 1, 6 and 9 months of storage in room temperature.

To get compotes we use fruits of cornelian cherry from Arboretum and Institute of Physiography in Bolestraszyce. The fruits were harvested fully ripe, from five distinct bushes. Stewed fruits were prepared in two variants (W1 – fruits with stones, and W2 – fruits without stones) according to the standard for stewed cherries.

In stewed fruits (separately in fruits themselves and in syrup) after 1 (control sample), 6 and 9 months of storage in room temperature, without light access, the basic chemical composition, anthocyanin contents (HPLC), vitamin C, polyphenols and antioxidant activity (FRAP, ABTS, DPPH) were determined. Color parameters L^*, a^*, b^* and *haze* of syrup were assayed using Color –Quest XE.

After 1 month after stewing, the level of extract and acidity in fruits and in syrup was similar, and was 22-26% and 0,9-1,5%, respectively. In turn, the contents of vitamin C, polyphenols, and anthocyanins, as well as antioxidant activity was higher in fruits than in syrup.

Compotes made of fruits with stones were richer in polyphenols and showed higher activity against radical than compotes made of raw material without stones. Different behavior was exhibited by anthocyanins, the amount of which was greater in stewed fruits without stones, in comparison to those with stones. In turn, in the case of vitamin C no clear tendency was observed.

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Syrups from compotes without stones, exhibited large cloudiness – 10 times greater than syrups from stewed fruits made of fruits with stones.

Fruits and syrup of compotes made according to W1 had higher values of color parameters L^*, a^*, b^* than fruits and syrup of compotes obtained according to W2.

During storage of compotes there was a degradation of active compounds, and what follows, the antioxidant activity lowered. Anthocyanin colors were subject to degradation in the highest degree. Their loss after 9 months was about 90%.

Key words: cornelian cherry, compote, anthocyanins, polyphenols, antioxidant activity

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INFLUENCE OF CLARIFICATION AND STORAGE ON ANTHOCYANINS, VITAMIN C, ANTIOXIDANT ACTIVITY AND COLOR OF CORNELIAN CHERRY JUICE

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Fruits of cornelian cherry (*Cornus mas* L.) constitute an attractive raw material for juice production, because of their color, chemical composition and antioxidant activity.

However, they contain large amount of pectins and other compounds causing clouding, like for example polyphenols. Therefore, during the production of clear juices, clarifying additions should be used. They can however cause a loss of active compounds contained in the raw material.

The aim of this study was to investigate the changes that occur in the anthocyanins, vitamin C, antioxidant activity, and color of cornelian cherry juices, after clarification and storage at different conditions.

The juices were obtained from fruits of cornelian cherry coming from Arboretum and Institute of Physiography in Bolestraszyce. The juice was obtained in the laboratory press, after heating (90°C, 5 min) and depectinization (Pectinex BE XXL; 50°C, 90 min) of fruits. Two doses of bentonite for clarification were chosen: 0.4 g/1l - W1 and 0.2 g/1l W2.

Clear juices were pasteurized (85°C, 10 min) and stored in different conditions (3 months; 4°C, 30°C and room temperature in light and dark). The anthocyanins in juice were analyzed by HPLC method. The Vitamin C content in fruit juice was measured according to the Tillmans method (PN -90/A-75101/1) prior to absorption of pigments into a C18 Sep-Pack cartridge. Total polyphenolics content was measured with the method Folin-Ciocalteu. Antioxidant activity of juice was determined by ABTS, DPPH and FRAP methods. Color was measured by Color –Quest XE and expressed as L^*, a^*, b^* and *haze* parameters.

As the result of clarification, the juice cloudiness was lowered 13 times (W1) and 17 times (W2). At the same time the lowering of the contents of anthocyanins (about 20% for W1 and 9% for W2), vitamin C (about 32% for W1 and 23% for W2), and polyphenols (about 4% for W1 and 3% for W2) was observed, in comparison to the control sample. In juices

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after clarification, values of L^*, a^*, b^* parameters increased 2 times, 1,5 times and 2 times, respectively.

During storage, the temperature affected the degradation of anthocyanins more than the presence of light. In the case of vitamin C, storage losses were high, independently of the temperature and light access. Antioxidant activity of the juices was lowered during clarification and storage. In the juices, during storage, lowering of values of color parameters L^*, a^*, b^* was noted.

Key words: cornelian cherry, juice, anthocyanin, vitamin C, antioxidant capacity

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COMPARISON OF EFFECTIVENESS OF HIGH HYDROSTATIC PRESSURES (HHP) ACTIVITY AND PASTEURIZATION PROCESS ON BIOSTATIC QUALITY OF ALOE TISSUE TOWARDS *CANDIDA ALBICANS*

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The aim of carried research was to evaluate the influence of high hydrostatic pressures (HHP) and pasteurization process on biostatic activity of aloe pulp in relation to *Candida albicans*. Fresh aloe with skin added to the breed of *Candida albicans* caused reduction of investigated fungi from the amount 7,04 $\log_{10}$ jtk/g to around 6,58 $\log_{10}$ jtk/g. The addition of 10% amount of fresh aloe pulp without skin to the breed of *Candida albicans* caused about 0,3 of logarithm cycle lower reduction of investigated microorganisms than when 20% of aloe pulp was added. Stored for 1 day pasteurized homogenate with skin and without skin caused reduction of *Candida albicans* population relatively by 0,4 and 0,6 of logarithm cycle. Pasteurized aloe pulp, stored for 30, 60 and 180 days in cool conditions showed inconsiderable biostatic activity towards *Candida albicans* population. Stated level of reduction resulted in 0,2 of logarithm cycle. The analysis of statistic data revealed that the time of storage ($p<0,05$) was the main factor influencing the biostatic activity towards *Candida albicans.* After observation the following conclusions were drawn: the longer time of storage, the lower the biostatic activity of aloe pulp. Secondly**,** estimated equation of regression for aloe without skin appeared to be of crucial importance ($p = 0,04$, $R^2 = 0,577$).

It was indicated that both, fresh and preserved with high pressure, aloe pulp, than stored for 1, 30 and 60 days, did not show any biostatic activity towards *Candida albicans.* The exception was aloe tissue with skin and without skin, preserved with high pressure of 400 MPa for 10 and 20 min, and then stored for 30 days as it caused reduction of *Candida albicans* population from the amount: 6,87 $\log_{10}$ jtk/g relatively to the amount 4,78 i 6,03 $\log_{10}$ jtk/g and 5,2 and 6,06 $\log_{10}$ jtk/g. In the final stage of investigation the level of biostatic activity of both aloe' forms increased. The addition of preserved homogenate with skin resulted in lowering the number of *Candida albicans* of about 1,1 logarithm cycle for pulp preserved with high pressure of 500MPa, and of about 2 logarithm cycles when 400MPa pressure was applied.

The addition of aloe without skin caused reduction in *Candida albicans* population of 1,4 $\log_{10}$ jtk/g in average.

In case of biostatic activity towards *Candida albicans,* it was stated that for received biostatic activity, time of storage and the level of used pressure ($p \leq 0,01$) were the most important factors influencing biostatic activity. Among investigated double-agent interactions the relationship between the time of storage and level of pressure ($p=0,04$) was of important value. For biostatic activity towards *Candida albicans* the analysis of regression equation for tissue with skin and without skin allowed the statement that the time of storage at critical level $p<0,01$ had significant meaning. Regression equations for forms with skin and without skin appeared to be important and amounted to: $R^2=0,705$; $p<0,01$ and $R^2=0,758$; $p<0,01$.

At a long-term storage period in cooling conditions the form of preparing aloe pulp does not affect biostatic activity towards *Candida albicans,* if the tissue is subjected to high pressure of 400 MPa for 10 min. Pasteurization at 85°C for 20min allows to maintain high biostatic activity of aloe tissue.

Key words: high hydrostatic pressures, pasteurization process, biostatic activity, aloe pulp, *Candida albicans*

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THE INFLUENCE OF CULTIVARS AND FERTILIZERS ON VITAMIN E CONTENT IN OIL PUMPKIN (*CUCURBITA PEPO* L.) SEEDS AND OIL

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The aim of this work was to estimate the influence of different organic and mineral fertilizers on tocopherols (α-, β-, δ- and γ-) content in pumpkin seeds and extracted pumpkin oil. Three field oil pumpkin (*Cucurbita pepo* L.) cultivars 'Miranda', 'Herakles' and 'Golosemiannaja' were used in the experiment. Field pumpkins were fertilized with various fertilizers: 1 – control (without fertilizers), 2- humic acid fertilizers 30 l ha–1, 3 – complex fertilizers 500 kg ha–1, 4 – compost 40 t ha–1, 5 – complex fertilizers (N:P:K = 10:10:20) + humic acid fertilizers (fertilizers mixture) 500 kg ha–1+30 l ha-1.

Analysis of contents of different vitamin E isomers showed the predominance of γ-tocopherol, irrespective of cultivar and fertilization. Significant and moderately strong positive relationship was found between fat-soluble isomers of α-, β-, γ- and δ-tocopherol and oil content in pumpkin seeds (r = 0.57; r = 0.61; r = 0.58 and r = 0.4, respectively). All applied fertilizers have no significant effect on tocopherol isomers content in pumpkin seeds and oil.

Running title: Vitamin E in oil pumpkin seeds and oil

Key words: pumpkin, seeds, oil, fertilizers, vitamin E.

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THE INFLUENCE OF CULTIVARS AND FERTILIZERS UPON AMOUNT OF VITAMIN E IN FIELD PUMPKIN (*CUCURBITA PEPO* L.) SEEDS AND OIL

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Field pumpkin *(Cucurbita pepo* L.*)* cultivars 'Miranda', 'Herakles' and 'Golosemiannaja' were used in the experiment with different fertilizers, carried out in experimental station of Lithuanian University of Agriculture in 2005–2006. The aim of this work was to estimate the influence of different organic and mineral fertilizers on tocopherols (α-, β-, δ-, γ-) content in field pumpkin oil and seeds. Field pumpkins were fertilized with various methods: 1 – control (without fertilizers), 2- humic acid fertilizers 30 l ha^{-1}, 3 – complex fertilizers 500 kg ha^{-1}, 4 – compost 40 t ha^{-1}, 5 – complex fertilizers (N:P:K = 10:10:20) + humic acid fertilizers (fertilizers mixture) 500 kg ha^{-1}+30 l ha^{-1}. Tocopherols (α-, β-, δ-, γ-) have been separated by high-performance liquid chromatography (HPLC) on Pinacle II silica 5 µm particle size, 4,6x150 mm column, according to the method described by Murkovic et al. (1999). Analyses were performed with Shimadzu HPLC 10A system.

The experimental data was subjected to ANOVA, using software STATISTICA (Sakalauskas, 2003). Means and standard errors for the experimental data were calculated. Fisher's LSD test ($p<0.05$) was applied to determine the significance of differences between the means. Regression analysis was carried out to determine strength and character of relationship between the variables.

Analysis of contents of different vitamin E isomers showed the predominance of γ-tocopherol, irrespective of cultivar and fertilization. Significant and moderately strong positive relationship was found between fat-soluble isomers of α, β, γ and δ tocopherols and fats content in pumpkin seeds ($r = 0.57$, $r = 0.61$, $r = 0.58$, $r = 0.4$, respectively).

Key words: field pumpkin, fertilizers, tocopherols (α-, β-, δ-, γ-)

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LAVOUR COMPOUNDS PRODUCED DURING TEMPEH FERMENTATION

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Tempeh is a traditional Indonesian product, made from soy seeds, inoculated with mould, (mainly Rhizopus oligosporus) and fermented. Tempeh is a highly nutritious, easily digestible and delicious food, and is especially interested for consumers looking for products rich in healthy components for their diet. Many publications showed that consumption of tempeh exert positive influence on human health: anti-diarrhoea, anti-oxidative properties and anti chronic degenerative diseases (cancers, heart diseases and osteoporosis). The aim of this study was to estimate the changes in the volatile compounds profile during tempeh fermentation. For tempeh production bean seeds (Phaseolus vulgaris variety Igołomska) and soy seeds (Glycine max variety Noviko) were boiled 5 minutes, dehulled, and boiled again 20 minutes for bean and 40 minutes for soybean and inoculated by spores of Rhizopus oligosporus. The material was placed in Petri dishes and fermented at 37ºC . Samples to analysis were taken every 24 h. 9 g of fermented material was placed in glass tube. Then volatile compounds were absorbed using SPME method, and analyzed by GC-MS. In the first days of fermentation ethanol was found, after two days also pyrazine forming was observed. The amount of caryophyllene produced depended on the Rhisiopus oligosporus strains used for fermentation.

The evaluation of fermentation time, kind of material and species of R. oligosporus used for the process might be estimated by analyzing volatile compound profile of the product. Analysis of flavour compounds is useful for the assessment of fermentation process and quality of the final product.

Key words: flavour compounds, fermentation process

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EFFECT OF NUTRITION DOSE MODIFICATION ON CONTENT OF FATTY ACIDS IN MILK AND BUTTER IN DAIRY COWS

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The aim of this work was an estimation of fish oil use in form of mineral-fat preparation (FO-M), in feeding of high yield cows, on fatty acids profile in milk and butter. The experiment included 20 multiparous cows. Fish oil was given as 1% of DM (563 g/day) in form of mineral-fatty preparation (FO-M) to the experimental groups. The preparation was composed of: fish oil 33%, baidelit 25%, vermiculite 33% and Humokarbowit® 9%. The investigated milk was sampled before beginning of experiment (1 week *post partum*), and after 4 weeks. Production of butter was done in semi-technical conditions. The butter was stored during 3 weeks period. Fatty acids composition was determined in milk and butter samples by using Agilent Technologies 5973 gas chromatograph (GGMS).

The assessment of fatty acid contents in fish oil (FO-M) showed that it features high percentage of polyunsaturated fatty acids (PUFA) – 40.43%, including eicosapentaenoic (EPA) 8.19% and docoshexaenoic acids (DHA) 13.83%. The total of n-6 acids amounted 10.83% and those of n-3 group 29.3%. The FO-M preparation caused decrease of short-chain fatty acids (C4:0 - C12:0) concentration in milk fat as well as it caused the increase ($P \leq 0.01$) of long-chain fatty acids (>C16:0) level already after 4 weeks of using. The CLA content in milk increase to 2.75 g/100 g fatty acid at experimental cows. In control groups, the content of DHA in milk was below of detection threshold. The significant increase ($P \leq 0.01$) of EPA and DHA in milk fat was stated for experimental cows (to 0.46 and 0.25%, respectively).

Organoleptic evaluation of butter showed, that 1% addition of FO had no influence on changes of taste and aroma. The growth of long-chain fatty acids content was affirmed in received butter after 4 weeks of preparation feeding (40.92 g/100g fatty acids). There was also a growth of non-saturated fatty acids. In butter that received from control cows, content of CLA was 0.61 g/100 g of fatty acid, however in experimental group content of CLA was 2.71 g/100 g of fatty acids. There were similar relationships in EPA and DHA content. Storing of butter during 3 weeks period had no significant influence on CLA, EPA and DHA content.

The own research shows, that addition of fish oil to nutritional dose can profitably modify the fatty acids profile in cow's milk. Received butter was also characterized with higher content of CLA, EPA and DHA, that levels did not significantly decrease during storage.

Key words: fatty acids, milk, butter

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THE EVALUATION OF POSSIBILITIES OF APPLE POMACE UTILIZATION FOR ACETIC ACID BIOSYNTHESIS

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Apple pomace is a primary by-product in the apple processing industry. It constitutes about 25–35% of the weight of fresh fruit. This waste material contains approximately 10–20% of sugars in the form of glucose and fructose. A low protein concentration in the pomace, cause that only small part of this by-product can be used as an ingredient in livestock feed supplementation. So disposal of this waste material presents a serious environmental problem.

The aim of this study was to evaluate the possibility of apple pomace utilization for production of an added value bioproduct – acetic acid. The microorganism selected for this process was the yeast of the genus *Brettanomyces*. In the beverage industry, *Brettanomyces* is well known yeast, which cause a microbial spoilage of wine. Their presence in wine is often associated to off-odours described as phenolic, horse sweat, Band-Aid, mousy, wet wool, medicinal, smoky, spicy, etc. The analysis of *Brettanomyces* metabolism shows also their ability to directly bioconversion of glucose to acetic acid, without the alcoholic fermentation. This might be a reason to try to use this yeast as an alternative microorganism to *Acetobacter* bacteria commercially used for acetic acid production.

In the presented work three strains of *Brettanomyces bruxellensis* (Cornell Enology Strain Collection, NYSAES, NY, USA) were tested. The characteristic of growth and vitality of the yeast as well as the metabolism, specially from the point of view of the dynamic and efficiency of acetic acid biosynthesis were performed. It was found, that all the three tested *Brettanomyces* strains were able to produce acetic acid from the sugars from apple pomace, in the aerobic conditions, at the temp. 30ºC and without pH regulation. The highest obtained acetic acid concentration constituted from 43.2 to 49.2 g of acetic acid / kg of apple pomace.

Key words: apple pomace, acetic acid, *Brettanomyces*

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AN ATTEMPT TO APPLY MEDIUM PRESSURE LIQUID CHROMATOGRAPHY TO SEPARATE LYSOZYME OLIGOMERS IN MODIFIED ENZYME PREPARATIONS

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In the study it was attempted to increase the amount of dimer in modified preparations by purifying them with the use of medium pressure liquid chromatography. The analyses were conducted on preparations of thermochemically modified lysozyme. A module set for practical liquid chromatography by Büchi (Switerland) was used to separate individual oligomeric fractions of lysozyme. Columns of 100 and 1800 ml were filled with the stationary phase Fractogel® EMD SO_3- by Merck and Sephadex™ G-75 by GE Healthcare Bio-Sciences AB.

With the use of Fractogel EMD as a sorbent, lysozyme was separated into two fractions F1 and F2, exhibiting considerable variation in the proportions of monomer and dimer, and differing from the original oligomeric composition of modified lysozyme preparation. Fraction F1 was supplemented with dimer, while the primary component of fraction F2 was still the monomer. As a result two preparations F1 and F2 were produced, which contained approx. 72% dimer and 28% monomer, and 77% monomer and 23% dimer, respectively.

In turn, the application of Sephadex™ G-75 as packing material resulted in the production of another fraction, which main component was lysozyme trimer. It was shown that the isolation of trimer was dependent on the conditions at which chromatography was run, first of all on the amount of the sample introduced to the column.

It was shown that produced preparations were characterized by high effectiveness of the antibacterial action against Gram-negative bacteria. The highest activity was recorded for the preparation containing the highest amount of dimer. God effectiveness against these bacteria was also observed for the fraction which main component was lysozyme trimer.

Analyses indicated that medium pressure liquid chromatography may be successfully used to produce modified lysozyme considerably enriched with its oligomeric fractions (dimer and trimer) and exhibiting antibacterial action against both Gram-positive and Gram-negative bacteria.

Key words: lysozyme, liquid chromatography, thermochemically modified lysozyme

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HEN EGG QUALITY TRAITS IN THE ASPECT OF CONSUMER REQUIREMENTS

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Dynamic changes observed in the nutrition patterns as well as in the food quality requirements and wholesomeness require a better cooperation between food consumers, manufactures and researchers aimed improving the quantitative and qualitative attributes of animal production with the current requirements of the society.

The aim of study was the quality evaluation of eggs laid by selected two-strain hybrids obtained on the basis of the local strains of laying chicken.

The experimental material comprised eggs from the following laying hybrids: KA-62, KA-42, KA-68 and KA-48 (National Research Institute of Animal Production-Experimental Farm Ltd Co. in Duszniki Wlkp.). The laying birds were kept under uniform environmental and feeding conditions. Their eggs were taken from birds at 36 weeks of age whereas 100 eggs from each experimental group of layers. The examined physical traits of eggs comprised: egg weight and its main fractions expressed also in percent, albumen height and Haugh units, yolk colour, thickness and colour of egg shell. The chemical analysis comprised the content of crude protein, water, ash and egg albumen and yolk lipids.

The studied physical traits revealed that KA-62 eggs demonstrated the highest weight (62.97 g) and the highest percentage content of albumen in the egg (59.33%) whereas the lowest content of yolk (27.53%). The hybrids also laid eggs of the most desirable albumen quality traits, e.g. the greatest weight (37.38 g), height (7.63 mm) and Haugh units (86.14). KA-68 layers laid eggs of the greatest weight of yolk (17.72 g) and the darkest yolk colour (8.52 points). Moreover those eggs were found to have the greatest shell weight (5.78g) and thickness (368.71 μm), while the egg shell colour varied from 34.06 (KA-62) to 36.81points (KA-48). The chemical analysis of egg content from the examined two-strains hybrid demonstrated egg albumen of KA-48 birds was at the lowest raw protein (9.88%) and ash content (0.84%). Water content in the eggs was in the range from 88.69% (KA-62) to 88.92% (KA-68). The chemical composition of eggs from the studied experimental layers was found to be on relatively equal level. The noted difference in the percentage content of raw protein in the examined eggs reached 0.85% and 1.01% in the fat content as well as 0.19% and 1.04% in the ash and water content. The observed differences were statistically significant.

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KA-62 eggs due to the greatest percentage content of albumen and its most desirable quality traits can be a very good raw material in the manufacture of egg further processed product. On the other hand, the eggs from KA-68 having good egg yolk and shell quality can be used in the bakery industry or in the back-yard hen flocks for the purposes of poultry keepers.

Key words: consumer requirements, egg quality

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SENSORY EVALUATION OF SOUS VIDE – PROCESSED SALAD WITH MEAT IN MAYONNAISE DURING THE STORAGE TIME

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In recent years ready-to-eat meals have become more popular compared to traditionally home-cooked meals. There is strong buoyancy in the ready-to-eat meals sector in Europe due to lifestyle changes and the need for convenience. The ready-to-eat products like salads in mayonnaise have become popular in the Baltic States day by day. Salad business of Latvian food producers is increasing, and it is a very successful one. Consumers expect and demand tasty, safe, high quality salad products. An innovative approach that could give all good sensory properties for salad products and satisfy consumers is using of "Sous vide" technology. The "Sous vide" technology has been used a long time as a method for cooking catering products and enhancing quality and sensory attributes compared with conventional cooking methods. Very recently, "Sous vide" products are being increasingly steered towards the retail market in consumer sized packs as ready-to-eat meals. The purpose of this study was to investigate the sensory evaluation of "Sous vide" − processed salad with meat in mayonnaise during the storage time. The salads were vacuum packaged in polyamide/polyethylene pouches with barrier properties, PURASAL Poewder Opti Form (sodium/potassium lactate) in addition of 0.1% was used as single preservatives for separate sample, applying pasteurization ("Sous vide"). Control samples without preservatives were packed in traditional polypropylene containers covered with non hermetic lids. The studies were carried out for samples after 1, 15, 29, 42 and 52 chilled storage days at temperature +4±0.5 ºC. The intensity of sensory properties of salad with meat in mayonnaise was determined by the line scale, the ranking test. The sensory data were analyzed using Fizz Forms – Sensory Analysis and Consumer Test Management Software. Statistical analysis ANOVA has been used for evaluation of sensory test results. The sensory tests showed good results that demonstrate potentiality to use the "Sous vide" technology for shelf life extending of salad with meat in mayonnaise up to four weeks and more.

Key words: sensory evaluation, sous vide technology, salad with meat

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EVALUATION OF ANTIOXID ACTIVITY OF POLYPHENOLS FROM PLANTS BY MEANS OF ANALYTICAL TECHNIQUES

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The eatable plant material contains various groups of biologically active compounds such as polyphenols, vitamins, proteins, organic acids, sugars, glicosides among others.

Flavonoids, anthocyanins, catechins and other belong to the polyphenols group. Many flavonoids are found in plants (leaves and fruits), herbs and products such as wines, beers, juices, etc., but their presence in mosses and liverworts and even their occurrence in algae has been reported. Over 4000 flavonoids have been identified, many of which occur in fruits, vegetables and beverages (tea, coffee, beer, wine). They are classified into classes according to chemical structure. The important roles of falvonoids are the capillary protective effect and antioxidant activity, the modulation of enzymatic activity, insect attraction or repulsion, nectar guides, viral, fungal, and bacterial protection, etc. Flavonoids are antioxidants and that reason they scavenge free radicals in organisms and protect most important biomolecules such as dna, proteins, lipids from their damaging activity.

Flavonoids are most successfully analyzed by liquid chromatography (lc) techniques. Research on flavonoids requires a variety of analytical techniques including thin-layer chromatography (tlc) and over pressure thin-layer chromatography (oplc). Modern analysis employs mass spectrometry techniques (ms) and electrospray, which have had the ability to elucidate complex flavonoid glycosidic structures through the determination of accurate molecular weights and limited fragmentation patterns. The development of advanced methods of separation e.g. Hplc as well as hplc/ms has been observed especially in qualitative and quantitative analyses of flavonoid mixtures.

The main aim of presented investigations was the presentation of main differences in the concentration of selected flavonoids in tea, rooibos, and honey extracts. For separation of determined compounds from plant material supercritical fluid extraction (sfe) and classical liquid extraction (le) have been used. Methods for the separation and determination of these compounds (le-tlc, sfe-tlc, le-hplc) have been applied. In order to compare tea, rooibos, and honey extracts their antioxidant and radical scavenging activities using reaction detection. Reaction detection was used for on-line determination of free radicals of 2,2-diphenyl-1- picrylhydrazil (dpph) binding by high performance liquid chromatography.

Key words: antioxidant activity, polyphenols, plant material, biologically active compounds

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APPLICATION OF PREDICTIVE MICROBIOLOGY FOR MODELING THE SAFETY OF MOZARELLA CHEESE WITH REGARD TO *LISTERIA MONOCYTOGENES*

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The purpose of the study was to generate predictive models describing the growth of *Listeria monocytogenes* in mozarella cheese and models validation according to data obtained from different dairy products (*www.combase.cc*).

Listeria monocytogenes is a widespread pathogen, which has been detected in many food products, including raw milk and dairy products. It is responsible for many outbreaks, with high mortality rate.

The growth of *Listeria monocytogenes* in mozarella cheese was evaluated in a temperature range 3-21°C (3, 6, 9, 12, 15, 21°C). The traditional plate count method (Oxford and ALOA, Merck) was used to check the number of *Listeria* during storage.

DMFit curve fitting program was used to fit Baranyi and Roberts function as a primary growth model. Estimated growth rate, as a main parameter describing the growth of microorganisms, was plotted against temperature in accordance with Arrhenius and Ratkowsky equation. Validation was performed using bias and accuracy factors.

Listeria monocytogenes grew well in all temperatures, growth rate was higher as the temperature increased. Baranyi and Roberts model provided a good fit to the observed data (high correlation coefficients). The influence of storage temperature was evaluated with the Arrhenius and Ratkowsky models.

Better prediction with the Ratkowsky model was obtained according to bias and accuracy factors. The model was further tested to determine its capacity for predicting the growth of *Listeria monocytogenes* in different dairy products, where more or less acceptable results were obtained. The simulation using the tertiary predictive models (Pathogen Modeling Program, ComBase Predictor) was performed in order to check their accordance with generated models.

It was concluded that usefulness of predictive models describing the growth of foodborne pathogens must be checked with the validation studies carried out in the food products

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of interest. Predictive models generated on microbiological media with defined chemical composition do not describe the growth accurately, and it is worth investing into dairy products-specific predictive models.

Key words: predictive microbiology, *Listeria monocytogenes*

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ACTIVITY OF NATIONAL REFERENCE LABORATORY FOR MONITORING BACTERIOLOGICAL CONTAMINATION OF BIVALVE MOLLUSCS

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In the recent years, significant increase of seafood consumption is observed in Poland. It is no own shellfish production in Poland for reason too low salinity and low temperatures in Baltic sea. However, it is expanding import of these commodities caused by duty abrogation after joining European Union by our country. To ensure public health protection food safety requirements were established for seafood introduced to the market. The microiological criteria relating to bivalve shellfish destined for consumption are included in Regulations (EC) No 2073/2005 of 15 November 2005 and No 1441/2007 of 5 December 2007. With regard to European Union also Poland was obliged to develop and implement system for microbiological contaminants of bivalve molluscs.

National Reference Laboratory which is occupied with this activity is located in Department of Food of Animal Origin, National Veterinary Research Institute in Pulawy. The NRL is responsible for cooperation with CRL(CEFAS, Weymouth) in domain of its competence, co-ordinating activities of the various national laboratories in the Member State, providing scientific and technical assistance to competent authority in the Member State to organize a monitoring system for bacteriological contamination and disseminating information provided by the CRL.

In the aim of evaluation of microbiological contaminants of live bivalve molluscs commercially available in Poland, Department of Food of Animal Origin, NVRI, examined 70 samples of oysters (*Crassostrea gigas*) and 46 samples of mussels (*Mytilus edulis*) in the years 2006–2008. The samples were evaluated in three directions: detection of *Salmonella* spp. and *Vibrio parahaemolyticus,* and number of *Escherichia coli* by most probable number method (MPN). These examinations were performed on the basis of reference, normalized methods: for *Salmonella* spp. – PN-EN ISO 6579:2003, for *Vibrio parahaemolyticus* – PN ISO 8914:2002 and for *Escherichia coli* ISO/TS 16649-3:2005. The number of *Escherichia coli* established by MPN method in none of the samples exceeded acceptable level 230 MPN/100 g of meat and shell liquid. In one sample this number achieved a limit of *E. coli* established for live bivalve molluscs. No *Salmonella* spp. nor *Vibrio parahaemolyticus* was detected in tested 25 g samples.

Currently, we carrying out validation of ISO/TS 21872-1:2007 method for the detection of enteropathogenic *Vibrio* (*Vibrio parahaemolyticus* and *Vibrio cholera*).

NRL for monitoring bacteriological contamination of bivalve molluscs in Poland participates in proficiency testing organized by CRL – CEFAS (ring trials for *E. coli* and *Salmonella* spp. in whole shellfish, detection *Vibrio parahaemolyticus* and detrmination genetic pathogenicity markers – *tdh* and *trh* by PCR). Our department takes part in external quality assurance (Shellfish Scheme), FEPTU – HPA as well as in comparative tests organizing by FEPAS. We also participates in the meeting of expert working groups and training programmes.

Seafood often is a source of pathogenic microorganisms. With regard to European Union directive, each country is obliged to supervise microbiological contamination of bivalve molluscs. The tasks are main activity of National Reference Laboratories for monitoring bacteriological contamination of live shellfish.

Key words: reference laboratory, monitoring bacteriological contamination

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THE EFFECT OF GENETICALLY MODIFIED SOYA ON RABBIT MEAT QUALITY

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The use of ingredients and products from genetically modified plants (GMP) in animal nutrition properly raises many questions, about the possible influence of genetically modified (GM) products on animal health and animal product quality (eg. meat, milk or eggs). The scientific literature in this field is quite scarce. The aim of this study was to determine the effect of genetically modified soya on chemical composition (water, protein fat, and ash content), pH, meat colour (lightness (L^*), redness (a^*), yellowness (b^*)), and meat texture parameters (hardness, springiness, cohesiveness, chewiness) of Thermond White rabbits (n = 44). From 7. to 12. week rabbits were fed pellets containing 20% conventional (nonmodified) or 20% genetically modified soya (*cp4 epsps* gene), and pellets without soya (16.5% protein, a max of 14% crude fibre and min of 10.2 MJ metabolizable energy). Pellets and water were given *ad libitum*. Feeding stopped 12h before slaughtering.

The results showed that the addition of genetically modified soya to pellets hadn't impaired the quality of the meat. The meat of rabbits which were fed pellets with the addition of GMO is to the same extent safe, as the meat originating from traditionally fed rabbits.

Key words: genetically modified, rabbit meat, meat quality

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PHYSICOCHEMICAL PROPERTIES IN HONEYDEW HONEY

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Floral honey is made by honeybees from the nectar of blossoms, while honeydew honey is prepared from secretions of living parts of plants or excretions of plant-sucking insects on the living part of plants. Differentiation between floral and honeydew honey is a response to consumer demands, in many countries nectar honey is valued more highly than honeydew honey but, in other countries, honeydew honey is preferred.

Honey authenticity is defined by the Codex Alimentarius standard, the EU Honey Directive and several national legislations. The Codex and EU standard were recently revised. The authenticity of honey have two aspects. Authenticity in respect of production to prevent adulteration by addition of other food ingredients by correct beekeeping practice and processing. The other aspect concerns authenticity in respect of geographical and botanical origin. As honeys from certain geographical regions or botanical sources attain higher prices than others, mislabeling is of economic interest.

The aim of thesis was to verify the authenticity of honeydew honey by application of physical and chemical parameters, and honey aroma profiles' analysis by using solid phase microextraction (SPME) together with gas chromatography coupled with mass spectrometry (GCMS).

The research material was honeydew honey, accessible on Warsaw market, but coming from different region of Poland and EU.

The outcomes confirmed the hypothesis that the determination of some parameters, such as content of glucose, fructose and sucrose, hydroxymethyl furfural, proline, ash and electrical conductivity, can be helpful in finding adulteration with inverted syrup. Analysis of aroma profiles let us differentiate samples of honey within the precincts of the same type and indicate that this method is useful for honeydew authentication.

Key words: honeydew honey, physicochemical properties

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**Agnieszka Makowska, Wiktor Obuchowski,
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EFFECT OF RAW MATERIAL COMPOSITION AND TECHNOLOGICAL FACTORS ON GLUTEN- FREE PASTA QUALITY

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Coeliac disease is a life-long intolerance of prolamin proteins of wheat, rye, barley and possibly oat. Currently the only available treatment of the disease is strict adherence to gluten-free diet. Unfortunately preparation of gluten-free food is difficult as gluten is the main structure forming protein in flour and it is responsible for the elastic characteristic of dough. It plays an important role not only in bread, but also in other cereal-based food. In pasta gluten contributes to a strong protein network that prevents dissolution of the pasta during cooking.

In this work effect of different ingredients and production methods on the quality of gluten-free pasta was examinated. Pasta samples made of blend of corn flour, corn starch, gluten-free wheat starch, potato starch and defatted soy flour with addition of guar or xanthan gum, emulsifier and egg white were produced by traditional method and by using two screw extruder. At the first stage the effect of raw material composition and production method on pasta samples quality was studied. Pasta samples were subjected to organoleptic analysis. The color of pasta was analyzed colorimetrically in L*a*b scale. The cooking water absorption, cooking loss and texture were measured according to Method AACC 66-50.

The highest scores obtained pasta made of corn flour (70%) with addition of xanthan gum, produced by traditional method. According to panelists the worst quality had the sample made of corn flour (50%) with addition of guar gum produced with extruder. Addition of soy flour to pasta causes color worsening, particularly in samples made by extrusion technology. Pasta samples made by traditional method were better than pasta made by extrusion cooking, but the cooking loss of extruded samples was lower. Cooking water absorption of all the samples were on the same level regardless of production method. Pasta samples with the addition of xanthan gum were valued higher than samples with guar gum.

In the next experiment the effect of raw material and hydrocolloid additives on hardness and firmness of pasta samples was determined.

Key words: pasta quality, gluten-free pasta, starch, firmness

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RELATIONSHIP BETWEEN THE LEVEL OF NITROGEN CROP FERTILZATION, NITRATES CONTENT IN CATTLE FEED AND OBTAINED MILK

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Nitrates have been monitored in soil, cattle feed and milk. Nitrate content in milk was in direct correlation with nitrate contents in feed and soil. At the same time, nitrate content in milk depended also on individual animals. Despite the similar level of crop fertilization, nitrate content varied from 3.8 to 29.2 ppm, depending on the examined animal. Along with the increasing of the nitrate content in feed (200, 750, 1175, 1700 ppm), the nitrate content in milk increased from 7.5 to 32.0 ppm. The feed high in nitrates originated from plots fertilized by high dozes of nitrogen. In most cases, the nitrate excess ranged from 17 to 321 kgha-1. Nitrate content in the soil was directly correlated with that in roughage (cornstalks, alfalfa hay), and in smaller degree with the content in grain. Optimum or high yields of agricultural crops have been achieved when the level of nitrogen fertilization was not high, and vice versa.

Key words: nitrates, milk, cattle feed, soil

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EGG-WHITE CYSTATIN IZOLATION FROM PROTEINACEOUS AGENTS OBTAINED BY ETHANOL EXTRACTION

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Avian egg whites are a rich source of bioactive substances which may find wide application in medicine and food production. One of them is cystatin – reversible, tight-binding, competitive inhibitor of cysteine proteinases. It exhibits antibacterial and antiviral properties and is a factor inhibiting the development of cancer cells.

Several methods of isolation and purification of chicken cystatin have been found. They are mainly based on the combination of liquid chromatographies: ion exchange, gel filtration and affinity chromatography. But still the chalange is to propose cheap and efficient method, which may find an application on industrial scale.

In this study a new method of purification chicken cystatin from egg white is demonstrated. Cystatin was purified from the egg white homogenate by ethanol protein precipitation according to the method by Sokołowska *et al.,* 2007. In the first step of this procedure about 90% of egg-white proteins irrespective of formulation were precipitated. The obtained supernatant contained 50–80% of initial specific activity against papain. In the next step cystatin was purified in an affinity chromatography on immobilized carboxymethyl-papain linked to acrylic resin. The specific activity against papain of eluted protein was 3.0 times higher compared to starting material. The efficiency of the cystatin isolation amounted 37%. The lysozyme activity and residual antitrypsin activity were also presented in isolated material. Lysozyme was further separated by ion-exchange chromatography on slightly acidic Amberlite IRC 50 resin. This preparation resulted the 1.25 fold increasment of cystatin specific activity.

Key words: cystatin, egg, bioactive substances

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INFLUENCE OF SPICES ON QUALITY AND STABILITY OF REFINED RAPESEED OIL

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The aim of the study was to determine the impact of seasoning on oil quality and stability. The material for research was a fully refined rapeseed oil with chosen seasonings (garlic, onion, pepper, parsley, fresh and dry rosemary) in amount of 2% and pure refined rapeseed oil (control sample). The samples of oil were stored for 6 months at room temperature (22 °C – storage test). Oxidative stability of the oils was tested by the Rancimat test (temp. 120 °C, quantity sample 2.5 g, air flow 20 l/h) by induction times. In all oils after the storage test were determined the changes of acid value (mg KOH/g), peroxide value (meqO_2/kg) and anisidine value.

It was stated that the amount of water in seasoning (9–90%) affected the oil quality and stability. Rosemary used in two forms (fresh and dry) had diversified impact on oil quality and stability. The oils with fresh rosemary and parsley were the first to undergo a process of hydrolysis. Dry rosemary (water content – 9%) turned out to be the best seasoning (acid value after 6 month increased only from 0.24 to 0.36) whereas the parsley (water content – 78%) turned out to be the worst (acid value increased from 0.24 to 7.00). In Rancimat test the oil with dry rosemary had the best oxidative stability (induction times – 8.09 h), and the oil with parsley had the worst (4.10 h).

A significant increase in peroxides and secondary products of oxidation (storage test) was observed in all samples of oils. Only the oil with dry rosemary and pepper had higher peroxide values than the control sample. The oil samples with seasoning, after 6 months of storage, had peroxide values lower than the oil without seasoning, it was showed that most of the seasoning has prooxidant properties.

Key words: oil quality, oxidation products, rapeseed oil

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M. Michalski

PRACTICAL ASPECTS OF IMPLEMENTATION OF HACCP SYSTEM

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Regulation (EC) No 852/2004 of the European Parliament and of the Council on the hygiene of foodstuffs requires food business operators (FBO) to put in place, implement and maintain a permanent procedure based on Hazard Analysis and Critical Control Point (HACCP) principles (in Article 5).

HACCP systems are considered to be a useful tool for FBO in order to control hazards that may occur in food. In view of the great diversity of food commodities and manufacturing procedures that are applied to food, it seems useful to issue general guidance on the development and implementation of HACCP based procedures.

Regulation (EC) No 852/2004 allows the HACCP based procedures to be implemented with flexibility so as to ensure that they can be applied in all situations. For this purposes we needs high experienced personnel in HACCP team. Since the adoption of Regulation the Commission has been requested to clarify to what extent flexibility with regard to the implementation of the procedures based on the HACCP principles can be applied.

But some problems may occur during implementation and keep system "alive". This problems are: lack of proper training of personnel and HACCP team; not enough of money for necessary equipment and lack of time; not fully understanding of HACCP idea on managements level; not enough of emotional commitment by production departments; low education level (knowledge) of team leader; no technical and technological experience in team members; too wide range of implementation works for making in the same time; lack of good knowledge of risk analysis/risk assessment in food hygiene and food technology. Very important is to practical skill in working and understanding of decision tree. Not allow to use HACCP plans which are bought or copy from others FOB. Also not proper sampling plan according to technological process. Also to much paper work, additional recording of process parameters without analysis or too much complicated are often not useful in HACCP. This activity should be eliminated by team leaders.

For easy implementation of HACCP system management should be commitment with HACCP system. President/director should be convinced with HACCP system in his factory. Team leader should built fully conscious all workers about profits with HACCP system. Continuously training team members and all workers. All documents should be collected in one place. One person should be obligated to keep yours eyes on HACCP system and be

on time with requirement and law rules on HACCP. Also management shoujd supply team/ responsible persons in computers and, if necessary, in HACCP-PC programs which are very useful for systematic keeping under supervision all system HACCP, including GMP/GHP programs.

Key words: HACCP system, GMP, GHP, practical aspects implementation

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PROFICIENCY TESTING BY ITERLABORATORY COMPARISON (ROUND 1) ON BASIC CHEMISTRY OF MEAT/MEAT PRODUCTS CARRIED OUT IN NVRI IN PULAWY IN 2008

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National Veterinary Research Institute

The aim of interlaboratory proficiency testing was determined proficient of laboratories in range of determined substances. Samples were meat products (sausages) made in National Veterinary Research Institute, Department of Hygiene of Food of Animal Origin in cooperation with meat factory. Each participant received samples of meat products. Laboratorium should determined at least one parameter: sodium nitrate, sodium nitrite, moisture, fat, salt, phosphorus, protein, ash, hydroxyproline, starch. Organizer established term of start of the analysis.

In 5 random select samples from batch/samples were designed for experiment for checking up the homogeneity of meat product samples. Criterion for acceptable homogeneity is $S_s \leq 0.3\delta$. Experiment confirmed homogeneity of materials used in our IPT. Statistical calculations made according to lSO/DIS 13528.

In the interlaboratory proficiency testing 29 labs were participated. The codes of samples were known only organizer and lab, which this number belongs. Participants of interlaboratory testing used normalized methods or these which they using in daily laboratory practice.

To determine certified value was used algorithm A from Polish Standard PN-ISO 57255:2000. Reference value was calculated from results of labs participants. Standard ISO/DIS 13528:2005 was used to identify outliers among participant's data. Results of analysis were provide to organizer in set term on a appriopriate forms.

Parameter of evaluation was "z" – score. Results received in laboratories can be higher or lower than reference value, "z" – score can has positive or negative value. Negative value of "z" – score tells that lab determined lower level of substance than reference value. Positive value of "z" – score tells that determined value was higher than reference value. On basis interlaboratory comparison can accept following criteria for evaluation:

$|z| \leq 2$ = "satisfactory"
$2 < |z| < 3$ = "doubty"
$|z| \geq 3$ = "unsatisfactory"

The value of "z" – score for most of parameters were in range ±2 and only in a few cases value of "z" – score excced ±3. From among received 594 results, 522 had "z" – score in range $|z| \leq 2$. This tells us that results were satisfactory. 72 results were statistic essentially from reference value.

Key words: meat, meat products, interlaboratory testing

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IMPACT OF MARINATING PROCESS ON TECHNOLOGICAL AND SENSORY PROPERTIES OF BEEF MUSCLES

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Marinating, described as diffusion or penetration of mainly water soluble components into the meat structure opens possibilities for better utilisation of raw materials and development of a wider variety of fresh muscle products. The injection process allows more rapid diffusion of the marinade components into the muscles and results in a faster decrease in mechanical strength and increase in tenderness. The bovine carcass has a large number of muscles, but only few of these have traditionally been utilized as steaks or roasts due to the large variability in quality attributes. The aim of this study was to evaluate the impact of marinating process on the technological and sensory parameters of different beef muscles.

The experiment was conducted on muscles from chucks and rounds, sampled from six 1.5 -2.5 years old Norwegian bulls. The following muscles: *Supraspinatus* (**SUP**), *Triceps brachii (**TRB**), Longissimus dorsi (***LGD**), *Vastus lateralis (***VAL**), *Biceps femoris* (**BIF**), *Semitendinosus* (**SET**), *Semimembranosus* (SEM) were examined. Muscles were trimmed after 48 hrs *p.m*., labelled, vacuum-packaged and aged for 6 days at 4°C prior to marinating. The marinated muscles were injected with solution consisted of water (80%), salt (6%), sodium lactate/sodium diacetate (10%) and polyphosphate (4%) to a target of 110% of initial weight, using a Falcon multi-needle injector. Then the muscles were vacuum-packed and stored for 12 days at 1°C. After the storage time the muscles were cut in the 3,5 cm thick steaks, vacuum-packed and earmarked for different analyses. Marinating gain (%) and pH were determined on the raw meat samples. The vacuum packaged beef steaks assigned to assess the cooking loss, tenderness (WB), and sensory attributes were cooked in water bath, chilled in iced water and then stored at -1 °C until analyses.

Results for technological and sensory properties of beef steaks revealed that marinating process had the great effect on the muscles characteristics. Injections of the alkaline marinade to the meat resulted in the significantly higher pH values and weight gain, and lower cooking losses. Marinating improved significantly meat tenderness assessed by sensory panel and instrumentally by Instron. On contrary, the un-marinated samples showed higher values of WB shear force and higher scores for hardness, elasticity and acidic flavour than marinated muscles. The gain% and tenderness were negatively correlated with hardness, elasticity, acidic flavour and WB shear force. The greatest effect of muscle type was revealed for cooking losses and WB shear force. The benefit of marinating processes differed depending on the type of muscle.

Key words: beef muscles, sensory properties marinating process

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THE EFFECT OF RAW MATERIALS ON ACRYLAMIDE CONTENT IN PASTRY

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Pastry constitutes one of most popular groups of willingly consumed food products. According to investigations of TNS OBOP as much as 96% Poles consumes sweet snacks comprising sweet baked goods. Owing to the palatability and attractive appearance these products play an important role in a diet of an average consumer.

Principal raw materials used to prepare the pastry are flour, sucrose and fat. The flour is a rich source of reducing sugars and free amino acids, including asparagine, which are principal precursors of acrylamide. The contents of reducing sugars and free amino acids are dependent upon the type of flour.

Acrylamide is potentially toxic to humans and contributes to development of many health disorders. It is formed through Maillard reactions generating also compounds responsible for taste and aroma of baked products.

This study aimed at determination of the effect of chemical composition of raw materials such as flour and fats as well as the presence of sucrose on concentration of acrylamide in such products as: crisp biscuits, sponge-fat cakes and sponge cakes.

The following fats were used to produce these cakes: Akobake XP 2523 and Vegao MT 73-02 purchased from AarhusKarlshamn, and spread "Kasia". The flours used for backing were as follows: Szymanowską type 480 and Krupczatka type 450 purchased from Polish Mills, and Poznańską type 500.

Dough samples were analyzed for: water content and activity, acidity, pH and viscosity. On completion of baking the products were subjected to the same analyses and additionally tested for acrylamide concentration and sensory properties.

Our results provide evidence that the type of flour and fat decide of the acrylamide content in cakes. The lowest acrylamide concentration was found in cakes produced by using fat Vegao MT 73-02 and flour Krupczatka type 450 manufactured by Polish Mills. Also sucrose affected the concentration of acrylamide in pastry. Its presence increased acrylamide content in sponge cakes and sponge-fat cakes. However, crisp biscuits contained less acrylamide when sucrose was one of their ingredients.

Key words: acrylamide, pastry, chemical composition, raw material

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DIFFERENTIATION OF MEAT OF VARIOUS ANIMAL SPECIES USING TWO-DIMENSIONAL ELECTROPHORESIS

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Authenticity of meat has been gaining in practical importance in recent years and is connected with traceability and a lack of confidence of European citizens regarding the origin of components of meat products. This problem is becoming more and more important in recent years. The main reason for that are outbreaks of danger illnesses related with beef and poultry and adulterations of meat products, which are quite frequent.

According to European Council Regulation (EC) No 178/2002 of Jan. 28th 2002, laying down the general principles and requirements of food law, producers are obliged to precisely label of food products and declare all ingredients. Animal species identification is not easy task, especially after removing of morphological features of meat and after its processing. Adulteration can cause danger to human health also in the case of allergy to protein of certain animal species. The need for meat species identification is also connected with religious customs and traditions concerning meat consumption by certain groups of consumers. Therefore there is still the necessity to work out the specialized, standardized methods for quantitative analysis of components of meat products, which allow the evaluation of meat authenticity.

In recent years two-dimensional electrophoresis (2-DE) has become one of the main tools on proteomic studies. Its primary advantage is the possibility to analyze mixtures of proteins isolated from different systems, such as cell lines, tissues or biological fluids based on two physico-chemical properties of proteins, i.e. isoelectric point (pI) and molecular weight. This method facilitates a simultaneous qualitative and quantitative analysis of hundreds of proteins and their identification, especially in combination with mass spectrometry technique.

The aim of our investigation was species identification of muscle tissue of selected poultry species to distinguish them from pork and beef using 2-DE. The experimental material comprised the samples of muscle (*m. longissimus and thoracis* and *m. pectoralis)* was obtained from pig, cow, chicken, turkey, duck and goose. Both feeding and rearing conditions of the animals were controlled.

This study was supported by the European Commission, project ΣChain, Contract no.: FP6-518451. Developing a Stakeholders' Guide on the vulnerability of food and feed chains to dangerous agents and substances. Available: http://www.sigmachain.eu.

Proteins were extracted by suspending tissue in extraction buffer with CHAPS. The separation in the first dimension (IEF) was carried out on an Immobiline DryStrip pH 3-10, 24 cm long using the Ettan IPGphor 3 (GE Healthcare). The second dimension (SDS-PAGE) was carried out on 15% SDS-polyacrylamide gels (200 x 260 x 1 mm) using Ettan Daltsix Large Vertical System (GE Healthcare). Gels were stained with silver nitrate and scanned using Image Master Scanner.

The protein separations were species-specific. There were visible about 3000 spots of protein on the gels. These preliminary results revealed that the biggest differences in 2-DE separations were found when analyzing proteins with molecular weight below 60 kDa. The final target is to identify species specific proteins using the method of mass spectrometry in which identification is achieved on the basis of analysis of peptide and amino-acid sequences.

Key words: muscle tissue, differentiation of meat, electrophoresis

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Agnieszka Mularczyk[1], Małgorzata Narkiewicz-Jodko[1], Zygmunt Gil[1], Marek Urban[2]

THE EFFECT OF HERBICIDES ON WINTER WHEAT GRAIN HEALTH

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The aim of this study was to evaluate whether chemical weed control can affect fungi occurrence on winter wheat grain, especially taking into account cereal pathogens.

Fungi composition of four winter wheat varieties (Smuga, Zawisza, Kobiera, Nadobna) was investigated. During growing season crops were treated with the following herbicides: Glean 75 WG at dose 0,25 g/ha, Kantor 050 SC at dose 0,1 l/ha, Atlantis 04 WG + Atpolan 80 EC at dose 0,4 g/ha + 1,0 l/ha and Axial 100 EC + Chwastox Extra 300 SL at dose 0,3 l/ha + 3,0 l/ha. Grain from untreated crops was the control. Grain was harvested in 3 following years: 2006, 2007 and 2008. The material came from Regional Station of Institute of Plant Protection in Trzebnica, Poland.

Grain surface and its deeper tissues were examined. Number of isolates of total fungi, *Alternaria alternata*, *Epicoccum nigrum*, and *Fusarium* spp. was evaluated. A dominant species was *A. alternata*, while *E. nigrum* and pathogenic *Fusarium* spp. were occurring on grain lesser but in equal quantities. However, in the last year of experiment pathogenic *Bipolaris sorokiniana* was observed, probably for the sake of weather conditions during growing season.

Herbicide application lowered the number of total fungi both on grain surface and in its deeper tissues. However, the effect of herbicides on separate species was rather weak. Fungi occurring on grain did not depend on wheat variety, but weather conditions during growing season changed the number of evaluated fungi. Summer rainfalls enhanced the increase of number of fungi isolates.

Key words: herbicides, cereal pathogens, wheat grain

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Anne Maria Mullen, Begonya Marcos

APPLICATION OF PROTEOME PLATFORMS IN THE MEAT QUALITY RESEARCH

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Variation in meat quality traits arises from a number of intrinsic and extrinsic factors. In particular quality traits such as tenderness and water holding capacity are influenced both. Inherent characteristics of the muscle give rise to variation in quality for example the rate and level of proteolysis influences tenderness. External factors can impact on these inherent characteristics to result in variations to product quality. Many advances have been made in understanding at a molecular and supra-molecular level the underlying basis of quality traits. Advancements in proteome platforms have greatly aided this effort and have highlighted the potential that further exists in this field. Through the application of tools of proteomics we are gaining a deeper insight into these processes and pathway underpinning many quality traits. In addition we are learning how factors such as processing conditions interact with them to impact on product quality. Knowledge gained from these approaches can be beneficial in defining and optimising management systems for quality, providing assurance of meat quality and in tailoring quality to suit market needs. This presentation will give an update on the applications of this technology in the meat quality arena with particular focus on the research activity at AFRC.

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Key words: meat quality, proteome platforms

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I. Murniece, D. Karklina, Ruta Galoburda

THE EFFECT OF STORAGE DURATION AND COOKING CONDITIONS ON REDUCING SUGAR LEVEL AND COLOUR IN LATVIAN POTATO VARIETIES

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The Maillard reaction between amino acids and sugars is responsible for the development of colour and taste of fried potato products. Whereas intensity of the reaction is related to the sugar content which changes during storage period; this further influences rate of the colour formation.

The aim of the research was to analyse the effect of storage duration on sugar level and colour intensity in five Latvian potato varieties prepared by common cooking methods used in preparation potato dishes.

The research was carried out on five Latvian potato varieties ('Lenora', 'Brasla', 'Imanta', 'Zile' and 'Madara') in two periods: two weeks after harvesting and after a six month period of storage at temperature 5±1ºC and relative air humidity 80±5%. Potatoes were prepared by several cooking methods: roasting in oven (210 ± 5°C), shallow frying (150 ± 5°C) and deep-fat frying (180 ± 5°C). Time and temperature was recorded. Analysis on total reducing sugar, fructose and glucose content as well as the colour (L*a*b*) of potatoes processed with various frying methods were determined.

Differences in colour were significant on the factor b* and a*. Significance in the factor a* was found within the methods of cooking ($p<0.001$) while b* – within all factors considered: method of cooking ($p<0.001$), period of storage ($p<0.05$) and potato variety ($p<0.001$). According to the amount of total reducing sugar it differs per each type of coking method and potato variety. Glucose and fructose content was higher potatoes stoed for longer time. The highest amount of glucose was after storage, in the potato variety 'Zile' (i.e. 0.808 g 100 g^{-1}) while fructose – 'Brasla' (i.e. 0.143 g 100 g^{-1}).

The effect of storage and heat treatment on the colour formation and amount of reducing sugars differs per each potato variety; therefore it is important to figure out which potato variety would be more adequate for each of cooking methods used in the research.

Key words: potato varieties, storage, heat treatment, sugar, colour

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POLYPHENOLS IN EMULSION AND LIPOSOMES AS EFFECTIVE PROTECTORS OF MEET PRODUCTS AGAINST OXIDATION

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Autooxidation is a free radical process of a micromolecules living organisms. In general it concerns lipid's tissues, which are transformed in peroxidation into aldehydes, alcohols, ketones and saturated fatty acid chains. Products of these processes change functions of the cell membrane in living cells, and in the case of fat containing diet they dramatically decrease their sensor characteristics. Usage of natural antioxidants may be the rational protection for the macromolecules in the peroxidation processes because they additionally eliminate the toxic effects caused by artificial protectors.

Our previous study of polyphenols used on liposomes phospolipids membrane in oxidation stress conditions allowed to select extracts from hawthorn (*Crataegus oxyacanta* L), buckwheat (*Fagopyrum esculentum*), rosemary (*Rosmarinus officinalis,* used as standard) and rutin, baicalin and quercetin to further studies in autolipoperoxidation of chicken and beef meat products. The objective of the study was to analyse the antioxidant efficiency of selected polyphenols in form of dry powder, emulsion and liposomes applied to frozen and fresh chicken and beef meat. The level of autooxidation processes was determined by TBARS method in control and in samples containing polyphenols after three days of storage at the temperature 4°C. Results of the study showed higher effectiveness of polyphenols applied to meat in emulsion and liposomes state comparing to the powder form. There was no significant differences in effectivity of the variant polyphenol forms depending on type of meat. A higher antioxidative activity of the polyphenols used in the emulsion and liposomes, than in powder form, may be the results of their better availability to the lipid fraction of muscle tissue when associated with phosphatidylocholine in emulsion or liposomes.

Key words: polyphenols, liposomes, phospholipids membrane, antioxidant activity

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PUMPKIN PUREE ENRICHED WITH QUINCE, CORNELIAN CHERRY, STRAWBERRIES AND APPLES[26]

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Pumpkin in itself is not very attractive as a raw material when evaluated in terms of taste, smell and active ingredients. It seems therefore advisable to blend pumpkin with other fruits, which are aromatic, have a defined taste, and contain a large quantity of active ingredients and organic acids.

The aim of this study was to determine the antioxidative properties of pumpkin puree enriched by the addition of quince, cornelian cherry, strawberries and apples. The pumpkin used in the study was of the variety Karowita, which belongs to the species *C. maxima.*

Ten variants of compositions were prepared: 10, 20 and 30% of quince and cornelian cherry each, and 20 and 30% of strawberry and apple each. The puree samples prepared earlier were mixed, subjected to heat treatment in a thermomix at 900C for 2 mins and poured hot into jars. Than the puree was analyzed for dry matter, extract, viscosity, colour, vitamin C, polyphenols, carotenes and antioxidative properties (DPPH, ABTS and FRAP).

Viscosity was found to vary over a very wide range: from 101227 mPas (at 5 rpm) to 7258 mPas (at 20 rpm). The highest value was determined in the puree enriched with 30% addition of quince, and the lowest value in the puree enriched with 30% addition of strawberries. The brightness of the puree samples (CIElab system) ranged between 39.6 and 60.1. The darkest and the brightest were the samples containing cornelian cherry and quince, respectively. The highest content of vitamin C was detected the in the quince-enriched puree, and was in direct proportion to the quantity of quince added (from 17.88 to 23.43 mg/100 g). The lowest vitamin C content was determined in apple-enriched samples (1.36 mg/100 g at 30%, and 1.6 mg/100 g at 20% enrichment). A similar pattern was observed with total polyphenols: the highest values were measured in quince-enriched puree (from 53.35 to 135.15 mg/100 g), and the lowest in the puree enriched with apples (38.9 mg/100 g at 20%, and 40.55 mg/100 g at 30% enrichment). Quince-enriched puree samples also showed the best antioxidative

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properties. Statistical analysis has revealed a high correlation between ABTS, FRAP and polyphenols content.

Considering the organoleptic and antioxidative properties of the samples, quince-enriched pumpkin puree was found to be the most attractive, and apple-enriched pumpkin puree the least attractive. The results suggest a wide range of application for pumpkin puree enriched with various additives. The puree prepared in this way is of a good organoleptic quality and displays a high concentration of active ingredients with antioxidative properties.

Key words: pumpkin puree enriched, cornellian cherry, strawberries, apple, antioxidative properties

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QUALITY CHANGES IN PORK-NECK PROCESSED WITHOUT ADDITION OF NITRATE DURING REFRIGERATING STORAGE

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Quality changes in pork-neck (boneless) products without nitrate addition, ("home-neck") during refrigerated storage (t = 2±1°C, 4 weeks) were compared. The meat samples was stored: 1 – under modified atmosphere MAP (80% N_2+20% CO_2), 2 – vacuum-packed (VP), 3 – in high permeable film-packed (air atmosphere). Before the storage (time zero) and after 7, 14, 21, and 28 days total count of microorganisms (TCM), psychrotrophic bacteria (TCP), count of *Clostridium* sp., lactic acid bacteria (LAB) and count of *Brochothrix thermosphacta* were determined. The total protein, non protein nitrogen substances, soluble protein content, TBA values, meat acidity and sensory attributes changes were also tested.

It was found that the investigated pork-neck products without nitrate addition were microbiological perishable. After about two weeks maximal growth of all investigated groups of microorganisms was observed, regardless of packaging systems. Initially, *Brochothrix thermosphacta* constituted about 9% of TCM. During storage, the bacterial flora was gradually selected towards *Brochothrix thermosphacta,* independly of packaging system. Finally this species constituted 40–56% of TCM. Sensory changes of high permeable film-packed samples (air atmosphere) was observed after two week of storage. Also TBA values suddenly increased after this time. Changes of chemical and sensory properties of MAP and VP stored products were insignificant.

Key words: pork-neck product, microbiological quality, chemical properties, sensory properties, refrigeration storage

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MICROBIAL CONTAMINATION OF AIR IN MEAT PROCESSING PLANT

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In a meat processing plant, microbiological testing is an essential factor to assure and document the best possible safety and quality of products. Processing areas have been established as a source of microbial contamination in food production.

Presented study aimed at determination of the microbial contamination of air at various stages of meat processing. Six locations along the production line (carcass cutting area, sausages stuffing area, smoking area, maturation area, cold store, packaging area) were examined. The air was sampled using MAS 100 air sampler (Merck). Total count of bacteria, *Pseudomonas* sp., lactic acid bacteria (LAB), hemolytic microorganisms and moulds were determined using standard media. Potential pathogenic bacteria were identified using Bergey's Manual criteria and API STAPH test (BioMerieux). Identification of fungi was performed by morphological traits.

The contamination with bacteria ranged from 1.9×10^2 cfu/m^3 to 2.6×10^4 cfu/m^3 and with moulds 10–1.2×10^3 cfu/m^3 according to analysed area. The sausages stuffing area was the most contaminated. Lactic acid bacteria, *Pseudomonas* sp., *Staphylococcus haeomolyticus* were found in this place. Potential pathogenic bacteria belonging to *Staphylococcus genera* were isolated from smoking area and cold store. Fungal species belonging to the following genera: *Penicillium chrysogenum*, *P. glabrum*, *Acremonium strictum*, *Phoma glomerata*, *Cladosporium cladosporioides* and *Aspergillus* versicolor were isolated.

The levels of air contamination found in presented study were high. The detection of haemolytic bacteria and potential toxigenic fungi indicates that air may be a significant source of dissemination of pathogens. At present there are no official microbial standards for air quality in meat processing plants. The results of our research suggest that air should be established as a control point in HACCP plan.

Key words: meat processing plant, microbiological testing, quality food products

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Regina Olędzka

LEGISLATION RELATING TO NUTRACEUTICALS, DIETARY SUPPLEMENTS AND FUNCTIONAL FOODS IN THE EUROPEAN UNION

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Since the eighties, scientists and producers are working on the development and introduction of food that has not only the standard nutritional value but can also improve health, wellbeing and even prevent development of chronic diseases. The interest in this kind of food is caused by high numbers of people suffering from the civilization diseases in economically developed countries and the need to prevent these diseases by consumption of food with added substances that have a beneficial influence on the body's physiological functions.

Nutraceuticals, functional foods, fortified or enriched food, novel foods, food for special dietary uses and dietary supplements are terms that consumers not always completely understand but they can see the connection between these terms and health protection. The production of this kind of food is increasing quickly. For example nutraceuticals are a significant sector of food industry. In United States it is estimated to be worth 30 mld dollars a year and it is increasing by approximately 5% a year. The challenge for the authorities responsible for the food safety, as well as food and nutritional specialists, is to keep the expansion of lucrative business (irresponsible opening of the market) and adequate consumer protection, balanced. This is especially important in ensuring adequate security of quality of these products and regulation of laws about production and everything related to sale and usage. The other important aspect is to define the level of effectiveness and prove it with scientific methods. In this paper will be presented the definitions of nutraceuticals, functional foods, examples of usage and roles in the health protection. There will be as well a brief review of regulations regarding usage of nutraceuticals , dietary supplements and functional foods, . in Europe and other parts of the world. The problems of legal control in European Union of nutraceuticals derived from plants will be discussed.

Nutraceuticals and functional foods will play the major role in maintaining good health, and prevention of chronic diseases, in the coming years.

Key words: nutraceutical food, functional food, legislation

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Jan Oszmiański, Aneta Wojdyło, J. Kolniak

QUANTIFICATION OF PHENOLIC COMPOUNDS AND ANTIOXIDANT ACTIVITY FROM DIFFERENT VARIETY OF APPLE POMACE

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Residues from the processing of fruits and vegetables, traditionally considered as an environmental problem, are being increasingly recognized as sources for obtaining high-phenolic products. The polyphenolics from waste materials deriving from agro-industrial production may be used as functional food ingredients and as natural antioxidants to replace their synthetic equivalents that have experienced growing rejection. Pomace is the residue remaining when fruits are processed for juice, wine, or other products. Many studies reported the fruit pomaces contained abundant phenolic compounds might be useful raw materials for creating new value-added products.

This study investigated the phenolic compounds and antioxidant properties of apple pomaces made from different apple cultivars used in juices industry. The content and relationships between the phenolic compounds and their antioxidant capacities were also assayed.

Thirteen advanced apple cultivars (Ozark Gold, Arlet, Szampion, Jonafree, Rubin, Rajka, Jonathan, Gold Elstar, Ligol, Topaz, Idared, Gloster, Elstar) were picked at commercial maturity during 2007 harvest season from the Research Station for Cultivar Testing in Zybiszów near Wrocław. Apple pomace was obtained after juices pressing. The phytochemical composition (flavanol, hydroxycinnamic acids, flavonols, dihydrochalcones and anthocyanins) of the pomaces were analyzed by HPLC, and *in vitro* antioxidant activity (DPPH$^{\bullet}$ assay).

Five major polyphenolic groups have been found in apple pomace: flavanols > hydroxycinnamates > dihydrochalcones > flavonols and anthocyanins. HPLC analyses have shown that rich in polyphenol compounds was Shampion (347,5 mg/100g of pomace). The pomace from varieties: Ligol, Gloster, Jonafree and Szara Reneta contained the lowest amount of polyphenol compounds. The proanthocyanidins are the major group of apple pomace polyphenols. The content of procyanidins was from 2380.3 to 536.42 mg/100g dm. Large variation was found in the antioxidant activity among in the studies varieties. Polyphenols responsible for the antioxidant activity in apple, are still present in the pomace, therefore the TEAC was very high. Ozark Gold and Shampion possessed the greatest antioxidant capacity, than other varieties.

The apple pomace could provide a cheap and readily available source of dietary antioxidants.

Key words: antioxidant capacity, phenolic compounds, apple pomace

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T. Pakulski, A. Jarzynowska

OBSERVATIONS ON THE COMPOSITION AND QUALITY OF SHEEP MILK COTTAGE CHEESES MADE USING DIFFERENT METHODS

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The aim of the study was to determine the composition and nutritive value of cottage cheeses produced by three different methods from the milk pf prolific-dairy Kołuda sheep in the spring-summer season (May-August) over two successive years.

The control product was "traditional" (Tr) rennet cottage cheese. The experimental cottage cheeses were made from all milk proteins using two methods: a) acid-rennet (Tkp) – after preliminary acidification of milk with butter cultures, rennet was added and they were curdled for several hours (10-12) at room temperature (21–30°C); b) serwit method (Ts) – by precipitation of some proteins at 93–95°C using calcium chloride solution and after cooling the milk of the other proteins using the rennet. Milk was obtained after weaning of lambs at 56 days on average from adult sheep milked twice daily.

Each type of cheese was boiled four times in the first year and five times (at intervals of 2–3 weeks) in the second year of the study. Cheese yield and retention of milk components in cheese were determined. The cheese and milk samples were analysed for composition (solids, protein and fat) and mineral content, and fat was analysed using gas chromatography for the content of individual fatty acids, CLA and cholesterol. The results obtained were analysed statistically by two-way analysis of variance using Statistica software. The milk used for making different cheeses did not differ in the basic composition, mineral content and lipid fraction profile. The sheep milk differed in composition between the first and second year of the study. In the second year, the milk contained more solids (17.01 and 18.36%), protein (5.60 and 6.13%), solids not fat (SMB – 10.74 and 11.98%), Zn, Fe, Cu, Mg, Ca and P, and the lipid fraction contained more cholesterol and PUFA (including Ω-6) and less saturated medium chain fatty acids. The cottage cheeses, which were made using different methods, differed in composition (the content of solids, ash, lipid proteins being Tr – 41.70, 2.56, 17.93 and 17.13 in Tr, 35.89, 1.45, 14.11 and 15.53 in Tkp, and 37.49, 2.71, 16.27 and 15.32% in Ts, respectively). Except for fat, the other differences were statistically significant. Cheese yield was highest for Tkp (39.4), intermediate for Ts (35.3) and lowest for Tr (25.9%) – $P<0.01$. The retention of all milk components was higher ($P<0.01$) in the cheeses made

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from all milk proteins (Tkp and Ts) compared to traditional cheese and amounted for solids, protein and fat to 63.3, 80.3 and 72.8 in Tr, 76.5, 91.6 and 91.4 in Tkp, and 73.6, 93.3 and 83.9% in Ts, respectively. Ca : P ratio was less favourable for Tkp compared to other cheeses (Tkp – 0.876, Tr – 1.482, Ts – 1.593). Compared to Ts cheese, Tr cheese contained more Zn, Fe, Ca, Mg and P, and less Na. The cheeses compared did not differ markedly in energy value (Tr – 242.3, Tkp – 215.4, Ts – 216.8 kcal). No marked differences were found between the cheeses in the content of individual fatty acids and fatty acid groups in fat, in the relationship between them, and in cholesterol level. There were differences in cheese composition between the first and second year of the study. As in milk, cheeses in the second year contained more solids and protein.

Key words: sheep milk, cottage cheese, nutritive value

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T. Pakulski, E. Pakulska

EVALUATION OF THE USEFULNESS OF MERINO MILK FOR PRODUCTION OF MOZZARELLA-TYPE CHEESE AND SEMI-HARD CHEESE FROM ALL MILK PROTEINS

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The aim of the study was to determine the usefulness of Merino milk for production of mozzarella-type cheese (Owc – "Owcarela") and semi-hard maturing cheese from all milk proteins (WBM) in an on-farm processing plant. Semi-hard maturing cheese (PT – "Kołudzki cheese") was the control product. The study was conducted over two successive years. Cheeses were produced five times in the first year and four times in the second. Cheeses were produced as follows: for mozzarella-type cheese (Owc), pasteurized milk was cooled to 36–34°C, treated with appropriate cheese cultures and rennet. After curdling, the clot was cut and after secretion of whey, cheese mass was pressed for 0.5–1 h, cooled in ice-cold water for 30 min, placed for 24 h at 4–6°C, sliced and scalded. Thereafter cheese mass was plasticized, cheeses were formed, salted in 16% brine (30 min) and packed after drying. The cheese from all milk proteins (WBM) was produced as follows: milk with calcium chloride (5 g/100 kg) was heated to 90–92°C, cooled to 34–36°C, adding the remaining part of calcium chloride (15 g/100 kg), acidified with cheese cultures and treated with rennet. After curdling of milk, the procedure was the same as for semi-hard cheese production. Semi-hard cheese was made from pasteurized milk, which was inoculated with cheese cultures and treated with rennet. Both semi-hard cheeses were subjected to pretreatment of cheese mass and moulding of cheeses, which were pressed for 20–24 h, salted for 24 h in brine solution and placed in a ripening room (10–12°C) for 5–6 weeks. No differences were found in the composition of milk used to make different cheeses. In the first year of the study, the milk was characterized by lower ($P<0.01$) content of protein (5.87 and 6.64%) and solids not fat (SMB, 10.66 and 11.97%), less favourable protein: fat ratio (0.652 and 0.803), higher content of minerals: Ca (2.49 and 2.29), Mg (0.22 and 0.21), Na (0.68 and 0.55) and P (1.85 and 1.61 g/kg) and lower Ca : P ratio (1.349 and 1.420, respectively). Differences were found between the first and second year of the study in the fatty acid content and proportions between fatty acid groups in milk fat. It was shown that semi-hard cheese from all milk proteins and mozzarella-type cheese can be produced from sheep milk in an on-farm processing plant. The cheeses were characterized by the following parameters: content of solids, protein and fat was 55.3, 23.3

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and 19.92 in Owcarela, 55.6, 23.0 and 20.5 in WBM and 56.8, 21.3 and 23.0% in PT, respectively; energy value was 305, 306 and 329 kcal; protein/fat ratio was 1.18, 1.18 and 0.93; fatty acid profile of cheese fat was 14.3, 15.9 and 16.2 g/100 g fat except for lower content in Owcarela cheese ($P<0.05$). In general, however, the content of individual groups of fatty acids in cheese fat (saturated, mono- and polyunsaturated, Ω-6 and Ω-3, DFA and OFA) and the proportions between them remained at a similar level. Owcarela and WBM cheeses had a higher content of protein in solids (42.17 and 42.01, respectively) compared to PT cheese (35.57%), retention of milk proteins was highest in WBM (90.97), intermediate in PT (88.21) and lowest in Owcarela cheese (81.79%), which was also characterized by lower cheese yield (Owcarela – 21.8, WBM – 25.8, PT – 25.5%). The cheeses differed in the mineral content: Owcarela cheese had a higher content of Zn (28.1, 24.8 and 22.8), Fe (3.0. 2,3 and 2.3 mg/kg), Ca (9.7, 8,0 and 8.3), Mg (0.50, 0.42 and 0.43) and P (6.25, 5.05 and 5.43 g/kg) and a lower content of Cu (0.26, 0.36 and 0.31 mg/kg), Na (9.2, 12.7 and 10.2) and K (0.58, 0.68 and 0.77 g/kg) compared to the other cheeses, which showed no important differences except the lower potassium content of WBM cheese.

Key words: mozzarella-type cheese, semi-hard cheese, milk proteins

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DETERMINATION OF BIOTIN CONTENT IN MOLASSES AND YEAST SAMPLES

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Biotin is one of the crucial factors influencing on economics of propagation and the rising power of baker's yeast. In this work biotin content in molasses and yeast biomass samples obtained after cultivation was investigated.

Two methods of biotin assays were employed: microbiological with *Saccharomyces cerevisiae 225* test strain and the ELISA method based on biotin-avidin affinity. Biotin concentration in molasses samples was in range: of 0,9 µg/100g to 2,5µg/100g of d.m. whereas in yeast biomass it's concentration was: 25–43µg/100g of d.m. Results obtained by means of ELISA method were approximately 7% lower than obtained with microbiological method for the same samples. Microbiological method was time consuming but not expensive (price was calculated per one sample), ELISA method may be considered more specific and approximately 6 times faster, however was more expensive.

Thanks to the results obtained during this research it can be concluded that both methods can be used for biotin assay in the molasses and yeast biomass.

Key words: biotin, molasses, yeast biomass

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CLOUDY APPLE JUICES – QUALITY ASSESSMENT ON THE BASIS OF POLYPHENOL CONTENT AND THE ANTIOXIDANT ACTIVITY

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The production and consumption of cloudy fruits juices have increased significantly during last years in Poland (Nosecka, 2008). Apples and their juices, because of their relatively high consumption in our climatic region, are important dietary sources of pectin – soluble fraction of fiber, vitamins and wide variety of polyphenolic compounds (Aprikian et al., 2003). However, little is known about the antioxidant activity of cloudy apple juices and especially the cloudy apple juices with berry juices and species addition. The aim of this study was to evaluate the quality of fresh cloudy apple juices, available on the Polish market, on the basis of their polyphenol content and on their radical scavenging antioxidant activity.

Thirteen fresh apple cloudy juices with different berry juices and spices additions were obtained both from the manufacturer and also from local supermarkets. Total polyphenol content of cloudy apple juices were measured by Folin-Ciocalteu method (Singleton and Rossi, 1965) and the radical scavenging antioxidant activity was quantified by the TEAC method (Tyrakowska, 1999) using ABTS kation radical and DPPH method (Yen and Chen, 1995). Based on polyphenol content, the TEAC values and DPPH values marked differences in the radical scavenging antioxidant activity of cloudy apple juices, delivered by the various producers, were demonstrated. Influence of berry juice addition on cloudy apple juice antioxidant activity is increasing in following order: cranberry > elderberry > blackberry > aronia. Significant correlations between polyphenol content and antioxidant activity values (TEAC and DPPH values) of fresh cloudy apple juices with different additions indicate that their antioxidant activity mainly depends on their polyphenol content. These correlations provides the basis for the application the antioxidant activity values as a parameters to assess the quality of polyphenol-rich food products, like different fruit juices.

Key words: apple juices, quality, polyphenols, antioxidant activity

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EFFECTS OF NON-MEAT ADDITIVES ON THE FORMATION OF HETEROCYCLIC AROMATIC AMINES IN GRILLED MEAT

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For several years, there has been conducting numerous research aiming at defining factors which influence the formation of HCAs and possibilities to decrease the HCA's content in food. Research has shown that the non-meat additives applied in meat products during the process of production and thermal treatment conditions play a major role in HCA's synthesis.

Grilling in high temperature is conducive to HCA's formation and as a result, the actions have been undertaken in order to get a proper selection of marinades which reduce synthesis of mutagenic and carcinogenic HCAs.

The purpose of the study was to find the influence of non-meat additives on speeding up or inhibition of HCA's formation in meat during grilling.

The study was carried out on beef (*musculus longissimus dorsi*). Marinated muscles and a sample test were put to thermal treatment and then they were analysed. The meat was grilled for 10 minutes at 230°C. Isolation and purification of HCA's fractions were carried out using solid – phase extraction. The samples were analysed by High Performance Liquid Chromatography and mass spectra.

Four different heterocyclic aromatic amines (2-amino-3-methylimidazo [4,5-*f*]-quinoline (IQ), 2-amino-3,4-dimethylimidazo[4,5-*f*]-quinoline (MeIQ), 2-amino-3,4,8-trimethylimidazo[4,5-*f*]quinoxaline (DiMeIQx) and 2-amino-1-methyl-6-phenylimidazo [4,5-*b*]pyridine (PhIP)) were found in meat extract. The results proved that many different non-meat additives have an influence on the amount of HCA's formation.

Key words: additives, heterocyclic aromatic amines, grilled meat

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ACRYLAMIDE FORMATION IN EXTRUDED CORN SNACKS AS AN EFFECT OF PROTEIN PRODUCTS AND RYE FIBER ADDITION

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Acrylamide (AA) was discovered in certain starch-based foods (e.g. French fries, potato chips or different snacks). AA is formed during heating at high temperatures, above 120°C. High amounts of this chemical compound was discovered in food products subjected to high-temperature terming processing (i.e. frying, banking, roasting or extrusion).

The aim of the experiment was to determine potato protein, dried distillery yeast and rye fiber addition on acrylamide formation in corn snacks during HTST extrusion.

As a raw material fine-grained maize semolina of 500–1250 μm was used. As the additives there were used: salt, soybean protein isolate Supro 595, yeast Safethanol 3035 produced by Fermentis, potato protein concentrate in the quantities of 6% and extruded rye fiber (10%) obtained during the experiment.

Dry components were mixed and the moisture of obtained mixtures was adjusted to *ca*. 14% by adding an appropriate volume of water. The process of extrusion was carried out on a laboratory single-screw extruder (Brabender type EAV 650) using the following parameters of the process: the screw with the compression ratio of 4:1, speed of screw rotation – 160 rpm, screw load of 5 A, die of 4 mm in diameter. The temperature in particular three zones of the extruder reached: 140/160/180°C. There was determined in obtained snacks acrylamide content due to the method elaborated by Hoenicke et al. (2004), Rosén and Hellenäs (2002), modified at Department of Food Technology and Storage, Wrocław University of Environmental and Life Sciences, with the use of HPLC-MS-MS apparatus.

As an effect of carried over research there was stated that the introducing of protein products to snacks' recipe did not have the synonymous influence on acrylamide formation in extruded snacks. Any significant effect of soy protein isolate, distillery yeast and extruded rye fiber on the content of this toxic substance in ready products was stated. Only potato protein concentrate addition affected acrylamide content in obtained corn snacks which increased from 70 μg/kg in snacks without any additives to 370 μg/kg in ready products when potato protein preparation was used.

Key words: acrylamide, extruded corn snacks, potato protein, rye fiber

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Dorota Piasecka-Kwiatkowska, J. Czubiński

PURIFICATION OF ANTIBODIES FROM CRUDE SERUM FOR THE DETECTION OF GRANARY WEEVIL (SITOPHILUS GRANARIUS L.) IN WHEAT GRAIN BY ELISA METHOD

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Poznań University of Life Sciences

The granary weevil (*Sitophilus granarius* L.) belongs to group of grain pests causing hidden infestation, because it larvae are developed inside the kernel. There are available several methods for the detection of hidden infestation of wheat but each of them have some limitation. The immunochemical methods based on reaction between specific antibody which recognized trace amount of antigen in mixture of different substances are promising method for detection hidden insect infestation of cereal grains. The few years ago first step were made in application antibodies developed against insect α-amylase to early detection of granary weevil cereals infestation.

The purpose of the study was to purify antibodies from crude serum for the detection of granary weevil hidden infestation in wheat grain by ELISA.

The serum was obtained from two rabbits which were immunized by α-amylase digestive enzymes isolated from granary weevil. Antibodies from serum were purified by protein A chromatography as well as protein G chromatography on AKTA Prime FPLC protein purification system. Purification efficiency was checked by ELISA method with obtained antibodies against α-amylases from granary weevil and wheat. Before detection protein concentration of the antibodies were uniformed.

It was stated that immunoreactivity of antibodies obtained from two rabbits were different. The serum as well as purified antibodies obtained from female rabbit were neither specific for α-amylase from granary weevil extract nor wheat. However the serum and purified antibodies from male rabbit were specific against *Sitophilus granarius* L. α-amylase. The immunoreactivity of antibodies purified on protein A chromatography as well as protein G chromatography were the same. Protein concentration of antibodies obtained from purification on protein A was higher compare to protein G whereas the volume were the same. For purification of antibodies obtained from crude rabbit serum for detection of granary weevil (*Sitophilus granarius* L.) in wheat grain by ELISA it is recommended to use chromatography by protein A.

Key words: ELISA, wheat grain

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Dorota Piasecka-Kwiatkowska, Sylwia Mirek, M. Pawlak

DETECTION OF HORDEIN IN BEER BY ELISA WITH COMMERCIALE ANTIGLIADIN ANTIBODIES

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Celiac disease is a permanent intolerance to gluten prolamins from wheat, barley, rye and in some patients oats. Patients affected by celiac disease have to avoid eating of food containing these cereals. Also beer is a beverage not recommended for celiac patients. The reason is fact that wheat and barley are raw materials for beer production. During malting and fermentation process, barley hordeins are hydrolyzed into smaller peptides. Generally no hordein proteins can be found in beer but peptides resulting from digestion of hordeins may be present. Barley hordein might have a polypeptide chain including 300 amino acids in it sequence, polypeptide few amino acid residues in the chain but can be still toxic for celiac patients. Even if only peptides remain in the final product after the brewing process, it can not be excluded that beer still contains traces of gluten.

Different methods of analysis are used to assess gluten content in food. Among them the most commonly used quantitative methods to determine gliadin content of food for celiac patients are immunoassays. Commercially available test kits can detect gluten in wheat and rye, but have limited reactivity to barley hordein and peptides resulting from enzymatic degradation of prolamins.

The purpose of the study was evaluation the practical efficiency of SIGMA polyclonal antigliadin antibodies (A1052 and G9144) as analytical tools for the detection of hordeins in beer by western blotting and ELISA. Both conjugates cross react with prolamins fractions of barley, rye, soy and oats. The prolamin content was determined in laboratory worth obtained from barley malt and 24 beer samples by direct and indirect ELISA. Identification protein fractions recognizing by studied antibodies was made by western blotting. In both methods hordeins isolated from brewery barley malt and gliadin (SIGMA G3375) were used as standards.

The specificity of utilized antibodies was different. The utilized in indirect western blotting SIGMA polyclonal antibodies (G9144) exhibited poor cross-reactivity and sensitivity for peptides from barley malt. These polyclonal antibodies were specific only to hordein fraction but not adequately measure hydrolysed prolamins so they are not useful in ELISA for determination of gluten content in beer. The polyclonal antibody A1052 which was utilized in direct detection was specific to hordein as well as to the product of it degradation. These antibodies can be utilized in direct ELISA for prolamins detection in beer.

Key words: ELISA, gluten, food

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Małgorza Piecyk, I. Łyczko, Anna Bzducha, Mieczysław Obiedziński

CHARACTERISTICS AND ASSESS OF THE QUALITY OF CHOSEN DIETARY SUPPLEMENTS CONTAINING FATTY ACIDS OMEGA-3 AND OMEGA-6

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Warsaw University of Life Sciences

The aim of the study was to evaluate the quality of chosen diet supplements of fatty acids from the group of omega-3 and omega-6. All supplements were accessible on the Varsovian market. The experimental material were 8. diet supplements of fatty acids differ from each other considering producers, mass of the capsule, content of fatty acids and addition of not fatty compounds, like extract from the garlic, folic acid or other vitamins.

The experiment included the evaluation of declaration of producer taking into account the agreement with Regulation of Health Minister obligatory in Poland. The analytical part of work included the qualitative and quantitative investigation of fatty acids composition. The gas chromatography conjugated with mass spectrometry was applied. Obtained results were compared with declaration of producer and literature.

On the basis of analysis of declaration it was concluded that most from them had been incomprehensible, as also misguided consumer. Two from the declaration contained errors resulted from miscalculation because the mass of capsule were not taken into account during calculation of fatty acids content per capsule. Results of the qualitative analysis of examined supplements obtained with GC / MS showed that, in most cases, the profile of fatty acids overlapped with the profile of fatty acids of raw materials used for their production. However the quantitative analysis showed that, in two events, the appointed quantitative content of the group of fatty acids had run away from the declaration, while the calculated percentage participation of the same acids was in agreement with the declaration. It resulted from errors in declaration. Besides, in most of supplements, only partial agreement with the producer declaration was stated. It means, that only for some acids the value given at the label answered the real content. It was probably due to variation in the composition of fatty acids in raw materials because the season of production, the place of the fishing or the fish kind. Only in one preparation of diet supplement the content of all analyzed fatty acids (these for which the producer placed the information on the label) answered to values given in the declaration.

Key words: fatty acids, diet supplements

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Małgorzata Piecyk, Barbara Nowak, Beata Drużyńska

CONTENT OF SOME SELECTED BIOLOGICALLY ACTIVE COMPOUNDS AND THEIR INFLUENCE ON ANTIOXIDANT PROPERTIES OF TOMATO PRODUCTS

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The objective of this research was to determine the contents of high activity compounds in tomato products and their influence on antioxidant properties of these preserves.

The research material were three tomato juices and three tomato pastes commonly available in Warsaw markets. In these products licopene by spectophotometric method, vitamin C by xylene method and total polyphenols by Folin method were determinated. Antioxidant properties of compounds in examined extracts were investigated using $DPPH^{\bullet}$ radicals and $ABTS^{\bullet+}$ cation radicals. The ability of those extracts to chelate iron ions (II) was determinated also.

The content of licopene was included in range 7.56 – 9.29 mg% in juices and 33.69 – 50.73 mg% in pastes. However, contents of total polyphenols was differentiated in range from 55.5 mg% in juice 3 to 193.7 mg% in paste 3. The greatest amount of vitamin C was obtained in juice from fresh tomato (18.3 mg%) as contrasted with pastes (10.22 – 15.78 mg%).

The ability to deactivate stabile $DPPH^{\bullet}$ radicals was higher for the preparation obtained by methanol extraction (57.99 – 99.48%), than by the compounds from chloroform extraction (14.76 – 38.51%). However, activity of hydrophilic compounds against $ABTS^{\bullet+}$ radicals was enough low and included in range 7.0 – 36.4%. The ability to chelate iron ions (II) by extracts from tomato products was in the same range and was included in narrow range 96.9 – 98.8%. Gotten results have allowed determination of dependence between contents of biologically active compounds and antioxidant activity. The strongest correlation was observed between ability to inactivate $DPPH^{\bullet}$ radicals by compounds in chloroform extracts and licopene amount, so between ability to inactivate $ABTS^{\bullet+}$ cation radicals by components in methanol extracts and total polyphenols amount.

Key words: biologically active compounds, tomato products

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CONCENTRATION OF BY-PRODUCTS IN RYE AGRICULTURAL DISTILLATES OBTAINED BY USING THE PRESSURE COOKING AND THE PRESSURELESS (PLS) METHODS OF STARCH LIBERATION

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The effect of methods used to prepare rye mashes (a pressure cooking and a pressureless, i.e. PLS, starch liberation), strains of yeast Saccharomyces cerevisiae (D-2 and As4) and pH of fermentation wort (4.3 and 4.8) on the concentration of by-products of alcoholic fermentation in agricultural distillates was determined. Three different rye varieties: Dańkowskie Diament, Dańkowskie Złote and Amilo were used as raw materials. Alcoholic fermentation was conducted for 3 days at 28 ÷ 30°C. Its dynamics was determined and the agricultural distillates were analyzed for their qualitative and quantitative chemical composition. Raw spirits were also analyzed for higher alcohols concentration by chromatography techniques.

Results of these analyses revealed that the yield of alcoholic fermentation was not affected by the method of wort preparing. The dynamics of fermentation was better for the yeast D-2. The method of starch liberation and saccharification considerably affected the concentration of methanol and aldehydes in agricultural distillates obtained from all 3 rye varieties. They were by 31.9 ÷ 42.4% and 19% lower, respectively, in distillates obtained by using the PLS method. However, concentrations of acids and esters was at the same level, irrespective of wort preparing method, yeast strain and rye variety. It is to note that methanol concentration depended on wort's pH. Raw spirits obtained by means of cold mashing at pH of 4.8 contained by 21.5 ÷ 76.7% more methanol than those obtained at pH of 4.3.

Chromatography analysis of raw spirits showed that the total concentration of higher alcohols (a sum of n-propanol, iso-butyl alcohol, 2-methyl-1-butanol and 3-methyl-1-butanol) in raw spirits derived by means of the pressure cooking method was by 24.2% lower as compared to that in spirits obtained by using the PLS method. Raw spirits obtained from Dańkowskie Diament variety were characterized by 10.1% and 8.6% higher content of fusel alcohols than spirits from Dańkowskie Złote and Amilo varieties, respectively. The average n-propanol: isobutanol ratio in raw spirits produced by using the pressure cooking and the pressureless methods was close to 2.1:1 and 1:2.4, respectively. The most abundant of higher alcohols were the isoamyl ones. The sum of 2-methyl-1-butanol and 3-methyl-1-butanol ac-

counted for 65.4 ÷ 86.3% all fusel alcohols in the tested samples. Analysis of raw spirits obtained by using the PLS method revealed no effect of wort's pH on higher alcohols concentration. The lowest concentration of fusel alcohols was found in samples obtained from Dańkowskie Diament variety subjected to pressure cooking starch liberation method and fermented by the yeast D-2.

Key words: higher alcohols, PSL, pressure cooking, rye

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OILS FROM STRAWBERRY, BLACK CURRANT AND RAPBERRY SEEDS AND APPLE PIPS AS A VALUABLE SOURCE OF EUFA, TOCOPHEROLS AND TOCOTRIENOLS

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Oils from strawberry, black currant and raspberry seeds and apple pips, originating from Mega-Sort company engaged in the drying of fruit residues from the juice processing industry, were studied. Dried fruit residues were segregated and seeds were separated from the rest of the residues. Oils were obtained from the seeds on a standard technological line used for cold pressing of oilseeds (Farmet, Czech Republic) equipped with a UNO screw press, a sedimentation tank and a board filter. Pressed and filtered oils from raspberry, black currant, strawberry and apple seeds were placed in dark glass containers with added N_2, tightly closed and refrigerated at 4°C until further analyses.

The composition of fatty acids was analysed using gas chromatography. Fatty acid methyl ester derivatives were determined on a Varian 3400 equipped with a FID detector on CP-Wax column (25 m). Tocopherols and tocotrienols were determined by HPLC using an Agilent Series 1100 system. Chromatographic separation was performed using a normal phase chromatographic column (LiChroCART™ 250-4 Lichrospher Si 60 (5μ), Merck, Darmstadt, Germany) at room temperature. Fluorescent detection was applied and the determinations were made at Ex 290 nm and Em 330 nm wavelengths.

The composition of fatty acids from the oils of strawberry, black currant and raspberry seeds and apple pips was characterized by a high content of unsaturated fatty acids (90.8%, 88.6%, 94.0% and 86.9%, respectively). Oils from strawberry and raspberry seeds had high levels of linoleic (C18:2) (45.4% and 49.0%) and alpha-linolenic acid (αC18:3) (29.0% and 33.0%, respectively). Black currant seeds were the richest source of gamma-linoleic (γC18:3) and stearidonic acids (C18:4) (18.5% and 3.6%, respectively). Apple pip oil was high in linoleic (C18:2) (55.5%) and oleic acids (C18:1) (29.4%).

The analysed oils were characterized by a high content of tocochromanols (tocopherols and tocotrienols). Black currant oil was found to contain 229.5 mg/100 g of tocochromanols, including gamma-tocopherol (117.8 mg/100 g) and alpha-tocopherol (84.3 mg/100 g). Raspberry seed oil was rich in beta-, alpha- and delta-tocopherols (193.5, 65.6 and 32.2 mg/100 g, respectively). Strawberry seed oil contained gamma- and delta-tocopherols at amounts of

49.0 and 6.1 mg/100 g, respectively. Apple pip oil was found to contain all isomers of alpha-, beta-, gamma- and delta-tocopherols (41.7, 62.7, 13.6 and 21.8 mg/100 g, respectively). The level of tocopherol in the analysed oils ranged from 0.85 to 6.73 mg/100 g.

Being a rich source of PUFA and tocochromanols, the oils obtained from strawberry, black currant and raspberry seeds and apple pips could find wide application in the cosmetic, pharmaceutical and food industries.

Key words: oil, strawberry, black currant, raspberry, apple pips

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M. Piotrowska

CHARACTERISTICS OF MOULDS CONTAMINATING SURFACES IN COLD STORES AND FREEZERS

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Moulds show little sensitivity to low temperatures and therefore they often contaminate cold stores where foods are kept. It is a relatively significant problem due to the possibility of secondary food contamination that leads to its spoilage or to production of toxic metabolites.

The aim of the presented research was to examine the contamination of cold stores and freezers by moulds. The research included the analyses of 12 different places meant for storing foods in which the temperature equaled from -20°C to 5°C. The products stored there included meat and fruit. On the surface of some of these rooms it was possible to notice mould efflorescence.

The research focused on the identification and characteristics of mould microflora. In laboratory conditions the researchers determined the cardinal growth temperatures for each strain, and also assessed the enzymatic abilities and defined the profiles of metabolites produced by microorganisms in the temperature equaling 0°C, 6°C and 30°C.

The total number of mesophilic moulds in cold stores equaled from 8 to $6.0x10^1$jtk/100 cm^2, and the number of psychotrophic moulds in freezers $2.3x10^1 – 4.3x10^2$jtk/100 cm^2. The level of contamination with psychotrophic microflora concerning the surfaces with visible symptoms of mould growth was the highest, the total number of moulds in these places reached the value of $4.5x10^4$jtk/100 cm^2.

In total, there were 25 species of moulds isolated from the surfaces of cold stores and freezers and they included both mesophilic moulds (40% of the moulds examined) and psychotrophic moulds (60%).

The most common contamination of cold stores was caused by *Alternaria, Cladosporium* and *Penicillium* moulds. Other isolated species belonged to *Phoma, Acremonium, Fusarium, Humicola, Mucor* and *Trichoderma* moulds. Among the isolated organisms 36% were organisms showing growth at the temperature of 0°C.

Proteolytic activity was determined in case of 6 strains, out of which three strains (*Mucor spinosus*, *Acremonium strictum* and *Acremonium murorum*) showed such activity only in low temperatures (0 and 6°C).

The ability to produce secondary metabolites of mycotoxic nature was discovered in case of 15 strains. It was also found out that the metabolic profile of moulds is strongly

dependent on temperature and this factor can influence the synthesis of side products in a stimulating or hampering way.

The results of the presented research indicate that the presence of moulds on the walls of cold stores – due to the proven features and enzymatic abilities – may form a potential source of contamination of chilling foods and influence their durability and safety.

Key words: mould contamination, cold storage, freezers

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SOCIAL MEDIA TOOLS ENHANCING COMPETENCES IN FOOD SCIENCE EDUCATION

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Competences can be defined as combinations of knowledge, skills and attitudes. Some competences required from professionals in food chain are the same as decades ago, but many of them have changed and many new generic and specific competences have emerged. European higher education institutes have characterised competences and developed learning process based curricula, bearing in mind the technological and social changes that constantly force us to update our skills. In optimal cases, food industry has had an important contribution to this professional profiling for engineering education on bachelors' and masters' levels.

Recently, eLearning methods have been used in a wide range of food science education. Videos, animations, simulations and other multimedia tools have improved visualisation and eLearning platforms have facilitated tutoring and mastering of courses. The use of social media tools in food education is still in its infancy. However, these tools have potential to enhance generic competences (including learning, development, communication and social competences) and subject-specific competences in food science. Web conferences, wikis, blogs, internet phones, open source social networking platforms and virtual worlds are based on collaborative working and networking. They provide natural channels for internationalisation which is one of the important aims in the strategies of most higher education institutes. Today many alternatives are already available, but it is important to utilise only tools potential for collaboration and sharing in education.

In our institute, the use of social media tools in tutoring the food technology students during their work placement in industry has improved learning. During the thesis work process, also those working far from the institute have a possibility to participate seminars without travelling. Social media tools open new opportunities in design, development and implementation of joint courses and dual or joint degree programs.

Key words: food science education

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Anna Platta, Halina Kolenda

THE INFLUENCE OF THE FREEZING PROCESS AND STORAGE PERIOD ON THE SENSORY QUALITY OF COOKED CARROTS OF SELECTED VARIETIES

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The sensory analysis plays the significant role in food industry and gastronomic production, because it ensures the production on the appropriate level and constitutes an indispensable factor in the continuous improvement of the quality of the produced goods. The sensory characteristics are: taste, smell, appearance including colour, and consistency of the food that can be distinguished and evaluated with the help of human senses. The people's sense organs allow identify the quality of the impression and determine its intensity as well as stating to what degree this impression is desirable or undesirable.

In general, the quality evaluation of vegetables is defined by the senses relative to the product and their sensory attraction. Cooking processes aim at giving vegetables the right consistency, appearance, smell and taste.

The aim of this work was to define the sensory quality of the cooked carrot of selected varieties after the freezing process and the storage period. The tested material used in the experiment consisted of ten carrot varieties. Sensory characteristics of cooked carrots were established with the use of 5-point scale (1 – minimum value; 5 – maximum value). Quality factors were taken into consideration: general appearance, smell, consistency and taste. The raw and the frozen carrots of selected varieties were cooked in the traditional way, starting from boiling water.

The results showed that the sensory characteristics depended of the carrot variety and time of storage period. The raw Nigel and Nipomo carrot varieties and the frozen Nandrin carrot variety gained the highest sensory evaluation scores after the cooking process. In addition, the storage period influenced on the quality characteristics of the cooked vegetables. The raw Nigel, Napa, Nagadir carrots varieties and the frozen carrot varieties: Bristol, Nagadir, Napa, Narbonne, Nigel, had the lowest sensory estimation after three and six months of the storage period.

Key words: sensory quality, carrot varieties, freezing process, storage period

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Anna Platta, Halina Kolenda

THE INFLUENCE OF A FREEZING PROCESS ON THE CHANGES IN NITRATES (V) AND (III) CONCENTRATIONS IN THE CARROT OF SELECTED VARIETIES

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The common feature of raw materials and food products is non-durability, which means susceptibility to natural and constant transformation in chemical, physical, biological and microbiological features. The character of quality changes depends of the sorts of products and the technology used in processing and preservation. The main conditions for the good quality of frozen food are: the used raw material, the proper package, the freezing process and the storage process.

Food safety is the main purpose of satisfying customers' expectations. Nitrates are among the contaminating substances in food, which causes great menace to people's health and therefore their quantity is limited by the Ministry of Health and Welfare regulations. They are treated as conservative additives and potentially cancerous substance. Since vegetables are consumed in large quantities, the appearance of nitrates can cause civilisation illnesses. It is said that 60-80% percent of nitrates in a daily diet comes from vegetables.

The object of this work was the observation of nitrates (V) and (III) changes in the selected carrot varieties. The tested material in the experiment consisted of six carrot varieties. The carrots were fresh and frozen. Nitrates (V) and (III) were analysed by Griess colorimetry technique. The examined vegetables were blanched and deep-frozen at –22ºC. After the freezing process the carrots of selected varieties were cooked in a traditional way, starting from the boiling water.

The results of freezing process in – 22°C showed that the content of nitrates (V) and (III) in all sorts of the frozen carrot was much lower than in the fresh carrot. The freezing and cooking processes reduced the concentration of nitrates (V) and (III) in all of analysed samples of carrots. The storage process caused the decrease of nitrates (V) concentration with the observed increase of nitrates (III) concentration. In all the analysed carrot samples, the mean nitrate levels were found to be below the maximum level of 400 mg $NaNO_3$/kg raw material.

Key words: nitrates (V) and (III), carrot varieties, freezing process, storage period

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Agnieszka Plawgo[1], Kazimiera Zgórska[1], Mariusz Kubiak[2], Łukasz Szparaga[3], Przemysław Bartosik[4]

STATIC OPTIMALISATION OF OSMOTIC DEHYDRATION AND STORAGE PROCESS OF PREVIOUSLY FROZEN PLUMS

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Recently there was a great interest in dehydration process, because of a possibility in obtaining a product which is well preserved and has good nutritious and sensor values. Although in the area of interest there are plant raw materials, previously frozen, because of its availability during the whole year.

To receive a product of a high quality and low costs of production, optimal setups of a dehydration process are looked for. The aim of this work, was to find optimal setups for a dehydration process of halves plums (previously frozen), which were frozen and later storaged, using scalar criteria of optimalisation coupled with multidimensional euclidean metrics.

Key words: osmotic dehydration, storage process, food product

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INFLUENCE OF CAMELINA'S GRAINS ON BREAD WITH WHEAT RYE QUALITY

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The work was a trial qualification of optimum addition of crumbled camelina's grains which has influence on the highest bread quality. Thats way breads were baked from wheat rye flour of early Plawo change without and with 3, 6, 9% camelina addition. The various times of second phaze of the fermentaton were also used. Than a physico-chemical and organoleptic analysis were made. The investigations showed the positive influence of addition camelina's grains on physico-chemical parameters of breads. Organoleptic analysis ididcated that addition of 9% camelina had slightly influence on taste and smell of bread worsening. The best bread's quality was obtained with applied 30 minutes time of the second phase of fermentation's stage and 6% camelina addition.

Key words: camelina's grains, bread's quality

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A. Pluta, M. Olkowski, M. Dolińska, M. Kostowska

THE INFLUENCE OF STARTERS PREPARING METHOD ON THE QUALITY FACTORS OF REDUCED-FAT DUTCH-TYPE CHEESES

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The aim of this study was to determine the preparation method starters on yield, chosen physic-chemicals parameters and sensory quality of Dutch-type cheeses.

Study was conducted in the commercial scale. 76 cheese-batches were produced with usage of: (DVS) Direct Vat Set, traditional milk bulk starter, medium bulk starter, milk bulk starter and additional thermized bulk XT-312 starter and analyzed.

Obtained cheeses were submitted to physic-chemical analyzes either after salting and after 4 or 16 weeks of ripening. Sensory evaluation was conducted after 4 and 8 weeks of ripening. Additionally cheese yield based on the weight after pressing and salting was determined.

Application of milk bulk starter with additional thermized bulk XT-312 starter in production of reduced-fat Dutch-type cheese gave highest scope and depth of ripening. This finding was confirmed on the basis of organoleptic assessment. It was also stated that addition of milk based working-terminized starter boosts yield. Cheese obtained with usage of milk bulk starter with additional thermized bulk XT-312 had best sensory quality. The highest pH values and salt concentration were noted in case of DVS usage, whey obtained in production of those cheeses consists also the highest amounts of proteins.

Key words: physicochemical parameters, sensory quality, Dutch-type cheese

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EFFECT OF THERMAL PROCESSING AND VEGETABLE OIL ADDITION ON FUNCTIONAL PROPERTIES OF MODEL MEAT PRODUCTS

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The thermal treatment is one of the most important operations in meat processing. Temperature and duration of cooking process have a large effect on functional properties and eating quality of meat and meat products.

The purpose of this study was to analyse the effect of thermal processing and addition of vegetable oil on the functional properties of model meat products. The final meat products with 0,3 or 5% content of vegetable oil were subjected to thermal processing at temperatures 75°C, 85°C or 95°C. The measurements included some physical properties: dry matter content, pH value, water holding capacity, cooking loss. In addition, the effects of heat treatment on the sensory value and texture profile were studied.

The results obtained in this study proved that WHC and dry matter depended on the temperature of thermal processing and vegetable oil level. In the present study cooking losses were not appreciably affected by vegetable oil addition. Addition of vegetable oil was not effecting in improving quality parameters of final products. There were observed changes in textural profile which were affected by increased temperature. Addition of vegetable oil did not improve significantly sensory quality and textural properties of meat products under investigation.

Key words: vegetable oil, additives, thermal processing, meat products

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RHEOLOGICAL AND SENSORY PROPERTIES OF APPLE CUBES DEHYDRATED BY DIFFERENT METHODS

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Apple cubes of 15 mm were dehydrated by four different methods. In the three methods heating pomp was applied as a source of energy: hot air followed by low temperature dehumidified air and resume of hot air after that (HA-LTDA-HA), vertical heat pump drying (VHP), vertical heat pump drying followed by vacuum-microwave finish-drying (VHP-VM). The fourth method was convective pre-drying and vacuum-microwave finish-drying (C-VM).

The dried product was subjected to compressive strength test, stress relaxation test and sensory evaluation. The instrumental tests were performed by using an Instron 5544 strength testing machine. In compressive strength test apple cubes were compressed until the breaking point. Stress relaxation test consisted of apple samples compression until 50% of breaking strength and stress reduction under a constant deformation. The stress relaxation curve was fit to the experimental points. The best correlation was found for function, which was the sum of two exponential terms and one free term. The coefficients of that function enabled estimation of rheological parameters.

The sensory panel consisted of 11 trained students. Five sensory attributes were evaluated: flavour, colour, hardness, crunchiness and taste. The intensity as well as consumer acceptance of particular attributes were estimated.

The dried apple cubes differed in moisture content, texture and other sensory attributes despite of the drying method applied. The moisture content of C-VM finish dried samples was significantly lower comparing with other samples. Higher strength was found for apple cubes dried until lower moisture content. A Maxwell model consisted of two visco-elastic and one elastic elements represented rheological properties of studied material. The increase in moisture content decreased elasticity modules and viscosities of Maxwell model elements. VHP samples were found as the best and C-VM samples as the worst in general sensory assessment. The instrumental and sensory texture parameters were in a good correlation.

Key words: rheological properties, sensory properties, apple, dehydrated method

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YORBN- A NEW MEDIUM FOR SELECTIVE ISOLATION OF *CANDIDA FAMATA* YEAST STRAINS FROM MOULD RIPENED CHEESES [33]

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Yeasts *C. famata* (anamorph *D. hansenii*) occur in all types of ripening cheeses, especially in mould ripened cheeses, where together with lactic acid bacteria, mould *Penicillium roqueforti* and other yeast species participate in maturation process. Those yeasts tolerate high salt concentrations (even 24% NaCl), low growth temperatures and are capable to synthesize killer toxins. Killer activity of those yeasts is even stimulated by sodium chloride and temperature of cheese ripening. Currently, intensive studies on the subject of killer toxins produced by *C. famata* are conducted at the Faculty of Food Sciences, Wrocław University of Environmental and Life Sciences. Those experiments require collecting of the proper pool of *C. famata* strains from mould cheeses. Isolation from such environment meets with many difficulties with concomitant microflora.

For experimental purposes special medium named YORBN was developed. The medium contained nutritive compounds like in standard YPG medium supplemented with oxytetracycline (bacteria growth inhibition), Rose Bengal (inhibition of mould sporulation) and 12% NaCl (selection of halophilic yeasts). In this work usefulness of that medium for selective isolation of *C. famata* strains from mould ripened cheeses was tested.

At the beginning, the level of growth inhibition of *C. famata* and other yeast species occurring in cheese was evaluated on YORBN comparing to standard YPG medium. Two strains of *C. famata* and *Yarrowia lipolytica*, one strain of *C. kefyr* and *C. sphaerica* were utilized in this part of work. New medium compounds resulted in more than 2 logarithmic cycle reduction of both strains of *Y. lipolytica* and the strain of *C. sphaerica*, while *C. kefyr* strain was inhibited about 1 log cycle. Also, the number of both *C. famata* strains decreased, but less than for other strains; about 50% of initial number was observed. However, *C. famata* strains grew faster than others and differed with colony morphology.

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In further investigations, the selectivity of new medium was analyzed. For that purpose yeast strains were isolated from four samples of different cheese types: Fourme Dambert (France), Bleu Davergne (France), Edelpilz (Germany) and Rokpol (Poland). Four randomly chosen colonies from each cheese sample were identified by PCR-RFLP of rDNA method. All obtained colonies on YORBN medium were of the same morphology and belonged to *C. famata* species, what was confirmed by restriction analyses of amplification product.

Key words: *Candida famata*, cheese, *Penicillium roqueforti*

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R. Pomykała, J. Osek

PROFICIENCY TESTING OF OFFICIAL VETERINARY CONTROL LABORATORIES FOR FOOD MICROBIOLOGY ACCORDING TO THE EU REGULATION 882/2004

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Appropriate quality assurance systems for laboratory activities are a vital component of good laboratory practice. Quality assurance systems include accreditation to EN ISO/IEC 17025 on "General requirements for the competence of testing and calibration laboratories" and participation in external quality assurance schemes (EQA) and comparative testing through ring trials. Part of the National Reference Laboratory (NRL) remit is to assist official laboratories achieve good quality assurance practices.

The NRL, as part of its remit, organises regular proficiency testing (PT) for relevant methods amongst official laboratories and others. Proficiency testing programmes cover the current microbiological testing requirements of Regulation (EC) No 854/2004 and Regulation (EC) No 2073/2005 for food of animal origin.

The National Reference Laboratory for microbiology of food has been accredited by the relevant Polish authority for conformity to the requirements of EN ISO/ISO 17025 in scope of microbiological examinations of food.

Regulation (EC) No 882/2004 on official controls performed to ensure verification of compliance with feed and food law, animal health and animal welfare rules requires that official laboratories (including official laboratories) are assessed and accredited to EN ISO/ISO 17025. A derogation on the accreditation of laboratories is contained within the transitional measures Regulation (EC) No 2076/2005 of 5 December 2005 laying down transitional arrangements for the implementation of Regulations (EC) No 853/2004, (EC) No 854/2004 and (EC) No 882/2004 of the European Parliament and of the Council and amending Regulations (EC) No 853/2004 and (EC) No 854/2004 provided that a laboratory has initiated and is pursuing the necessary accreditation or can provide the competent authority with satisfactory guarantees that quality control schemes are in place. As part of its remit, the NRL must assist official laboratories, where necessary, to meet these international accreditation and quality standards.

Key words: veterinary control laboratories, food microbiology

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R. Pomykała, J. Osek

PROFICIENCY TESTING BY INTERLABORATORY COMPARISONS OF FOOD MICROBIOLOGY LABORATORIES ORGANIZED BY NATIONAL REFERENCE LABORATORY – NATIONAL VETERINARY RESEARCH INSTITUTE IN 2008

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National Reference Laboratory for microbiology of food of animal origin of the Department of Hygiene of Food of Animal Origin National Research Veterinary Institute in Pulawy organized 3 rounds of proficiency testing by interlaboratory comparisons in 2008. A total of 164 veterinary inspection laboratories as well as commercial, were participating in the program. Proficiency tests were organized according to ISO/IEC 43-1:1997 and ILAC -G13:2008/07 guides.

Aim of the present study is estimation of proficiency of laboratories carrying out microbiological examinations of food by interlaboratory comparisons.

In 2008 provider organized and sent a total of 1264 samples for qualitative and quantitative microbiological tests. As a matrix a chicken meat, minced pork meat, mortadella sausage, smoked fish and sponge swab has been choose. Before using matrix were tested for the presence and enumeration of target microorganisms and for the presence of antibacterial substances. Naturally contaminated as well as fortificated with standard microorganisms strains samples were used. Samples were transported to participants under lower temperature conditions. As a criterion of qualitative tests concordance with correct result was accepted and for qualitative tests value of z-score rate.

There were 10 qualitative and 9 quantitative directions of examinations in 2008. For qualitative examinations were organised: detection of *Escherichia coli, Escherichia coli* O157, *Enterobacteriaceae*, detection of anaerobic spore forming and sulfite reducing bacteria, *Salmonella* spp. in a food matrix and in a swab, *Listeria monocytogenes*, coagulase-positive *Staphylococcus* spp, *Campylobacter* spp. and coliforms. For quantitative examinations were organised: total plate count , enumeration of coagulase-positive *Staphylococcus* spp., enumeration of yeasts and moulds, coliforms, *Escherichia coli*, *Listeria monocytogenes*, *Enterobacteriaceae*, *Campylobacter* spp. and anaerobe bacteria. Statistical methods for proficiency testing were choose according to standard ISO 13528. For each direction of examination a z-score or z'-score rate were calculated.

The results of the proficiency testing, conducted through the interlaboratory comparison, show continually decreasing number of laboratories that achieve incorrect scores. These outcomes prove that microbiological laboratories constantly improve their work, hence that food of animal origin is under proper surveillance.

Key words: food microbiology laboratories, food hygiene, Veterinary Institute

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THE QUALITY OF COLD-PRESSED OILS AVAILABLE ON THE POLISH MARKET

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In recent years the presence of cold-pressed oils from seeds and fruits of various plants on the polish market significantly increased. These oils have specific taste and flavor and often obtain valuable bioactive substances. The aim of this study was to investigate the quality of cold-pressed oils from the Wrocław market. The fatty acid composition, peroxide value, anisidine value, acid value and as well as conjugated diene and triene contents were determined in walnut, poppy seed, sesame seed, avocado, macadamia nut, safflower, apricot kernel, pumpkin seed, hemp seed, rose hip, linola, and linseed oils. The analyses were conducted in oils at the time of purchased and after 3 months of shelf life.

There were observed only slight changes in fatty acid composition after 3 months in oils with high participation of α-linolenic acid: hemp seed, rose hip, and linseed oil and also to a lesser degree walnut oil. The percentage of saturated fatty acids increased up to 1% and polyunsaturated acids decreased up to 1,5% in these oils in comparison with fresh oils. It was shown an occurrence of ca. 3% of C18:1t in hemp seed oil after 3 months of storage, while the participation of this fatty acid in fresh oil was inconsiderable. The oils rich in oleic acid: sesame seed, avocado, macadamia nut, safflower and apricot kernel oil underwent up to 1,2% decrease of this fatty acid content after 3 months of shelf life. The peroxide values of investigated fresh oils ranged between 0,48 and 4,6. The storage of the oils with high peroxide value (apricot kernel, avocado and safflower oils) resulted in negligible changes of this parameter, whereas in hemp and pumpkin seed oils the peroxide values increased by 50 – 56% to 4,5 and 4,9, respectively. The fresh avocado and rose hip oils were distinguished by relatively high anisidine value: 6,3 and 9,0, respectively. In other investigated oils this parameter was in range from 0,96 to 2,44. After storage of oils the anisidine value increased up to 104% (hemp oil). The acid values of fresh oils ranged from 0,24 (sesame seed oil) to 2,61 (linseed oil) and did not change considerably after 3 months. The conjugated diene contents in analyzed fresh oils ranged between 8,6 in hemp seed oil and 162,4 mol/kg in pumpkin seed oil, and the highest increase of conjugated diene content (ca. 20%) was observed in stored hemp seed and macadamia nut oils. Pumpkin seed oil contained the most conjugated trienes among the fresh oils (105,1 mol/kg). The quantities of these compounds did not differ markedly in oils after 3 months of shelf life.

Key words: polish market, cold-pressed oil

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THE QUALITY OF CLARIFIED APPLE JUICE DEPENDING ON THE TYPE OF PACKAGE AND BRAND OF THE PRODUCT

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Apple juice is very popular among consumers and its production in recent years accounted for 25% of the production of drinking fruit juice in Poland.

The aim of this study was to make a comparative assessment of the quality of clarified apple juice depending on the type of package and brand of the product available in retail sale. The research material included juice of four national producers which was made from apple concentrate and offered in cardboard boxes and glass bottles. With reference to the aim of the study the following was carried out: 1. Sensoric analysis of apple juice on the basis of the sensoric profiling method which took into consideration the following features: appearance, smell, taste and general sensoric assessment, and 2. Physical and chemical analysis of fruit juice which covered recording of the content of vitamin C, directly reduced monosaccharides and general saccharides, general extract and general acidity as well as the level of sucrose and sugar-free extract in the types of juice under examination.

Statistical analysis of obtained results of physical and chemical tests demonstrated that the type of package had a statistically significant influence on the content of vitamin C, general extract and general acidity of examined products. It was found that the brand of the product also had a statistically significant influence on the content of vitamin C and general extract, directly reducing monosaccharides and sucrose in the examined juice. There was found no statistically significant influence of the type of package on the sensoric features of apple juice.

On the basis of sensoric and physical and chemical examinations it was found that the quality of apple juice under examination of the leading brands on the Polish market was at a good, satisfactory level. Moreover, the obtained results indicate that cardboard boxes are a better type of package for preserving the quality of apple juice.

Key words: quality apple juice, sensoric quality, physicochemical capacity

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R. Rezler, H.M. Baranowska

MECHANICAL-RHEOLOGICAL PROPERTIES OF FINELY-COMMINUTED SAUSAGE BATTERS WITH ADDITION MODIFIED POTATO STARCH

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The paper analyses relaxation macro-parameters describing the elasticity of model meat-batters. Investigations were carried out on finely-ground sausage meat-batters in which animal fat was replaced in constant quantities (15%) by potato starches modified in three different ways (roasted – A, agglomerated – B, alkalized – C).

The following parameters were determined:

- the content of free water in the meat-batter using the filter paper method,
- the content of thermal drip using the method developed by Kijowski and Niewiarowicz.

Determination of the basic composition:

- the content of total water by the drier method,
- the content of fat by the Soxhlet method,
- the content of total protein in the muscle tissue by the Kjejdahl method.

Measurements of rheological properties:

- apparent viscosities of the examined meat-batters were estimated using a Rheotest II, type RV roto-viscosimetre with a coaxial system of measuring cylinders.
- changes in the basic parameters characterising the rheological properties (elasticity modulus G_1, tangent of loss angle tgδ as well as dynamic viscosity η) were determined.

In the course of the performed investigations, a prototype of a DMA spectrometer was employed which operates on the principle of the analysis of free vibrations in the system of a reversed torsional pendulum. In the course of the performed experiments, a measuring thermo-regulatory system in the form of coaxial cylinder was applied and the examined samples were formed between their walls. The frequency of the system's own vibrations amounted to 0.4Hz. Investigations were carried out at the temperature of 20°C.

The replacement in the meat-batters of the fat tissue of animal origin by physically modified starches (irrespective of the method of modification) resulted in a much better binding of their individual constituents. This was reflected in the level of the analysed rheological parameters (viscosity and elasticity).

In the analysed systems of experimental sausages, it was also determined that only the starch preparation obtained as a result of roasting of potato starch (A) underwent complete gelatinisation in the course of the applied technological process and fulfilled the binding

function in relation to the remaining constituents of the system and improved the quality of the product. As to the remaining starch preparations (agglomeration – B and alkalisation – C), the employed technological process failed to ansure conditions for their complete gelatinisation.

Key words: mechanical-rheological properties, modified potato starch, sausage meat-batters

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Jolanta G. Rola

DETERMINATION OF ALKALINE PHOSPHATASE ACTIVITY IN MILK PRODUCTS BY FLUORIMETRIC METHOD

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Determination of alkaline phosphatase activity in dairy products is used to assess the completeness of pasteurization or presence of raw milk addition in pasteurized products. Legislation of the European Union adapts the level of 350 mU/L of ALP activity as safe for consumption of milk and milk-based drinks. For cheese this limit has not been established yet. According to AFFSA, tentative limits for cheese from pasteurized milk ranged from 2 to 6 mU/g. Official reference method for the measurement of ALP is the fluorimetric method (PN-EN ISO 11816-1:2007 and PN-EN ISO 11816-2:2005). It is adequate for measurement of ALP in cow, ovine and caprine milk, whole, semi-skimmed and skimmed milk, milk-based drinks and cheese. It is suitable for the determination of ALP activity in raw milk and milk after heat treatment with ALP activity over 2000 mU/L after dilution of the sample. The Advanced Fluorophos assay is based on a fluorometric substrate called Fluorophos, which, when acted upon by ALP, is converted to a highly fluorescent product. The rate of fluorophore formation is monitored for 3 min in a fluorometer. The enzyme activity is calculated automatically in mU/L (for milk and milk-based drinks) or mU/g (for cheese). The subject of this study was revalidation of the assay used for determination of residual alkaline phosphatase in cheese. The precision of the method was determined by assignation of repeatability, reproducibility and uncertainity of measure. The cheese "Gouda" was used in the study. The samples of cheese were diluted with milk without ALP (heating at 95°C by 5 min) and fortified with raw cow milk to establish 3 levels of ALP activity: 2, 270, 900 mU/g. ALP activity in samples was measured by 3 analitics, in 6 repetitions. The values of repeatability dependent on ALP activity level and were equel to 0,2; 27,28; 42,05 mU/g and the reproducibility reached the levels of 0,22; 30,87; 67,88 mU/g. The values of uncertainity were established at the levels of 0,16; 22,05; 48,49 mU/g. Obtained values of the precision of the method fited criteria established for interlaboratory comparisons which are included in standard PN-EN ISO 11816-2:2005. In the frames of control samples of cheese derived from retail trade were examined. Mean value of ALP activity ranged from <0,01 mU/g to 0,38 mU/g.

Key words: milk products, fluorimetric method, alkaline phosphatase activity

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Jolanta G. Rola, Weronika Korpysa-Dzirba

DETECTION OF *LISTERIA MONOCYTOGENES* AND *SALMONELLA* SPP. IN POWDERED MILK: A COLLABORATIVE STUDY

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This paper describes proficiency test organized in June 2004 by the Department of Hygiene of Food of Animal Origin of the National Veterinary Research Institute – State Research Institute in Pulawy, Poland.

The aim of this collaborative study was to evaluate the ability of Veterinary Inspection Laboratories to detect *Listeria monocytogenes* and *Salmonella* spp. in milk products.

Twenty four laboratories participated in this proficiency test including the coordinator. The interlaboratory comparisons were organized according to ISO/IEC Guide 43 – 1:1997. The organizer prepared for each participant a set of samples containing 6 samples for the detection of *Listeria monocytogenes* and 5 samples for the detection of *Salmonella* spp. The samples were artificially contaminated on two levels – 100 cfu and 100 000 cfu and were prepared in blind duplicates. The participants have also received uninoculate control samples.

The majority of the participated laboratories obtained satisfactory results in detection of both analyzed pathogens. Two laboratories did not detect *Listeria monocytogenes* in low level contaminated samples and four laboratories obtained positive results in blined samples.

Key words: *Listeria monocytogene*s, *Salmonella*, milk products

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EFFECT OF INTERACTIONS BETWEEN NON-STARCH COMPONENTS OF STARCH GRANULES AND SURFACE OF THE LATTER ON PHYSICOCHEMICAL PROPERTIES OF STARCH

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Apart from starch its granules of different botanical origin contain various amounts of other components such as: lipids, proteins and pentosans. Friabilins (circa 15 kDa) rank among proteins bonded to the surface of starch granules. Most important members of this group of proteins are puroindoline a and puroindoline b, generally regarded as markers of hardness of cereal endosperm. Owing to the occurrence of tryptophan domain in their polypeptide chains both puroindoline a and b are capable of binding lipids. It gave rise to a hypothesis that lipids participated in binding of puroindolins with the surface of starch granules.

Verification of the hypothesis postulating that puroindolins display various affinities for the surface of starch granules isolated under industrial conditions from starch samples produced from 3 different wheat varieties was an objective of this work. Four different starch fractions: A, B, C and rich in pentosans were used in experiments. These starch fractions differed in dimensions of starch granules and their chemical composition. Fractions of proteins associated with the surface of starch granules (SGAPs) obtained by using different solvents and extraction conditions (dependent on composition of fractions of surface-bonded lipids) were subjected to qualitative and quantitative analyses.

Our experiments revealed that the size of starch granules affected the quantity of substances adsorbed on their surface such as proteins, lipids, pentosans. The smallest starch granules adsorbed the greatest amounts of proteins and lipids. We found that lipids interacted with members of puroindoline family of proteins on the surface of starch granules. The presence of surface-bonded proteins in wheat starch granules contributed to worse filtration performance and lower degree of saccharification of glucose syrups produced from starch. We found a correlation between the percentage content of puroindolins in total surface proteins and the color of starch hydrolysates.

Key words: starch, physicochemical properties

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DETERMINATION OF POLICHLORINATED BIPHENYLS (PCB) IN WHEAT GRAIN AND CEREAL PRODUCTS

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Polychlorinated biphenyls are class of chlorinated organic chemicals widely spread in the environment as a consequence of industrial development. According to Stockholm Convention PCBs are regarded as dangerous persistent organic pollutants, and are banned from use and production in the most of developed countries. PCB molecule consists of two biphenyl rings substituted with 1 to 10 chlorine atoms. As a consequence PCB occurs as isomers and homologues commonly known as congeners. Physicochemical properties of PCBs significantly differs between particular congener. What's the most important several congeners due to it's planar spatial structure have toxicological properties similar to dibenzo-para-dioxins and are known as dioxin-like PCBs. Exposition to high levels of PCB's might cause several health effects like skin rashes or liver damage. are also suspected human carcinogens.

Presents of PCBs due to its highly lipophilic properties is typical for fatty food matrix like for example animal tissues, however elevated levels of PCBs are also reported in low fat products.

The aim of this study was to develop a sensitive method for determination of PCBs in wheat grain and cereal products. Developed method was based on sample extraction with mixture of organic solvent, subsequent extract dialysis through semi permeable polymeric membrane and cleanup with gel permeation chromatography (GPC) and multi layer silica gel column(SiO_2, $SiO_2xH_2SO_4$, SiO_2xKOH, anhydrous Na_2SO_4).

PCB determination was carried out with high resolution gas chromatographic system coupled to an ion-trap based low resolution mass spectrometer operated in tandem MS/MS mode. Chromatographic separations were conducted on a 60 m x 0.25 mm x 0.25 um fussed silica capillary column with 5%-Phenyl-Arylene-95%-dimethylopolisiloxane bounded phase. Recovery rates of PCB from spiked samples varied between 47–96% for marker PCB congeners and 72–89% for dioxin-like congeners. Limit of quantification for most of the congeners was 0,4 pg g^{-1} estimated on the basis of signal to noise level.

Developed method was used for analysis of 15 retail samples of grain and cereal products. Concentrations of so called eight marker and twelve dioxin-like congeners were investigated. Obtained results showed low concentrations of investigated compound in analyzed samples. Sum of eight so called marker PCB's did not exceed 1 ng g^{-1} in any sample. Lower chlorinated marker PCB congeners like 28, 52 or 101 were mostly observed in the analyzed

samples. Concentrations of dioxin-like PCB congeners in most cases did not exceed 6 pg g^{-1} except of congener 105 and 118 which were observed in relatively higher concentrations (5-22 pg g^{-1}).

In conclusion levels of polychlorinated biphenyl concentrations in analyzed grain and cereal product samples were low. Mostly lower chlorinated biphenyls were determined in major quantities. However it should be firmly stated that due to importance of grain and cereal as an animal feed, further research on the presents of PCB's in this type of products should be taken.

Key words: cereal products, polichlorinated biphenyls

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TRENDS IN MEAT PROCESSING

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Although meat consumption has been considered as a driven force for human evolution, it seems that during the time its consumption together with the decrease of physical activity are been considered as cause of some occidental healthy problems such us cardiovascular diseases, due to the intake of fat and salt related with meat products. At the same time, meat industry demands processes more cost-effective that can comply with the consumers' demands. In that sense, in this article several examples developed in the main four types of meat products, whole muscle or ground products heat or non heat treated, will be exposed and discussed. In the case of whole muscle heat treated products, the use of high hydrostatic pressure to obtain a low salt product will be analysed. The use of fat replacers and changes in fat composition are being used for obtaining healthier luncheon meat products. In the field of traditional dry cured meat products important efforts have been done for reducing salt content, modifying fat composition in fermented sausages and improving and developing quick drying processing methods that allow obtaining safe and good products owing to obtain dry cured hams and dry-fermented sausages in few days instead of several weeks.

Key words: meat, meat processing, fermented products, heat treatment

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M. Różycki

THE RESULTS OF PROFICIENCY TESTING OF VETERINARY LABORATORIES FOR TRICHINELLA IN POLAND IN 2008

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All analytical laboratories should operate a quality assurance system which includes internal quality control procedures, participation in proficiency testing schemes (PT), use of reference standards and certification/accreditation to a recognized standard such as ISO 9001 or EN ISO/IEC 17025. Taking into account all of these approaches, only PT or the use of certified reference materials can establish the bias and accuracy of the results. Regular participation in a PT provides independent verification of the analytical competence of a laboratory. Obtained results demonstrates to the public, customers, accreditation bodies, regulators, and management that analytical procedures are under control and gives analysts confidence that the service which they provide is reliable and satisfactory. Since 2005 National Veterinary Research Institute and Department of Food Hygiene of Animal Origin acting as National Reference Laboratory. Organizes the PT for official veterinary laboratories inspecting pork, horse and game meats for *Trichinella spiralis*. Proficiency testing schemes operate by providing participating laboratories meat samples containing living larvae *Trichinella spiralis*. The number of parasites in the sample was known only to the organizers. The laboratory analyses the samples as part of their normal routine, and reports the results to the scheme organizers. The reference laboratory provide a report showing how closely their results agree with the accepted value, and where necessary, can then take appropriate action to improve performance. In 2008 the second national wide proficiency tests to detect *Trichinella spiralis* muscle larvae in pork by an approved method was conducted. Over 827 laboratories took part in the test. Each laboratory obtain four samples, one or two of them was negative, one with low dose with 3–5 larvae, one with 8–10. The samples were made of 50g of ground pork with added known number of larvae. Samples were sent by courier to participants. All samples were examined within one week from reception of samples. The results of investigations were reported to NVRI web (www.piwet.pulawy.pl/pt). Average overall recovery% was over 75%. Only in few cases laboratories were not able to detect trichinella. In all cases corrective actions were undertaken, and problems were identified. In such cases laboratories were immediate re-tested, recovery increased from 30% up to 90%. The next proficiency testing of all laboratories (over 800) is planned for the September 2009.

Key words: veterinary control, *Trichinella spiralis*

Iwona Rudkowska

FUNCTIONAL FOODS TAILORED TO GENES: CURRENT RESEARCH AND FUTURE HYPOTHESIS

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Functional foods have been suggested to play an important role in combating cardiovascular diseases (CVD) and other chronic illnesses. Typical examples of functional foods include: omega-3 fatty acids (n-3 FAs), plant sterols (PSs), nuts, soluble fiber and many more. However, the data demonstrates a large inter-study variability in response to functional foods that is possibly due to the dose of bioactive compound, the duration of study, the health status, the diet and other confounding factors. Yet, the large heterogeneity within studies is likely to be attributable to genetic variability within the study population. The study of nutrigenomics describes both the effects of genetic variation on response to diet and the effects of diet on gene expression. The aim of this presentation is to examine the recent studies, which have used genomics techniques to reveal the mechanism of action of functional foods on CVD risk factors. In particular, n-3 FA and PS supplementation will be examined to provide additional insights on diet-gene interaction effects that modulating the CVD risk factor profile.

First, it is well known that consumption of n-3 FA decreases the risk of CVD by decreasing triglycerides (TG) levels and pro-inflammatory parameters. These effects of n-3 FA are likely mediated by changes in gene expression, which precede changes in membrane composition, by directly governing the activity of nuclear transcription factors. Yet, intervention studies have observed inter-individual variability in TG-lowering and inflammatory response. For example, epidemiological and clinical studies have demonstrated that individuals carrying the peroxisome proliferator-activated receptor alpha (PPAR-alpha) L162V polymorphism display a deteriorated metabolic profile after n-3 FAs supplementation. *In vitro* results also indicate that both allelic variants of the PPAR-alpha L162V are activated by n-3 FAs; however, the mutated form displays a lower transcriptional activity than the wildtype variant after incubation with n-3 FAs. Additionally, a study shows that expression levels of PPAR-alpha and apolipoprotein AI genes were lower for subjects' carrying the mutated allele compared to the wildtype after the addition of n-3 FAs. Consequently, subjects bearing the PPAR-alpha L162V polymorphism may demonstrate inferior beneficial improvements in response to n-3 FA. Future research should investigate the impact of n-3 FA supplementation on other SNP and their impact on gene expression rates.

Secondly, PS consumption decreases low-density lipoprotein cholesterol (LDL-C) levels; however, high variability of responsiveness of lipid levels to PS intervention has been observed. A recent study hypothesized that common SNPs in the ATP binding cassette pro-

tein G5 (ABCG5) and G8 (ABCG8), Niemann-Pick C1-like 1 (NPC1L1) or in other genes of the cholesterol pathway, would underline inter-individual variations in response to PS. However, none of the polymorphisms examined occurred consistently in the responsive or non-responsive subgroups. In addition, PS have do not shown clear effects on gene expression of key pathways involved in cholesterol-lowering mechanism. Therefore, studies are needed to clarify the genetic basis related to the variability to PS consumption and to determine the precise molecular mechanism of PS action.

Overall, genomic techniques can assist in the development of functional foods that are able to: (1) alter favourably gene expression in individuals and (2) develop a "personalized nutrition" approach, where nutrient intake is optimized based on an individual's genetic profile to reduce the disease risk and/or improve the effectiveness of dietary guidelines in general.

Key words: functional food, genomic techniques

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FORMATION OF PHYTOSTEROL OXIDEX DURING OIL REFINING PROCESS

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Autoxidation of sterols is theorized to be a free radical process. The conditions of common food-processing operations involve contact with light, heat, air, water, and metal ions. Refining plant oils intentionally induce oxidation to formation of phytosterol oxides.

The content of phytosterol oxides in rapeseed oil from successive stages of refining were determined by GC/MS technique. Presented results are the average from three replicated from three separeated processes.

Obtained data showed that the total content of phytosterol oxides in crude oil was about 300 μg/g of oil and increased during neutralization to 550 μg/g of oil. The bleaching process removed from oil also a part of these substances, and their content decreased to 300 μg/g of oil. The deodorization caused increase of the oxyphytosterols content to 350 μg/g of oil.

The crude and neutralized oil, such as deodorized, characterized the higher level of 7α-hhydroxy derivatives of phytosterols and its content was respectively 127 μg/g, 223 μg/g and 111 μg/g of oil. In bleached oil dominated 7-keto-derivatives and their contents were about 77 μg/g.

Formation of phytosterols oxides during oil refining process is a great interest from nutritional viewpoint. The different stages of this process influenced on the phytosterols oxidation. Limitation of oxyphytosterols oxides formation ought to be first priority for technologists.

Key words: phytosterol oxides, oil refining process

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OXIDATION CHANGES OF MARGARINES ENRICHED IN PHYTOSTANOLS

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Oxidative changes of fatty acids in plant lipids were extensively researched however phytosterols oxidation products also were detected in plant oils. Cholesterol lowering properties of phytosterols, and their saturated derivatives – phytostanols, caused increase the production of functional food enriched in these substances. Up to now, no systematic studies have been conducted on the autoxidation of stanols.

Margarines enriched in plant stanols were stored at 4 and 18ºC for up to 18 weeks. Changes in sitostanol content and its oxidation products were analysed by GC-FID method. GC/MS technique was used to identification of sitostanol oxidation derivatives. Peroxide value was determined in all samples by AOCS method.

In analysed margarines identified four phytosterols (brassicasterol, campesterol, sitosterol, avenasterol) and two phytostanols (sitostanol, campestanol). The content of total phytosterols/stanols in margarines ranged from 79 mg/g in control sample to 63 and 55 mg/g after storage for 18 weeks at 4 and 20ºC, respectively. The contribution of sitostanol ranged from 72 to 75%. During storage of margarine at 4 and 20ºC for 18 weeks sitostanol content decreased respectively from 58 mg/g to 45 and 41 mg/g. The content of its oxidation derivatives increased from 0.3 mg/g in fresh products to 0.4 and 0.6 mg/g after storage at 4 and 20ºC, respectively. In all samples 7-hydroxy derivatives dominated and their content increased from 0.102 mg/g in control sample to 0.290 and 0.317 mg/g after storage for 18 weeks at 4 and 20ºC, respectively. The content of epoxy derivatives of stanols in control sample was 0.071 mg/g and increased rapidly after 6 weeks at 20ºC to 0.333 mg/g. During storage this amount decreased to 0.184 mg/g after 12 weeks and 0.106 mg/g after 18 weeks. In samples stored at 4ºC the epoxy-stanol content ranged from 0.098 mg/g after 6 weeks, 0.089 mg/g after 12 weeks and 0.065 mg/g after 18 weeks.

Stanols do not contain a double bond at the Δ5 position and are considered to be more stable than their counterparts containing an olefinic unsaturation. But presented results show that they can form oxidation derivatives in food products enriched in stanols during storage in fridge or at room temperature.

Key words: oxidative changes, fatty acids, plant lipid

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THE TRIAL OF THE ENZYMATIC MODIFICATION OF THE POTATO PROTEINS BY FATTY ACID WITH USE OF THE MICROBIAL ORIGIN LIPASE

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The aim of the work was to obtain the potato protein modified by fatty acid with use of the microbial origin lipase and the comparison of chosen functional proprieties of received products with the proprieties of the unmodified substance.

The investigative material was the preparation of the potato protein received by the Pęksa method [2006]. The potato protein was subjected the reactions of the enzymatic modification by oleic acid in the environment of tert-butanol as a organic solvent. Applying the proportions 1:1 (the preparation of the potato protein to the oleic acid) the reaction mixture was prepared . The organic solvent as a medium of the reaction was tert-butanol. The molecular sieve (4 Å, 8-12 mesh) was applied in the aim of absorption of water coming into reaction mixture. The catalyst of the reaction was immobilized lipase Novozym 435. The test of the reference not including the enzyme was prepared simultaneously. The reaction of the modification was led by 10 days in the temperature 60 º C with the use of the system of continuous mixing (350 rpm). After finishing the reaction the excess of the oleic acid was removed by extracting the mixture with acetone in temperature 50ºC by 1 hour, and then it was filtered. Obtained precipitate after drying was submitted magnetic resonance spectra (*H* NMR) for checking of the degree of the modification, the thermal characteristic of the substance was measured on the differential scanning calorimeter DSC of the firm Mettler -Toledo, model 822e. The profile of chemical bonds was qualified with use of spectroscopy in infra-red radiation FTIR. Water absorption and the oil absorption of received substance were estimated moreover.

The got results of investigations let affirm, that in the result of the enzymatic reaction with the use of the Novozym 435 lipase, the protein modified with oleic acid was obtained. Received modificate differed from the unmodified protein physical properties (thermal profile DSC) and water absorption, which was above 3 times lower than the clean protein. However differences in oil absorption were not noted down between investigated samples.

Key words: potato protein, fatty acid, microbial origin lipase

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Niva Shapira

EVERY EGG MAY HAVE A PURPOSE: TAILORING EGG COMPOSITION FOR NUTRITIONAL AND FUNCTIONAL BENEFITS

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Introduction: Despite suggested health advantages of 'traditional' and 'designer' eggs (produced under natural conditions) over the 'western' type, and flexibility of egg composition, epidemiological studies on health effects of egg refer only to quantity of consumption and overlook their quality. Beyond the egg's basic unique potential for nutritional contribution, health-oriented agricultural technologies could further increase the egg's nutritional and functional relevance, i.e. as related to brain development and cardiovascular disease (CVD) risks.

Methods: Studies assessing egg modification and application were examined. Original studies investigated two key areas of egg composition: (1) reduced human LDL oxidative response with high egg intake (two/day), by reducing n-6 PUFA and increasing n-9 MUFA and antioxidants compared to Western 'generic' (high n-6 PUFA) eggs, (2) increased n-3 PUFA/LCPUFA, and contribution to dietary recommendations (DRI). A review evaluated fortified egg for brain-specific support during peak perinatal development.

Results: Reducing egg n-6 PUFA FA 30% and PUFA:MUFA ratio 50%, and increasing vitamin E and carotenoids >200%, was found to reduce LDL oxidizability by 45% ($p<0.01$). N-3 PUFA fortification yielded higher total n-3 PUFA and DHA, 3.8-fold and 2.4-fold respectively, and 3.6-fold lower n-6:n-3 PUFA ratio ($p\leq0.0005$) compared to regular egg, attaining 10% upper n-3 PUFA DRI, 40% for DHA. Where regular egg provides 20–30% of pregnancy/lactation DRI for selenium, choline, and vitamins B2 and B12, and 30–70% for essential amino acids, fortified egg could attain additional significant%DRI for DHA, iodine, selenium, and vitamins A, D, and E;%recommendations attained for infants 1–3 years are even higher. With current high n-6 PUFA intake and scarce n-3 LCPUFA potentially associated with CVD risks of oxidative stress, dyslipidemia, and inflammatory processes, egg modification could suggest preventive advantages.

Discussion: Because egg composition is highly feed-dependent and potent nutritionally and functionally, it could be carefully tailored to address specific risks and requirements, i.e. during peak brain development or in dyslipidemic and/or highly oxidative states such as diabetics – found to be more adversely affected by Western 'generic' eggs – warranting further research to better differentiate between various compositions and to maximize the egg's beneficial impact.

Key words: egg, modification, functional food

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Shaun Bilsborough

APPLYING ACCURATE MASS TIME OF FLIGHT SPECTROMETRY TO ROUTINE SCREENING OF CONTAMINANTS IN FOOD AS AN ALTERNATIVE TO TARGETED APPROACHES

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The requirements for screening many hundreds of compounds in complex matrices presents a key analytical challenge.Targeted methods using triple quadrupole mass spectrometry provide sensitive detection combined with low limits of quantitation. However, such approaches require the analyst to optimise the methodology for a limited number of compounds within an analysis to maintain instrument performance. Non-targeted approaches allow for rapid screening of samples for many thousands of compounds without the need for any prior knowledge from the analyst of suspected contaminants.

The successful detection and identification of food contaminants using the non-targeted approach presented two challenges. Firstly, to locate and extract the relevant data resulting from the analysis of a complex mixture containing numerous compounds present across a wide dynamic range and secondly, to identify those contaminants. To address this, rapid resolution chromatography was employed to allow fast analysis while maintaining high resolution thereby avoiding the risk of chemical interference leading to a loss in mass accuracy. Dynamic range issues were overcome through the use of analogue to digital conversion for ion detection providing 5 orders of magnitude within the same scan. Compounds were identified using an Accurate Mass Retention Time (AMRT) database. The AMRT database used in this study contained over 7,000 compounds pertaining to forensic and toxicological studies. Additionally, any compound that was found but was not present in the database could be investigated further through empirical formula determination using the accurate mass measurement provided by time of flight mass spectrometry. Indeed, the development of analog to digital ion detection with fast digitization rates has provided the further advantage of accurate mass MSMS analysis leading to increased confidence in identification. We conclude by proposing the use of both targeted and non-targeted methodologies for food safety applications, by firstly screening samples for all contaminants and then targeting those compounds identified for quantitation using a triple quadrupole method.

Key words: Accurate Mass Retention Time, screening of contaminants food

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SUBSTRATE SPECIFICITY OF TRANSGLUTAMINASE. INFLUENCE OF TRANSGLUTAMINASE ON MILK WHEY PROTEINS CROSS-LINKING

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Enzymes play an important role in the food producing of both traditional and novel products. For many thousands of years, man has used naturally occurring micro-organisms – bacteria, yeasts and moulds - and the enzymes they produce to make foods such as bread, cheese, beer and wine. For example in bread-making the enzyme, amylase, is used to break down flour into soluble sugars, which are transformed by yeast into alcohol and carbon dioxide, that makes the dough rise.

Today, enzymes are used for an increasing range of applications: bakery, cheese making, starch processing and production of fruit juices and other drinks. Here, they can improve texture, appearance and nutritional value, and may generate desirable flavors and aromas. Currently-used food enzymes sometimes originate in animals and plants (for example, a starch-digesting enzyme, amylase, can be obtained from germinating barley seeds) but most come from a range of beneficial micro-organisms.

Majority of applied in food industry enzymes are hydrolases such as glycosidases, and in part proteases used for the meat tenderizing. The new direction is the use of enzymes as a tool for modificaton of protein structure. For this aim more often is used microbial transglutaminase (TGase). It produces the both inter- and intra-molecular isopeptide cross-linking bonds in the proteins. We investigate its substrate specificity to attempt to develop the combined products consisting of the proteins from different sources.

Some experiments were carried out. We have investigated the process of pasteurised milk fermentation with *L. acidophilum*. TGase was used as cross-linking agent. Kinetics of fermentation, clot texture, separated whey volume was determined. It was examined also non-enzymatic proteins (collagen, gelatin) influence on milk fermentation. The first protein to be cross-linked with TGase was chosen milk whey protein because of important problem of the rational utilization of protein rich milk whey.

Whey protein bioavailability is much more than other proteins. Whey protein has functional and revitalizing advantages. It is rich in sulfur amino acids, important in glutathion biosynthesis, tripeptide with antioxidant, and in anticarcinogenic and immunopotentiating effect. Whey protein has the highest content of essential amino acids, which promote muscle protein synthesis.

Separated whey samples was analysed enabling chemical methods. Residual protein content was determined. Gel permeation chromatography was used for protein content measuring and protein fractions molecular mass definition. SDS–PAGE was performed for demonstration TGase effectiveness in clot fixation of valuable protein. Some enzyme and substrate activators were involved in cross-linking. Others substrates was also investigated (i.e., gelatin).

Our findings indicate TGase applicability for choosen protein cross-linking. Further investigations will deal with other protein substrates and with their various combinations.

Key words: transglutaminase, milk protein

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EFFECTIVE RISK COMMUNICATION AT THE FOOD MARKET

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The article outlines the role of risk communication at the food market and reviews factors which make this process effective. Risk communication is an integral part of risk analysis framework defined by FAO/WHO (1995), comprising three elements: risk assessment, management and communication. Risk communication is an interactive process of exchange of information and opinions on risk among risk assessors, risk managers, and other interested parties, especially consumers.

The study commences from revealing an observation that consumers are highly sensitive to some risk messages and react immediately by changing their buying behavior (i.e. BSE and beef market), while at the same time being insensitive to other risk messages (i.e. cigarettes, mobile phones). It raises the question about the effectiveness of risk communication. We claim that risk communication is effective if followed by desired changes in perceptions, awareness and/or behavior of recipients of the messages.

Subsequently, we review factors that have been found as determining effectiveness of risk communication to the consumer at the food market, notably: public trust in risk communicators, nature of food hazard, mass media. The "expert-lay discrepancy" effect is also described as having an impact on this process.

Finally, we provide several implications on how to improve food risk communication efforts to make it successful (i.e. communication of risk-benefit messages, building trust, using proper format of information messages).

Key words: risk communication, food market

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Agnieszka Skolik

PREDICTION OF THE BITTER TASTE STUDIED BY COMPUTER MODELING

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Reviewed in this paper are the computer and scaling methods that were used for expressing differences in quality in terms of quantity.

The assessment of selected scaling methods consisted in effective, thorough investigation into their potential, thus enabling misassessments to be avoided informedly, and permitting results to be determined with as high accuracy and repeatability as possible while minimizing the time of assessment, quantity of samples and number of repetitions as well as a possibly simple and definite interpretation of results.

The respective scaling methods were assessed in accordance with generally applied requirements in a specially prepared laboratory by on a group of ten professionals, so-called selected assessment experts, having proven sensory sensitiveness and characterized by good assessment stability and memory, and the obtained results were used for establishing the intensity of the bitter taste of a number of vegetable alkaloids.

A variety of compounds with identical super-threshold concentrations were used for the tests. The samples were assigned numbers and codes. The assessment experts were requested to arrange the test samples according to their intensity of bitterness using different scales.

The findings for a series of alkaloids after being grouped, averaged, and arranged, resulted in scales describing the effect of bitter taste and were used for systematizing such compounds in respect of taste.

The sensory analysis has been made according to The Polish Standards: taste daltonism, sensibility threshold, and difference threshold.

The compounds were tested by 10 people using the rank order test. Extremely high bitter taste was quinine (standard).

Quinine, khellin, tetraiodosaccharine and coffeine were used as matrix in order to map the contours of the bitter taste mould.

Two options: the energetic (MM and VDW) and quantum-mechanics (MOPAC) of the Chem X program were used for the optimization of the structures investigation molecules.

The degree of bitterness for each of the alkaloids was determined by sensory analysis and this results was compared with the prediction of taste based on above computer analysis.

Our investigation showed that the obtained semi model of the bitter taste receptor (as e.g. molecular mould) can help chemists to predict taste on the basis computer modeling.

Key words: computer modeling, sensory quality

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PACKAGING OF HALF-FINISHED FRESH VEGETABLE PRODUCTS

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A progressive storage method for food is packaging in vacuum or modified gas atmosphere. Modified atmosphere packaging is the method for prolonging storage time by days or even weeks, maintaining high quality, original taste and texture of the foodstuff.

The most significant factor, characterising where and what food products consumer buys, is the safety and quality of the product which is provided by adequate packaging. Quality of production is of great importance in application of new technologies in catering enterprises. Foodstuff changes take place during pre-treatment of food products.

To comply with the current market demands, packaging has to provide: harmlessness, quality permanence of the food product, prolonged storage time, protection against mechanical and other external damage, protection against subordinate contamination, information availability about the packaged product and, the most important, it has to arouse consumer's interest. Packaging by use of modified atmosphere medium – MAP or vacuum is considered as potential method in storage of food products without using preservatives. Therefore in order to determine the optimum type of packaging for salad mixes, the following objective is proposed: to research quality changes of fresh vegetable salad mixes during storage in packages with protective gasses – modified medium by applying HACCP principles.

Packaged products have been stored in a chilled room at different temperatures. Quality changes of vegetables during storage have been investigated with instrumental methods. Regimes of storage time are determined, taking into account their influence on the structure-mechanical properties of the product. As the storage process of packaged vegetables is one of the most important, changes of physical and microbiological quality indices are determined just in this stage of technological process.

Key words: vegetables, storage, packaging, modified atmosphere, salad

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TECHNOLOGICAL ELABORATION OF BAKERY OF WHOLEMEAL RYE BREAD WITH REDUCED SALT CONTENT

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The aim of this thesis was to reduce a salt content in a wholemeal rye bread. The materials used for a research were: rye flour type 2000 and 720, wheat flour type 750 and herbs (fennel seed, caraway, thyme, savory). The herbs were added in the amount of 0,5 and 1% in the ratio to flour.

In the experimental part of the thesis an analysis of the basic physical and chemical properties was made. There was also made an amylographic analysis. The impact of the herbs on fermentation process was investigated. It was found that the herbs used had an impact on the ability of CO_2 production by yeast.

The following stage was test laboratory baking. In the first baking the breads containing 0,5, 1, 1,5 and 2% were baked. On the basis of the analysis conducted, for the next research was chosen bread containing 1% of salt.

The following stage was baking of bread with addition of the herbs and a blend of herbs. The organolepticaly assessment of the bread obtained was made and its physical and chemical properties were investigated. Used herbs as well as a mixture of herbs had different impacts on physical and chemical properties of bread. Feenel seed, savory and their mixtures had the most favourable effect on analysed parameters of bread. Trials with theirs addition characterized in higher porosity and volume, smaller wetness, acidity and hardness in comparison to the control trial. Consumer accepted bread from the trials with reduced content of salt and simultaneous addition of herbs.

Key words: salt, herbs, rye flour, wholemeal rye bread, rye dough, rye

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EFFECT OF WAITING TIME AND PRESLAUGHTER THERMAL CONDITIONS ON CARCASS AND MEAT QUALITY OF BROILER CHICKENS

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The objective of the study was to determine if ambient temperature and waiting time before slaughter affect the quality of carcasses and meat from broiler chickens.

A total of 240 broiler chickens aged 42 days were studied to analyse body weight losses, carcass quality and broiler meat quality after 4-, 8- and 16-hour waiting for slaughter at 18 and 30°C.

Carcass and meat quality was evaluated postmortem using slaughter analysis and calculation of dressing percentage, breast and leg muscle percentage, and percentages of liver, bones and abdominal fat in carcasses. Acidity (pH_{15min} and pH_{24h}) of breast and leg muscles was measured 15 minutes and 24 h postmortem. Colour of breast and leg muscles was determined 24 h postmortem using L* a* b* colour scale. Chemical composition of the meat of breast and thigh muscles was determined by analysing the content of water, protein and fatty acids.

It was found that waiting time and thermal conditions before slaughter affect the quality of broiler carcasses and meat.

Body weight losses were found to increase with increased waiting time and were higher at 30°C compared to 18°C. The fact that body weight losses increased with increasing waiting time is associated with lack of access to feed and water and increased stress reaction of the chickens exposed to high temperature.

After 16 h of waiting at 30°C, breast muscles of the chickens were characterized by greater lightness (L*) and smaller acidity. The experimental conditions had no effect on pH and colour of leg muscles.

The present study showed the effect of temperature and waiting time before slaughter on the water and fatty acid content of leg muscles.

Key words: meat quality, broiler chicken

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ANTIOXIDANT ACTIVITY OF ROSE LIQUEURS

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The aim of this study was to investigate the influence of the production technology on antioxidant properties of fruits liqueurs from four rose fruit species: *Rosa canina* L., *Rosa rugosa, Rosa spinosissima, Rosa hybryda.*

Total phenolics were determined according to the Folin–Ciocalteu method. Antioxidant capacity was determined by reducing power (FRAP) and scavenging of the 2,2-diphenyl-1-picryhydrazyl (DPPH) and 2,2'-azino-bis(3-ethylbenzthiazoline-6-sulphonic acid) (ABTS) radicals.

The highest total polyphenols content and antioxidant activity were determined in liqueurs made from black rose (*Rosa spinosissima),* and the lowest in *Rosa rugosa* liquors that was about three times weaker than these from black rose.

Strength of ethanolic solutions and sequence of adding alcohol and sugar also influenced on antioxidant activity. The richest in active compounds were variants in which fruits were mixed with sugar and ethanol grade 45% was added after 30 days. Higher antioxidant activity (over about 20%) was observed in liqueurs made from fruits without seeds.

Usage of 65% grade ethanol caused worse extraction of phenolic compounds and consequently antioxidant activity was lower than in other liqueurs.

Total phenolic and activity against ABTS radical initially increased, and after 26 months storage decreased to initial, or slightly higher values. Activity against DPPH radicals and reducing power were continuously decreased during the storage in most cases.

Key words: rose liqueur, antioxidant activity

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IDENTIFICATION OF GLUCOSINOLATES DETERMINED IN SEEDS, SPROUTS AND VEGETABLES FROM BRASSICACEAE FAMILY APPLYING LIQUID CHROMATOGRAPHY COUPLED WITH MASS SPECTROMETRY AND POSITIVE ELECTROSPRAY IONIZATION (LC-ESI/MS)

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Glucosinolates, are sulfur glucosides present in plants from Brassicaceae family as cabbage, cauliflower, broccoli, turnip and radish. Occurrence of glucosinolates in food gives it functional and health promoting character. Those secondary plant metabolites are undergoing enzymatic, thermal or due intestinal microflora degradation, which results in forming variety of degradation products. Certain glucosinolates' degradation products have ability for multidirectional anticarcinogenic actions. Factors like species, strain, cultivation conditions etc. influence significantly on glucosinolates profiles in plants.

The method of desulfoglucosinolates identification by means of liquid chromatography coupled with mass spectrometry and positive electrospray ionization (LC-ESI/MS) was developed. Glucosinolates were isolated from seeds, sprouts or vegetables of broccoli (*Brassica oleracea* L. var *italica*), cauliflower (*Brassica oleracea* L. var. *botrytis*), red cabbage (*Brassica oleracea* L. var. *Capitata* f. *rubra*), radish (*Raphanus sativus* L.) and rapeseed (*Brassica napus* L. subsp. *napus*) with principles based on international standard ISO 9167-1. Glucosinolates' extraction with methanol was followed by purification on ion exchange columns and subsequently desulfation. Desulfogluocosinolates were separated by reversed phase liquid chromatography with water and acetonitrile as mobile phases in gradient elution.

Several desulfoglucosinolates, mainly aliphatic, were identified in Brassicaceae plants by means of liquid chromatography coupled with mass spectrometry and positive electrospray ionization (LC-ESI/MS). Sodium $[M+Na]^+$ and potassium $[M+K]^+$ desulfoglucosinolates' adducts were detected when positive ions were analysed. In spectra of majority desulfoglucosinolates the most abundant adduct was the sodium one, for e.g. in case of desulfoglucoiberin or desulfosinigrin; only for few other was the potassium one e.g. desulfoglucoerucin or

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desulfoglucobrasscin. However, it was observed that some desulfoglucosinolates has adducts with similar relative abundance for e.g. in desulfoglucoraphanin spectrum (MW=357) sodium adduct $[M+Na]^+$ = 380 m/z was the most abundant one (100%), and potassium $[M+K]^+$ = 396 m/z has relative abundance 94%.

Key words: glucosinolates, *Brassicaceae*, liquid chromatography

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APPLICATION OF SDS – PAGE ELECTROPHORESIS FOR MEAT SPECIES IDENTIFICATION

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Food adulteration, including meat and meat products, is becoming an increasingly frequent phenomenon making consumers bear higher expenses when buying a specific product than its real value. It is also important to realise that the adulterated articles fail to meet health, dietary or religious requirements and may pose a threat to consumers' lives.

The objective of the performed investigations was to assess possibilities of meat identification derived from six, most common animal species found on the market on the basis of the analysis of electrophoretic separations obtained with the assistance of the SDS-PAGE technique with special emphasis on titin.

Investigations were carried out on raw muscle tissue which derived from: chicken, turkey, duck, goose, cattle and swine in different time after slaughter. In the case of poultry, samples were collected from the breast muscle (*m. pectoralis major*), whereas in the case of cattle and swine carcasses, raw material for experiments was collected from the longest muscle of the breast and loin (*m. longissimus thoracis et lumborum*). Muscle tissue samples were subjected to hydrolysis in a special buffer at the temperature of 60°C for 20 minutes and then applied onto 15% polyacrylamide gel with the addition of 8M urea on which they underwent electrophoresis using, for that purpose, an SE 250 Mighty Small II apparatus. At the termination of protein separation, gels were stained using *Coomassie Brilliant Blue* solution. Titin was identified by immunoblotting employing its antibody 9D10 derived from the Developmental Studies Hybridoma Bank in the USA. Gels and membranes were scanned by a video camera and the obtained images were digitally processed in computer with the assistance of the ImageMaster® 1D software.

The performed analysis of electrophoretic separations revealed differences between the examined meat species. A series of protein bands ranging from 205 to 3700 kDa were observed in all six analysed meat species but, in the case of meat from cattle and swine, these bands were distinctly more intense than in poultry meat and they were more numerous. The

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band corresponding most probably to α-actinin, protein of 105 kDa molecular weight, looked slightly different. In the case of poultry, it occurred on the polyacrylamide gel as a single band, while in cattle and swine – as a double band. The remaining differences between the analysed species concerned proteins of molecular weight below 50 kDa and were associated, primarily, with the number of bands observed on gels. Only in the case of poultry, a protein was identified over the actin band which was visible on the gel in the form of a distinct stripe of 48 kDa molecular weight. The performed immunoblotting using the titin antibody 9D10 indicated that these were probably products of titin degradation. Only in the case of turkey, cattle and swine a thin band of molecular weight of about 40 kDa appeared regularly below the band of actin.

The performed investigations revealed that the application of SDS-PAGE electrophoresis makes it possible to identify species of raw meat derived from chicken, turkey, duck, goose, cattle and swine if the analysis refers to raw material obtained from single animal species.

Key words: SDS-PAGE electrophoresis, meat products

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J. Stankiewicz

ASSESSMENT OF MICROBIOLOGICAL QUALITY OF FOODSTUFFS INTENDED FOR PARTICULAR NUTRITIONAL USES

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Foodstuffs intended for particular nutritional uses includes, amongst others, infant and baby food. The mentioned food should be subjected to a strict sanitary control measures on every step of its production and its introduction to the trade.

Microbiological criteria relating to foodstuffs intended for particular nutritional uses, which are described in regulation by European Commission 1141/2007, limit the allowed amount of *Bacillus cereus*. The origination of the mentioned Microorganisms is, among all, raw milk and its products, eggs, raw fruits, confectionery, desserts, puddings, creams, rice and pre-packed baby food.

Generated by *Bacillus cereus* diarrhea and nausea toxin, which can cause food poisoning, is synthesized by vegetative cells that develop form spores.

The aim of research was to assess the degree of contamination of infant and baby food with *Bacillus cereus.*

In total, 86 samples of soups, main courses and desserts manufactured by 5 different manufacturers of baby food have been tested. The research material included dishes which were suitable for immediate consumption (n = 42) and dishes which required further thermal treatment (n= 44).

The size of the *Bacillus cereus* population was marked on manufactured by Merck Mossela base with added selective factor; egg yolk emulsion and polymyxin B antibiotic. The study has been carried out between May and July 2008.

The carried out research indicated contamination on levels between 0 and $9*10^3$ cfu/g, while 30% of the samples indicated the presence of *Bacillus cereus.* The highest percentage of samples which contained *Bacillus cereus* was amongst main-course samples. Only in 4.7% of tested infant and baby food samples, the amount of *Bacillus cereus* exceeded permissible limits stated in regulation by the Commission.

Key words: microbiological quality, foodstuffs intendend

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I. Steinka

PLANT ORIGIN FOOD PACKAGING SYSTEM OPTIMALIZATION WITH *KLANCHOE* AEROSOL APPLICATION

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Food products of animal origin can be packed into different types of packaging, which develop antibacterial character by adding the certain chemical substances.

It can be observed that bactericide compounds used for incorporating into packaging involve mostly the products of secondary metabolism of micro-flora.

Study indicate six systems connected with localisation and bacteriostatic activity of special kinds of active packaging (Han 2000).

Investigation provide to used the system, where, there exists the equilibrium between the amount of emitted volatile and liquid anti-microbiological substances and the space in-between the packaging and products surfaces.

It is also possible to use active substance directly to the food product (spry coating before packaging)

In the our new technology, the aerosol obtained from macerated *kalanchoe* pulp was spray-coated to the surface of plant product directly before hermetic packing of the product into polystyrene box.

Used this system let us obtain the best quality of plant products packaging with rigid polystyrene box.

We observed decrease the level of the enterococci, staphylococci and mould count on the products surface. This investigations support efficiency of bacteriostatic action *klanchoe* juice in this packaging system.

Key words: food packaging systems, bacteriostatic activity

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Evita Straumite, Inese Lejniece, Dace Klava, Ruta Galoburda

QUALITY CHANGES OF CONFECTIONERY PRODUCTS DURING FROZEN STORAGE TIME

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The economic and demographic evolution of the foodservice and in-store baking industries will provide an ample foundation for growth of the frozen baked goods industry in Latvia in the years to come. Whether marketed through foodservice or food retailing outlets, frozen confectionery provide an important venue for achieving cost efficiencies in the face of increased competition and fragmenting markets. With time, product quality will improve as the industry climbs the technological learning curve. The success of the frozen confectionery industry remains first and foremost economical driver. The aim of this study was – to evaluate the quality changes of confectionery products during frozen storage time.

In the research five types of the following frozen ready-to-bake products made from yeast dough and flaky paste were used: roll with boiled cream, roll with curd (cottage cheese type product), roll with apple filling, flaky paste meat pies and partially baked spicy meat pies. The freshly prepared ready-to-bake products were packaged in unsealed PP pouches, frozen and stored at -18±2°C temperature for 3 months.

Sensory properties (flavour, taste and appearance), moisture content and microbiological contamination were determined for three types of samples – fillings, frozen and baked confectionery products. Plate counting method was used for microbiological analysis. The samples (dilutions 1:100; 1:1000) for the investigation were taken on the 1st, 30th, 60th and 90th days. *Enterobactery* was detected on VRBD agar (1:10; 1:100) in two replications. Counting of colonies formed and calculating the number of CFUs was accomplished by Acolyte colony counter. Moisture content in samples was determined using moisture balance XM 120 Precisa.

Experimental results proved that total plate count was higher in rolls with cottage cheese and pies with meat filling (6.3800×10^4–8.1217×10^4 CFU g^{-1}), while in rolls filled with boiled cream or apples it was in a range of 2.100×10^3–7.284×10^3 CFU g^{-1}. It allows drawing a conclusion that the producer has to pay a special attention to preparation of products containing raw materials of animal origin because those may contain higher numbers of microorganisms, which in this study exceeded the limits permitted by Latvian legislation 5×10^4 CFU. Part of microorganisms do not survive freezing and frozen storage while part of them reach the state of anabyosis, therefore total plate count is reduced within three month frozen storage.

In the research the shelf life for frozen storage of the tested ready-to-bake products in unsealed PP pouches was found about 60 days at -18±2 °C temperature. During longer storage the sensory properties and moisture content was changed exceeding the acceptable limits.

Key words: frozen storage, confectionery products, quality

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Kinga Stuper[1], Alicja Kawka[2], Maciej Buśko[1], Elżbieta Suchowilska[3], Lidia Szwajkowska-Michałek[1], Anna Matysiak[1], Marian Wiwart[3], Juliusz Perkowski[1]

THE EFFECT OF MYCOFLORA AND TRICHOTHECENE CONTENTS IN BREAD WHEAT ON QUALITY OF ITS MILLING PRODUCTS

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The food pyramid is based on cereals, thus it is crucial to control their quality at every stage of production. Microscopic fungi, found already during plant vegetation, are major pathogenic microorganisms affecting the quality of cereal products. Toxic secondary metabolites of these fungi called mycotoxins may have a significant effect on the quality of grain, its milling products, and as a consequence also the final product, i.e. baked goods.

For the purpose of the study 14 samples of naturally infected grain of two cultivars: Torka (n = 7) and Griwa (n = 7) were collected. Analyzed samples were characterized by a varied content of mycoflora measured by the amount of ergosterol (ERG) and fusarium toxins (trichothecenes B). In case of wheat cv. Torka ERG content ranged from 10.85 mg/kg to 1.41 mg/kg, while that of fusarium toxins ranged from 63.94 ug/kg to 0.00 ug/kg, respectively. In case of cv. Griwa ERG concentration ranged from 23.50 mg/kg to 0.99 mg/kg, while trichothecene content ranged from 92.00 ug/kg to 0.00 ug/kg. Analyzed grain was milled at the laboratory, as a result of which flour type 750 and bran were produced. Contents of both ERG and toxins in comparison to their levels in the parent material increased on average two times in bran, while in flour it dropped on average by 90%. Flours were used in baking under laboratory conditions, on the basis of which a variation was observed in baking value. Quality of baked goods was observed to deteriorate considerably in samples with the highest mycotoxin and ERG contents.

Based on the conducted analyses it was found that elevated contents of both mycoflora and trichothecenes had a significant effect on the quality of cereal milling products.

Key words: bread wheat, quality, cereal milling products

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Kinga Stuper, Juliusz Perkowski

CONCENTRATION OF ERGOSTEROL IN CEREALS AND CEREALS PRODUCTS

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Ergosterol (ERG) is a major sterol constituent of most fungi. Its concentration is negligible in higher plants, but can be used as a chemical marker of the presence of fungal contaminations. In this study, ERG concentration was assessed in randomly collected 65 samples of naturally contaminated grain (wheat, barley, rye and oat) from west Poland in 2007. The lowest ERG concentration was found in wheat samples (4,13 mg/kg), the highest in oat (11,92 mg/kg). The study presents also results of determination of ERG content in milling and processing products of small grain cereals (wheat, oat, barley and rye) collected in year 2008 in retail stories in Poznań. A total of 261 samples of different types of cereal processing products (light flours, dark flours, groats, pastas, flakes, bran) were analyzed. In samples of cereal processing products the highest ERG concentration was recorded in bran 31,72 mg/kg, followed by dark flours with 2,44 mg/kg, then flakes with 1,32 mg/kg, groats with 0,97 mg/kg, and light flours with 0,42 mg/kg, respectively. The lowest concentration was found in pastas, where it was 0,15 mg/kg.

The lowest ERG amounts were assayed in flours with a high degree of purification, while the highest in case of flours and products with a low purification rate. The content of ERG was also analyzed other foodstuffs, where a considerable variation was observed. The results show that reversed-phase high-performance liquid chromatography combined with microwave-assisted extraction is reliable and useful for ERG natural determination in low-weight samples of small-grained cereals.

Key words: ergosterol, cereals products

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**Tomasz Szablewski, Jacek Kijowski,
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UV-C IRRADIATION TO SANITISE SHELL SURFACE OF EGGS LAID BY LAYER HENS IN LITTER HOUSING SYSTEM

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Most food poisoning cases in humans are caused by bacteria from genus *Salmonella*. Bacteria excreted with feces of carriers penetrate into the environment and next food products. Most commonly *Salmonella enteritidis* (SE) is found in poultry foodstuffs in the EU.

In June 2006 the European Food Safety Agency (EFSA) published a report indicating very high contamination with Gram (-) bacteria, including *Salmonella*, in poultry houses in Poland in commercial flocks of layer hens. The primary site of microbial contamination of egg shells is the farm and the extent of contamination depends to a considerable extent on the management method of layer hens. The contamination of egg shell surface in case of litter management is over 15 times higher than in eggs from battery housing management.

Probably starting from 2010 a ban will be imposed on the sale of eggs for human consumption coming from poultry houses where the presence of bacteria from genus *Salmonella* has been detected. This is consistent with the Directive of the European Commission no. 1168/2006 of 31 July 2006 on the reduction of incidence of *Salmonella* to 1% commercial flocks of layer hens. One of the recommended methods to reduce the risk of salmonellosis is to sanitize the egg shell surface by UV-C irradiation at 254 nm. The sanitation effect could be better if egg shells have been washed prior to irradiation. This procedure, thanks to the reduction of bacterial counts on egg shells, improves egg hygienic quality and for years has been successfully used in Sweden, the USA, Canada and Japan.

The aim of the study was to assess the effectiveness of UV-C irradiation, in combination with previous washing of egg shell surface, as a method to sanitize shells of eggs laid by layer hens kept in litter housing, i.e. eggs with dirty surface.

Microbiological analyses included assays of total microbial and coli-form bacteria counts by the conventional flooding method according to Koch. Analyses were performed immediately after egg shell surface was irradiated with UV-C for 30, 60 and 90 s in a CompArt 245 irradiator and after 2 and 4 weeks of storage.

In this study, thanks to washing of egg shell surface in combination with UV-C irradiation at 254 nm, considerable amounts of bacteria were removed from eggs laid in the litter housing system. A statistically significant reduction of the counts of mesophilic bacteria and coli-form bacteria was observed, dependent on irradiation time. In contrast, no significant effect was found of egg storage time on changes in microbiological indexes.

Results of conducted experiments suggest that UV-C radiation in combination with washing may be a suitable method to sanitize egg shell surface.

Key words: UV-C irradiation, egg

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Tadeusz Szmańko, Małgorzata Korzeniowska, Adam Malicki, Ewa Wierzbicka, Roman Kawałko

PROTEIN AND FAT CHANGES AND MICROBIOLOGICAL STATUS OF HAMBURGERS IN RELATION TO PACKAGING AND STORAGE CONDITIONS, AS WELL AS HEATING PROCEDURE

Department of Animal Products Technology and Quality Management,
Wrocław University of Environmental and Life Sciences

The aim of the study was the evaluation of proteins and lipids degenerative changes as well as microbiological status of beef hamburgers which were packed under vacuum or MAP stored at the temp. +3 or -3°C up to 28 days. Proteolytical changes in proteins and oxidative and hydrolitical changes in lipids were analysed in hamburgers after three different thermal treatment i.e. microvawing, steaming and baking.

The results of the study showed that hamburgers stored for 14 days were characterised by higher amount of free amine groups. Moreover, storage of the hamburgers for 21 days resulted in lower protein solubility, which was the effect of proteins changes during storage. Hamburgers heated in microwave oven expressed higher protein solubility than thermally treated by steaming or baking. Prolong storage of the hamburgers for 14, 21 and 28 days effected also in increasing the level of acidic and peroxide as well as TBA values, respectively. The highest dynamic of lipids oxidative changes was observed in baked hamburgers in comparison to microvawed and steamed products. General count of aerobic bacteria analysed in hamburgers stored at the temp. -3°C up to 28 days, despite the packaging method, was on the level of about $5x10^5$ cfu/g, whereas products kept at the temp. +3°C for 14 days expressed higher amount of analysed bacteria (2,8 –4,0 x 10^6 cfu/g). Hamburgers stored at the temperature close to cryoscopic point (-3°C), despite the packaging method, were free from Enterobacteriaceae and lactic acid bacteria. In all analysed hamburgers no Salmonella, Escherichia. coli, Staphylococcus aureus and proteolytic bacteria were found. It can be concluded that storage of the beef hamburgers at the temperature close to cryoscopic point (-3°C) resulted in lower oxidative changes in lipids as well as higher hygienic (microbiological) status.

Key words: hamburger, storage, thermal treatment, changes in proteins and fat, microbiological status

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Tadeusz Szmańko, Małgorzata Korzeniowska, Ewa Wierzbicka, Roman Kawałko

THE EVALUATION OF RHEOLOGICAL AND SENSORY PROPERTIES OF HAMBURGERS IN RELATION TO PACKAGING AND STORAGE CONDITIONS, AS WELL AS HEATING PROCEDURE

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Wrocław University of Environmental and Life Sciences

The objective of the study was the evaluation of the effect of packaging methods and storage conditions, as well as heating procedure on rheological and sensory properties of hamburgers. Experimental material consisted of hamburgers formulated from beef. Factors of variation were: packaging method – vaccuum and MAP; storage conditions – chilling (+3±1°C), – cryoscopic (-3±1°C); storage period: – 0, 7, 21, 28 days; method of thermal treatment after storage – microwaving, steam heating at the temp. 100°C, baking at electric oven at the temp 170±2°C. Hamburgers were subjected to sensory analysis with evaluation of colour, flavour, taste, juiciness, texture, saltiness and overall acceptability. Rheological analysis included cutting force and strength needed for product crosscut or disruption. The results of the study showed that vacuum packaging of the hamburgers resulted in higher values of cutting force and strength needed for product crosscut. Whereas packing with MAP caused increase values of cutting force and strength needed for product disruption. Vacuum packed hamburgers were characterised by the tendency of higher taste acceptability. Moreover, those stored at the temperature close to cryoscopic point (-3°C) got higher notes in sensory analysis of taste intensity. Strong tendency for higher notes in overall acceptability was observed when analysed vacuum packed hamburgers and those kept at the temperature close to cryoscopic point (-3°C). Hamburger's texture evaluated by sensory analysis was strictly correlated with rheological parameters analysed by using specific equipment (Zwick Roel). However, there was no correlation between sensory evaluated texture and cutting force values.

Key words: hamburger, storage, thermal treatment, rheological and sensory properties

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**Tadeusz Szmańko, Małgorzata Korzeniowska,
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TECHNOLOGICAL PROPERTIES OF HAMBURGERS IN RELATION TO PACKAGING AND STORAGE CONDITIONS, AS WELL AS HEATING PROCEDURE

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The objective of the study was to evaluate the technological properties of beef hamburgers in relation to packaging method, storage conditions and heating procedure. Experimental hamburgers were manufactured from beef meat. Variation factors were as follows: packaging method – vacuum and MAP; storage temperature - chilling (3±1°C) or temperature close to cryoscopic point (-3±1°C); storage period – 0, 7, 21, 28 days; method of thermal treatment after storage – microvawing, steaming at the temp. 100°C, baking in electric oven at the temp. 170 ±2°C.

The effects of variation factors on technological properties of beef hamburgers were analysed by changes in protein and NaCl contents, pH, water holding capacity (WHC), colour parameters (L*,a*,b*), diameter, height and deformation degree of the product, as well as cooking loss.

Hamburgers packed under MAP and stored up to 28 days were characterised by higher dimensions and lower cooking loss that those packed under vacuum. The use of vaccum packaging resulted in lighter colour of the hamburgers, which was also connected with lower red (a*) colour contribution in reflective spectrum. Hamburgers stored at the temperature close to cryoscopic point (-3°C) as well as baking were characterised by darker colour and higher values of red colour parameter (a*). Steamed hamburgers expressed almost two fold less cooking loss when compared to microwaved and baked products.

Key words: hamburger, packaging, storage, thermal treatment, technological properties

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STRUCTURE OF CHICKEN DEFECTIVE MEAT HEAT TREATED

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The aim of this study was to compare the structure and the ability to maintain water (WHC) heat-treated "normal" and PSE/DFD like chicken breast muscles. Experimental material was chicken pectoral muscles (*pectoralis superficialis*) of Cobb breed selected within the above three quality groups. The raw material was collected at 3 or 24 h post mortem (p.m.). The conducted qualitative division of muscles was based on the value of the color parameter, i.e. lightness (L*): L*= 48-54 for "normal", L*> 54 for PSE; and L* <48 for DFD. Muscles were vacuum-packed, cooked in water with temperature 74°C and the samples were heated to a temperature 72°C in the geometric center of the muscles.

Breast chicken muscles selected 24 h p.m. when compared with that after 3 h p.m. had higher WHC and muscle fiber diameter ("normal", DFD) and larger distances between the fibers (PSE, DFD). Also, PSE muscle-type compared with "normal" was characterized by increased muscle fiber diameter and wider distances between the fibers, while DFD muscles compared to the PSE and "normal" muscles had lower values of the above observed parameters. "Normal" muscles as compared to the defective (PSE and DFD) muscles were characterized by a very well-preserved structure with clearly marked perimysium, muscle bundles, fibers and endomysium. Typical changes in muscle building type of PSE and DFD meat in comparison with the "normal" muscles were longitudinal, transverse/lateral and multidirectional cracks of-muscle fibers.

Keywords: chicken muscle, PSE, DFD, structure, WHC

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THE APPLICATION OF MILK WITH MODIFIED FATTY ACID COMPOSITOIN IN RIPENING CHEESE PRODUCTION

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Cheese is an important component in the developmental societies diet, however because of the high content of saturated fatty acids and low content (3%) of polyunsaturated long-chain acids it may be consider as a risk factor for diet dependent diseases. The manipulation with daily food intake and the introducing of fish oil to the diet of diary cattle is a one of the possible ways to change the percentage composition of fatty acids in milk. It has been shown that this kind of manipulation were very effective and the cheeses produced from modified milk exhibited the improved amount of CLA and polyunsaturated fatty acids in compare to saturated ones.

The purpose of this study was to evaluate if the modified milk, obtained by enrichment the caw fodder in the fish oil, keeps the technological value as a cheese milk and has no negative impact on the quality of cheese. The investigated milk was obtained from healthy cows (primiparous and multiparous) feeded for 8 weeks with fodder enriched with 2% of fish oil. The Dutch type experimental cheeses have been produced. The ripening process was monitored for 8 weeks. The changes in composition of cheeses, proteolysis, lipolysis and the number of different microorganisms groups were analyzed.

It has been shown that the introduction of fish oil to the caw fodder did not caused any changes in chemical composition of cheeses, as well asin development of starter microflora or the proteolysis process. In the fatty acid composition the increased content of unsaturated and decreased amount of saturated fatty acids were observed The supplement of fish oil in to the fodder caused also an increase of conjugated linoleic acids, which contend was finally about 4–5 time higher comparing to control cheeses. In experimental cheeses the raised amount of omega-3 acids as eikopentanoic (EPA) and dokozaheksanoic (DHA) were noticed.

Key words: milk, fatty acid composition, cheese

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ACCELERATION OF CHEESE RIPENING PROCESS BY INTRODUCTION OF YEAST ENZYMES

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Cheese ripening process is a complex biochemical phenomenon involving lactose fermentation, proteolysis and lipolysis. Depending on the type of cheese it can take from few weeks to few years. Acceleration of this process is of high importance from economical point of view. There are many methods to accelerate this process. One of the most promising is application of exogenous enzymes: proteases and/or lipases to cheese.

The aim of this work was to study proteolysis and lipolysis of Dutch – type cheeses produced with yeast hydrolytic enzymes. Two enzyme preparations from yeast *Yarrowia lipolytica* : Yl1 and Yl2 were applied to cheeses during their manufacturing.

Preparations: Yl1 and Yl2 contained both *Y. lipolytica* extracellular lipase and extracellular aspartic or serine proteinase, respectively. Control cheeses were produced without addition of yeast enzymes. During ripening the level of protein degradation was monitored by determination of water soluble nitrogen (WSN) using Kiejdahl's method and free amino groups concentration in fractions soluble in water and in phosphotungstic acid (PTA) by reaction with trinitrobenzene sulphonic acid (TNBS). Proteolysis was also analyzed by urea-PAGE. The lipolysis was studied by determination of free fatty acid concentration using GC-MS. At the end of maturation period cheeses were evaluated organolepticaly.

It was shown that introduction of yeast enzymes to Dutch-type cheeses caused intensification of protein and lipid degradation during ripening process. The concentration of WSN in these cheeses was 2–5 times higher than in control cheese during entire ripening period. The increased concentrations of free amino groups in both water and PTA soluble fractions was also noticed in cheeses produced with Yl1 and Yl2 yeast enzymes preparations and reached the level of 10 000 and 5 800 μMGly/100 g for Yl1 and 12 000 and 8 890 μMGly/100 g for Yl2, respectively. Significant degradation of proteins in both cheeses was also observed in urea-PAGE. Higher concentrations of free fatty acid were observed in yeast cheeses than in control. However lipolysis was slightly more intensive in cheeses produced with Yl2 than

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with Yl1. The organoleptic evaluation of 8 weeks maturated cheeses showed that application of Yl1 improved their taste and flavour comparing to control cheese while addition of Yl2 preparation caused overripening effect.

Key words: cheese produced, hydrolytic enzymes, *Yarrowia lipolytica*

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APPLICATION OF *Y. LIPOLYTICA* ENZYMES IN LOW FAT CHEESE MAKING TECHNOLOGY

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The growing knowledge about the impact of the quality and quantity of consumed fat on the diet dependent diseases development leads to increased interest of consumers in low fat cheeses. However the limited content of this component in ripening chesses may result in the taste, aroma or structure defects. The application of enzymatic preparate accelerating the hydrolytic changes in cheeses may improve the organoleptic attractiveness and quality of low fat cheeses. Yeast *Yarrowia lipoltyica* are the one of microorganisms which can be a rich source of hydrolases. It has been shown the enzymes of that this microorganism exhibit high abilities to degraded both milk proteins and fat, and their introducing during cheese production improves their quality.

The purpose of this study was to evaluate the usefulness of the extracellular enzymes preparate derived from *Y. lipolytica* as a supplements improving organoleptic attractiveness of low fat chesses. The enzymatic preparate (500 u/g) were introduced to model cheeses in two ways: directly to cheese milk or via first prepared paracaseine curd – slurry. The cheese produced without enzyme supplementation were used as a control. During 8 weeks of ripening the acidity, chemical composition, number of selected microorganisms as well as proteolytic and lipolytic changes were monitored. The composition of volatile components was investigated at the beginning and the ends of ripening process. The organoleptic featuers were also evaluated in the final product.

It was shown that the use of investigated enzymatic preparate from *Y. lipolytica* did not effect the growth of starter and non starter lactic acid bacteria. In model cheeses more intensive degradation of protein and lipid were observed than in control. After 8 weeks of ripening the highest level of water soluble nitrogen (14831 μM Gly/100 g) was determined in cheeses produced with enzymes introduced directly to milk, whereas in cheese produced with slurry the value of this parameter was about two times lower (7650 μM Gly/100 g). The model cheeses exhibited also increased counted of free fatty acids (18027 mg/kg and 13512 mg/kg respectively) comparing to control. In both kind of model cheeses the higher concentration of aroma components was detected.

Key words: *Yarrowia lipolytica*, low fat cheese

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Agnieszka Tajner-Czopek[1], Agnieszka Kita[1], Adam Figiel[2], Grażyna Lisińska[1], Karol Aniołowski[1]

THE EFFECTS OF PRE-DRYING METHOD AND THE KIND OF FRYING OIL ON ACRYLAMIDE CONTENT IN FRENCH FRIES

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Acrylamide (a substance potentially cancerogenous for humans) was discovered in starch-based foods (i.e. French fries) subjected to high-temperature terming processing (frying, banking, roasting). Pre-drying is another high-temperature process, which can have influence on contents of acrylamide in French fries.

The aim of the work was the assessment of the effect of pre-drying degree potato strips were subjected to, using convective or microwave methods and different types of oil used to frying, on acrylamide content in French fries.

The material for investigation were French fries prepared from fresh potato strips (originating from processing line of French fries factory near Wrocław), blanched and then predried. The latter process was conducted according to the convective and microwave methods to increase dry matter content by 22–27%. French fries were prepared by one-stage frying in two kinds of frying palm oil (SPO-solid palm oil and LPO- liquid palm oil). In French fries there was determined acrylamide content due to the method elaborated by Hoenicke et al. (2004), Rosén and Hellenäs (2002), modified at Department of Food Technology and Storage, Wrocław University of Environmental and Life Sciences, with the use of HPLC-MS-MS apparatus.

On the basis of the examinations it could be stated that the degree of pre-drying, as well as the kind of frying oil, did significantly effect on acrylamide content in French fries. It was also recorded that as the degree of pre-drying potato strip increased, acrylamide content was getting higher in the examined samples. French fries pre-dried by the microwave method featured higher acrylamide content in comparison to those pre-dried convectively. French fries fried in SPO i LPO oils, regardless the method and degree of pre–drying, characterized higher acrylamide content as compared to control sample.

Key words: acrylamid, french fries

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THE EFFECTS OF THE PRE-DRYING METHOD ON THE STRUCTURE OF FRENCH FRIES

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Pre-drying is one of technological stages used in French fries processing. Its aim is to decrease fat absorption during frying, as well as to obtain desired texture of a final product, whose external surface should be crispy and delicate, while the internal one – mealy and firmly sticking to the skin.

The purpose of this investigation was to determine the influence of various pre-drying levels of previously blanched potato strips, using convective and microwave methods, on the structure of fried French fries.

The material for investigation were French fries prepared from fresh potato strips (originating from processing line of French fries factory near Wrocław), subjected to blanching and pre-drying. The latter process was conducted using convective and microwave methods to increase dry matter content by 22–27%. French fries were prepared by one-stage frying in palm oil. Control sample involved French fries prepared from potato strips without application of pre-drying process. The structure of French fries was analysed with the use of SMZ 1500 Nikon microscope cooperating with the camera. The measurements of cross – section area of French fries (mealy inside, air spaces, oiled part, i. e. external layer which absorbed oil) were done due to NIS Elements Basic 2.30 SP1 computer program.

On the basis of the results obtained it was possible to conclude that pre-drying contributed to the occurrence of free spaces (air spaces) inside French fries. Air spaces enlarged as the degree of pre-drying increased, regardless the method applied. More regular distribution of air spaces featured French fries obtained according to microwave pre-drying as compared to convective pre-drying. French fries resulting from the introduction of pre-drying cumulated higher amounts of fat in their surface layer. Convective pre-drying was more effective regarding protection of French fries inside from oil penetration..

Key words: french fries, structure, pre-drying method

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Anna S. Tarczyńska

FACTORS DETERMINING CONSUMER PREFERENCES IN RESPECT OF YOGHURTS AVAILABLE ON THE MARKET

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A survey research enables the prediction of purchase preferences and behaviors of consumers in a long time perspective. The objective of the undertaken study was to identify behavioral determinants of consumers of yoghurts on the market of dairy products and to determine their hierarchy. It was conducted with the use of a self-completed questionnaire in the city of Olsztyn, with a target population covering 500 respondents. The analysis of factors determining the purchase of yoghurts demonstrated that, irrespective of gender and age, the respondents were mainly driven by their flavor values, followed by their health-promoting properties. It should additionally be emphasized that price was also of great significance to the respondents. Again, irrespective of age, gender and education, yoghurt flavors most often chosen by the respondents included: strawberry, blueberry, vanilla and forest fruits. The conducted survey demonstrated a tendency maintaining in the entire surveyed population in respect of yoghurt packaging properties, namely: the Polish consumers pay little attention to the detrimental effect of the package on the environment.

Key words: consumer preferences, yoghurt, food market

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Ludwig-Georg Theuvsen

FOOD QUALITY AND SAFETY: ROLE, DISSEMINATION AND ASSESSMENT OF CERTIFICATION SYSTEMS

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Over the last decade, certification schemes in the agribusiness sector have gained great importance as an instrument of ensuring food quality and safety. Within this context, certification is defined as the voluntary (or, in some cases, quasi-voluntary) assessment and approval by an accredited party on an accredited standard. A key feature of certification schemes is that inspections of farms and firms are carried out by independent bodies beholden to standards laid down by external organisations (third-party certification).

A large number of certification standards have been established which diverge with regard to their targets, focuses, goals, content, food chain coverage, standard owner, and number of participants. An important distinction can be made between minimum requirement schemes that try to improve food safety in mass markets (for instance, GlobalGAP) and differentiation schemes that guarantee above-average product or process qualities. The latter often address niche markets and include, but are not restricted to, characteristics such as guaranteed region-of-origin, organic farming, traditional production methods, or higher animal welfare standards. Differentiation schemes typically rely on labelling to inform consumers willing to pay for special process or product characteristics, whereas most minimum requirement schemes are only used as quality signals in business-to-business relationships.

In recent years, an on-going internationalization of certification schemes could be observed. Although certification schemes are still most prevalent in Western and Southern Europe, for instance, Germany, the UK, France, Italy and Spain, Central and Eastern Europe are in the process of catching up with regard to the number of such schemes. Some schemes established in the Eastern and Central European countries, for instance, the Czech KLASA system, have already gained considerable publicity and importance. Moreover, more and more Central and Eastern European PDOs and PGIs have been registered and are now protected by the European Union. The international dissemination of certification scheme has gained much momentum and successful certification has nearly become a precondition for the integration of farms and firms into international food supply chains. Therefore, it is now vividly discussed whether certification schemes have become catalysts of or barriers to the participation of transformational and developing economies in international trade with agricultural and food products.

In recent years, the number of in-depth analyses of the efficiency and effectiveness as well as of the proper design of certification schemes in the agribusiness has been rising. A considerable number of studies focuses on the question how farms and firms assess the implementation of certification schemes. Whereas earlier studies very much focus on how firms assess the generic ISO 9001 standard, more recent studies focus on the assessment of sector-specific certification schemes such as GlobalGAP, the BRC Global Standard or the International Food Standard (IFS). Most of these studies provide a mixed picture; cluster analyses often reveal three distinct groups of respondents: One group is very satisfied and perceives clear advantages of implementing certification schemes; the perceived advantages include, for instance, improved business processes and improved quality motivation of employees. A second group strongly rejects certification and considers the implementation of certification schemes a complete waste of costs and time. A third group is somewhat indifferent and perceives minor advantages as well as disadvantages of the schemes implemented; their main reason for acquiring a certificate is that important customers have required certificates.

All in all, certification schemes have turned out to become one of the most important elements of the private regulation of food supply chains. Therefore, they have become more and more important for guaranteeing and enforcing food quality and safety.

Key words: certification systems, assessment, internationalization

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PROPERTIES OF POTATO STARCH EXTRUDED TWICE

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It is still searched the innovative possibilities of the modifying the starch which would make possible to made products about new applicable attributes. In order to that it could be used not only not applied so far natural starch materials and chemical substances, but also the new parameters of processes e.g. in the process of extrusion: the temperature moisture of the extruded material, the kind of applied plasticizer, the quantity of pressure and mechanical strengths. Essential also seems qualification of changes properties of preparations of starch got in the result of extrusion and reextrusion.

The aim of this investigation was determination of some properties of the starch extruded once and twice.

The potato starch was bringed to moisture 25% and subject the process of extrusion in the single screw extruder of the firm Brabender – the type 20DN. The process of extrusion was conducted in three temperature variants. Produced preparations were crumbled, moisturize to moisture 21% and subject renewed process of extrusion applying identical temperature variants as during first extrusion. Thickness, the degree of the expansion, breaking stress and bending moment were marked in preparations produced in the result of single and twofold extrusion before crumbling with use of the testing machine Instron 5544 with the attachment bend Fixture.

The proprieties of the extruded starch depend on the temperature of the process of single extrusion. The proprieties of preparations produced in the process of second extrusion depended on the parameters of both processes. As highest was the temperature of extrusion then higher was the degree of expansion and then smaller thickness. The process of second extrusion conducted in lower temperatures reduced the degree of the expansion and this parameter enlarged in higher temperatures. The thickness of produced preparations was inversely proportional to the degree of the expansion. The mechanical proprieties of preparations produced in first process of extrusion were as worse then higher was the temperature of that process showed by lowering of the parameter of the bending moment of extrudates. The lower temperatures of the reextrusion process also improved the resistance on the working of mechanical strengths on produced extrudates.

Key words: potato starch, extrusion parameters

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Jolanta Tomaszewska-Gras, Jacek Kijowski

STUDIES ON APPLICABILITY OF DIFFERENTIAL SCANNING CALORIMETRY DSC TO DETECT ADULTERATION IN BUTTER

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Consumers are interested in purchasing authentic foodstuffs; however, in practice it frequently turns out that the easiest method to reduce the price of products is to replace raw materials with other, cheaper substitutes. This is the case e.g. in production of butter, where to the relatively expensive butterfat cheaper (approx. 5-fold) vegetable fats are added, primarily palm oil, thus reducing the nutritive value of butter. In accordance with the Act of 24 October 2008 on the commercial quality of agri-food products (the official gazette "Dziennik Ustaw" of 2008, no. 214, item 1346) a change in the composition with no respective information given on the label is against the law. Different analytical methods are used to detect adulterations in butter, including most frequently labour-consuming and expensive chromatographic methods.

The aim of the study was to investigate the applicability of differential scanning calorimetry to detect the presence of foreign fats in butter.

A differential scanning calorimeter DSC7 by Perkin Elmer was used to analyze fat samples in this study. Phase transitions connected with melting and crystallization processes were evaluated for samples of 100% butter, butter with a 5, 10, 20, 40, 60 and 80% addition of palm oil and a sample of 100% palm oil. It results from the analysis of obtained thermograms that the basis for the identification of foreign fats in butter is both the shape of the thermal curve and individual thermodynamic parameters of melting and crystallization processes, such as maximum transition temperature, final transition temperature for the melting process and the initial transition point for crystallization, parameter ΔT , which is the difference in temperatures for individual peaks, as well as enthalpy of phase transition (ΔH).

As a result of conducted analyses of the melting process of butter with an addition of palm oil it was found that with an increasing amount of oil the shape of the curve on the thermogram changes, the temperature of individual peaks decreases, the final transition temperature increases and new peaks atypical for butterfat appear. High correlation coefficients were recorded for the dependence between the amount of added oil and the values of temperatures for individual peaks and parameter ΔT.

The presence of two peaks was observed for crystallization in case of butterfat, which with an addition of palm oil were shifting away from each other, resulting also in an increase in parameter ΔT, and peak areas also changed, which was manifested in changes.

Key words: scanning calorimetry (DSC), butter, fat

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Ø. Ueland

BEAUTY OR BEAST: CONSUMER PERCEPTION OF BEEF SAFETY

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Meat consumption in Europe has declined noticeably in the last decades. In addition, consumption practises have changed from predominantly red meat towards white meat. Understanding factors influencing changes in consumption of and attitudes towards beef meat can contribute to production of meat products that satisfy consumers' need for safe, tasteful and healthy products.

Red meat, and in particular beef meat, is sensitive to several safety related issues that are important for food choice. These issues are; safety against food risks, safety in an environmental perspective, and safety in terms of personal health.

The major food scare in Europe in the last decades concerning meat products has been the BSE-crisis. In addition, other food scares related to animal diseases, like foot-and-mouth disease, or meat production issues, such as dioxin contamination, use of hormones, or storage problems, add to the already shaky faith of consumers in meat production. Recently, environmental considerations related to meat production further confuse consumers in deciding what their attitudes to meat should be. Lastly, beef meat has been considered unhealthy partly due to the fatty acid composition of the meat. Thus, three important criteria for meat avoidance are met. These criteria are all related to safety.

On the positive side, beef meat scores high on consumption aspects related to liking, as a major and important ingredient in meals, and as a carrier of traditions. These factors can moderate consumers' negative perception of beef safety issues.

Two major points concerning consumer risk perceptions are of interest to beef meat producers; actual risk connected to beef meat production and consumption, and consumers' perceived risk of beef consumption. These two aspects of beef safety are not necessarily linked, but both may influence total risk perception of consumers. For instance, a recent pan-European study on consumers' perception of beef safety conducted among beef consumers in four different European countries showed that tradition and liking aspects were strongly influencing positive attitudes towards beef meat (EU-IP Prosafebeef). However, when focusing on food industry involvement in beef meat production, scepticism and distrust about beef safety practices were evident among the consumers. In general, one's own kitchen is regarded as a safe area for meat preparation, whereas industrial production processes may be considered to interfere with the purity of the meat.

Exploring the diversification of attitudes to beef meat can help understand which issues worry or comfort consumers and how to tailor products and communication that encompass desirable attributes for consumers.

Key words: consumer perception, beef safety

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DRYING KINETICS OF APPLE CUBES DEHYDRATED BY DIFFERENT METHODS

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Hot-air drying is the most popular method of food products dehydration. However, that method has several disadvantages. First of all, it requires relatively long times and high temperatures. The contact of dried material with hot air causes degradation of important flavour compounds and nutritional substances as well as colour alteration. Another disadvantage of that method is shrinkage. Heat pump dryer offers several advantages as compared with conventional hot-air dryers for the drying of heat-labile food products. Heat pump evaporator is used to dehumidify the processing air in the drying chamber. This dryer allows tempering period to be conducted at relatively low temperatures. It can also be classified as intermittent dryer whereas low temperature dehumidified air (LTDA) can be applied at any stages of drying. For instance, LTDA tempering period can be introduced between two hot air drying periods or applied as the first stage of drying. Vacuum-microwave method (VM) is another non conventional method of drying. During VM drying the energy of microwaves is absorbed by water located in the whole volume of the material being dried. This creates a large vapour pressure in the centre of the material, allowing rapid transfer of moisture to the surrounding vacuum and preventing structural collapse. This process, well-known as the puffing phenomenon, creates a porous texture of the food. The lowered pressure induces faster evaporation of water from the material at relatively low temperature. However, an uncontrolled irradiation with microwaves can cause a jump in temperature of the material at the end of drying.

Apple cubes of 15 mm were dehydrated by four different methods. In the three methods heating pomp was applied as a source of energy: low temperature dehumidified air followed by hot air (LTDA-HA), hot air followed by low temperature dehumidified air and again hot air after that (HA-LTDA-HA), vertical heat pump drying (VHP). The fourth method was convective pre-drying and vacuum-microwave finish-drying (C-VM).

The drying kinetics was determined by mass losses measuring of apple cubes with known moisture content. Derivation of the functions describing the apple cubes drying process permit determination of the drying rate.

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Based on the measuring points obtained it was stated that drying kinetics can consist of two or three periods despite of the method applied. In LTDA-HA method a linear period was followed by an exponential one. HA-LTDA-HA consisted of three periods: exponential, linear and exponential. VHP kinetics was described with two term exponential model, while C-VM kinetics had linear period followed by exponential one for convective pre-drying and exponential period for VM finish-drying. It was found that application of vacuum–microwaves significantly increased the drying rate and reduced the entire time of drying.

Key words: apple, method of dehydrated

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MICROBIOLOGICAL AND TECHNOLOGICAL QUALITY OF MALTING BARLEY PRESERVED IN A METAL SILO USING NEAR-AMBIENT METHOD

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Quality of freshly harvested healthy grain to a considerable degree depends on preservation and storage conditions. An inappropriately conducted grain preservation process may lead to a deterioration of technological quality of grain and as a result of grain contamination with toxic metabolites of moulds it may constitute a threat to consumer health and safety and lead to the condemnation of grain as unfit to food production.

Grain for use as malt has to meet high quality requirements; therefore, during storage grain should be provided proper protection, especially against mould development. As a raw material for malt production, malting barley requires especially mild drying conditions, thus one of the most popular post-harvest preservation methods of malting barley grain is convection drying and cooling by the so-called near-ambient method. This method consists in ventilation of a thin static grain bed with air at a temperature close to ambient temperature. The near-ambient drying process is time-consuming and depends on the drying potential of ambient air, and as such it carries a risk of grain quality deterioration. This risk for the quality of plant materials dried using the near-ambient method makes it necessary to conduct research on their microbiological and technological quality.

Numerous studies have been carried out at the Institute of Plant Origin Food Technology of Poznań University of Life Sciences on the microbiological and technological quality of malting barley dried using the near-ambient method. Assessment of microbiological quality of malting barley consisted in the determination of the level of mould contamination of grain with the use of count of colony-forming units (CFU) of moulds per 1 g of grain and concentration of ergosterol, the main sterol of mould cell membranes. Research on the technological quality of barley preserved using the near-ambient drying method was based on germinative energy of grains, the activity of α–amylase and parameters which evaluate of malt produced from dried malting barley.

Results obtained during microbiological analysis and ergosterol content determinations in examined barley samples showed that the level of grain infection with fungi during the

whole drying process was similar to the initial mould contamination of the grain after harvest, while values of all determined parameters describing technological quality of barley grain and malt produced from it remained within the normal range for malting barley grain. Results of presented investigations on the quality of malting barley grain preserved in a metal silo using the near-ambient method demonstrated that microbiological and technological quality of grain was maintained. They indicate at the same time that the near-ambient drying method may be advisable for post-harvest preservation of malting barley grain.

Key words: microbiological quality, technological quality, malting barley grain

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MICROFLORA COMPOSITION AND PSYSICO-CHEMICAL PROPERTIES DURING RIPENING OF TRADITIONAL RAW FERMENTED MEAT PRODUCTS

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The aim of the study was to evaluate changes and characterize of microflora composition during the ripening in raw fermented meat products from Podlasie region. The raw smoked beef products were aged at 12–15°C and 85–90% of relative humidity for four weeks. They were made of sirloin (*m. psoas minor*, *m. psoas major*) and two muscles: *m. semitendinosus* and *m. semimembranosus*. The evaluation of microflora composition was conducted in internal and external layers in all products during their ripening.

After 0, 2 and 4 weeks, dependently on each product's ripening time, in samples were estimated: water activity, pH, enumeration of microorganisms at 30°C, enumeration of yeastes and moulds, lactic acid bacteria, *Bacillus subtilis* and *Bacillus cereus*, the presence of staphylococci therein *Staphylococcus aureus* (on the Polish Standards).

The traditional method of ripening allows to obtain microbiologically safety meat products. Coagulase-positive staphylococci (*Staphylococcus aureus*), *Escherichia coli* and moulds were not found. It is possible that smoke components (phenols, carbonyl ingredients and organic acids) deactivated mold spores. The number of yeasts cells rose steadily to 5–5,5 D (logarythmic level) in external layers and 4,3–5 D in internal layers of all products.

The microbiological analysis confirmed cenobiotic replacement of bacteria during ripening. The group of lactic acid bacteria (*Lactobacillus* sp., lactic streptococci) was a main part of dominant microflora. At the end of production the number of both agents was evaluated on 7 D level. The rising of coagulase-negative staphylococci correlated with number of lactic acid bacteria, pH and spore-forming aerobic *Bacillus* of the interior products' layers.

Key words: fermented meat products, beef, ripening, microflora

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Ewelina Węsierska[1], Marek Szołtysik[2], M. Zaczyńska[1], K. Bies[1]

BIOCHEMICAL CHANGES DURING RIPENING OF TRADITIONAL RAW FERMENTED MEAT PRODUCTS

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The aim of the study was to evaluate the progress of biochemical reactions during the ripening of traditionally fermented meat products from Podlasie region. The raw smoked beef products were aged at 12–15°C and 85–90% of relative humidity for four weeks. They were made from sirloin (*m. psoas minor*, *m. psoas major*) and two muscles: *m. semitendinosus* and *m. semimembranosus*.

After 0, 2 and 4 weeks, dependently on each product's ripening time in samples were estimated: basal chemical composition, water activity and pH. The protein degradation was evaluated by measurement of increases of free amine groups in water and phosphotungstic acid (PTA) solution. The lipolysis was controlled by measurement of increase of freee fatty acids (FFA) determined by gas-chromatography method. Thiobarbituric test (TBA) was used to determine the progress of fat rancidity.

The quantity of soluble nitrogen and FFA indicated a dynamic progress of lipo- and proteolytic reactions during production of all raw fermented products. The amount of free amine groups in water, correlated with pH level, increased nearly four time in third and forth week of ripening. The similar tendency was observed with free amine groups solubled in PTA in all one-month ripened products however the slowest process was noted in sirloin products. Superior total amount of FFA (2476,5 mg/kg) was observed after four-week ripening of *m. semimembranosus* products. The most dynamic progress of lipolysis was found out just in them during first two weeks of ripening. In the rest products the concentration of FFA was lower and rose steadily.

The gradually rise of malonic aldehyde value in *m. semitendinosus* products indicated the progress of rancidity of fat. In meat of rest product TBA test indicated gradual drop in dynamic of fat rancidity. At the beginning of production (ripening) the amount of this compound was depended mainly of a type of meat and its chemical composition.

Key words: fermented meat products, beef, ripening, proteolysis, lipolysis, fat rancidity

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K. Wieczorek, E. Denis, I. Kania, J. Osek

MOLECULAR CHARACTERISTIC FOOD-BORNE PATHOGENS ISOLATED FROM BOVINE CARCASSES AS AN AID TO ASSESS THE PUBLIC HEALTH RISK

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Verotoxin-producing *Escherichia coli* (VTEC), *Campylobacter* spp., and *Listeria monocytogenes* are the most common agents of food borne illness' in humans. Pathogens present on bovine hides can be transferred to carcasses during slaughter and processing. The aim of this study was to examine the presence of main virulence-associated genes in VTEC, *Campylobacter* spp., and *L. monocytogenes* strains isolated from cattle slaughtered in Poland.

All samples were taken from the brisket area (400 cm^2) using the swab method after carcass spliting. The pathogenic bacteria were identified with the ISO standard methods with some modifications and molecular methods for determine occurrence of virulence marker genes were also used. For VTEC the *eaeA* (intimin), *vtx* (Shiga toxin) and *ehlyA* (enterohemolysin) genes were identified whereas *Campylobacter* spp. isolates were characterized for the presence of *cadF*, *cdtA*, *cdtB*, *cdtC*, *flaA*, *iam, virB11, flhA, ciaB, docA*, *wlaN* genes. Moreover, molecular serotyping of *L. monocytogenes* strains was performed.

A total of 276 carcasses samples were tasted. Most of the 9 isolated VTEC strains contained the *vtx2* gene. Moreover, 5 and 3 of them possessed the *vtx2c* and *vtx2e* genes, respectively. Only one strain contained *vtx1* gene. Additional virulence markers such as intimin and enterohemolysin were found in 2 isolates. *C. jejuni* was detected in 4 samples just as *C. coli*. The molecular analysis of the isolates revealed that the majority of *C. jejuni* strains had *cadF*, *cdtA*, *cdtB*, *cdtC*, *flhA, ciaB, docA* (100%), *flaA* (75%) and *iam* (50%) genes. Only 1 (25%) isolate possessed *wlaN* marker and none of them had *virB11* gene. However, *C. coli* isolates contained only some of virulence markers such as *iam* (100%), *cadF*, *flhA* (75%) and *flaA*, *cdtA*, *cdtB*, *cdtC* (50%). Seven *L. monocytogenes* strains isolated from carcasses were serotyped with the PCR method. It was found that most of them (71.4%) belong to 1/2a serogroup and other (28.6%) were of the 1/2c serogroup.

In conclusion, data profiles of food-borne pathogens tested can contribute to microbial risk assessment by helping to assess the relative risks of cross-contamination the kitchen and of eating undercooked meats.

Key words: safety bovine carcasses, food-borne pathogens

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ASSESMENT OF PUBLIC HEALTH EFFECTS ASSOCIATED WITH OCCURRENCE OF MICROBIAL PATHOGENS IN POLISH BOVINE CARCASSES

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This study was conducted to investigate bovine carcasses as a potential source of important pathogenic bacteria responsible for human food infection, such as verotoxigenic *Escherichia coli* (VTEC), *Salmonella* spp., *Campylobacter* spp. and *Listeria monocytogenes*.

During the study period, a total of 276 bovine carcasses were analyzed. Samples were collected in slaughterhouses, from carcasses after evisceration, where 400 cm^2 area of brisket was wiped with a sterile swab. These swabs were processed in the laboratory to determine the prevalence of above mentioned pathogenic bacteria which were identified using the ISO standard methods with some modifications and molecular approaches.

Bovine carcasses were more frequently contaminated with *Campylobacter* spp. and *L. monocytogenes* than other tested pathogens. *Campylobacter* spp. was isolated from 8 samples (2.9%) and *L. monocytogenes* from 7 (2.5%) compared with 5 (1.8%) positive for *Salmonella* spp. as well as 4 (1.4%) contaminated with VTEC (total number of VTEC isolates – 9). Moreover, at least one pathogen tested was found at 24 of 276 (8.7%) of carcasses, Factor affecting prevalence of pathogens in bovine carcasses such as age of the animals was also examined. The most contaminated bovine carcasses were originated from the animals of more than 6 years old, in which *L. monocytogenes* was found in 3.4%, *Campylobacter* spp. in 2.9%, *Salmonella* spp., and VTEC in 1.7% samples tested.

The results indicate that the brisket area of bovine carcasses relatively frequently carries food-borne pathogens. The findings reinforce the importance of adequate cooking of meat and good hygiene to avoid cross-contamination.

Key words: pathogens in bovine carcasses, safety of meat

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Agata Wojciechowicz, Zygmunt Gil

INFLUENCE OF RESISTANT STARCH ON WHEAT DOUGH AND BREAD QUALITY

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Wrocław University of Environmental and Life Sciences

There is a trend to find new sources of dietary fibre as ingredients for the food industry. The most widespread consumed dietary fibre products are those derived from cereals. Cereal products and bread are perhaps the most important item in our daily diet. Using resistant starch (RS), which exhibits similar physiological effects to those of dietary fibre, so called "unctional food" can be produced with an enhanced dietary fibre content.

The objective of the study was to evaluate the impact of content level of retrograded acetylated starch (RS4 resistant starch) in dough and bread on the quality properties of dough and wheat bread made of three types of wheat flour: 550, 750 and 2000. In the experiment, the following content levels of resistant starch were applied: 0, 10, 20, 30 and 40%.

In the investigations, the following parameters were determined: quality characteristics (total protein, wet gluten yield, deliquescence of wet gluten, sedimentation value, falling number) and amylographic features (initial and final temperature of gelanization, gelanization time, maximum viscosity of gelatinized doughs) of wheat flour enriched with resistant starch, and farinographic (rheological) properties of the dough (water absorption of flour, development time of dough, dough stability, softening of dough, quality number). Next, bread was baked and its quality was evaluated (bread volume, overbake, porosity of the crumb).

The results obtained showed that the best quality traits of wheat flour gained flour type 750 but the best dough rheological traits gained flour type 2000. The increasing content of RS4 starch positively impacted the water absorption of flour, development time of dough, quality number, and overbake of bread. It was found that the increasing content of resistant starch caused the values of quality parameters of flour, initial temperature of gelanization, and of bread volume to decrease. In the samples containing 40% of resistant starch, final temperature of gelanization and gelanization time showed the lowest values and maximum viscosity of dough the highest.

Key words: resistant starch, bread quality, wheat flour

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APPLE POMACE AS A SOURCE OF DIETARY FIBER IN WHEAT BREAD

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The aim of the present work was to evaluate the impact of apple pomace content on the quality properties of dough and wheat bread. Blends of 5, 10 and 15 percent were prepared by substituting wheat flour type 750 with apple pomace.

The measurements of blends quality included: quality characteristics (total protein, wet gluten yield, deliquescence of wet gluten, sedimentation value, falling number) and amylographic features (initial and final temperature of gelanization, gelanization time, maximum viscosity of gelatinized doughs) of wheat flour enriched with pomace, and farinographic (rheological) properties of the dough (water absorption of flour, development time of dough, dough stability, softening of dough, quality number). Next, bread was baked and its quality was evaluated (bread volume, overbake, porosity of the crumb). In flour with apple pomace amounts of particular dietary fibre fractions were analyzed.

The results indicated that the increasing pomace content positively impacted maximum viscosity of gelatinized doughs, water absorption of the flour, overbake of bread and porosity of the crumb. Breads prepared with apple pomace had pleasant fruity flavour. It was found that the increasing content of apple pomace caused the values of quality parameters of flour and of bread volume to decrease. Supplementing the dough with apple pomace has resulted in increasing the content of dietary fiber in the mixtures.

Key words: apple pomace, wheat bread, dietary fibre fractions

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Aneta Wojdyło, Jan Oszmiański

ANTIOXIDANT CAPACITY, AND PHENOLIC COMPOUND CONTENT OF ORGANICALLY AND CONVENTIONALLY GROWN BLUEBERRIES

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The demand for organic food products has increased rapidly during recent years, partially due to the notion that health benefits are linked with the consumption of organic products. Organic produce is perceived to be more nutritious, better tasting, and environmentally friendlier, compared to conventionally grown crops. However, research results are inconclusive, and there is insufficient evidence to claim differences in nutritional value related to cultural methods. Epidemiological studies have shown that diets rich in fruits and vegetables are associated with longer life expectancy, and these beneficial effects may be due to rich antioxidants contained in these produce.

The objectives of this investigation were to evaluate the effects of cultural systems, organic or conventional, on phenolic contents and antioxidant activity chemical composition, in blueberries.

The berries of three highbush blueberry cultivars: Patriot, Brigitta, Duke were grown on certified organic and conventional private farms near Szczecin in the year 2008. Immediately after harvesting, fruits were frozen and stored at –18^{O}C until analysis. Phenolic profiles of a total berries were analyzed by HPLC. Antioxidant capacity of fruits was assessed by means of two methods ABTS and FRAP, and were expressed as Trolox equivalent antioxidant capacity (TEAC). Dry weight content, titratable acidity (as citric acid) and soluble solids (as Brix) were estimated by PN norm.

Blueberries contain high quantities of anthocyanins, mainly in their glycosylated forms, flavonols (such as quercetin, kaempferol and myricetin), flavan-3-ols (such as oligomeric forms), and hydroxycinnamic acids (chlorogenic acid). Some organically cultured fruits had more phenolic compounds than conventional fruits (5–30%). The organic berry also produced fruit with higher contents of myricetin 3-arabinoside, quercetin 3-glucoside, delphinidin 3-galactoside, delphinidin 3-glucoside, delphinidin 3-arabinoside, petunidin 3-galactoside, petunidin 3-glucoside, and malvidin 3-arabinoside than conventional berry. Due to their high phenolic content, blueberries show a strong antioxidant activity, which seems more correla-

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ted to their total phenolic content rather than to their anthocyanin concentration. The difference between cultivars but not grown system of berries had the influence on titratable acid, dry weight and soluble solids.

In conclusion, our data presented here suggest that different cultural systems significantly affect blueberry fruit quality. Blueberries produced from organic grown contained significantly higher amounts of phytonutrients than those produced from conventional grown berries. Organically produced food is generally considered healthier than corresponding conventionally produced food.

Key words: antioxidant capacity, phenolic compound, blueberry, fruit quality

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Aneta Wojdyło, Jan Oszmiański

IDENTIFICATION AND QUANTIFICATION OF PHENOLIC COMPOUNDS AND THEIR EFFECTS ON ANTIOXIDANT ACTIVITY IN QUINCE JUICE

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Phenolic compounds are widely distributed in nature and have been successfully used for the determination of genuineness of some fruit products as juices. The importance of many plants as natural cheap sources of polyphenols and as nutrition promoting human health is well established. Nowadays, some fruits, i.e. quince fruit (*Cydonia oblonga* Miller) is recognized as a good, cheap and important dietary source of health-promoting compounds, due to its biologically active constituents which are characterized by their antioxidant, antimicrobial and anti-ulcerative properties. Quince is the fruit of a deciduous tree of the *Rosaceae* family with other fruits such as apple and pear. Because of its hardness, acidity, and astringency, it is not edible unprocessed; nevertheless, it is often used to prepare jam and jelly.

The aim of the present study was to influence of antioxidants on the content of phenolic compounds and antioxidant activity of quince juices.

Quince fruits were collected at mature stage from the Garden of Medicinal Plants herbarium at the Medical University in Wrocław, Poland. The fruits were crushed and heated at 90^{o}C for 5 min with the use of Thermomix (Vorwerk, Germany). After cooling, the pulp was depectinized at 50^{o}C for 1 h by treating with enzyme (0.5 mL of Pectinex Yield Mash (Begerow, Germany) per kg) as follows in two variants. Variant I was prepared without antioxidant and variant II with antioxidant (2,5 and 5% of juice from rhubarb). After pulp pressed and pasteurized (10 min) obtained juices was analysed. Juices was stored by 6 month on 30^{0}C. Phenolic profiles were analyzed by HPLC. Antioxidant capacity of fruits was assessed by means of two methods ABTS and FRAP, and were expressed as Trolox equivalent antioxidant capacity (TEAC).

The main phenolic compound in obtained juices from quince fruits was: oligomeric procyanidin > hydroxycinnamic acid (chlorogenic acid derivatives) > and flavonol. The content of phenolic compound was higher (25%) when juice was prepared with 2,5% of antioxidant (rhubarb juice). Antioxidant activity measured by ABTS and FRAP method was strong correlated by the content of phenolic compounds, especially with oligomeric procyanidins.

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After storage time of investigated juices from quince polyphenols and antioxidant activity was degraded. Polyphenols content and antioxidant activity was rapidly degraded in juice without antioxidant. Chlorogenic acid and they derivatives was more stable than the rest of polyphenol compounds. Rhubarb juice had high and positive effect on L* value in the case of juices of quince. The results showed that this juice before and after storage time had higher L* values than juice from variant I.

The phenolic profile and high antioxidant capacity make the quince potentially very interesting sources for the food processing industry, but this juices must be produced by added antioxidant.

Key words: antioxidant acivity, quince juice

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SEA BUCKTHORN AND APPLE: A NEW MIX OF HIGH ANTIOXIDANT ACTIVITY JUICES RICH IN PHENOLIC COMPOUNDS

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Flavonoids are important phytonutrients because of their antioxidative, anti-inflammatory, antiallergic, antiviral, antiproliferative, antimutagenic, cardiovascular, and anticarcinogenic activities. Apple are a rich source of nutrients, including polyphenolic compound, ascorbic acid (vitamin C), pectins, which provide many health-related properties. Nowadays, there is a trend and worldwide pursuit of designing new functional foods and healthy food products. In this sense, a design of new beverages combining apple juice with other fruits (rich in polyphenols and vitamin C) interesting healthy product.

The aim of this work was to evaluate the antioxidant activity and the content of the bioactive compounds present in the new mixed beverages such as apple and sea buckthorn juice being the new health-promoting food products.

Apple juice was enriched with fruits of sea bucthorn in one proportions (80% apple: 20% of fruits) to design new beverages rich in bioactive ingredients; and was proper of 100% of apple and sea bucthorn juices. The phytochemical composition (flavan-3-ols, flavonols, dihydrochalcones and hydroxycinnamic acids and vitamin C) of the beverages were analyzed by high-performance liquid chromatography with a diode array detector (HPLC-DAD), as well as color alterations (L a* b*) and *in vitro* antioxidant activity (DPPH• assay) before and after 6 month of storage time at different conditions.

The 100% of buckthorn juice had the very interesting components, especially vitamin C and carotenoids and it had a very attractive yellow colour. Obtained results showed that the addition of sea buckthorn fruits had beneficial influence on conservation of phenolic compounds in apple juices during preparation and had a good effect on antioxidant activity. Therefore, the new drink based on apple juice plus sea buckthorn fruits showed potential for the development of interesting functional products, rendering an interesting beverage in the growing market of food consumed for the benefit of health.

Key words: antioxidant acivity, quality fruit juices

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Rafał Wołosiak, Agnieszka Korba, Beata Worobiej, Elwira Drużyńska

THE INFLUENCE OF EMULSIFIER TYPE AND CHOSEN ANTIOXIDANTS ON STABILITY OF OIL-IN-WATER EMULSIONS

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The aim of the study was the examination of the effects of different antioxidants addition to emulsions prepared using emulsifiers of different kind on physical and oxidative stability of 10% emulsions of sunflower oil (pH 4.0 and 5.5). Three emulsifiers were applied: non-ionic (Tween), negatively charged (sodium stearyol lactate) and amphoteric (soya lecithin, ethanol-soluble fraction). One hydrophobic antioxidant (α-tocopherol), one hydrophilic (L-ascorbic acid) and one amphoteric (dephosphorylated casein) were used to control the range of oxidation processes.

Physical stability of emulsions were determined using Turbiscan Lab Expert apparatus, by determining particle size index and through microscopic observations. Oxidative stability was measured by spectrophotometric peroxides content test (ferric thiocyanate method) and by determination of volatile secondary reaction products (HS-SPME-GC-MS).

Nonionic emulsifier formed the most stable emulsions while the anionic one – the least stable. The antioxidants showed different activities on two measured stages of the process. The combination of ascorbic acid and tocopherol was the best in retarding peroxide formation. In samples containing casein (separately and with tocopherol) the lowest levels of secondary oxidation products were noted.

Key words: antioxidant stability, oil-in-water emulsions

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Rafał Wołosiak, Agnieszka Korba, Beata Worobiej, Elwira Drużyńska

THE INFLUENCE OF ENZYMATIC MODEL SYSTEM ON PROPERTIES OF CHOSEN ANTIOXIDANTS

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The aim of the study was the determination of the influence of oxidative reaction mechanism, kind of model system, ionic character of emulsifier and the kind as well as the addition level of antioxidants on linoleic acid oxidation in enzymatic model systems. The emulsifiers were as follows: anionic (sodium dodecyl sulphate), non-ionic (Triton) and cationic (hexadecyltrimethylammonium bromide). Two low-molecular-weight antioxidants were applied (β-carotene and L-ascorbic acid) and two biopolymers of a potential antioxidant action (dephosphorylated casein and soluble starch).

Total and soluble nitrogen content was determined in protein preparation and its purity was checked electrophoretically. Dry matter content and amylase content were determined in starch preparation. Two enzymes were used in the oxidation processes: lipoxygenase and xanthine oxidase, both in continuous and biphasic model systems.

The substrate was faster oxidized by enzyme of direct action (lipoxygenase) than by indirect xanthine oxidase. Linoleic acid solution was better protected by ascorbic acid than carotene which was effective only in emulsions, whereas casein was effective in both systems. A clear influence of emulsifier charge on the activity of antioxidants was stated, especially in case of ionic antioxidants. Growth of antioxidants' addition resulted in both gain and decrease of their activity. The least effective in model systems tested turned out starch.

Key words: enzymatic model system, antioxidants

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Elwira Worobiej, Rafał Wołosiak, Beata Drużyńska, M. Bieniek

ANTIOXIDANT PROPERTIES OF GLOBULIN PREPARATIONS FROM THE SEEDS OF CHOSEN LEGUMINOUS SPECIES

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The aim of the study was the examination of antioxidant properties of globulins isolated from legume seeds. Protein preparations of globulins were obtained from red (Red Kidney), brown (Nida) and white beans (Prosna) as well as pea (Poa) and broad beans (Bartom).

Characteristics of protein preparation were carried out in the study, including determination of protein content and free thiol groups, electrophoretic (SDS-PAGE) and chromatographic (SE-HPLC) separation of fractions and determination of surface hydrophobicity. Antioxidative properties of globulin preparations were determined by antiradical activity test against hydroxyl radicals and ABTS radical cations while for examination of the influence of globulin preparations' addition on linoleic acid emulsion oxidation – spectrophotometric measurement of peroxides content resulting from the reaction catalysed by hemoglobin addition was performed.

It was proved that among proteins of pea and broad bean preparations the dominant fraction was 11S globulin (legumin), among bean proteins vicillin-like proteins (7S globulin) predominated. The proteins in preparations exhibited thiol group availability in the range of 11–15 nM SH/mg of protein. The highest thiol groups content was found in white bean preparations. Hydrophobicity of the proteins of 3 varieties of common bean was similar and the lowest of all the preparations investigated. Broad bean proteins were characterized by lower surface hydrophobicity than pea proteins.

Been seeds globulin preparations showed higher antiradical activity against radicals applied in the study comparing to broad bean and pea preparations. Inhibition of linoleic acid oxidation process was more effective in case of broad bean and pea preparations than bean preparations.

Key words: antioxidants properties, globulins, legume seeds

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ATTEMPTS AT INCREASING OF OXIDATIVE STABILITY OF SUNFLOWERSEED AND RAPESEED COLD PRESSED AND FULLY REFINED OILS BY USING GREEN TEA EXTRACT

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The aim of this work was to improve an oxidative stability of cold pressed and fully refined rapeseed and sunflower oils with green tea extract and for comparison synthetic BHT was used. A commercially available samples of oils (cold pressed and refined rapeseed and sunflower oils from local plant) and antioxidant – extract of green tea OS were used. In tests it was used following doses: 0,02, 0,04, 0,06, 0,1, 0,2%. The quality of oils was examined with: acid value, peroxide value, fatty acid composition and oxidative stability by Rancimat test at 120ºC. The effectiveness of antioxidants was expressed as a stabilization factor.

The quality of cold pressed and refined oils was good with good physicochemical characteristic. The oxidative stability of cold pressed oils was lower then refined oils: in the case of rapeseed oils induction time was 3,60 h and 5,05 h, respectively and in the case of sunflower oil induction time was 1,65 h and 2,65 h, respectively. Fatty acids composition was typical and characteristic for kind of oil. The antioxidant activity dependent on dose and type of oil and extract. The highest efficiency was demonstrated by extract of green tea in fully refined oils: sunflower oil (F = 0,88) and rapeseed oil (F = 0,85) and following were cold pressed oils: rapeseed (F = 0,42) and sunflowerseed (F = 0,39) for maximum dose (0,2%). The least efficiency was demonstrated by BHT in both oils.

Key words: oxidative stability, green tea, cold pressed oil, natural antioxidants

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THE QUALITY OF CONSUMER MILK STERILIZED IN THE PERIOD OF CONSUMPTION

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The aim of this work was to determine the rate of change of acidity and microbial quality of UHT milk and therefore its suitability for consumption after the opening the package.

The study used UHT milk from different producers, different way of opening the carton. The research was conducted in three series. Throughout the study were the milk in a refrigerator at 4°C and was only removed from it at the time of analysis.

In each series of microbiological tests performed, using Petrifilm test – aerobic bacteria, measured the active acidity (pH) and potential (SH). In a series of second and third were made in addition to the organoleptic evaluation of the practical control of microbiological changes in milk. In the first two series in the milk refrigerator closed. In the third series of the milk cartons labeled as A, B, C, D, E were kept in the refrigerator open and F, G, H, H and J closed.

It has been shown that the development of micro-organisms in UHT milk each carton closing, with which it was collected shall only be made after 14 days. The lack of development of microflora in the milk of a closed point to a very high quality of the raw material used and properly performed sterilization procedure. In contrast, milk in the open only at the impact of aerobic bacteria from the outside there are adverse effects limiting its suitability for consumption of up to 7 days. Development of a large number of bacteria was accompanied by the appearance of flaws flavored milk. UHT milk before consumption, particularly after a few days after opening the package should be organoleptic its taste and aroma.

Key words: microbial quality, UHT milk

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MICROBIOLOGICAL ANALYSIS OF SLICED RENNET CHEESES PACKAGED IN MODIFIED ATMOSPHERE

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Requirements determining the acceptance of rennet cheeses applied to products available for consumers (food safety criterion) and functioning of the production process (process hygiene criterion) are described in Commission Regulation (EC) No 2073/2005 of 15 November 2005 on microbiological criteria for foodstuffs. Within a framework of process hygiene criterion, rennet cheeses made from milk or semi-manufactured products that have undergone a heat treatment are analyzed from the point of view of presence of *E. coli* and coagulase-positive staphylococci. Within a framework of food safety criterion - cheeses are analyzed from the point of view of presence of *Salmonella*. The acceptable quality means that the number of E. coli or coagulase-positive staphylococci have not exceed 1000 CFU/g in two of five samples (the number of bacteria in the rest samples have be lower than 100 CFU/g). *Salmonella* have be absent in 25 g of all five samples. In cited Regulation on microbiological criteria for foodstuffs there are no requirements on the presence of fungus (yeasts and moulds).

The aim of this study was to determine the presence of *Enterobacteriaceae* bacteria, yeasts and moulds in market sliced rennet cheeses packaged at modified atmosphere.

This work included the study of presence of *Enterobacteriaceae* bacteria, yeasts and moulds in 88 samples of market sliced rennet cheeses packaged at modified atmosphere. The samples were analyzed in two repetitions from one lot of market products. The analysis were carried out in the day of purchase of cheese samples (44 cheese samples) and after storage at 6ºC for two weeks (44 cheese samples). The samples of cheese were analyzed with using the rinsing method of all content of cheese packages.

The study showed that amongst 44 samples of cheeses analyzed in the day of purchase, *Enterobacteriaceae* bacteria were observed in ten samples. It meant that all these samples met also process hygiene criteria. After two weeks of storage at 6ºC, *Enterobacteriaceae* bacteria were observed also in ten samples of 44 analyzed samples. And these samples met also process hygiene criteria. The moulds were detected in eight samples (at level below 25 CFU/mL in the day of purchase of cheese samples) and in ten samples (at level up to 10,000 CFU/mL after two weeks of storage at 6ºC). In case of yeasts, only two samples of market sliced rennet cheeses packaged at modified atmosphere did not contain yeasts in the day of purchase. The rest cheese samples contained ca. 10,000 CFU of yeasts per 1 mL of rinsed peptone water. After two weeks of cold storage still two samples did not contain yeasts, and in the rest of samples the number of yeasts was at level 10,000 CFU/mL.

Key words: cheese, system packed, modified atmosphere, microbiological analysis

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PLANT MILKS FERMENTED BY LACTIC ACID BACTERIA

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Plant milks (soy, rice, oat, almond, and coconut milks, for example) are a general term used for non-dairy substitutes for animal-based milk products. There are many reasons for consuming plant milks such as: animal-based milk protein allergy, lactose intolerance, vegan diet, and religion rules. Lactic acid bacteria, probiotics especially, are normally used as starter cultures for fermented milk products. But many consumers increasingly demand for non-animal-based fermented milks.

The aim of that study was to determine the viability of lactic acid bacteria (LAB) in fermented soy, rice, and coconut milks during fermentation process and 3-weeks chilled storage, in comparison to non-fermented plant milks containing LAB.

Seven commercial yoghurt dairy starter cultures (YC-180, YC X-11, YC X-16, ABY-3, Yo-A, Yo-B, and Yo-S) were used in this study for fermentation (37ºC/3h) of three plant milks: soy, rice, and coconut. After fermentation process, all plant milk samples were stored at 6ºC for 3 weeks and microbiologically analyzed each week. The number of lactobacilli and bifidobacteria was carried out using with MRS Agar and anaerobic condition of incubation at 37ºC/72 h. The number of streptococci was carried out using with M17 Agar and aerobic condition of incubation at 37ºC/72 h.

The initial number of lactobacilli and bifidobacteria in all plant milk samples was 5.2 log CFU/mL before the fermentation process, and 5.5 log CFU/mL, after the fermentation process. The initial number of streptococci in all plant milk samples was 8.6 log CFU/mL before the fermentation process, and 8.7 log CFU/mL, after the fermentation process. The highest number of LAB was observed in plant milk sample fermented by YC-180 culture (7.7 log CFU/mL and 8.0 log CFU/mL in non-fermented and fermented plant milk samples, respectively). The changes of LAB population were observed in all plant milk samples during 3-weeks chilled storage. After three weeks of storage at 6ºC, the number of lactobacilli and bifidobacteria in non-fermented plant milk samples was 2.7–7.0 log CFU/mL, and 2.7–7.4 log CFU/mL in fermented plant milk samples. The highest number of lactobacilli was observed in soy milk non-fermented containing YC–180 culture (7.0 log CFU/mL), and in soy and rice milk samples fermented by YC-180 culture (7.4 log CFU/mL). The number of streptococci in non-fermented plant milk samples was 7.0–8.4 log CFU/mL, and 6.6–9.0 log CFU/mL in fermented plant milk samples. The highest number of streptococci was observed

in coconut milk non-fermented containing Yo-B culture (8.4 log CFU/mL), and in rice milk samples fermented by Yo-A culture (7.4 log CFU/mL).

There is a possibility to produce soy, rice, and coconut milks containing active LAB cells. The choice of proper starter culture is necessary to obtain fermented or non-fermented product witch meets the requirements of therapeutic level of lactic acid bacteria population.

Key words: fermented milk product, lactic acid bacteria

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THE INFLUENCE OF MATURITY AND GENOTYPE ON TGA ACCUMULATION, INDUCED BY STRESS IMPACTS, IN POTATOES TUBERS AND HEALTHY HAZARD

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Glycoalkaloids (TGA, Total Glyco Alkaloids) are toxic stereoidal glycosides, naturally occurring in plants of the family *Solanacea*. The significance of TGA in potatoes was not exactly specify. In opinions of many authors, its presence in plants is connected with physiological stress resistance, induced by mechanical damages and infections caused by some microorganisms and insects.

In spite of perennial decreasing, the consumption of potatoes in Poland, against the background of UE, is still very high. They are indispensable component in diet of average Pole. Although consuming the potatoes contained high concentration of TGA may caused diseases or even death. 20 mg/100 g fresh weight in potatoes is the upper limit, guaranteed food safety. Harmful interactions include disturbances of central nervous system, tearing cell membranes, perturbation in calcium transport, etc.

The influence of the genotype on TGA accumulation, induced by mechanical damages and light exposure was the aim of the first part of the first part of the work. The investigations were carried on 27 potatoes cultivars after harvest and 5 months storing in experimental repository (temperature 8°C). The second part of this work was connected with specifying the influence of the harvest term on TGA accumulation in damaged tubers exposed to light. The third stage consists in TGA content investigations in "young" potatoes tubers, occurring in retail trade.

Key words: glycoalkaloids, potato, healty hazard

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CHANGES IN PROTEOLYTIC AND AMYLOLYTIC ACTIVITY INDUCED DURING GERMINATION OF PLANTS IN OF $FeSO_4$ SOLUTIONS

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Addition processed sprouts biofortified in iron can be an excellent choice for improving the nutrition value of various food products. During germination in hydroponic cultures enriched in $FeSO_4$ high accumulation of iron in sprouts is observed. However, iron concentration in raising medium induces also some defence mechanisms in plants, thereby also changes in protein expression. These changes are observed also in a hydrolytic enzymes group: in activity of amylases and proteases. The activity of these enzymes in sprouts cultured in medium with iron ions was compared.

The experiments were carried out on soya bean and alphalpha seeds and wheat grain. Plants were cultured in 0-25 mM solution of $FeSO_4$ in special germination dishes for 7 days. They were sprinkled every day with $FeSO_4$ solution with respective concentration and finally dried in a stream of circulating warm. The samples were milled and extracts from received powder were prepared. Total amylolytic activity of these extract was determined according to Bernfeld method and proteolytic activity according to Fritz procedure.

The high abiotic stress during germination time decreases the level of activity examined hydrolytic enzymes. Amylolytic activity is higher for wheat-germs than for legumes sprouts contrary to proteolytic activity. Proteolytic activity in wheat-germs is more dependent on abiotic stress.

Supplementation of food in sprouts biofortified in iron during raising still requires to consider changes in hydrolytic enzymes expression. However, the level of these enzymes activity in prepared sprouts depends on plant species and variety, it may induce serious changes in susceptibility to fermentation and rheological properties during food processing.

Key words: sprouts, amylases, proteases, iron, abiotic stress

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THE VIABILITY OF LACTIC ACID BACTERIA IN DIFFERENT GROWTH CONDITIONS

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Lactic acid bacteria (LAB) are beneficial to human health and thus many of strains of LAB are probiotics. Is commonly accepted now that LAB, probiotics especially, have to be alive in the gastrointestinal tract (GIT). It means that they have to survive in GIT, but the ability of LAB to survive passage through GIT is mainly attributed to their acid in the stomach, and bile tolerance in the intestinal. It is known that food compounds such as fat, proteins and sugars may protect bacterial cells and thus improve growth or viability of LAB in GIT conditions.

The purpose of this study was to find the effects of whey protein concentrate (WPC-68) and Acacia gum (Fibregum™) on population of LAB in fermented milk in condition simulating GIT.

The study involved microbiological determinations of survival of LAB population from chosen dairy starter cultures (LCR, Bb-12, TAO-40, and La-5) and monocultures (*Lactobacillus* sp. isolated from sour bread and *B. bifidum*) in fermented milk in artificial GIT juices. Fermented milk samples were produced from cow milk (3.2% fat) with added WPC-68 (0, 1, 2, 2.5, and 5%) or Fibregum™ (0, 1, 2, 2.5, and 5%). Artificial GIT juice were prepared on the basic juices and the proper enzymes complexes. The basic gastric and intestinal juices were prepared according to Clavel et al. (2004) and Marteau et al. (1997), respectively. The experiments were performed at 37ºC for 3h and 5h, respectively in gastric and intestinal juices. At the beginning and the end of the experiment, the number of LAB cells was assayed using the plate method.

The initial number of LAB in fermented milk samples ranged from 7.7 to 9.5 log CFU/mL. After 3h of incubation in simulated gastric juice, the population of LAB was 7.8-9.4 log CFU/mL, independently on WPC-68 or Fibregum™ addition. And after 5h of incubation in simulated intestinal juice, the population of LAB ranged from 6.2 log CFU/mL to 9.4 log CFU/mL. The significant reduction of bacteria cells population was observed in all milk samples fermented by TAO-40 culture containing *Streptococcus thermophilus* monoculture. Addition of WPC-68 or Fibregum™ to the milk did not influence growth or viability of LAB, as well as did not improve of *Streptococcus thermophilus* viability in condition simulating GIT conditions. In other milk samples, fermented by lactobacilli or bifidobacteria, the reduction of LAB population was not observed.

Key words: lactic acid bacteria (LAB), fermented milk

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VISCOELASTIC BEHAVIOR OF PROTEIN-CARRAGEENAN BLENDS

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Response surface methodology was used to study the simultaneous effect of κ – carrageenan (0, 0.5, 1.0%) and myofibrillar proteins (2, 3, 4%) levels on rheological properties of carrageenan-myofibrillar protein blends containing 2% of NaCl.

Myofibrillar proteins were extracted from pork Longissimus dorsi muscles using 0.1 M KCl, 66 mM KH2PO4/Na2HPO4, 1 mM EDTA buffer, pH 7.0 buffer and 1 mM sodium chloride.

Protein/carrageenan mixtures were subjected to oscillatory measurements at a fixed frequency of 0.1 Hz and a constant strain amplitude of 0.1 mNm. Storage modulus (G'), loss modulus (G") and phase angle (δ) during heating (from 16 to 52°C) and cooling (from 52 to 16°C) processes of experimental samples were measured.

A significant reduction of phase angle with increase concentration of carrageenan was observed for gels at 42°C during heating process. The effect of increased protein concentration was dependant of carrageenan level. There was a slight increase in phase angle but only in samples without carrageenan addition. During a cooling phase an increase of carrageenan concentration resulted in significant increase of storage and loss modulus and reduction of phase angle at 33, 34 and 35°C suggesting a phase transition of the gels.

Key words: protein-carrageenan blend, response surface methodology, myofibrillar proteins

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TRACEABILITY SYSTEM IN FOOD CHAIN

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The paper presents functioning of the traceability system in food processing industry based on fish processing plant. Implementation of this system in processing plant enables to obtain high quality products which are also safe for customer's health. Traceability system ensures flow of information throughout the whole food chain contributing to the assurance of health safety of food.

The paper also describes the structure of the traceability system and presents results of the verification of system functioning in tested fish plant. Verification included identification of the selected fish products according to the requirements of respective PN-EN ISO 22005:2007 standard: *Traceability in the feed and food chain-General principles and basic requirements for system design and implementation* based on the identification of "Herring fillets in oil". Traceability consisted in following the history of processing a selected product from the fish raw material acceptance department through all departments of the plant to the final products warehouse. Information concerning "Herring fillets in oil" collected from the documentation available at every department of plant enabled to follow the processing history of this products in food chain. Results show that there is a possibility of tracing selected product in tested fish processing plant. An appropriately functioning traceability system enables the identification of potentially harmful products in food chain and withdraw them from distribution stage, thanks to which products offered by the plant are safe for costumers.

Key words: traceability, food chain

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OCCURRENCE OF PHTHALATES IN SOIL AND AGRICULTURAL PLANTS

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Phthalates are extensively used as softeners in plastics and as aditives in glues, cosmetics, defoaming agens, etc. Environmental contamination by man-made chemicals is the result of emission during production, use and subsequently degradation processes. The most of the PAEs are used di-*n*-butyl phthalate (DBP) and di(2-ethylhexyl) phthalate (DEHP). DBP and DEHP are characterized by low solubility in water and high octanol-water partition coefficients. DEHP is more strongly adsorbed in the soil than DBP, resulting in its concentration is lower than DBP. Microbial degradation is one of the major processes that cause decreasing of these pollutants in the soil.

The aim of this study was detection of phthalic acid esters (PAEs) in the soil and agricultural plants in the Middle Moravia in the Czech republic. The objective of our experiment was quantification of two PAEs, di-*n*-butyl phthalate (DBP) and di(2-ethylhexyl) phthalate (DEHP). All the chosen fields were amended by manure. Six partial samples of the soil from each one were removed. Samples of plants were removed in first phase of growth. All the samples were storaged in -18°C. The extraction was carried out with mixture of acetone and *n*-hexane. The detection of DBP and DEHP were determined by high performance liquid chromatography with UV detection.

The range of DBP concentration in agricultural lands were detected from 0,46 to 0,84. DEHP was not detected in any samples of soil. The mean concentrations of DBP in plants were detected from 3,5 to 14,26 $mg.kg^{-1}$ dry matter. DEHP was in range from 0,12 to 2,27 $mg.kg^{-1}$ dry matter. The concentrations of DEHP were much more lower than concentration of DBP in all the samples of plants.

Applied manure as fertilizer may cause the accumulation of these contaminants in plants, plant products and in the food chain consequently.

Key words: agricultural plants, phthalic acid esters

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Monika Żelazko, Marek Szołtysik, Anna Dąbrowska, Aleksandra Graszkiewicz, A. Wielowiejska, józefa Chrzanowska

BIOACTIVITY OF CASEIN HYDROLISATE OBTAINED WITH *YARROWIA LIPOLYTICA* EXTRACELLULAR ALKALINE PROTEINASE

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Bioactive peptides are defined as specific protein fragments that have a positive impact on body functions and may ultimately influence health. They are inactive while they are a part of the sequence of the parent protein and become active when released in one of three ways: enzymatic hydrolysis by digestive enzymes, during food processing or proteolysis by enzymes derived from microorganisms or plants. Casein, the main protein of milk is well known as a precursor of various bioactive peptides.

The aim of this study was to evaluate the antioxidative and antimicrobial activities of casein hydrolysate obtained with extracellular alkaline *Yarrowia lipolytica* proteinase.

The first step of the research was to establish the conditions of hydrolysis. The reaction was carried out at temp. 25°C and pH 7.5 with yeast enzyme used in two doses (1000 u and 2000 u per 1 g of casein). The progress of protein degradation was monitored during 48 hours by RP-HPLC as well as by determination of concentrations of released free amino groups and nitrogen products soluble at pH 4.5 and 10% TCA. Based on obtained results the 24 h casein hydrolysate was chosen for further investigation. In the next step this hydrolysate was ultrafiltrated (via membrane of cut off 10 kDa) and the resulted permeate was separated by RP-HPLC (column Zorbax Eclipse C-18, phase A: 0.1% TFA/H_2O, phase B: 0.1% TFA/ACN). In the obtained fractions of peptides the antioxidative properties as a free radical scavenger activity against DPPH as well as antimicrobial activity against *Bacillus subtilis* B3*, B. cereus* B512 and *Escherichia coli* PCM2560 were determined.

It was shown that the level of casein degradation depends on enzyme concentration and time of reaction. The most advanced hydrolysis (performed with the enzyme of conc. 2000 u/g of casein) was observed after 48 hours when concentrations of low molecular weight products soluble at pH 4.5 or TCA and free amino groups reached the highest level. Also RP-HPLC profiles of casein hydolysate confirmed the progress of protein degradation. The 24 hours hydrolysate after ultrafiltration was resolved by RP-HPLC into several peptide

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fractions. A remarkable antioxidant activity (around 0.5 μM Trolox/mg) was then observed in few fractions of casein derived peptides. The antimicrobial activity against both Gram positive and Gram negative bacteria were also noted, however its level for the peptide concentration of 0.5 mg/ml was not so high and caused reduction of bacterial growth by one logarithmic cycle.

Key words: *Yarrowia lipolytica*, bioactivity of casein hydrolisate

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Waldemar Żyngiel, Halina Kolenda

THE MICROBIOLOGICAL QUALITY AND STABILITY OF HIGH PRESSURE PROCESSED CARROT JUICES

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The raw carrot juices belongs to perishable products due to undesirable microbiological and enzymatic changes during storage so commercially produced juices are subjected to the process of preservation. Consumer's expectation for minimally processed, microbiologically safe, addtitives free and stable food products with "fresh like" characteristics has stimulated the interest of alternative food preservation technologies.

High pressure processing (HPP) as one of the emerging technologies in food processing and preservation offers the opportunity of producing food of high quality, greater safety and increased shelf-life. The usefulness of high pressure treatment of food products is the settlement of such compression parameters which do not lower the nutrient value and sensory features of the product and affect directly on his persistence by the elimination or significant reduction unprofitable microbiological and enzymatic processes.

The overall purpose of this study was to determine the effect of HPP parameters on microbiological quality and stability of processed carrot juices and to specify the changes in pressurized juices during storage period.

The object of researches were raw juices extracted from various carrot varieties, recommended for juice production. Raw carrot juices, packed into LDPE type plastic bottles were pressure processed due to the planned compression parameters: 400 MPa/20'/20^{o}C, 500 MPa/10'/20^{o}C/, 500 MPa/20'/20^{o}C, 600 MPa/10'/20^{o}C. The range of microbiological analysis included indication of presence: total aerobic mesophilic microorganisms, coliforms, bacterial cells of milk fermentation type, yeasts, moulds and anaerobic microorganisms spore forms in the samples of researched carrot juices. The microbiological analysis were performed according to the PN:ISO standards.

High pressure treatment of carrot juices significantly reduced the population of total aerobic microorganisms mesophilic type and bacterial cells of milk fermentation type. The inactivation level of researched microflora was more effective in the samples processed at higher pressure. The population of coliforms and moulds was reduced to below detectable level. Yeasts and anaerobic spore forms microorganisms were below detectable level in raw carrot juices and processed samples throughout storage period.

The received results of performed analysis indicated the positive effect of high pressure processing on microbiological quality and stability of processed and stored carrot juices which presented acceptable sensory properties up to the one month of storage period. The pressure treatment of carrot juices reduced the microbial load to non-detectable level or significantly reduced the population of researched microorganisms.

Key words: carrot juices, high pressure processing (HPP), microbiological factors, storage time

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