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PROCESSING POSSIBILITIES OF LEFT-OVER BREAD FROM AN ECONOMICAL AND TECHNICAL POINT OF VIEW

F. Meuser
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Bread returns and left-overs as well as left overs of doughs in bakeries are valuable raw materials for the production of food and feed products. The in-line use of bread and dough left-overs in bakeries, e. g. processed to sourdoughs or syrups are common practice. Bread returns and left-overs are also dried and milled to feed meals. All these remainders are also used for energy production. They serve as carbon source for the production of ethanol or methane and can also be burned for heat production. In their enzymically digested form, they can replace molasses as substrate for baker's yeast production. In addition to their reuse, a substantial part of the remainders is disposed as waste.
In Germany, the primary use of bread as food amounts to 85 % of the total production of 4.7 Million t/a. The remaining 15 % are not consumed and represent a monetary value of 1.7 Billion EUR/a. Half of the uneaten bread finds a secondary use, mainly by making it available as feed products. The proceeds of this secondary use are less than the price for a comparable amount of fodder cereal. The relatively largest gain can be made when dried bread returns and/or left-overs are directly burned.
Besides the in-line reuse of bread returns and left-overs, all other methods result in sharp reductions of the originally achieved proceeds gained in the processing of flour to bread. Therefore, bread returns place a constant burden on the economical production of bread. This burden can only be marginally reduced by the presently prevailing conditions for bread production and marketing.
In addition, sold but not eaten bread is a substantial source of food waste. The direct and indi¬rect losses in income caused by its disposal amount on average to about 20 EUR/consumer/a in Germany. These losses are an unwanted tribute to our modern life.

Key words: bread, dough, returns, left-overs, processing, economical evaluation

THE BRABENDER® GLUTOPEAK®. A NEW AND RAPID METHOD

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The quality of raw materials, especially the properties of flour and gluten are more and more important. Laboratories in research and development and also in quality control are having a high request for quick methods with a high output on information. Also the sample preparation must be very easy and the handling in general comfortable. All these facts together are the basic for results with a high reproducibility and good performance.
In the field of rheological tests of wheat flour, the Brabender® GlutoPeak® offers completely new possibilities of determining the quality of flour. The principle is that a flour sample is mixed under defined conditions. This forms gluten, which characteristics are rheologically documented and measured. Depending on the gluten properties and qualities a curve is obtained, which can be defined as the finger print of the tested flour.
The evaluation of the curve shows a peak after a flour specific mixing time. The height of the peak as well as the time until the curve maximum is reached (1 - 5 min) stands for the basic flour quality assessment.
This new GlutoPeak® method provides the possibility to perform a quick and reliable classification of the gluten and flour quality in the incoming grain section.

Key words: GlutoPeak®, flour, quality, rheology, gluten

IMPROVED LABORATORY TOOL FOR MEASURING GAS PRODUCTION AND RETENTION AS WELL AS DOUGH RISING DURING PROOFING

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Bread making is a complex process that goes beyond the kneading of the dough by the baker. Proofing is a major milestone: it begins with the incorporation of yeast to stop during the first stages of baking. During the process of fermentation, yeasts convert carbohydrates available from the amylase activity or directly added to flour, into carbon dioxide and ethanol. The ethanol is evaporated during baking, while the carbon dioxide fills the cells of the gluten network and participates to the dough rising.
The volume of the finished product depends on both the CO_2 production capacity and the ability of the dough to retain the gas while developing. A lack of mastery of these parameters inevitably leads to defects in volume of finished products. The new Rheofermentometer F4 allows a single test to determine the production and retention of CO_2 as well as the volume and tolerance of dough during proofing.
The talk will describe the instrument and discuss obtain results and applications in the baking and milling industry.

Key words: dough, proofing, gas production

NOVEL TECHNOLOGIES FOR WHEAT BRAN FRACTIONATION

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Wheat bran obtained after conventional milling is a by-product representing about 15% of the milling yield. But nowadays wheat bran is also considered as a source of bio-active compounds (fibres, minerals, vitamins, antioxidants). However, these bioactives compounds are poorly bio-accessible as they are trapped in resistant cell-walls.
A general study on dry fractionation processes was developed with the aim to recover separately the different layers of the bran and to produce fractions rich in the different bran tissues, like pericarp-rich fractions (rich in fibers) or aleurone-rich fractions (rich in vitamins, minerals, antioxidants). Two processes were more particularly studied: cryogenic grinding and electrostatic separation. The mechanical properties of the different bran layers were studied to define the conditions in which these bran layers were the most brittle. Grinding tests were then carried out to evaluate the effect of milling temperature on particle size reduction. In cryogenic conditions most of the bran layers and cellular structures were found to be disrupted. In a second time, the sorting of ultra-fine bran particles according to their origin (aleurone, pericarp…) was studied, using electrostatic separation. This new separative technic allows obtaining bran fractions with different biochemical compositions and with different bran tissues proportions. The different fractions obtained by ultra-fine grinding and electrostatic separation were incorporated into white flour to prepare enriched breads. In vitro digestion studies of these enriched breads have shown that the bio-accessibility of phenolic acids and minerals increases with decreasing particle size as well as with increasing the concentration of aleurone particles. This study demonstrated that wheat bran fractionation can help developing grain-based products with an improved nutritional potential. Some of wheat bran fractions might have a good potential for food ingredients.

Key words: wheat bran; cryogenic milling; electrostatic separation; bio-accessibility; micronutrients

INFLUENCE OF VARIETY AND LOCATION ON MINERAL COMPOSITION OF WHEAT AND FLOUR AND THE DISTRIBUTION OF MINERALS IN WHEAT MILLING FRACTIONS

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In cereal research content of ash i.e. minerals in kernel and especially in flour is a parameter which is by rule included in characterization of flour but the considerations of this parameter rarely go behind the simple statement about determined ash content. However, ash composition of kernel and especially of flour streams intended for processing and further consumption is important at least from nutritional point of view but also its relation and possible influence on processing properties of flour has not been the issue of thorough investigation. Investigations of mineral composition of thee varieties grown at three different locations are presented indicating significant influence of both parameters on content of micro and macro elements in wheat kernel. Mineral composition of flour milling streams of six varieties was analyzed indicating significant differences of distribution of individual minerals in flour milling streams.

Key words: wheat variety, mineral composition, milling fractions

TECHNOLOGICAL SOLUTIONS PREPARATION AND MILLING WHEAT IN LJUBAČE MILL TUZLA

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Preparation of grain for milling during storage is one of the important processes in the production of flour. Storage conditions are extremely important for the process of grain milling. The process of milling in Ljubače Mill and its technological solution have been valid and from the solutions brought forth of many modern plants for grain milling. In this paper will be possible to demonstrate a new improved technological solution of part of line production of flour from storage to vibrating sieves.

Key words: preparation, storage, grain, milling

MICROSTRUCTURE ANALYSIS TOOLS TO SUPPORT BREAD RESEARCH

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Analytical tools have been the support of great advances in the area of cereals and cereal based products, and microstructure studies have been conclusive for confirming and supporting research hypothesis. An overview about the microstructure analysis tools applied at bread level to follow crumb and crust features and the effect of recipes and processing on those will be presented. Cereal proteins and starch involvement in breadmaking has been followed by light microscopy and scanning electron microscopy (SEM) revealing protein network formation besides gelatinization and gelification. Particular emphasis will be made on enzymes acting on proteins and their role building a protein network when needed, and bakery additives like hydrocolloids, along with the correlation between microstructure with biochemistry and rheology. Recently, microtomography has been also applied to assess changes in crust and crumb of bread. In addition, image digital analysis of bread crumb allowed quantitatively discriminating recipe or process changes. Overall, an overview about the microstructure analysis tools applied to bread quality evaluation will be presented.

Key words: bread, microstructure, SEM, digital analysis, light microscopy, quality

OPTIMISATION OF TEST BAKING PROCEDURE AND DEVELOPMENT OF OBJECTIVE BAKING PROPERTIES EVALUATION SYSTEM

D. Živančev, J. Mastilović, A. Torbica, Ž. Kevrešan, J. Tomić, S. Rakita
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Development of objective baking properties evaluation system is necessary for exact and precise estimation of bread properties, whereas optimisation of test baking procedure is necessary to gain repeatable results of bread properties. In this work is presented modified baking procedure of pan bread for estimation different wheat varieties which allows measurement of different new parameters of bread volume and dough properties measured with simplified instrumentation which showed significant correlation with different properties of wheat quality. Additionally, this procedure allows good differentiation of properties of bread crumb obtained by TPA analysis and colour of bread crust. Furthermore, PCA analysis of these properties segregated four different parameters of bread volume and dough properties (Vcal, hf; delta h and b) and four properties gained by TPA analysis (HA-ss, CO-ss, SP-ss and Res) by which is possible to estimate quality of pan bread produced by this procedure.

Key words: baking procedure, pan bread, baking properties

RHEOLOGICAL BEHAVIOUR AND BAKING PERFORMANCE OF ALEURONE-RICH WHEAT MILLING FRACTION COMPARED TO OTHER CEREAL FLOUR TYPES

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There are two approaches to enhance nutritional value in cereal based products dosing previously isolated functional components e.g. dietary fibre, or changing the traditional milling process to gain dietary fibre-rich flour. In our R+D work, aleurone-rich wheat flour fractions were developed by altering the milling process by Bühler AG at Gyermelyi Co, Hungary. The aim of our study was to examine the technological and nutritional properties of the novel flour in comparison to other commercial milling fractions (rye, whole wheat flour). The effects of dosing cereal fractions to wheat flour were also investigated at different ratios (15, 40, and 75%). The chemical composition was determined. Comprehensive rheological characterisation was also investigated by micro-valorigraph, Rapid-Visco Analyzer, and the combined investigation by Mixolab. Performance of the final product was also examined by standard test baking. The newly developed wheat fraction showed the highest protein and dietary fibre content, and contains bioactive compounds in high amount. While the mixing values did not show a linear relationship, viscosity parameters showed dosage dependent correlation. The specific volume of aleurone-rich bread was similar to that of white bread. The novel wheat fraction can be a new and valuable member of wheat milling fractions due to its controllable technological and dietary properties.

Key words: rheology, functional food, wheat, aleurone

INFLUENCE OF FUNCTIONAL INGREDIENTS ON THE QUALITY, MICROSTRUCTURE AND SENSORY ATTRIBUTES OF PITA BREAD – RESPONSE SURFACE METHODOLOGY

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The demand for Functional foods and in particular dietary fibre rich products has been steadily increasing worldwide, driving the practice of adding DFs to bakery products for health benefits. However, these modifications could potentially change the quality and sensory attributes of breads. The aim of this work was to study the influence of 20 formulations resulting from combinations of three functional ingredients (FI) (inulin, guar gum and waxy wheat flour) on pita bread using a response surface methodology experimental design. Bread quality parameters (i.e. hardness, chewiness) were assessed texture analyser machine (TA.XT2) and sensorial with a battery of tests, including the visualisation of their microstructure using Scanning electron microscope (SEM).

The results showed that addition of FI alone significantly ($p<0.05$) increased hardness and chewiness, and decreased the springiness of pita bread. Guar gum and inulin alone increased ($p<0.05$) pita bread height and volume. Regarding microstructure SEM showed that FI added to pita bread had an impact on bread starch-protein matrix differences. Finally, Sensory evaluation results showed that pita breads enriched with FI were only significantly different in flavour, chewiness and overall acceptability.

Key words: pita bread, inulin, guar gum, waxy wheat flour, SEM, sensory

INVESTIGATION OF RELATIONSHIPS BETWEEN BREAD VOLUME AND SOME QUALITY PARAMETERS

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In this study, 199 genotypes (118 lines and 81 varieties) in winter bread wheat breeding program of Central Research Institute for Field Crops were analysed. The wheat samples were grown in 9 different locations in 2011-2012 growing season. Some quality parameters which were hardness, test and thousand kernel weights, flour yield, zeleny and modified zeleny sedimentation, protein content, alveograph (W, P, L, G) and farinograph (stability, softening degree, water absorption) parameters, wet and dry glutens, gluten index, falling number, bread volume and weight were determined and statistically analysed. Firstly correlations were investigated between bread volume and the others. Later regression relationships were examined between bread volume and properties that have significant correlations. According to results, there were positive ($p<0.01$) correlations between bread volume and zeleny sedimentation, modified zeleny sedimentation, grain protein content, alveograph parameters (W, L, G), wet gluten, dry gluten, bread weight while there were negative ($p<0.01$) correlations between bread volume and test weight, thousand kernel weight, flour yield. And also statistically important ($p<0.01$) results were obtained in regression analysis for these parameters. One of the aims in bread wheat breeding program is to improve cultivars with good quality especially high bread volume as flour and bread industries desire high quality wheats. These analyses can be successfully used for predicting bread volume in wheat breeding program and trade.

Key words: bread wheat quality

CEREALS STRAW - VALUABLE BIOTECHNOLOGICAL SUBSTRATE

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A huge amount of unused cereal straw originated from different industries is produced daily. These materials can be converted into different commercial products, among which biogas and bioethanol are perhaps the most important at present time.

Based on their chemical composition straws are categorized as lignocellulose materials comprised mainly of polymers - lignin, cellulose and hemicellulose. Lignocellulose pretreatment for biofuels production is complex because cellulose is incorporated in lignin and hemicellulose matrix and therefore less prone to degradation either chemical or enzymatic. The methods most usually applied for lignocellulose materials pretreatment include thermochemical and/or mechanical treatments which are environmentally unfriendly. The available biological environmentally friendly degradation methods are based on the use of lignolytic fungi, rare organisms that can efficiently degrade lignocellulose polymers.

This work seeks to address the following questions: the annual production of cereals straw in Europe, their chemical composition and possible biotechnological utilization as a substrate for production of different value-added products.

Key words: cereal straw, value-added products, biofuels, white-rot fungi

PRODUCTION CAKE FROM HARD WHEAT FLOUR

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The most important factor in cakes making is the availability of soft wheat flour. Sometimes cake flour is producing by milling hard wheat because the shortage of soft wheat flour. The aim of this study is to identify a specification for production cake flour from hard wheat which gives a high quality of cake products. Protein %, ash %, wet gluten %, dry gluten %, gluten index, falling no, acidity %, damaged starch, sedimentation values and particles size are 8.82, 0.5, 24.1, 8.44, 97.65, 310.3, 0.15, 7.71,72.7 and 10.07 respectively. The development time, stability, elasticity, softening, water absorption, resistance, extensibility and R:F values for dough are 1.35, 3.1, 102, 89.4, 57.73, 98.6, 357, 155 and 2.31 respectively. The average of cakes volume is 711 c.c. and overall acceptability is 7.55 of 9 hedonic scales. Both of cake volume and overall acceptability of sensory evaluation test correlate positively ($P<0.005$) with protein and gluten content, sedimentation rate and extensograph parameters which give an indication about hard wheat cake flour could be substituted for soft wheat flour. Cake producers should apply a special treatment to improve the quality of cake.

Key words: cake, flour, baking, quality, production

CONTINUOUS AERATION IN FOOD PRODUCTS, AS SPONGE CAKE AND WAFER FATCREAM FILLINGS

B. Peters
HAAS – MONDOMIX B.V., The Netherlands
TIM ZIP, Zagreb, Croatia

Continuous aeration can be the important tool in quality improvement, a more hygienic process and cost saving.
It is the completely controlled process of mixing air/nitrogen in a food product. The gas is incorporated in very small, invisible, stable bubbles. The objective is a lighter and healthier product, with a better mouthfeel, a finer taste and a more attractive appearance. The quality is very consistent.
It may concern a traditional product or a complete new innovation. Examples are sponge cake, meringue, fatcream fillings in wafer products or pralines, big bubble chocolate, whipped cream, chocopie, yoghurt mousses or aerated cheese and many more.
The presentation will give a basic introduction in the process of continuous aeration and all its possibilities. Technological aspects as bubble formation, bubble stability, density and recipe will be discussed in general and more specific for a selection of products in the bakery and confectionery industry.

Key words: sponge cake, quality improvement, bakery and confectionery industry

SALT INTAKE THROUGH BAKERY PRODUCTS IN SLAVONIA REGION

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The reduction of salt intake is a public health issue in many countries because it has been identified as the main cause of several diseases such as hypertension, heart and kidney diseases, stomach cancer, osteoporosis, stroke and obesity. The WHO has set a worldwide target of a maximum salt intake of 5 g/day for adults as a recommendation to reduce daily salt intake. Of all foodstuffs, bread has been identified as the single highest contributor to the total daily salt intake. Therefore, the aim of this paper was to estimate salt intake through bakery products in Slavonia Region and their dependency on different parameters.The quantity of bakery product intake derived from national food consumption survey.The results showed that consumers in Slavonia eat about 148 g/day of various bakery products, andconsequentlyintake 2.43 g/day of salt, which is half of the recommended daily intake.Research has shown that salt intake by bakery products are almost the same in villages and towns. Related to gender, men's intake is higher than women. The intake is highest at low body mass index, and is higher in younger than in elderly population.

Key words: salt intake, bakery products consumption, national food consumption survey

GUSTAL®, SOLUTION TO REDUCE SALT IN BREAD

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Gustal®, solution to reduce salt in bread, is an active principle in making it possible to reduce salt levels in bakery products by 30%. It exclusively combines the characteristics of a selection of deactivated sourdough and yeast varieties. It meets the official recommendations concerning public health problems related to the consumption of salt in bread. Combined in premixes or mixes, Gustal® offers a threefold solution: firstly by avoiding the need for changes to the baker's working methods, secondly by preserving the flavour of the bread and thirdly clean label approach. Gustal® premixes offer a precise and well targeted response to the demands of consumers seeking healthy, well-balanced and tasty food.

Key words: bread, salt, clean label, health

TOWARDS THE PRODUCTION OF REFERENCE MATERIALS FOR FOOD ALLERGEN AND GLUTEN-FREE ANALYSIS FOR IMPROVED FOOD SAFETY MANAGEMENT

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Effective allergenic risk assessment and management are important to protect allergic consumers and to comply with allergen labelling regulations. Such approaches require reliable analytical tools for the detection of allergens in food. In recent years various allergen-detection methods have been published, and immune-chemical test kits have become commercially available and widely used. Alternatively, methods using specific DNA fragment identification – usually based on PCR (polymerase chain reaction) have also been employed. More recent developments use also Liquid Chromatography - Mass Spectrometry (LC-MS) to analyse for allergen or gluten specific peptides in food products.

Due to the nature of the analytes and their susceptibility to various processing effects, reliability and comparability of results have posed a great challenge. Both reference methods and reference materials are urgently needed here. It is one of the aims of MoniQA— Monitoring and Quality Assurance in the Total food Supply Chain (www.moniqa.org) - the global food safety network registered as MoniQA Association (initially funded by the European Commission as a Network of Excellence, 2007-2012) to provide guidelines for method validation, reference materials and assess the reliability of methods and obtained results through validation studies and proficiency testing schemes.

MoniQA developed incurred reference materials for the analysis of milk and egg allergens, recently these materials were used in an international ring trial. Additionally, MoniQA worked on the development of LC-MS based reference methods for gluten-free and food allergen analysis. Currently the specific requirements and the design of global gluten-free standard materials and food allergen reference/testing materials are discussed by an international group under MoniQA's leadership and involving representatives from universities and food industries, the European Prolamin Working Group, AOAC, Health Canada, ICC, RMI Australia, and others.

The aim of MoniQA's initiative is the publication of a Guidance Document on the special requirements and production of allergen reference materials, following a similar effort by the same group in 2010 publishing a globally harmonized Guidance and Best Practice Document on validation procedures for quantitative food allergen ELISA methods (Abbott et al. 2010). The new document shall allow everyone who is able to fulfill the described requirements to produce and to offer reference material. This material shall receive a certain "certification or labeling" which identifies the material as such, produced according to this "Guidance Paper" (in effect a practical guide to implement ISO Guide 35 applied to the special issue of allergens and gluten). In a recent meeting in Washington, Missouri, USA (March 2013) MoniQA established a task force that identified the first priority commodities: gluten, milk, egg, peanut, hazelnut, and soy. The plan is to provide well characterized commodity materials for the eventual production of incurred reference materials, spiked samples and extracts.

The need for appropriate analytical tools to assure food safety for allergic consumers requires the collaboration of various disciplines, such as food technology, clinical research, consumer and social sciences, analytical chemistry and others, and various stakeholder groups bridging from research and training at the university and industry level, to international organisations (Codex, CEN, ISO, a.o.) and regulators.

METHODS FOR THE ROUTINE ANALYSIS OF MYCOTOXIN IN CEREALS

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Mycotoxins are secondary toxic metabolites produced by organisms of the fungi kingdom, commonly known as moulds. As the Mycotoxins cause severe health problems in human and animals, the routinely performed control in food and feed production is of great importance. This type of control typically involves many stages in the production chain, such as raw material control, production processes, final-product control but also pre-sales control.

While end products are officially tested for Mycotoxin content by the use of time consuming accredited analytical methods (different types of chromatography such as TLC, GC, HPLC/ MS), the demands for routine control in the production are speed, simplicity and low cost, in combination with reliable results. Commonly used routine methods in production control are Enzyme immunoassay (ELISA) for large amount of samples and Immunochromatographic assay (LATERAL FLOW TECHNOLOGY) for limited number of samples to be tested.

Charm ROSA (Rapid One Step Assay) Lateral Flow Assay is a perspective method for the routine Mycotoxin analysis. National Reference Laboratory for Mycotoxin testing CODA-CERVA* from Belgium performed a comparative study for various routine methods with DON. The best accuracy, reproducibility and detection limits were achieved by "CHARM ROSA®", which is also an approved by the USDA GIPSA**. The international results were also confirmed by regional tests, performed on Slovenian and Croatian samples.

*CODA-CERVA as National Reference Laboratory (NRL) for Mycotoxin; Veterinary and Agrochemical Research Centre, Operational Directorate of Chemical safety of food chain, Unit of Toxins and Natural Components, Belgium

**United States Department of Agriculture; Grain Inspection, Packers & Stockyards Administration, Laws & Regulations;

Key words: mycotoxin, production control, immunochromatography, lateral flow assay

TRANSFER OF HEAVY METALS FROM CEREALS AND FLOUR INTO FOOD CHAIN

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To determine the quantity and types of heavy metals in different types of flour and vegetable species detailed study was carried out in collaboration with the Faculty of Agriculture in Osijek.
Tests for toxic and essential heavy metals (Fe, Mn, Zn, Cu, Cd, Pb) in wheat grain were carried out on 5 production areas for 4 selected wheat varieties. Laboratory analysis determined total concentration of heavy metals in plant leaf and four different types of flour or grain fractions (bran, feed flour, flour T850, and flour T550).
Analysis of plant material was conducted on induction coupled plasma (ICP - OEC).
The results were statistically analyzed using SAS software for Windows, while the statistical significance was determined by ANOVA test, correlation and regression analysis. Dependence of the analyzed properties was shown in regression models.
The largest concentrations of heavy metals were found in the bran, feed flour and whole wheat flour of one wheat variety, and the lowest were found in the flour-type T850 and T550.

Key words: heavy metals, wheat, flour

NOVEL ANTIFUNGAL LACTIC ACID BACTERIA BIOPRODUCTS FOR HEALTH OF CEREAL GRAINS

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The study is dedicated to develop novel antifungal lactic acid bacteria bioproducts for the detoxification of cereal grains (seeds) used in the sustainable agriculture system. For the production of bioproducts lactic acid bacteria (belonging to *Lactobacillus* and *Pediococcus* genera) with the highest antimicrobial activity (producing bacteriocins) were selected from the collection of the KTU Department of Food Technology for the treatment of different cereal grains (wheat and barley). The anti-fungal and detoxification action of bioproducts against the main seed borne pathogens were tested under laboratory and field conditions in 2011-2012. Spring wheat and barley seed heavily infected by *Fusarium* spp. and Cochliobolus sativus were used for the treatment with LAB. Spring wheat seed treatment with the P. pentosaceus alone and in three-component mixtures with P. acidilactici and L. sakei gave the best control against *Fusarium* fungi and C. sativus infection among tested LAB. *Fusarium* spp. and C. sativus infection level in barley seed were best controlled by P. pentosaceus mixture.

The creation of such a type of bioproducts is necessary to increase the resistance of the plant against developing phytopathogens such as fungi and their secondary metabolites – mycotoxins during the growth of the plant as well as with that to increase the efficiency of the farming system.

The research was funded by a grant (31V-46, BIOEKOTECH) from Lithuanian Agency for Science, Innovation and Technology.

Key words: bioproduct, lactic acid bacteria, detoxification, wheat, barley, seeds

HYGIENIC FILLING OF BULK AND GRANULATED FOOD PRODUCTS INTO VALVE AND OPEN MOUTH BAGS

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Behn + Bates, world renowned producer of food-filling machinery, leads the way with constant innovations in development of multifunctional, yet customer-oriented filling systems which uphold to highest industry standards – hygienic and safe production of the machines which package most vital food-stuffs.
Behn + Bates filling lines for floury and granulated food products unify inside dust-tight housing applicatory, filling and sealing stations for valve and open mouth bags. Years of experience transformed into high-tech filling machines guarantee every individual client maximization of benefits through improved product protection and protection against humidity. All of these benefits are cumulated in reduced cost from a clean packing environment and high advertising impact through optimally filled bags that can be efficiently processed by your customers.

Key words: highest industry standards – hygienic and safe production

A REVOLUTIONARY ECOLOGICAL APPROACH IN ENHANCING AND STIMULATING PLANT GROWTH

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The earth is under stress!
Fertilizer plays a critical role in the world food production and is a necessary part of solving today's global food crisis.
There is a high demand for new generation of sustainable fertilizer for more efficient agriculture while improving environmental and organic compliances.
Mimicking the nature (Hurricanes) has shown interesting possibilities to find new interesting ecological solutions. With new patented technology TMA - tribomechanical activation, it is now possible to micronize -, and activate natural (100% organic) calcite for use in liquid fertilization with remarkable results.
This presentation is about New Generation of Technology (NGT) and fertilizer for growing healthy and nutritious food. The technology-, the importance of calcite-, and interesting results will be presented.

Key words: new technology, TMA, micronized Calcite, organic, liquid fertilizer

WHEAT ENZYMES STATUS INFLUENCED BY CLIMATE CHANGES

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Technological quality of wheat flour is influenced by various factors including genotype, environment, protein content and quality as well as climatic conditions during plant development time. The influence of enzymes, particularly the influence of amylases and proteases in wheat is also of significant importance in baking technology. Bread with increased amylolytic activity have wet, sticky crumb while the higher proteolytic activity leads to protein decomposition which is connected to changes in water absorption of gluten and its rheological properties. The aim of this work was to investigate the changes in activity of these enzymes in wheat flour during the 2011 and 2012 growing seasons. Regard to meteorological conditions, 2012 growing season was characterized by higher temperatures and higher amount of precipitation in comparison with 2011 growing season. Four different wheat cultivars (Triticum aestivum) Pobeda, Zvezdana, Gordana and Apache, in four regions in Serbia were selected for the study. The obtained results showed the significant decrease of amylolytic and proteolytic activity in the studied period. The level of enzyme activity in tested samples was significantly influenced by the cultivar and location. The highest amylolytic and proteolytic activity was obtained for cultivar Apache. The lowest level of amylolytic and proteolytic activity was observed for cultivar Zvezdana.

Key words: enzymes, wheat, cultivars, climatic conditions

QUALITY INDICATORS OF THE NEW BC INSTITUTE VARIETIES OF WINTER WHEAT

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The permanent goal in the Bc Institute winter wheat breeding program is simultaneous improvement of grain yield and baking quality. In this paper the indirect quality indicators and rheological properties of the new Bc Institute winter wheat varieties obtained in official trials conducted by the Croatian Commission for registration of new cultivars are presented. Winter wheat variety Bc Anica was released in 2010. It showed a very good and stable quality and was classified as B1 quality winter wheat. Bc Lorena was released in 2011. According to the results from the 2010, due to its high protein content Bc Lorena was at location Zagreb classified as A2, while at location Osijek as B1 quality winter wheat. Bc Darija and Bc Irma are the latest two Bc Institute's winter wheat varieties, released in 2012. According to the results from the 2011, the quality of both cultivars was at the level or better than of the standard cultivars. At location Zagreb, both varieties were classified as A2, while at Osijek as B1 quality winter wheats. We concluded that the new Bc Institute winter wheat varieties have a very good and stable baking quality that fully meets the requirements of modern bread-making industry.

Key words: winter wheat, grain quality, rheological properties, stability, breeding

SOME ASPECTS OF WHEAT BREEDING AT THE AGRICULTURAL INSTITUTE OSIJEK

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Winter wheat breeding at the Agricultural Institute Osijek has been continuously conducting since 1931. Wheat breeding work always was oriented toward creation of new wheat cultivars characterized by improved grain yield and technological quality, with better stability and adaptability in wide range of environmental conditions. The first successful wheat cultivar created at the Agricultural Institute Osijek (OS-cultivar) was U1 (multiplication 1) or Osijek awnless, released in production in 1936. It was the first OS-wheat cultivar with (for that time) high production potential realized through wide production in almost two next decades. Up today, at the Agricultural Institute Osijek more than 27 000 crossing combinations on wheat were made and extensive breeding work has been carried out. During more than 80 years of wheat breeding, generations of breeders were implementing scientific knowledge and methodology as well as their own professional skills and personal devotion in creation of new OS-wheat cultivars. As a result of that work, up to now to the Agricultural Institute Osijek had been recognized 116 winter wheat cultivars in Croatia and 47 cultivars abroad. In last more than 20 years OS-wheat cultivars have been sowing on 50-60% of wheat areas in Republic of Croatia with increasing trend of sowing areas in abroad (BiH, Kosovo, Slovenia, Romania, Turkey and Macedonia).

Key words: breeding, winter wheat, cultivars

COMPETITIVITY OF CROATIAN MILLING INDUSTRIES; DOMESTIC RESOURCE COST APPROACH

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The aim of this study was to evaluate, is it existing competitiveness of the milling industry in Croatia, ready for the market environment in the European Union. The research methodology is based on the application of a group of indicators trade openness and discovered competitive advantages, as well the overall analysis of the structure of the milling industry in Croatia. Analysis of competitivity of Croatian milling industries using the domestic resource cost (DRC) method, taking into account opportunity costs of not only input factors, but also the foreign exchange rate and the price of final product in the EU market, which refers to the ratio between opportunity costs of domestic production and value added. The conducted research has shown some specifics of the perception of the competitivity of Croatian milling industries.

Key words: competitivity, domestic resource cost, milling industires, Croatia

THE HEALTHBREAD EU PROJECT – NEW OPTIONS FOR NATURAL, NUTRITIONALLY ENRICHED AND SENSORY ATTRACTIVE BREAD

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Dietary guidelines recommend 25-35g fibre/day for adults, with cereal fibre and whole grain (WG) products as preferred options. In Europe, a major shift from white to WG bread will contribute to lowering the incidence of heart diseases, diabetes type-2 and colon cancer. However, most Europeans prefer the mild taste, soft crumb and crispy crusts of white bread.
The HealthBread FP7 EU project (2012-2014, www.healthbread.eu), based on FP6's HEALTHGRAIN, will develop:
- 'White bread Plus' breads, high in cereal fibre (as WG bread), but sensory like white bread.
- 'Whole grain Plus breads, with >30% more fibre and minerals than WG bread.
This will be realised by using specific parts of wheat grain kernels, combined with enzyme- and bioprocessing technology. By prolonged fermentation, bioavailability of nutrients can be increased.
Each of the 8 participating SME (< 250 staff) bakeries (Austria, Germany, Italy, Netherlands) will launch a new HealthBread-type product. The project will publish a Manual with guidelines for product development.
In addition to first results, the presentation will outline opportunities for SME's for joining new EU projects, together, as in HealthBread, with renowned research organisation and with mentoring partners experienced both in research and in daily contacts with bakers.

Key words: white bread, high fibre, milling, enzymes, fermentation

WHEAT COMPOSITE FLOUR WITH HEMP, TEFF AND CHIA

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Non-traditional ingredients (chia, hemp, teff) in baking technology enhance the rheological properties of dough, increase of bread quality and nutritional value. The aim of the presented research was to evaluate the features of wheat flour composites with hemp (*Cannabis sativa*) (5 - 20%), teff (*Eragrostis tef*) (10 - 30%) and chia (*Salvia hispanica*) (2.5 – 5.0%) grinded seeds and rheological behaviour of dough. The investigation of flour (M) and dough characteristics has been conducted using of farinograph, amylograph and mixolab. Relation of mixolab features to others rheological characteristics are described by correlation analysis. Changing of rheological features of composite flours depends on the type of fortification. Level of addition corresponds with increasing of water absorption and dough time development. Characteristics of starch described as amylograph features are connected more with added components than their amount. Influence of tested recipe according to mixolab was reflected mainly in starch retrogradation. In case of hemp addition, extent of C5-C4 values is equal to 0.24 Nm between M and K1-20 samples.

Key words: composites wheat-hemp, teff, chia

STUDY OF BREAD QUALITY ENRICHED WITH (BROMELIN) FROM PINEAPPLE (*Ananas comosus*) DECANTER WASTE AS A NOVEL FUNCTIONAL INGREDIENT

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Bromelin was extracted from Pineapple agro waste, processed into powder by conventional method. Results of proximate analysis indicated that pineapple powder from the agriculture waste contains 4.17 % of protein, 1.15% of crude fat, 70.3% of crude fibre, 11.19% of moisture and 2.67% of ash. The total available carbohydrate was calculated as 10.5%. The powder was added into the bread dough as functional ingredients in three variables; bread dough 1; 1.5 % powder, bread dough 2; 3.0 % powder and bread dough 3; 6.0% powder. The analysis on physicochemical property and acceptibility were studied. The breads were analyzed for proximate compositions (crude fibre, crude protein, fat, moisture, ash content), physical (hardness, crust colour, height and weight) and sensory (Quantitative Descriptive analysis test and hedonic test). For physical analysis, the chroma value, height and weight of all breads were significantly different ($P<0.05$). The hardness of the bread crumb and hue angle value of crust colour showed no significant difference. Results indicated that crude protein ranging from 14.20%-14.90%; crude fat (from 0.89%- 1.04%); crude fibre (from 25.93%-35.37%), moisture (from 29.0%-35%); ash (1.42%-2.23%). The Hedonic Test showed that, bread 1 (using 1.5% powder) is more preferable than the other samples. It can be concluded that bread enriched with bromelin from pineapple agro waste is applicable as a Novel Functional Ingredient in the Bread.

Key words: Bromelin, pineapple agro waste powder, bread, proximate analysis, physical analysis, sensory analysis

SPELT – INFLUENCES OF VARIETY AND LOCATION ON QUALITY

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At the beginning of the last century the cultivation of spelt (*Triticum monococcum*, *Triticum dicoccon*, *Triticum aestivum* ssp spelta) was very common. This has been subsequently changed, spelt has been displaces by the cultivation of soft wheat (*Triticum aestivum*). Soft wheat showed some advantages for example: an increased stability, a significantly improved harvest yield and higher resistance for plant diseases, also through better and simplified processing of milled products to baked goods. Nowadays the aims of agriculture and food production have been enlarged -the conservation of genetic resources is one of them. The policy goal of sustainably managed agriculture and the desire for healthy, maybe even food made in organic quality, influenced the agriculture and food technology to. Therefore interest in old original grain has been growing. Food from Einkorn and Emmer are still niche products with a very limited market potential. In contrast, baked goods from spelt products (*Triticum aestivum* ssp spelta) have found a re-increasing regional and sometimes even national distribution.

The processing properties of *Triticum aestivum* ssp spelta are often different from the processing properties of soft wheat. Therefore special technology knowledge is very important. However, the bakery range is extended with the production of typical spelt baked goods, making an additional clients can be developed. A dividend increase customer demand makes the spelt cultivation for agriculture increasingly interesting.

With this presentation the results of analytical-, rheological- and backing tests of spelt (*Triticum aestivum* ssp spelta) from harvest 2012, registered in the descriptive list of varieties of German Federal Plant Variety Office, will be presented and compared with findings of the Croatian spelt variety Bc Vigor.

Key words: spelt variety, analytical data, rheological properties, baking behaviour

EFFECT OF BREAD TYPE CHOICE ON NUTRITION QUALITY IN ELDERLY

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Physiologic and functional changes during aging result in changes in nutrient needs. Older adults have specialized requirements because of aging effects on absorption, utilization, and excretion. They need less energy but have higher needs of some micronutrients like folic acid, vitamin B_6 and B_{12}. The aim of this study was to evaluate how small choices can influence dietary intake in elderly nursing home resident with limited selection of foods.
Monthly menus in which only choice that residents have is white or brown bread were analysed and compared regarding energy and nutrient content. Obtained values were compared to recommendations for the elderly based upon the presumption that the whole portion was eaten. Gender and age of residents were also taken into consideration during these comparisons.
Black or white bread choice did not have impact on energy, proteins or fats, but small change in carbohydrate intake was noticed. Black bread choice positively influenced intake of dietary fibres, which is especially important in male population where white bread choice results in fibres intake below the recommendations. Among minerals black bread choice the most positively influenced iron intake, while in the group of vitamins increase was noticed for thiamine, riboflavin, niacin, vitamin B_6 and folate.
In conclusion the simple choice of black instead of white bread results in improved intake of dietary fibres and B group of vitamins, as well as the intake of certain minerals.

Key words: energy value, nutrient content, food, nursing home, elderly

A COMPARATIVE ANALYSIS OF TRADITIONAL AND E-MARKETING POTENTIALS IN THE BAKING INDUSTRY

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In modern times it is almost impossible to find a product that does not have very strong competition and whose sales are not closely related to successful marketing. In the past, when the market was characterized by shortage of goods, the dominant concept was the one in which the manufacturer produced relying on his own judgement, i.e. the production concept. As the number of producers grew, there was a quantitative and qualitative leap resulting in stronger competition. How to sell your products soon became the key issue facing all producers. The initial attempts to push a product in the market, characteristic of the production concept, could not achieve long-term success. A buyer can be persuaded to buy a certain product once or twice, however, the consumer learns and will lose interest in a product that does not satisfy his/her needs. Therefore, it is no wonder that the new, marketing concept appeared as a solution for this problem. The basic idea of the marketing concept is to examine consumer needs, and to devise products which can satisfy those needs. In this way the consumer will decide to buy such products of his/her own, without any 'coercion'. The physical world allows for occasional research of consumer needs, whereas the virtual world comprised of the Internet, i.e. the Web environment, allows for permanent investigation into consumer needs, which is the basis of the electronic, that is, e-Marketing. This research focuses on the comparative analysis of potentials of the traditional and e-Marketing in the baking industry.

Key words: Marketing, e-Marketing, baking industry, Internet, Web, consumers, market research.

BETA-GLUCAN AS BIOLOGICALLY ACTIVE FOOD INGREDIENT

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Chemistry of beta (β)-glucan began to investigate in 1941, and research has intensified in the sixties of the last century and has published over 8,500 scientific papers about β-glucans and their effects on health.

Beta glucans are polymers of D-glucose linked β glycosidic bond and chain length, degree of branching and the type of glycosidic bond is different and they will most likely depend on the origin. They are found in the cell walls: bacteria, fungi, yeasts, algae, lichens and plants such as oats and barley. Significant representatives of β-glucan are: cellulose (β-1, 4), lentinan (β-1, 6, and β-1, 3), zymosan, chrysolaminarin, curdlan and ficarin (β-1, 3), and pleuran laminarin (β -1,3 - and β-1, 6), lichenin (β-1, 3 - and β-1, 4) and others.

Action and biological activity of β-glucan depends on their origin and chemical structure. The biological activity of β-glucan and action on the human body have been explored in the following areas: improving immunity and increase the body's defense capabilities, prevent colds, flu and other infections, lower cholesterol, prevent and assist in the inhibition of tumor growth, reduce consequences of radiation exposure, etc.In the immune system is predominantly active β-glucans from yeast and fungi, and heart health influencers glucans from barley, oats and yeast, and β-glucans from yeast and fungi are known as "biological response modifiers" because of their ability to activate immune system.

Effects of food consumption and dietary supplements-containing β glucans are recognized in traditional medicine and modern research. The list supplements the criteria of EBM (evidence base medicine), β glucans located at the top along with folic acid, fish oil, probiotics, etc..

The production of functional products, dietary preparations with added value as a supplement containing β glucans increasing in last decade. Research intends to define scientifically established correlation between the chemical structure of β-glucan and the mechanisms of their action as an active foods ingredient.

Key words: β-glucans, active ingredients

ANTI-INFLAMMATORY *IN VITRO* ACTIVITY OF BREADS ENRICHED WITH *Chenopodium quinoa* LEAVES

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Chenopodium quinoa leaves (QL) have been recognized as a rich source of bioaccessible in vitro compounds with antioxidant and anticancer properties probably linked with strong ability to inhibit lipooxygenase (LOX) activity. The aim of this study was to evaluate the influence of QL addition on the antyinflammatory *in vitro* activity of wheat bread. The bread dough formula was: wheat bread flour (type 750), instant yeast (1%), salt (2%), water (optimum), dried and pulverized QL (tested at 1%, 2%, 3%, 4% and 5% levels).

Taking into account mastication-extractable LOX inhibitors it may be concluded that fortification of breads with QL powder not influenced of tested activity. Digestion in simulated human gastrointestinal tract caused release of LOX inhibitors from functional supplement. Activity of LOX inhibitors was positively correlated with percentage of QL addition. Most importantly, QL enriched breads with potentially bioavailable LOX inhibitors. Activity of fortificated breads extracts was statistically significant higher than those from control breads. The highest activity was determined for breads with 5% QL addition.

The results indicated that a partial replacement of wheat flour in bread with QL caused an increase of LOX-inhibitory activity. Proposed product may be useful in helping the treatment of inflammatory diseases.

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Key words: quinoa, lipoxygenase, bread, quality

STARCH MODIFICATION FOR FOOD INDUSTRY APPLICATION

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Starch is naturally occurring, inexpensive polymer with unique gelling, film forming, thickening and other technological properties. In addition, it is safe and biodegradable, and its properties are easily altered by physical, chemical and/or enzymatic procedures to meet specific needs.

Due to these characteristics starch has nowadays extensive application in food industry. In addition to traditional application as thickening agent, in modern food production starch is used as fat mimetic, encapsulating agent, texture modifier, emulsifier, calorie reducing agent, film forming material and biodegradable packaging material.

The aim of this review is giving short overview of modified starch types and their application in food industry.

Key words: modified starch, resistant starch, edible films, food industry application

PHENOLIC CONTENT AND ANTIOXIDANT ACTIVITY OF CONVENTIONAL AND ORGANIC CEREAL GRAINS

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Organic plants are thought to contain more secondary plant metabolites than conventional. In this study we analysed bound phenolic acids, lignans, total phenolic content (TPC) and antioxidant activity (AO) of conventional and organic cereal grains from the Croatian market.
Phenolic acid content was determined by HPLC-PDA. Lignans were quantified by GC-ECD. TPC was determined by Folin-Ciocalteu method, and AO evaluated using DPPH and FRAP assay.
The most abundant phenolic acid in corn, wheat, rye, oat, barely, spelt, and rice was ferulic acid. Organic wheat bran had the highest content of ferulic acid (3.015±0.227 mg/g DW), while the lowest amount was found in the conventional refined wheat flour (0.071±0.027 mg/g DW). Wheat bran was also found to be the richest in TPC and lignans, as well as to have the strongest AO. Among whole grain cereals the highest TPC has organic corn flour (2.576±0.147 mg FAE/g DW). Organic corn flour showed also to have the strongest AO. The whole grain cereal richest in lignans was organic oat with the total amount of lignans being 10.064±0.282 μg/g DW. All organic cereals had higher lignan content compared to their conventional counterparts, but not all organic cereals showed higher values of TPC, phenolic acids and AO.

Key words: conventional, organic, cereals, phenols, phenolic acids, lignans, antioxidant activity

SCIENCE AND NEW TECHNOLOGIES IN PRODUCTION OF AUTOCHTHONOUS PRODUCTS

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Due to everyday's bigger demand of market for specific nutritional products in recent years there is more demand for autochtonous products. Rich hystory and geographical diversity of Croatia brought out many autochtonous food products like slavonski kulen, zagorske štrukle, istarski and dalmatinski pršut, paški sir, istarsko and dalmatinsko maslinovo ulje, poljički soparnik, etc. But very often we have problem when comes to inconsistency of quality, which is result of technical differences between some manufactures which on the other hand has positive effect on promotion of autochtoncy. However in many cases, not registered manufactures due to the way of manufacturing, have a health incorectness, specially with the products of animal origin (meat and milk). Therefore more careful implementation of a scientific achievements and new technologies in manufacturing of autochtonous products, with prescribed conditions when comes to safety of the food, is the way to advance quality of the products and the same time not to the disturb there originality. As a good example is the use of origin microbe starter cultures isolated from autochtonous products and there use in manufacturing (cheese, sausage, kulen, etc.). Finally, as a very important fact which directly has an impact and quality of autochtonous products is lack of domestic raw materials, non-animal and animal origin, which brings in question not just quality but also originality of autochtonous products.

When it comes to the market demand for particular autochtonous products as well as disloyal competition which very often under name of autochtonous products places products unadequate quality, manufactures alone would have to value is there need to protect there own product through registry and some other special labels or trademarks while placing products on the market.

Key words: autochtonous products, quality, PDO, PGI and TSG

DURUM WHEAT AND KAMUT® BREAD CHARACTERISTICS: INFLUENCE OF CHEMICAL ACIDIFICATION

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In the Mediterranean area, durum wheat flour has been used in the formulation of several types of bread to give products largely appreciated by the consumers for their organoleptic characteristics. Nowadays is growing interest on other crops that constitute highly nutritional grain ingredients for healthy food production and special dietary uses. The addition of sourdough during production of wheat bread can have a considerable effect on dough characteristics. It is known that not only acid production and therefore changes in the environmental pH but also the sourdough organisms may contribute to changes in the dough structure.

The purpose of the present work is to study the modifications induced by a chemical acidification mimicking sourdough fermentation of bread obtained by durum wheat and Kamut® flour. The acidification was realized by using lactic acid. Physical properties (Texture Profile Analysis), specific volume, crumb grain characteristics and volatile compounds were evaluated.

The obtained results showed that bread realized with Kamut® flour, control and acidified, showed better structural properties and more volatile compounds especially furans, acids, esters and aldehydes compared to the durum wheat bread. Moreover the acidification just slightly changed those differences which probably accounted mainly to the flour composition.

Key words: durum wheat flour, Kamut® flour, chemical acidification

INFRARED STABILIZED RICE BRAN: NUTRICIOUS BREADMAKING INGREDIENT

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Infrared stabilized rice bran (SRB) substitution to white wheat, wheat bran and whole grain wheat breads at the levels of 2.5, 5.0 and 10.0 % was evaluated in terms of proximate composition, color, minerals, texture and sensory attributes, thiamine, riboflavin, niacin, pyridoxamine, pyridoxine, dietary fiber and phytic acid. An increasing tendency was observed in crude fat and ash content of the breads. Zinc, iron, potassium and phosphorus levels of the breads were increased gradually and significantly with the inclusion of SRB ($p<0.05$). In general, whole grain wheat bread showed different textural behavior when compared to other bread types. Based on the overall acceptability scores, white wheat and wheat bran breads were sensory accepted up to 10% of flour replacement with SRB, while substitution level higher than 2.5% negatively affected the sensory scores of whole grain wheat bread. The incorporation of SRB significantly increased the amount of the noted B vitamins, especially niacin, in all bread types ($p<0.05$). SRB inclusion did not affect the content of soluble dietary fiber of the breads while it significantly increased the content of insoluble and total dietary fiber ($p<0.05$). Phytic acid content of the breads increased in proportion to the addition level of SRB ($p<0.05$).

Key words: rice bran, bread, B vitamins, dietary fiber, phytic acid

PHYSICOCHEMICAL PROPERTIES AND ACCEPTIBILITY STUDY OF HIGH ENERGY CEREAL BAR MADE FROM MALAYSIAN PUFF GLUTINOUS RICE WITH HALAL / SUNNAH INGREDIENTS

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Cereal bar is a sweet, nutritious food due to rich content of protein, lipids and carbohydrates. The aim of this work was to develop some formulations of cereal bar using glutinous rice and Halal / Sunnah foods to produce high energy bar. The cereal bars was formulated with different formulations of binding agent: syrup glucose, honey and brown sugar. The dried ingredients were glutinous rice and Halal foods were added with the same concentration for each formulation. The cereal bars were evaluated for texture, water activity, proximate analysis and sensory evaluation. It was observed that the cereal bar CB3 made with 10 g syrup glucose and 20 g brown sugar as binding agents produced highest value for hardness 22.68+0.099 N. The cereal bar CB1 formulated with 10 g of syrup glucose and 20g of honey has the highest value of energy kcal which was 515.43 kcal. It was observed that CB5 formulated with 20 g honey and 10g brown sugar has the highest score among consumer's acceptance 5.38+1.04 nearest to the score of commercial cereal bar 5.68+1.17. Incorporation of glutinous rice and Sunnah food with different binding agent, honey, syrup glucose and brown sugar, can be used as a new formulation for high energy cereal bars.

Key words: energy cereal bar, puff glutineous rice, sunnah food

INNOVATION: THE USE OF NIXTAMALIZED CORN FLOUR IN THE DEVELOPMENT OF GLUTEN FREE PRODUCTS

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Celiac disease (CD) is an immune-mediated enteropathy triggered by the ingestion of gluten in genetically susceptible individuals. The only effective treatment for CD is a gluten free diet with total avoidance of proteins present in wheat, rye, barley and other cereals, which may damage intestinal mucosa. In general cereal products such as bread, pasta and snacks are wheat based; in consequence persons with CD must consume gluten free substitutes. Unfortunately, the nutritional quality of these products is considered inferior to the wheat-based as they are made with refined flours or starches, having low protein and fiber content and in some cases high sugar and fat contents. In this sense, the development of gluten free products with better nutritional profile is of primary importance. Nixtamalized corn flour (NCF) is obtained by the cooking of maize grains in an alkaline solution of $Ca(OH)_2$, known as Nixtamalization. Diverse studies confirm that Nixtamalization improves the nutritional quality of maize resulting in flour with niacin bioavailable and high calcium and fiber content. Considering the nutritional benefits of NCF the aim of our work was to evaluate its potential use in the development of gluten free products such as: baked goods, pasta, snacks and breakfast cereal.

Key words: gluten free products, corn flour, celiac disease

EFFECT AND OPTIMIZATION OF CONCENTRACION DIFFERENT ENZYMES ON THE VISCOELASTICITY OF SUBSTANDARD WHEAT DOUGH

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The objective of this study was to analyze the individual and synergistic effects of three enzyme preparations (transglutaminase, lipase and xylanase) on the viscoelastic properties of wheat dough. The experiment was done by Box-Benhken design. A response surface method was used to evaluate the effects observed on the dynamic oscillatory parameters of in wheat dough system made from substandard quality flour.
Transglutaminase (TG) and lipase (LP) have a significantly effect on the strength of wheat dough. Lipase significantly decreased loss modulus (G") of dough. Xylanase (Xyl) does not significantly affect on the G', but with increasing concentration significantly increases the value of G".
Individual effects of transglutaminase, lipase and xylanase by their intensity and direction depend on the applied concentration. The interaction between TG and LP leads to improved handling of dough (significantly increases the storage modulus and also decreases its loss modulus, but not in the domain of statistical significance). Optimal levels of the tested enzymes were determined by the desirability function approach. It was found that the combined effect of 25.98 mg/kg transglutaminase, 25.59 mg/kg lipase and 34.06 mg/kg xylanase achieved a positive synergistic effect on wheat dough viscoelasticity made from substandard flour.

Key words: transglutaminase, lipase, xylanase, storage modulus, loss modulus optimization, desirability function

SINGLE LABORATORY VALIDATION OF ACOUSTIC METHOD FOR SCREENING MYCOTOXINS IN CEREALS

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DON (deoxynivalenol) is a naturally worldwide occurring toxic metabolite produced by several species of filamentus fungi of the genus *Fusarium*. It is estimated that about a quarter of the world's food crops (mainly cereals) are affected by this mycotoxin. A lack of awareness about the quality, health and safety risks related to this mycotoxins and effective control has led to numerous health problems worldwide. Since at least 60% of the food and feed produced in the world originates from cereal crops one can imagine the magnitude of the problem. In the framework of EUREKA ITEA2 project ACOUSTICS the first portable acoustic spectrometer to detect deoxynivalenol (DON) in cereal grains has been developed at Kaunas University of Technology in Lithuania. This technique is completely different from currently applied wet chemistry techniques and is based on acoustic wave's penetrating through and/or reflected by air-filled porous materials such as unconsolidated solid beads of grain.

To determine the performance criteria for the acoustic method, a single laboratory validation was carried out. For determining the reliability characteristics different wheat model system (DON concentration range 0-4300 μg/kg) were used. To increase the accuracy of the analysis and optimize the acoustic signal an optimal frequency has been determined. High correlations between DON concentration in wheat samples and the different amounts of shriveled grains in mixtures determined by the acoustic technique have been obtained. Good performance characteristics for repeatability have been found. It can be confirmed that the acoustic method is precise and can be used to detect quantitatively direct DON in cereals.

The research was funded by a grant (EUREKA ITEA 2 project 09041 ACOUSTICS) from Lithuanian Agency for Science, Innovation and Technology.

Key words: mycotoxins, *Fusarium*, wheat, acoustic method

A METHODOLOGY FOR CHARACTERIZATION OF VOLATILE AND AROMATIC PROFILE OF DRY SOURDOUGH AND THEIR RELATED BREAD

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Sourdough had ever been used as improvers for bread aroma and taste. However, considering the sourdough process constraints, the use of dry sourdough (DSD) for bread sensory enhancement is growing up as an alternative. The aim of this study was (i) to characterize the volatiles compounds of different dry commercial sourdough and the corresponding DSD bread and (ii) to characterize dry sourdough and DSD-bread aroma and sensorial profile. HS-SPME extraction technique, Gas Chromatography, GC-Mass Spectrometry and GC-Olfactometry were applied and combined to sensorial analyses to characterize the different products. The sensorial analyses performed were: at first the odor profile determination for dry sourdough and for DSD bread with a trained panel of 12 people and then the volatiles odor characterization with GC-O using a unique odor wheel for sourdough and bread composed by 15 major poles defined by odor profile assessment and GC-O training. All these results were statistically treated to study the aromatic interest and contribution of DSD for bread aroma. The sourdough and the corresponding bread sensorial profiles are not always associated which can be explained by their odorant molecules composition .This methodology and the results obtained give tools to diversify bread sensorial characteristics.

Key words: dry sourdough, dry sourdough bread, aroma, HS-SPME, gas chromatography-olfactometry, sensory analysis

DEVELOPMENT OF SPECIFIC PROFILE IN MIXOLAB FOR STARCH-PROTEIN CHARACTERIZATION OF WHEAT GENOTYPES IN GENETIC BREEDING PROGRAMS

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Wheat (*Triticum aestivum* L.) end-use quality evaluation is an important component of breeding programs. Small scale methods to characterize starch and proteins are needed for early generation selection (EGS), due to the grain quantities limitation in breeding. Mixolab is an option to evaluate simultaneously protein and starch features, using relatively small sample amount. The traditional Mixolab profile Chopin+ uses fixed mixing time (8 min), but the development of gluten network is greatly dependent on wheat cultivars. The aim of this study was to set up specific profiles for screening wheat quality in EGS attending to protein and starch behavior during mixing, heating and cooling. Four wheat flour samples were performed using both a variable and fix time of mixing to differentiate genotypes and results were compared. Only the samples with lower stability (< 8 min) presented the same analysis time for both profiles. The most important mixolab parameters that presented significant differences were: stability, initial pasting temperature, gamma value, and cooking stability range. Overall results suggest that mixolab breeding profile can be used successfully to differentiate wheat for EGS.

Keywords: wheat, breeding, rheological analysis, Mixolab, mixing

INFLUENCE OF INGREDIENTS ON THE RHEOLOGICAL PROPERTIES OF SUNFLOWER SPREAD

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Rheological properties of the most important factors are the quality of sunflower spread. Knowledge of rheological properties is important in creating the desired consistency of spread, in quality control during production and during storage. The share of solid particles, the oil phase, the presence of stabilizers and emulsifiers determine the rheological properties of the sunflower spread. The task of this study was to examine the impact of types of oils, types of carbohydrates, milk components and time of homogenization on the rheological properties of sunflower spread. Measuring the rheological properties of spread was conducted on a rotational viscosimeter with concentric cylinders at a temperature of 24°C and 10°C per day production. From the obtained data to calculate the rheological parameters consistency coefficient, flow index and apparent viscosity of sunflower spread. Based on the results of research on the influence of ingredients on the rheological properties of sunflower spread that comes with sunflower spreads showed non-Newtonian pseudoplastic properties. The addition of a rapeseed oil (30% and 60%) in sunflower oil increases the apparent viscosity and consistency of the sunflower spread. Also types of carbohydrates and milk components affect the change in rheological properties of spread. Spread made with glucose has a lower viscosity and consistency, and with lactose has higher values of rheological parameters. Using whole milk powder in making sunflower spread increase higher values of rheological parameters.

Key words: sunflower spread, rheological properties, carbohydrates, milk components

THE ADVANTAGES OF SOLID STATE FERMENTATION TO DEVELOP NOVEL PLANT PRODUCTS FOR WHEAT BAKED GOODS WITH A HIGHER NUTRITIONAL VALUE AND SAFETY

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Solid-state fermentation has recently attracted a special attention of researchers and manufacturers since it is more economical and more secure, compared with the traditional liquid-state fermentation. Main attention up till now was paid to apply solid-state fermentation to develop novel flavour compounds and use this technique for the production of enzymes.

This study is dedicated to apply bacteriocin like inhibitory substances producing lactic acid bacteria (belonging to *Lactobacillus* and *Pediococcus* genera) isolated from traditional Lithuanian rye sourdough for the solid-state fermentation of black cumin (*Nigella sativa* L.) seeds and to evaluate their application potential in production of wheat baked goods.

The solid-state fermentation showed positive changes of the phenolic and flavonoid contents with developing special flavour compounds such as sabinene, eucalyptol and terpinen-4-ol. Besides, the total binding activity of radicals was found to be significant higher for the fermented product then for the raw material. The total content of microorganisms and fungi spores present in the crumb of experimental wheat bread with *Nigella sativa* L. fermented products after 5 days storage was about 8 and 4 times lower, respectively.

Thus, the application of solid-state fermentation could be used for higher value and safety food production with enriched phenolic and flavour compounds.

The research was funded by a grant (SVE-09/2011) from Research Council of Lithuania.

Key words: solid-state fermentation, lactic acid bacteria, wheat bread, *Nigella sativa* L.

INCORPORATION OF TWO TYPES OF FIBERS INTO A BAKERY PRODUCT: EFFECT ON THERMAL, STRUCTURAL AND SENSORIAL CHARACTERISTICS

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The presence of fibre in bread is known to affect the rheological properties of the dough, interfere with gluten formation, influence bread stability and modify the macromolecular and molecular water distribution and dynamics. The fibre source and the type and degree of processing are the main factors influencing functional properties of high-fibre ingredients and thus affecting the functional quality of the intermediate manufacturing and final products. The potential use of two different commercial fibres from different sources has been recently investigated.

The aim of this preliminary research was to determine the influence of these fibres on the structural, thermal and sensorial characteristics of final product as well as their changes during storage.

Bread evaluation revealed that fibre supplementation at 0.5% level increase the crumb hardness of fresh and stored samples. Regarding sensory evaluation small differences were found between control and fibre-enriched bread. These samples seemed to maintain higher water content and water mobility compared with the control during storage. The evaluation of starch retrogradation kinetics through the use of differential scanning calorimetry did not evidence relevant differences among the differently formulated breads. Finally interesting relations between instrumental and sensorial evaluation were found.

Key words: durum wheat flour, Kamut® flour; chemical acidification, quality, stability

EFFECT OF WATER, EGG ALBUMEN, MODIFIED CASSAVA STARCH AND ENZYME MALTOGENIC AMYLASE ON QUALITY OF LOAF BREAD BASED ON RICE FLOUR

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The central composite rotational design 24 including eight star points and four replicates at the central point was used to determine which independent variables - dried and acidified egg albumen, water, enzyme maltogenic amylase and modified cassava starch – had a significant effect on the average height of central slice and crumb firmness on days 01, 03, 07 and 10 of gluten-free loaves based on rice flour. As a result of this work, it was found that the average height of the central slice was positively and significantly impacted ($p<0.05$) by water in the form of a parabolic shape with a maximum at the level 1.1. Regarding the firmness, it was significantly, linear and positively affected ($p <0.10$ on day 01 and $p <0.05$ on the other days) by the modified cassava starch, dried and acidified egg albumen. The quadratic and linear terms of the water on the firmness were significantly positive and negative, respectively ($p <0.10$ on day 01 and $p <0.05$ on the other days). On the contrary expected, the enzyme maltogenic amylase showed no effect on firmness.
All formulations showed good proofing and visual aspects, lacking the flavor that ranged from slightly rice flour to bitter.

Key words: bread, gluten free, rice flour, coeliac disease

CHARACTERISTICS OF BREAD PREPARED FROM WHEAT FLOUR AND SEVERAL KINDS OF RICE FLOUR

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Due to increasing number of people having intolerance for gluten, a need is raised for the production of breads without the gluten. Now the wheat/rice blended bread is becoming a promising food. The aim of this study was to improve the qualities of the bread made from rice and wheat flours by selecting the suitable rice cultivars, and compare the sensory and texture characteristics of rice bread which was made from the pre-gelatinized rice and non-gelatinized rice. Five varieties (LiaoJing294, LiaoHe Five, XiangNuo 1, RuanNuo, QianMiNuo) of rice flour were used as the main raw materials. The sensory and texture characteristics of rice bread were measured under two conditions that one is with pre-gelatinized rice, and the other was with non-gelatinized rice. For the bread making, the wheat flour was partly replaced with the gelatinized rice or non-gelatinized rice. The rice bread quality can be obviously improved by using the pre-gelatinized rice, and the rice bread with best quality can be obtained from wheat flour which was replaced by about 20% gelatinized rice. Compared the five rice varieties, the rice bread with good quality can be obtained from Xiangnuo 1, followed by RuanNuo and QianMiNuo.

Key words: rice flour bread, pre-gelatinized, texture analysis

EFFECT OF POTATO PASTE ON STALLING OF BARBARI BREAD

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In this study to determine the effect of potato paste at two varieties and five levels of one, 2, 4, 8 and 10 % (w / w flour basis) on stalling properties of barbari bread a completely randomized experiment with factorial arrangement and 3 replications was conducted. Immediately, three and five days after baking, moisture content of crumb and crust, textural properties and thermal analysis of prepared bread were determined. In this study varieties of potato didn't have any significant impact on shelf life of breads ($p > 0.05$). Higher amounts of potato paste were able to reduce the dehydration rate of crumb and hydration rate of crust during bread storage. The evaluation results of texture showed that addition of potato paste reduced the firmness of breads and over time, these samples were softer than the other samples. Enthalpy thermal analysis has also showed Lower retrogradation enthalpy in breads containing higher amount of potato. In conclusion 8 and 10 percent of potato paste in the Barbari bread formulation will retard the bread stalling.

Key words: Barbari bread, potato, stalling

EFFECT OF POTATO PASTE ON QUALITY OF BARBARI BREAD

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This study reports on the effects of potato paste additions on the quality of Iranian flat bread (Barbari). Tests were done on two varieties of potato at five levels; 1, 2, 4, 8 and 10 % for quality of Iranian flat bread (Barbari). Quality was determined by physical properties of bread namely its specific volume, oven spring, height to width ratio and crumb to crust ratio, also moisture content, hardness, porosity parameters, and microstructure of bread. Results of this study determined that variety of potato had a non-significant effect on the physical, textural and microstructural properties of bread improved with potato. The results also showed that physical properties of bread improved ($p<0.05$) by increasing the amount of potato paste up to 10%. In addition, the best effect on moisture content was observed at10% in both tested potato varieties. Porosity of breadcrumb showed a finer and more uniform overall structure. According to the results of bread texture and microstructure, hardness decreased according to an increase of potato paste and bread containing potato paste remained softer for the duration of the storage period. In most cases Sante variety had significant impact on bread quality ($p<0.05$). In conclusion, a 10 percent addition of potato paste in the Barbari bread formulation improved its quality factors.

Key words: Barbari bread, physical properties, potato, quality

EFFECT OF BARLEY MALT ON THE STALLING OF BARBARI BREAD

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Statistics show that over 30% of traditional bread produced in Iran like Barbari bread-that has the highest rate of consumption-become to waste due to poor quality. According to the propensity of people to consume fresh bread, that plays a special role in the consumer's daily diet, stalling of the bread, is considered one of the country's economic problems. Bread staling, is a complex physicochemical process that results in an undesirable appearance, and crumb and crust hardness. Stalling suggests changes in appearance, flavor, taste and texture of the bread, and ultimately reduce its reception by the consumer. Reducing the bread stalling by amylases, is related to inhibition of the binding of starch to protein by production of dextrines and reducing amylopectin retrogradation. Therefore, to reduce the Barbari bread stalling, barley malt flour in concentration of 0.5, 1, 2 and 4% based on the weight of flour added and five bread samples including control (no barley malt) and four samples of bread with quantities listed from barley malt, was prepared. Then the thermal properties and firmness of bread tested by DSC and instron respectively, and changes in crumb and crust moisture measured by the oven method. A sensory test was also conducted to measure the stalling of bread. All tests done on the first, second and fourth day after baking. Results showed that the bread with 1% barley malt flour, has lower firmness than the control bread; although barley malt in 1% level, could reduce the stalling of Barbari bread.

Key words: stalling, barley malt, barbari bread

PHYSICAL AND SENSORY PROPERTIES OF BREAD CONTAINING BROCCOLI SPROUTS POWDER

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Broccoli sprouts (BS) have been recognized as a rich source of versatile biologically-active compounds with antioxidant and anticancer properties. The aim of this study was to evaluate the influence of BS addition on the physical and sensorial properties of wheat bread.

The bread dough formula was: wheat bread flour (type 750), instant yeast (1%), salt (2%), water (optimum), dried and pulverized BS (tested at 1%, 2%, 3%, 4% and 5% levels). Bread quality attributes were evaluated 24 h after baking. Loaf weight and textural properties (TPA test) were determined, as well as sensory evaluation of the bread samples.

The breads supplemented with BS were characterized by the lower specific volume in comparison to control bread. An increase in the share of BS resulted in the production of breads with decreasing crumb elasticity and cohesiveness, and increasing hardness of the breads. The taste, aroma and overall acceptability of control bread and bread at substitution levels of 1 and 2% had the highest linking score. Higher levels of BS addition caused an unpleasant aroma and taste.

The results indicated that a partial replacement of wheat flour in bread with up to 2% BS addition gives satisfactory overall consumer acceptability.

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Key words: broccoli, sprouts, bread, quality

STUDY OF OXIDATIVE IMPROVERS ON RHEOLOGICAL PROPERTIES OF DOUGH

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Impact of oxidants on the rheological properties of bread dough is known, mechanisms of these effects are not yet fully described. L-ascorbic acid is the most widely used commercial bakery improver with oxidation effect. This paper will present influence of oxidizing improvers studied by empirical rheology. Investigations include the analysis of the impact of commercial pure L-ascorbic acid (0.005, 0.008, and 0.011%), hydrogen peroxid (0.001, 0.002 and 0.003%) and glucose oxidase (0.002, 0.004, 0.006%). The study includes farinograph and extensograph analysis of dough with and without oxidative improvers (control sample). Effect of L-ascorbic acid as the most used oxidative improver is compared with glucose oxidase as an alternative oxidative improver and with hydrogen peroxid as a product of glucose oxidase reaction with an oxidative effect on dough.

Key words: dough, extensograph, farinograph, improver, oxidation, rheological properties

IS IT POSSIBLE TO PRODUCE TRADITIONAL GLUTEN-FREE BAKERY FOODS? A JOINT RESEARCH PROJECT

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Coeliac disease is food intolerance to the gliadin fraction of gluten. The only treatment for coeliac patients is a lifetime strict adherence to a gluten-free diet. Cereals containing prolamins responsible for dough development and particular bread texture, such as wheat, rye and barley, are toxic for coeliacs. Food scientists and technologists have, thus, focused their attention to find alternative flours, ingredients and additives to produce gluten-free bakery products comparable to conventional gluten-containing counterparts. The main flours used derive from rice, corn, sorghum and pseudocereals (buckwheat), while different other additives aiming at imparting texture or increasing the nutritional properties have been proposed.

Sardinia that has an old tradition in producing a wide variety of bakery products, reaches the highest prevalence of coeliac disease in Italy.

For these reasons, a joint research project has been undertaken to develop new gluten-free products apparently similar to some Sardinian traditional products. The project covers a range of activities from selection of raw materials and ingredients, through rheological characterisation of doughs and production of two different bakery products, up to their qualitative analysis and shelf life evaluation.

A more detailed picture of the different project activities, work already done and expected results will be given.

Key words: coeliac disease, gluten, rheology, shelf life, traditional bakery foods

INCORPORATION OF EMULSIFYING STARCH IN BREAD PROCESSING: IMPACT ON DOUGH AND BREAD PERFORMANCE

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The objective of the present study was to examine the role of emulsifying starch in breadmaking. The impact of incorporation of modified starch - sodium octenyl succinate (OSA starch) in bread formulation on dough fundamental and empirical rheological properties and bread quality parameters (specific loaf volume, crust and crumb colour, crumb moisture, crumb grain features, texture) were evaluated. Considering the technological activity of salt and its influence on dough behaviour, measurements were performed on two bread dough systems prepared without salt: control and dough system prepared by substitution of 10% of flour by sodium octenyl succinate starch and addition of vital gluten for wheat flour to prevent flour gluten dilution. The bread was prepared by constant hydration.

The positive impact on bread appearance was observed in terms of crumb lightness and whiteness index, while the enhancement of textural properties was not observed probably due to application of constant hydration. However, the results of rheological measurements indicated the potential of selected modified starch to influence wheat flour gelling and resistance to retrogradation and consequently retard staling. The dough section was also monitored by magnetic resonance imaging (MRI) during baking, where results with modified starch showed higher oven-rise, but also stronger shrinkage than control.

Key words: OSA starch, dough, bread, rheology, texture, magnetic resonance imaging

INFLUENCE OF HYDROCOLLOIDS AND PROTEINS COMBINATION IN GLUTEN FREE BREAD CRUMBS ASSESSED BY DIGITAL IMAGE ANALYSIS

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To develop a viscoelastic network in gluten free matrixes is still a challenge in food technology. Different structuring agents have been proposed for building a network with sufficient elasticity, like hydrocolloids and proteins and the quality of the final breads was usually determined by quantifying volume and texture. The objective of this research was to analyze the potential use of digital image analysis (DIA) for assessing the effect of hydrocolloids and proteins on the crumb structure of gluten free breads. Specifically, hydrocolloids - Hydroxypropylmethycellulose (HPMC), UltraCel™ WF and a blend of xanthan gum and guar gum - and proteins -egg powder and pea protein- were included in a basic recipe of rice based bread. Breads with vegetal protein showed more open crumb structure than those containing animal proteins. The hydrocolloid blend of xanthan gum and guar gum presented higher values of cell/cm^2 and mean cell area. UltraCelTM and HPMC hydrocolloids led to greater heterogeneity in the cell crumb distribution. Therefore, hydrocolloids and proteins largely affected the crumb structure of the rice based gluten free breads, and DIA of the crumbs seems to be a potent tool for analyzing the quality of the gluten free breads regarding size and gas cells distribution.

Key words: gluten free bread, hydrocolloids, protein, crumb, image digital analysis, rice

EFFECTS OF DEFATTED SOY FLOUR, XANTHAN GUM AND PROCESSING TEMPERATURES ON QUALITY CRITERIA OF SPAGHETTI

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Spaghetti was prepared by replacing defatted soy flour (DSF) with wheat flour at 10% and 20% (w/w) levels and gluten 4%. Then they extruded at two distinct temperatures of 35 & 50 °C, and dried at two different temperatures of 55 & 90 °C. The color properties, protein content, cooking loss, cooked weight, and firmness and Isoflavone of finished spaghetti were measured. Also chew-ness, firmness, stickiness, color and flavor of cooked spaghetti at the optimum time (20min) were evaluated by a trained sensorial group. To determine the effects of modifying agent addition in spaghetti, xanthenes gum at two levels (0.2%-0.4%) was added to spaghetti dough containing 20% soy flour and 80% wheat flour. This sample was extruded at 35 °C and dried only at 55 °C.with regarding to correlation of sensorial analysis and physicochemical analysis, drying temperature 55 and extrusion temperature 35 and defatted soy flour 20% and xanthan gum 0.4% was offered in soy spaghetti formulation.

Key words: spaghetti, gluten, defatted soy flour, xanthan, cooking loss, cooking weight, firmness, sem, drying and extrusion temperature,

PHYSICOCHEMICAL PROPERTIES OF TAGLIATELLE ENRICHED WITH BUCKWHEAT FLOUR

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In order to found new nutritionally perspective pasta recipe, the replacement of wholegrain wheat flour with wholegrain buckwheat flour in pasta formulation was studied with the aim to determine the effect of buckwheat addition on pasta cooking quality and textural properties of cooked pasta, and to examine correlation between those parameters. The wholegrain buckwheat flour was added at the level of 10, 20% and 30%. The buckwheat enrichment had no significant ($P < 0.05$) effect on volume increase (VI) but significantly ($P < 0.05$) decreased optimal cooking time (OCT) and increased cooking loss (CL) in comparison with the control sample. Results were also showed that buckwheat pasta was significantly ($P < 0.05$) less firm and less adhesive. Correlation analysis revealed significant positive correlation between CL and hardness/adhesiveness and between adhesiveness and CL/ VI.

Key words: wholegrain buckwheat flour, cooked pasta, cooking quality, textural properties

EFFECT OF APPLE BY-PRODUCT AS A SUPPLEMENT ON ANTIOXIDANT ACTIVITY AND QUALITY PARAMETERS OF THE PASTA

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Apple peel is a by-product of apple processing industry. It is a rich source of phenolics, and could present a promising value-added food ingredient. Influence of dried apple peel powder (APP) addition on quality parameters of pasta (sensory properties, texture profile analysis, quality of uncooked and cooked pasta, color), total phenolic content (TPC) and antioxidant capacity (AOA) of raw and cooked pasta was investigated. Extraction methods (ultrasound US - 15 min; magnetic stirrer MS – 1 h) and solvents (methanol – Met and ethanol Et) used for extraction of phenolic compounds were compared, too. For pasta production APP was used to partially replace durum semolina (10 and 15%). Results showed that APP addition had significant influence on the color of the samples. APP addition decreased L* and a* and increased b* values. All texture parameters except springiness were decreased with APP addition. Addition of APP increased cooking tolerance and the amount of absorbed water of the pasta samples. Sensory evaluation showed that APP addition had negative effect on the total score of the pasta samples. However APP highly affected pasta TPC and AOA. Pasta with added APP had significant higher levels of TPC and AOA compared with pasta without addition of APP. The highest TPC (1.39 g of gallic acid equivalents/kg) was in raw pasta with addition of 15% of APP from which phenolics were extracted with US and Met. Regarding antioxidative activity, the highest AOA (0.84 mg gallic acid equivalents/100g) was also in raw pasta with 15% of APP from which phenolics were extracted with MS and Et. In cooked pasta the levels of TPC and AOA were lower compared to raw pasta.

Key words: apple peel powder, pasta quality, antioxidant capacity, phenolic content

QUALITY PARAMETERS OF PASTA ENRICHED WITH CHESTNUT FLOUR

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Effect of chestnut flour (CF) addition (10, 15 and 20%) and processing parameters on quality of durum pasta was investigated. Pasta was produced on laboratory press (moisture content of mixtures was set to 36%, mixing time was 10 min) and on laboratory single screw extruder at temperature profile 80/90/90 °C, using a screw with compression ratio 1:1 (moisture content of mixtures was set to 30%, mixing time was 10 min). Pasta samples were air dried and sensory evaluation of uncooked and cooked pasta samples was performed as well as determination of colour, optimum cooking time, water absorption and texture profile analysis (hardness, adhesiveness, cohesiveness).
Results showed that extruded pasta samples (EPS) had decreased cooking tolerance, shorter cooking time and lower apsorption of water in relation to samples produced on laboratory press (LPS). EPS and LPS showed increase in cooking tolerance with addition of CF. Overall, EPS were scored with a higher point then LPS.
EPS were darker then LPS. There were differences in colour between uncooked, dried and cooked pasta samples. Addition of CF decreased L* and b* parameter and increased a* in uncooked, as well as in dried and cooked pasta samples.
EPS showed higher hardness in relation to LPS, and the addition of CF decreased hardness of both samples.

Key words: durum semolina, chestnut flour, pasta, extrusion, cooking

PHYSICAL PROPERTIES OF DOUGH FOR COOKIES WITH CHESTNUT FLOUR

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Chestnut and chestnut-based foods have beneficial nutritional and organoleptic qualities. The biochemical composition of chestnut flour is close to that of many cereals and it can be used instead of wheat flour for people who suffer from celiac disease. The aim of this research is to characterise rheological and textural properties of dough for cookies in function of the amount of chestnut flour (20, 40 and 60%) and moisture content (20, 22 and 24%). The addition of chestnut flour leads to less flexibility of dough and worse ability to recover because of bad connection and brittle consistency of the dough, which is a consequence of reduced gluten content. The gradual substitution of wheat flour with chestnut flour contributes to the elasticity of the dough, due to chestnut starch granules ability to bind water. Extensibility and Resistance to Extension decrease with increasing addition of chestnut flour as a result of reduction gluten content. The increase in the share of chestnut flour from 20 to 60% resulted in an increase of hardness of the dough.

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Key words: chestnut flour, cookies, rheological properties, textural properties

RHEOLOGICAL AND TEXTURE PROPERTIES OF DOUGH FOR COOKIES WITH DIETARY FIBERS

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Alternative methods of dietary fibers application are within components for processed food enriched with dietary fibers. Bakery product, cookies and crackers, different kind of snack products, can be observed for this purpose.

The objective of this work was to determine the influence of three different dietary fibers on rheological and texture properties of dough for cookies. The part of main component of the dough, wheat flour, was replaced by 10% of oat fibers, potato fibers and wheat fibers, calculated on total weight of the flour. The dough moisture was 22%.

Alkaline water retention capacity (AWRC) analysis of wheat flour and the mixtures of the flour and 10% of different dietary fibers showed that each kind of dietary fibers increased hydration ability of the mixture, compared to AWRC value of wheat flour. That was reflected to rheological properties of obtained dough. Disrupted gluten matrix caused reduced viscoelastic properties of the dough with dietary fibers. Recovery ability decreased compared to control dough without fibers. Hardness of the dough with diatery fibers increased and extensibility decreased, thus the texture measurement confirmed the rheological results. The type of applied dietary fibers was significant. According to obtained results the influence of potato and oat fibers was more pronounced than the influence of wheat fibers.

Acknowledgements: This work was done within Project "Cookies and creckers with functional characteristics aimed for consumers with special diatery needs" financed by the Provincial Secretariat for Science and Technological Development of the Government of Autonomous Province of Vojvodina, Republic of Serbia.

Key words: dietary fibers, dough for cookies, rheology and texture

INVESTIGATION OF STRESS RELAXATION PARAMETERS DURING THE STORAGE OF GINGERBREAD COOKIES MADE FROM SPELT WHEAT

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Relaxation test in uniaxial compression mode was performed on gingerbread cookies made from spelt wheat. Relaxation data were modeled by Peleg and Normand. The aim was to calculate stress relaxation parameters (percent stress relaxation, k1 (initial rate of relaxation), k2 (extent of relaxation) and relaxation time) for this type of product and to observe the changes in these parametrs during their storage. At 10-80% strains tested, the measured stress relaxation parameters (k1, k2, %SR, RT) varied little up to 60% strain. In general, gingerbread cookies had little elastic character. During storage, solid character of the samples increased in all samples. Relaxation time was the parameter that was unable to observe changes in the textural properties of the cookies during storage at high relative humidity whereas in comparison to the dried out sample, all parameters changed significantly.

Key words: gingerbread cookie, spelt, stress relaxation, Peleg-Normand model

TOTAL PHENOL CONTENT AND ANTIOXIDANT ACTIVITY OF WHEAT BISCUITS RELATED TO FLOUR TYPE

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Flour type numbers indicate the amount of ash (mg) obtained from 100 g of dry mass of flour. Although the ash content is not directly related to the baking quality of flour, it serves as indicator of the flour extraction. So flour type, as measure of ash content, has strongly effect on flour quality.
Wheat flour samples of different type (T-400, T-500, T-710, T-850 and T-1100) used for rotary molded industry making biscuit samples, according to a standard recipe. Flour analysis included moisture content (%), ash content (% d.m.) acidity degree and wet gluten content (%). Rheological quality parameters of flour samples were analyzed, too.
The aim of this study was focused on examining the influence of wheat flour type on antioxidant and sensory properties of biscuits. The antioxidant properties of the samples were established by determining antioxidant capacity by FRAP method, and the determination of total phenols content (TPC) by Folin - Ciocalteu method.
Sensory evaluation of biscuits samples was carried out according descriptive method, by 30 assessors.
The obtained results indicate that the antioxidant capacity of biscuits (μmol Fe^{2+}/L) and TPC (mg GA/L extract) significantly increase according to flour type value used for biscuits production and were the highest in the samples produced of flour T-1100. The highest rating for overall impression had biscuit samples produced of flour T-400 and T-1100.

Key words: wheat biscuit, antioxidant activity, flour type

INFLUENCE OF NON-EXTRUDED AND EXTRUDED SPELT ON DOUGH PROPERTIES AND QUALITY OF COOKIES

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Spelt is grain that, because of its chemical composition, recently has attracted increased attention in the production of various food products. Since the extrusion process is used worldwide for the modification or quality improvement of different flour types, the aim of this study was to determine the effect of non-extruded and extruded spelt on dough properties and quality of cookies. Non-extruded and extruded spelt were used to prepare the cookies by replacing wheat flour (T-500) in ratio of 20%. Rheological properties of flour were determined by Brabender Amylograph test, and dough properties by Brabender Extensograph and Farinograph test. The obtained results showed that spelt flour had lower peak, hot and cold viscosity values in relation to wheat flour, with more pronounced difference for extruded spelt. By addition of non-extruded and extruded spelt flour, water absorption, development time and dough softening increased, whereas quality number slightly decreased. Furthermore, these substitutions strengthened the dough, mainly by decreasing its extensibility and, in extruded spelt addition, also by increasing the resistance to extension.

The sensory evaluation of cookies was determined on a 100-point scale. Replacement of wheat flour with non-extruded and extruded spelt decreased total sensory point, with significantly decrease for extruded flour.

Key words: spelt, extrusion, dough properties, cookies

INFLUENCE OF COOKIES COMPOSITION ON TEMPERATURE CHANGE DURING BAKING

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During baking of bakery products temperature of baking, temperature profiles inside the material, moisture content, volume and colour changes are strongly coupled. The objective of this study was to determine the influence of cookies composition on development of temperature profiles inside the cookies during baking. Composition of cookies differs due to type of flour and initial moisture content.
The cookies were prepared according to standard AACC (*American Association of Cereal Chemists*) formulation. It were used 6 different types of flour (flour for production of cookies, whole wheat flour, T-400, T-550, T-850 and T-1100) with three different moisture content (standard with 16 g water/225 g of flour, dry with 12 g water/225 g of flour and wet with 20 g water/225 g of flour). Investigation was conducted on 18 samples with 5 replications during 10 minutes baking and cooling. Cookies were bakedbaking on 205 °C and temperature was measured in the middle of samples which were thick 60 mm and high 7 mm.
Results showed the same trend of increasing and decreasing temperature inside of cookies at all 18 samples. During the first 300 seconds of baking the temperature inside of cookies increase up to boiling point of water which stays constant during period of evaporation. After that the temperature inside of cookies again gets started to increase up to maximal observed temperature range from 108 to 117 °C due to type of flour and moisture content. The lowest temperature was recorded at the cookies with higher moisture content while the highest temperature was recorded at the cookies with lower moisture content.

Key words: temperature profile, baking, cookies

CONSUMER ACCEPTANCE OF THE COOKIES ENRICHED WITH A DIGESTION STIMULATING MEDICINAL PLANT MIXTURE

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The objective of this study was to evaluate consumer acceptance of cookies prepared with 'Vitalplant' digestion stimulating mixture, which was added at three levels of supplementation, in the form of powder and extract. Cookies were evaluated by 64 consumers. Data were subjected to ANOVA, Kramer's Rank-sum test, Friedman analysis of variance and Duncan's multiple range tests and analyzed with respect to gender, age and education of the consumers. Comparing the results obtained for extract and powder supplemented samples, the differences were more pronounced in the case of extract supplemented cookies. Both, men and women, scored extract enriched samples higher than the control. The elderly population (>50 years old) reacted positively only to colour changes, while they were totally indifferent to the changes in colour, mouthfeel and taste of the supplemented cookies. According to Kramer's Rank-sum test ($P < 0.05$), no significant differences existed between powder supplemented cookies, while in the case of extract supplemented cookies consumers liked 4% extract supplemented cookies the most. Cookie presented suitable carrier for the development of a digestion stimulating functional product by mixture addition in the form of powder and extract can be applied.

Key words: consumer acceptance, cookies, plant mixture, plant extract, sensory properties

QUALITY INSPECTION OF COOKIES USING COMPUTER VISION

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Product appearance plays a vital role making a purchase decision, with colour, size and shape significantly influencing impulse purchases of bakery products. Food material shape is often closely related to its quality. Broken or deformed product may taste the same as an acceptable one, but customers are reluctant to buy seemingly damaged goods. Due to the demands of high quality, automated food shape inspection has become an important need for the food industry. Computer vision provides one alternative for an automated, non-destructive and cost-effective technique to accomplish these requirements. Features such as the internal and external appearance contribute to the overall impression of the products quality. Consequently such characteristics have been evaluated by computer vision.
The goal of this paper is to summarize and evaluate shape descriptors which can be used as indicators of final product, and also as additional parameter for decision an ending of baking process. According to results of size (width and height) and shape deformation of cookies during baking process, computer vision can be applied to inspect shape of final product and in combination with other process parameters better define the end of baking process. We believe that the proposed framework opens up new possibilities in the field of non- destructive, visual inspection of cookies (*i.e.* inspection texture and colour).

Key words: computer vision, cookies, shape descriptors, baking process

THE USE OF FACE READING TECHNOLOGY TO PREDICT CONSUMER ACCEPTANCE OF BAKED GOODS

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Traditional sensory and consumer tests predict long term consumer acceptance of new products rather poorly, as evidenced by the high their failure rates in the market. These tests typical reflect conscious processes whereas consumer acceptance may also be based on unconscious processes.

The aims of this work were to examine whether facial expressions measured with the Noldus FaceReader technology are a sufficiently accurate measure for differentiating between differing samples of baked goods (bread and pastry), and to investigate whether facial reactions are able to explain liking ratings on hedonic scales.

Naive consumers (mean age 22 years) were recruited at the University. They were asked to rate the sample with an intentional facial expression, which was recorded and then characterized by FaceReader Face Reader 4 (Noldus Information Technology, Wageningen, The Netherlands). The measurements showed significant differences between facial expressions elicited by the different samples and reflected the introspective liking ratings well. Facial expression patterns ''neutral'', ''happy'' and ''sad'' showed a high correlation with liking and were good indicators for liked and disliked samples.

It is concluded that Noldus FaceReader technology is sufficiently accurate to detect significant differences in facial expressions elicited by different samples of baked goods and can deliver additional information to conventional acceptance tests.

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Key words: baked goods, facial expressions, FaceReader, hedonic liking

IMPORTANCE OF PSEUDOCEREALS IN GLUTEN-FREE DIET

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Gluten-free diet is characterized by absolute exclusion of gluten, as far as the cereals are concerned hat means exclusion of wheat, rye, barley and oats. Main gluten-free cereals are rice and corn, but for greater diversity in diet and becose of its unique nutritional profile the growing role have psedocereals primarily buckwheat, then quinoa and amaranth. The aim of this paper is to show their nutritional value and health benefit in gluten-free diet.

Key words: gluten-free pseudocerelas, buckwheat, amaranth, quinoa, nutritional value, health benefit

ORGANOLEPTIC EVALUATION AND QUALITY OF WHEAT BREADS BAKED WITH ADDITION OF ALTERNATIVE FLOUR

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The objective of this study was the comparison of the quality and class of wheat bread with alternative flour addition, such as: oat flour, corn flour and spelled flour. The ratio of wheat flour type 750 and alternative flour, used for baking, was 2:1. Bread samples were tested in terms of sensory evaluation, physicochemical parameters (determination of: volume per 100 g of bread, moisture, acidity) by Polish standard. The evaluation points have been given. The nutritional value of bread was calculated. Based on the results, the quality class of bread has been given. Bread baked with the addition of alternative flour (oat, spelled) received the first quality class along with bread baked exclusively with wheat flour type 750. Bread baked with the addition of corn flour received the second quality class.

Key words: bread, white bread, alternative flour, bread quality class

WHAT KIND OF CEREALS STUDENTS FROM UNIVERSITY OF ZAGREB EAT FOR BREAKFAST?

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Breakfast, as a first meal of the day has been shown to improve health and also the cognitive abilities of individuals who consume it, specifically when it is composed of high-quality nutrients. The aim of this study was to determine what kind of cereals students eat for breakfast and how this affects their micronutrient intake. The subjects were 84 female undergraduates of the Nutrition studies aged from 18 to 24. Questionnaire was used to determine usual breakfast pattern. The results show that all subjects consume breakfast at least 3 days a week, yet only 43% of them eat breakfast every day. Usually, 56% of subjects eat cereals, 21% eat whole wheat bread, 15% eat white bread and 4% eat pastry. Average energy intake from breakfast was 395 ± 157 kcal. Subjects who eat cereals (ready-to-eat or cooked) had higher dietary fiber, thiamine, riboflavin, folate, calcium and iron intake than those who eat bread or pastry ($p<0.05$). Since breakfast cereals are often fortified, having them for breakfast may be a good strategy to reduce risk of dietary inadequacy of certain micronutrients.

Key words: breakfast, cereals, micronutrients

ULTRASOUND ASSISTED EXTRACTION OF SOLUBLE DIETARY FIBER FROM CEREAL BRAN

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The major component of soluble dietary fiber from cereal grains especially from barley are composed of mixed linkage (1→3) (1→4) β-glucan and they are mainly located in the cell walls of cereal. In this research, barley bran was used as a source for β-glucan extraction. For this purpose two different technique of extraction were used: mechanical-water and ultrasound bath assisted extraction. The effect of temperature, extraction time and amplitude has been studied for ultrasound bath assisted extraction. Water assisted extraction took 2 hours with ethanol pretreatment (inactivation of β-glucosidase) while application of ultrasonic bath (37 kHz) extraction took between 7 and 23 minutes without ethanol pretreatment. Conventional mechanical-water extraction resulted with lowest amount of extracted β-glucan (BGE = 0.4200 g/100 g) and extraction yield (Y1 = 27.11 %). Extraction yield and extracted β-glucan for ultrasound bath assisted extraction was in the range of 48.70 - 98.52 % and 0.7546 - 1.5267 g/100 g, respectively. For ultrasound assisted extraction temperature and amplitude showed a strong influence on extraction process. The best extraction yield (98.52% and 98.14%) was observed on 45 °C by application of 63 and 97 % of amplitude. Also, all studied cases with application of ultrasound bath assisted extraction resulted with 1.80 - 3.63 time higher extraction yield (Y2) than conventional mechanical water extraction.

Key words: ultrasonic bath, extraction, barley, β-glucan

A COMPLIANCE OF THE BAKERY AND CONFECTIONERY PRODUCTS WITH THE CONTEMPORARY FOOD CONSUMPTION HABITS

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Abstract: The bakery and confectionery products are in the constant focus of the massive population, in accordance to their nutritional value. While, the production and sale of this type of products are in permanent growth. The contemporary food consumption habits affect the whole food industry, thus the bakery and confectionery products are not an exception. Therefore is important to adjust the bakery and confectionery products with the contemporary food trends, because taste, aroma and surface appearance are no longer the only criteria for food acceptance. The contemporary consumer requirements are basically related to a healthy aspect, the convenience, the sustainability and the authenticity of food products. The dark chocolate cakes, the cranberry muffins, a pumpkin pie, an apple pie and the cherry cakes, are some of the products which may satisfy this kind of market requirements. It is also necessary to pay attention to the quality of ingredients, because the consumers recognize the quality difference, when the producer chooses low quality ingredients for the sake of making higher profit.

Key words: bakery products, confectionery products, contemporary trends, quality

USE OF MAIZE, SOY AND RICE BREADCRUMBS IN THE FORMULATION OF THE GLUTEN FREE MEATBALLS

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The effect of replacing the wheat with the maize, soy and rice breadcrumbs in the formulation of the gluten-free meatballs was investigated. Four different formations of meatballs were prepared by mixing the minced meat (pork and beef, 50 : 50) with 20% of wheat (control), maize, soy and rice breadcrumbs, eggs and spices. Meatballs 80 mm in diameter and 25 mm thick were fried in the pan on the sunflower oil for 5 minutes on both sides. Sensory evaluation, colour determination, oil uptake and texture profile analysis (hardness, springiness cohesiveness, chewiness and resilience) of meatballs were performed. Results showed that only the addition of soy breadcrumbs decreased the sensorial acceptability of meatballs. Sensorial properties of gluten-free meatballs did not deteriorate with replacement of the wheat breadcrumbs with that of maize and rice and some of the sensorial properties (taste) were even better when maize breadcrumbs were used. Colour and textural properties of gluten-free meatballs were quite similar, except for the instrumental colour L* value in meatballs with addition of soy breadcrumbs. In conclusion, in order to benefit consumers with celiac disease and gluten intolerance, maize and rice breadcrumbs could be used as an excellent replacement for wheat which is traditionally used in the formulation of the meatballs.

Key words: gluten-free meatballs, maize breadcrumbs, rice breadcrumbs, texture profile analysis, sensory evaluation

POTENTIAL APPLICATION OF BACTERIOCIN PRODUCING *Lactococcus lactis* SUBSP. *lactis*, AND FERMENTATION PRODUCTS TO INCREASE THE SHELF LIFE AND SAFETY OF CRUMPETS

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Bacteriocins are natural antibacterials produced by lactic acid bacteria which could inhibit the growth of pathogenic microorganisms in fermented foods.

The aim of this study was to extend the shelf life of leavened baked bread (crumpets) through adding buttermilk (BM) fermented to contain antibacterials which would reduce pathogenic bacteria sporulation on the product during storage.

The effect of four types of fermented buttermilk products with *Lactococcus lactis* subsp. *lactis* and commercial nisin (3, 6, 9, 12 μg/ml) as reference, were examined *in vitro* against some pathogenic bacteria. BM1 had the highest inhibitory activity against bacteria in comparison to other BM, while BM1 had an inhibitory activity equivalent to 9 μg/ml of nisin. These fermented ingredients could be suitable to add to crumpets formulations. The best fermented buttermilk and commercial nisin will be used as bio-preservatives for crumpets to validate the increase on the safety and shelf life of crumpets through reducing the levels of pathogenic bacteria and *Bacillus cereus* spores. Thereafter, the quality (i.e. hardness, springiness) of crumpets will be assessed instrumentally and sensorial to discover potential change as a result of adding BM and commercial nisin.

Key words: lactic acid bacteria, bacteriocins, nisin, shelf life, buttermilk products, bread crumpets

MOLDS PRESENT IN WHOLEGRAIN FLOURS USED IN GLUTEN-FREE PRODUCTS

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The approach in the creation and production of gluten-free products implies the use of gluten-free mixtures containing wholegrain buckwheat, corn and rice flour. According to the nutritive characteristics, the wholegrain flour is a high quality product, due to its high vitamin, mineral, and dietary fibers content. However, the cereal grains are susceptible to the series of contamination during the ripening, harvesting, processing and storage. On a grain surface, beside the impurities, numerous colonies of microorganisms can be developed and consequently affect the safety of a grain and the final product. The aim of this work was to determine molds presence in buckwheat, corn and rice flour. The total number and determination of isolated genera and species of molds were subject of this research.

All samples were contaminated by the molds. The total number of molds ranged between 10 - 3,7x104 cfu/g for the rice and the buckwheat flour, respectively. From the analyzed samples, 12 genera were isolated. The highest number of mold species was isolated from the *Aspergillus* and *Penicillium* genera. The most common species was *Aspergillus flavus*.

The results pointing out a necessity of the grain surface treatment, preceding the milling in wholegrain buckwheat, corn and rice flour production.

Key words: wholegrain buckwheat flour, corn flour, rice flour, molds

INVESTIGATION OF QUANTITY, QUALITY AND USAGE OF LEFTOVER BREAD IN HUMAN AND ANIMAL NUTRITION

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Lack of food for the continually growing population is becoming an increasing problem in the world and in our country as well. One of the solutions to increase food and feed supplies may be the use of novel technologies in bioindustry. On the basis of numerous inquiries made in small bakeries, large industrial bakeries and supermarket chains, restaurants, and municipal service companies, there is evidence for large quantities of leftover bread. Bread is a dominant cereal product and a staple food in numerous countries. It is made from flour and water as basic ingredients and some minor ingredients; by mixing, shaping, fermentation and baking. In our population, it has been a habit to use only fresh bread; bread one day post baking is considered aged due to staling and usually discarded. This paper focuses on several issues relating to leftover bread: quantity, quality and safety issues of old bread in light of elaborating possibilities for further uses.

Key words: leftover bread, safe food

EFFECT OF FLOUR TYPES AND SACCHARIDES ON ACRYLAMIDE FORMATION IN BISCUITS

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Harmful acrylamide is known to be form in many bakery wares. The aim of this study was to compare the levels of acrylamide in model biscuits differing in types of flour and saccharides. After replacing white wheat flour by whole wheat flour, the acrylamide content in biscuits with fructose increased from 1134 μg/kg to 2898 μg/kg. This corresponds to 2.2 times higher asparagine content in whole wheat flour comparing to white wheat flour. On the other hand, replacing fructose with sucrose resulted in app. 6 times lower acrylamide levels in model biscuits with white wheat flour. These results show that availability of both acrylamide precursors saccharides and asparagine in flour are very important in the acrylamide formation in biscuits. Adjustment of appropriate sources of saccharides and flour type can effectively reduce acrylamide level in biscuits.

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Key words: acrylamide, biscuits, flour, sugars

THE ISEKI_FOOD PROJECT 4 NETWORK

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ISEKI_Food was designed as a network of University and Research Institutions, Professional Associations, Industrial partners and Students Associations to foster collaboration on a variety of joint interest projects in the food area that received support by EU between 1998 and 2014.
The ongoing ISEKI-Food 4 project 2011 – 2014, is an Erasmus Academic Network project (www.iseki-food4.eu, 89 partners from 27 European countries and 3 non-European countries) has as main objectives the innovation of the Higher Education and training of Food Science and Technology (FS&T) graduates, the implementation of the labour market role in the 3rd level of education and promotion of the employability & entrepreneurship of the gratuates and food professionals, the creation of a framework offering a lecturing qualification for universities teaching staff.
Main outcomes of the series of ISEKI_Food projects are innovative teaching materials (included the Springer ISEKI Food book series), the e-journal „International Journal of Food
Studies" (www.iseki-food-ejournal.com), a database of stakeholders (PICAM), the European
Quality Assurance System of Food Study Programs (EQAS_Food), the International ISEKI_ Food Conference (3rd edition, Athens, Greece May 2014, www.isekiconferences.com/athens2014).

The network has funded the ISEKI_Food Association (www.iseki-food.net) that collects the outcomes of the projects and promotes activities to favour the interaction between the various stakeholders of the food sector.

Key words: ISEKI-Food 4, Erasmus thematic academic network, Food science, Food Engineering, Food Chain

INFLUENCE OF ANTIOXIDANTS ADDITION ON THE OXIDATIVE STABILITY OF A MIXTURE OF SUNFLOWER AND CORN OILS

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Oxidative stability is an important parameter in evaluation the quality of oils and fats, as it gives a good estimation of their susceptibility to oxidative deterioration. Synthetic antioxidants are less expensive than natural antioxidants. It is generally accepted that natural antioxidants are more potent, more efficient and safer than synthetic antioxidants. The aim of this study was to investigate the oxidative stability of sunflower oil, corn germ oil, and mixtures there of (50:50), and the effect of addition of rosemary extract (StabilEnhance ® OSR and OxyLess ® CS of 0.1% and 0.3%), and propyl gallate (0.01%) on the extension oxidative stability of the oil mixture (50:50). A determination of oxidation stability of oils and their combination, and the effect of antioxidants (rosemary extract and propyl gallate) was conducted by a test of rapid oxidation of oil - Rancimat test. The result of oil oxidation was expressed by the induction period (IP), a protective factor (PF) and by antioxidant activity of antioxidants (AA). The stability of a mixture of oil is proportional to the induction period. From these results it can be concluded that an addition of corn germ oil (50%) in sunflower oil led to changes in the oxidation stability of oil blends expressed within the induction period. The addition of corn germ oil in sunflower oil prolongs the stability of blends of oil degradation by oxidation. The natural antioxidant rosemary extract OxyLess®CS significantly increases the oxidative stability of a mixture of sunflower and corn oils compared to StabilEnhance®OSR and propyl gallate.

Key words: vegetable oils, oxidative stability, rosemary extract, propyl gallate

RELATIONSHIP OF BREAD INTAKE AND BLOOD LIPID PROFILE IN WOMEN

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Few researches suggest that bread, as important ingredient of human daily diet, could have possible protective effect to metabolic syndrome and could improve cardiovascular health. Our aim was to determine the relationship of bread intake and serum lipid profile in women of all ages (25-93 years).

Bread intake was assessed in 229 participants using four 24-hour dietary recalls. Body height (BH), body weight (BW), % body fat (%BF) and waist circumference (WC) were measured. From venous blood samples serum triglycerides, total cholesterol, HDL cholesterol and LDL cholesterol were measured.

There was significant difference in triglycerides level ($t(227) = -3.11$, $p<0.01$), HDL cholesterol level ($t(227 = 2.93$, $p<0.01$), %BF ($t(218) = -2.31$, $p<0.05$) and WC ($t(227) = -2.01$, $p<0.05$) between women with higher (>13.41%m kJ/day) and lower (<13.41 %kJ/day) daily energy intake from bread. The magnitude of difference was small; 1-4% of the variance of above mentioned parameters is explained by daily energy intake from bread. When participants were grouped according to median daily intake of bread (72 g/day), there was no significant difference in observed lipid profile parameters.

The results suggest that contribution of bread intake to total daily energy intake could have greater influence on blood lipid profile than bread intake itself.

Key words: bread intake, serum triglycerides, serum HDL, 24-hour dietary recall

ANTIOXIDANT AND SENSORY PROPERTIES OF RICE-BUCKWHEAT GLUTEN-FREE COOKIES

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Rice-buckwheat gluten-free cookies were produced using light buckwheat flour (LBF) to substitute rice flour (RF) in gluten-free cookies' formulation at the level of 10, 20% and 30%. Rice-buckwheat gluten-free cookies exhibited significantly higher ($P < 0.05$) total phenolic and rutin content, antiradical activity on 1,1-diphenyl-2-picrylhydrazyl radicals (DPPH◎), antioxidant activity (AOA) and reducing power than the rice cookies which were used as the control. LBF in the gluten-free cookies' formulation improved chelating activity on Fe^{2+} of rice-buckwheat gluten-free cookies, but there were no significant differences ($P < 0.05$) regarding the substitution levels. Cookies enriched with LBF at the level of 30% (30% RF/LBF cookies) possessed the highest antioxidant capacity. Concerning all evaluated sensory properties, cookies enriched with LBF at the level of 20% (20% RF/LBF cookies) had the most acceptable sensory properties.

Key words: gluten-free cookies, antioxidant activity, sensory properties, rice flour, buckwheat flour

COMPARISON OF ANTIOXIDANT ACTIVITY OF DIFFERENT FLOURS DETERMINED BY DPPH AND ABTS METHOD

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The objective of this study was to compare antioxidant activity of different flours (rye, barley, buckwheat, yellow corn and white corn) determined by DPPH and ABTS method. Antioxidant activity determined in extracts of flours by DPPH method ranged from 20.92 to 58.95 μmol TE/100 g and from 54.91 to 95.32 μmol TE/100 g by ABTS method. The lowest antioxidant activity was determined for yellow and white corn by both methods. The highest antioxidant activity was determined for barley, 58.95 μmol TE/100 g (DPPH method) and buckwheat, 95.32 μmol TE/100 g (ABTS method). Determination of antioxidant activity was also conducted by "QUENCHER" method which is based on using free radicals directly on sample without prior extraction. Values of antioxidant activity obtained from extracts, and directly from samples, were compared. Antioxidant activity was higher when "QUENCHER" method was used as evaluation method. ABTS antioxidant activity was higher in contrast to DPPH antioxidant activity (regardless of sample preparation) probably due to higher selectivity of DPPH free radicals. Also, EC50 (efficiency coefficient) and ARP (antiradical power) values were determined. Higher EC50 value was determined by DPPH method. Lower EC50 means that ARP is higher. The lowest EC50 had buckwheat flour (5.89 mg and 17.38 mg for ABTS and DPPH method, respectively) thus it had the highest ARP value.

Key words: antioxidant activity, DPPH, ABTS, flour

THE POTENTIAL BIOAVAILABILITY OF CALCIUM FROM GLUTEN-FREE BREADS WITH ADDITIVE POWDERED MILK

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The objective of this study was to determine the content and the release of calcium from gluten-free breads with powdered milk.

The content and the release of Ca from gluten-free products (control rice flour bread and buckwheat flour bread and with powdered milk) was determined. The samples were subjected to enzymatic digestion under in vitro conditions. The content of Ca in samples before and after enzymatic digestion was determined by the flame atomic absorption spectrometry.

It was found that calcium content in buckwheat and rice flour breads with powdered milk was significant higher than in control breads. The higher potential bioavailability for calcium in control rice flour bread than buckwheat flour was observed. Bioavailability of calcium was compared in both breads with powdered milk.

The contain calcium in gluten-free products without supplementation was relatively low. The additive of powdered milk to breads increased their nutritional value. The release of calcium from gluten-free products depends on the element and the composition of the analyzed product.

This study was partly financed from research funds in the years 2011-2014 as a research project no 2011/01/B/NZ9/00130

Key words: gluten-free breads, bioavailability, calcium, *in vitro*

CEREALS AND CEREAL PRODUCTS CONSUMPTION RELATED TO FOLATE INTAKE IN OLDER WOMEN ACCORDING TO DENTURE WEARING

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One of the factors that are related to dietary selection of older individuals is oral health status. Food choices change significantly when a patient begins using dentures. Denture wearers tend to eat fewer vegetables, fruits, and whole grains, which results in less than desirable intake of certain vitamins such as folate. The aim of this study was to determine whether there is an impact of denture wearing on cereals and cereal products intake, and also on folate intake in older women.

The study included 57 women (mean age 63.5 years). Validated quantitative food frequency questionnaire was used.

Denture wearers (n=20) had higher average daily intake of cereals and cereal products than non-denture wearers (n=37) (155.9 g vs. 145.3 g), but the difference was not significant. Folate intake was not significantly different according to denture wearing. Higher number of denture wearers avoided hard-to-chew foods, such as crusty, dry breads (25.0% vs. 8.6%), and sticky foods, such as soft, doughy breads (75.0% vs. 45.7%) compared to non-denture wearers.

The results showed no significant difference in the amount of cereals and cereal products consumed and in the average folate intake in older women according to denture wearing.

Key words: cereals, folate, older women, denture wearing

CEREALS AND THEIR PRODUCTS AS SOURCE OF FOLATE IN REPRODUCTIVE WOMEN CONSUMING VEGETARIAN AND OMNIVOROUS DIETS

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Adequate folate intake plays important role in reproductive women especially in preventing and reducing the risk of neural tube and other birth defects. Cereals and their products represents major source of energy, protein, B vitamins and minerals for the world population and are assumed to contribute notably to the overall folate intake.
The aim of this study was to determinate intake of cereals and their products in reproductive women consuming vegetarian and omnivorous diets, and estimate is there any difference in cereals and folate intake between groups. Subjects were 70 women aged 25 to 43 years, divided in two groups according their eating habits. Dietary method used was validated quantitative food frequency questionnaire for assessment folate intake.
This survey found no significant difference between amounts of cereals consumption among groups, but found 21% higher folate intake from cereals in vegetarian group. Statistically significant difference was found in bread consumption. Wholegrain bread made more than 85% of daily bread intake in vegetarians while only 61% in omnivores - resulting in 12% higher folate intake in vegetarian population. Also found was difference in breakfast cereals intake with women following vegetarian diet have 30% higher intake resulting in more than 30% higher folate intake.

Key words: cereals, folate, vegetarians, omnivores

OPTIMIZATION OF EXTRACTION CONDITIONS OF TOTAL PHENOLIC COMPOUNDS FROM WHEAT GRAIN USING RESPONSE SURFACE METHODOLOGY

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Response surface methodology (RSM) was applied to optimize the extraction conditions of total phenolic compounds from wheat grain. Tested samples were collected from three silos at different locations of Croatia: Kutjevo (WK), Čakovec (WC) and Beli Manastir (WB), and represent an average harvest of wheat in 2011/2012.
A Box-Behnken design was used to investigate the effects of solvent concentration (30-90% aqueous ethanol), extraction temperature (30-90 °C) and time (10-70 min) as well as their interaction on the extractability of total phenolic compounds.
The total phenolic content (TPC) in extract was determined by spectrophotometric Folin-Ciocalteau micro method at 765 nm and results were expressed as gallic acid equivalent per a dry basis of wheat grain (mg_{GAE}/g_{db}).
RSM analysis showed that solvent concentration and temperature had significant effect, while effect of time and interaction of factors on the observed extraction process were not significant. The optimal conditions for extraction of phenolic compounds were found to be 58 % aqueous ethanol, 83 °C and 70 minutes. Under these conditions, the experimental results of TPC (WK: 3.67 mg_{GAE}/g_{db}, WC: 3.33 mg_{GAE}/g_{db} and WB: 3.41 mg_{GAE}/g_{db}) were close to the predicted values (3.7 mg_{GAE}/g_{db}, 3.26 mg_{GAE}/g_{db} and 3.35 mg_{GAE}/g_{db}, respectively) calculated from the polynomial response surface model equation.

Key words: optimization of extraction, response surface methodology, wheat grain, total phenolic compounds

EXTRACTION OF TOTAL FLAVONOIDS FROM BARLEY GRAIN USING HIGH-TEMPERATURE/HIGH-PRESSURE REACTOR

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This work examined the influence of extraction temperature (90-180 °C), solvent concentration (36-90 % aqueous ethanol) and time (30-90 min) on the extractability of total flavonoids and on the antioxidant activity of extracts from three samples of barley grains. Barley samples were collected from three silos at different locations of Croatia: Nova Gradiška (BNG), Čakovec (BC) and Vinkovci (BV), and represent an average harvest of barley in 2011/2012.

Extractions were performed using high-temperature/high-pressure reactor and optimal extraction conditions determined using response surface methodology (RSM) by Box-Behnken design. The total flavonoids content (TF) was measured using the aluminium chloride colorimetric assay at 510 nm and results were expressed as (+)-catechin equivalent per a dry basis of barley grain (mg_{CE}/g_{db}).

Antioxidant activity of barley extract was evaluated by spectrophotometric method (515 nm) against stable 2.2-diphenil-1-picryhydrazyl radical (DPPH·) and results were expressed as antiradical power (ARP, $\mu g_{DPPH\cdot}/\mu L_{extract}$).

Based on RSM analysis, temperature was the most significant ($p < 0.05$) factor affecting the TF and optimum conditions for flavonoids extraction were 180 °C, 36 % aqueous ethanol, and 90 minutes. At these conditions, the predicted values of TF in extracts of BNG, BC and BV were 5.25 mg_{CE}/g_{db}, 5.31 mg_{CE}/g_{db} and 4.47 mg_{CE}/g_{db}, respectively. High positive correlation ($R > 0.88$) between TF and ARP of tested barley extracts was observed, which suggest that the flavonoids contribute to the overall antioxidant activity of barley extracts.

Key words: high-temperature/high-pressure extraction, optimization of extraction, response surface methodology, barley, total flavonoids

ANTIOXIDANT ACTIVITY, PROTEIN, PEPTIDE AND POLYPHENOL CONTENT OF BARLEY AS AFFECTED BY EXTRACTION pH

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The aim of this study was to determine pH dependence of barley grain protein, peptide and polyphenol solubility and their contribution to the antioxidant activity of six barley varieties. Extracts prepared by extraction of wholemeal barley flour with Britton-Robinson buffer (pH range 3-11, 1 pH unit increment) and their corresponding TCA-supernatants prepared by TCA protein precipitation from the extracts, were examined for protein/peptide, free amino group and polyphenol content, as well as their antioxidant activity. Significant increase in the protein, free amino group and polyphenol content in wholemeal barley flour extracts were observed with the increase of pH of extraction, but antioxidant activity decreased at basic pH. Different pattern of pH dependence was observed for TCA supernatants. TCA soluble peptide content was found to be highest at the lowest pH of extraction, free amino group content and antioxidant activity slightly increased with pH increase, while polyphenol content showed "S" shaped curve of pH dependence. The most striking was the difference in polyphenol content between extracts and their corresponding TCA-supernatants, being higher in supernatants than in extracts at basic pH. Similarly was observed for antioxidant activity, which was found to be higher in supernatants than in extracts at basic pH. This indicates that barley proteins soluble at basic pH significantly interfere with the polyphenols detection and probably act as quenchers of antioxidant activity.

Key words: antioxidant activity, barley grain, free amino groups, peptide, polyphenols, protein, solubility

FEATURES AND CHARACTERISTICS OF IFS FOOD STANDARD IMPLEMENTATION IN THE MILLING INDUSTRY

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International Featured Standards (IFS Food) aims to establish a safety management system and ensure the quality of food production. This standard is of special importance to food producers and is often a prerequisite for cooperation with retailers. The aim of this paper is to present experiences in the implementation of IFS Food/Version 6 in the milling industry, with special emphasize on the features and characteristics of the standard. IFS Food was implemented by using the methods for the food quality and safety management system. An analysis of hazards and risk assessment was conducted upon which monitoring and measurement of processes that could influence food quality and safety have been made. The standard provides specific scoring of each application, depending on the degree of implementation and compliance. The result of implementing IFS Food in the milling industry is increased supervision of major and supporting processes and the development of an action plan with corrective actions for all requests that do not receive the highest score upon assessment. Consequently, the implementation of IFS Food provides improved control over the quality and safety of products, as well as of the entire production process, and helps meet the requirements of customers.

Key words: IFS Food, food safety, milling industry

THE PRODUCTION OF MAGLICA

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Pasta is a permanent product of flour or semolina and water, with the possible addition of some ingredients to improve the organoleptic and nutritional properties of the finished product. Today is in production a large number of different types of pasta, which vary according to the raw material composition, method of manufacture, primary the design and purpose. The group of noodles and similar products include bark for pies and rolls and grinders and maglice. Maglice are a product which is obtained by making the dough mixture of flour, water and salt as for pie, develops, winding on rolling pin is pulled. Thus prepared dough is cut into pieces measuring up to 2 cm, which are baked in the oven.
The aim of this paper is to describe and implement production of maglica process, the monitoring of all parameters and changes during the kneading, shaping, baking and storage of the finished product.

Key words: maglice, production, pasta, flour

HMW-GS AS PROTEIN MARKERS IN DIFFERENTIATION OF WHEAT CULTIVARS

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12 wheat (*Triticum aestivum* L.) cultivars differing in high molecular weight-glutenin subunits (HMW-GS) composition were collected from experimental field of the Agricultural Institute Osijek in 2009 and 2010. HMW-GS was analyzed by SDS-PAGE method and according to the catalogue of alleles the Glu1-score was calculated. The most frequently occurring HMW-GS were 2* 7+ 8/9 5 + 10. The proportion of HMW-GS in total extractable proteins of grains was analyzed by RP-HPLC and their average values in 2009 and 2010 were 8.91 and 9.55%, respectively. Comparing the cultivars, a several groups of related HMW-GS attributes were separated. Cultivar Divana as the Croatian bread improver with favorable HMW-GS composition (2* 7+9 5+10) and the highest HMW-GS proportion (11.98%) had a distinct position. In contrast, the Croatian yielding cultivar Sana was positioned on the opposite side due to unfavorable HMW-GS composition (2* 6+8 2+12) and the lowest HMW-GS proportion (6.24%). Cultivars Soissons, Felix, Aida and Ilirija with the highest Glu-1 score (10) belonged to the same cluster and their HMW-GS proportion varied between 8.90 and 10.01%. Cultivars Srpanjka and Golubica were due to higher proportion of HMW-GS (9.80 and 10.01%, respectively) and similar Glu-1 score (6 and 5, respectively) positioned very close.

Key words: wheat, HMW-GS, Glu-1 score, RP-HPLC

CULTIVAR AND ENVIRONMENTAL VARIATIONS OF BARLEY β-GLUCAN CONTENT AND β-GLUCANASE ACTIVITY

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The cultivar and environmental variations of β-glucan content in grains and malt and malt β-glucanase activity were investigated in 6 barley cultivars grown in two different environments. Three winter cultivars (Zlatko, Barun and Vanessa) and three spring cultivars (Fran, Matej and Scarlett) were collected from experimental fields of the Agricultural Institute Osijek. Prior to micromalting the barley samples were analyzed for crude protein content by NIT method and β-glucan content. Grain protein content varied from 9.93% to 11.60%, and β-glucan content varied from 3.5% to 6.0%. Malt analyses were done according to the EBC official methods and the following parameters were determined: malt extract content, extract difference between fine and coarse grind malt, viscosity, friability, β-glucan content in malt and malt β-glucanase activity. A significant differences were found among winter and spring cultivars in extract difference, viscosity and friability, while statistically justified difference in malt extract content among winter and spring cultivars was not observed. The cultivar and environmental variations of β-glucan content were much higher in malt than in grains. Regarding malt β-glucanase activity, the significantly higher activity was found in spring cultivars, in contrast to winter cultivars.

Key words: barley, malting quality, β-glucan content, β-glucanase activity

DEVELOPMENT OF ENZYMATIC POWER IN WHEAT GRAIN DURING GERMINATION PROCESS

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This paper investigated development of enzymatic power in wheat grain during germination process (expressed as α-amylase activity and total diastatic power). The aim was to determine the optimal germination time in order to achieve the best results for investigated indicators in relation to the recommended values. Wheat samples underwent germination process in controlled conditions, regarding temperature and air humidity, over a period of 7 days. Obtained results for total distatic power were in range from 240° WK in starting sample to 420° WK at the end of the germination process. Results for α-amylase activity were in range from 0 DU/dm in starting sample to 60 DU/dm at the end of germination process. It was determined that germination time ranging from 158 to 168 h (from 5.5th – 6th day of germination) is optimal to obtain recommended values for wheat malt (diastatic power 250 – 420 °WK, α-amylase activity 40 - 60 DU/dm). Satisfying results were achieved on the half of the 4th day of germination (diastatic power ≈ 300 °WK, α-amylase activity ≈ 28 DU/dm). Furthermore, it was determined that by extending the germination time beyond 168 h no significant up growth of any of investigated indicators occurred, though other investigated indicators of malt quality were distorted. In conclusion, obtained results indicate that optimal germination time for synthesis of enzymes that affect the total diastatic power of malt (except β-amylase which is activated only during the germination process) and α-amylase synthesis, is between 156 - 168 h. In case of compromising these indicator values with the rest of important malt quality indicators, the optimal germination time ranges from 120 - 140 h.

Key words: wheat, germination, α-amylase activity, diastatic power, malting optimization

VARIABILITY OF GLUTENIN AND GLIADIN LOCI IN WINTER BREAD WHEAT GERMPLASM

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Glutenins and gliadins represent 80% of total wheat kernel proteins. Combination of high molecular weight subunits of glutenins (HMW GS) and ω-gliadins are highly important for quality of winter bread wheat. Both types of proteins are controlled by several different loci and allelic variations on different loci highly influence wheat flour quality. HMW GS are controlled with three loci Glu-A1, Glu-B1 and Glu-D1 while ω-gliadins are controlled by loci Gli-A1, Gli-B1 and Gli-D1. HMW GS and ω-gliadins loci were used for variability estimation in 50 varieties of winter bread wheat. For glutenins number of alleles per loci ranged from 3 at Glu-A1 to 5 at Glu-B1 and Glu-D1, the average number of alleles was 4.33. The highest genetic diversity was found at loci Glu-B1 (He=0.687). For ω-gliadins number of alleles per loci was from 3 (Gli-D1) to 7 (Gli-B1), high genetic diversity (He = 0,557) were estimated at loci Gli-B1, while significantly lower genetic diversity was estimated at loci Gli-D1 (He = 0,114). Results from this study allow further development of specific breeding programs for high winter wheat quality.

Key words: winter bread wheat, glutenins, ω-gliadins, variability

VARIABILITY OF QUALITY TRAITS IN WINTER WHEAT GERMPLASM

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Wheat breeders have to satisfy and find the right value of a wheat crop in the market which is generally determined by grain yield and grain attributes associated with its processing quality. Endosperm proteins can vary from 7% to 15%. Carbohydrates can account for about 68-76% of total flour weight. In wheat starches, amylopectin contribute to water absorption, swelling and pasting of starch granules, whereas amylose and lipids tend to retard these processes. During two vegetation years folowing traits were measured on 40 winter wheat varieties: hectoliter weight (hl/kg), thousand kernel mass (g), protein and starch content (%), grain hardness (NIR) and amylose/amylopectin ratio in starch. Starch and protein content varied depending on year with protein content ranged from 11 to 17%, and starch content ranged from 61 to 69%. We found statistical significant differences ($p<0.01$) between tested genotypes for amylose and amylopectin quantity as well in amylose/amylopectin ratio, varied from 0.99 to 0.06. We can select varieties which have 90% amylopectin (Bezostaja), and varieties that have 50% of amylose (Srpanjka). Achieved results give the opportunity to select genotypes suitable for plant breeding programs targeted towards different end use quality in food and industry.

Key words: winter wheat, protein and starch content, amylose/amylopectin ratio

FREE AMINO GROUP DISTRIBUTION BETWEEN BARLEY ALBUMIN AND GLOBULIN PROTEIN AND NON-PROTEIN FRACTIONS

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Free amino group determination in extracts of various cereal flours or doughs has been widely used for estimation of albumins/globulins and/or glutenins amino group loss caused by non-enzymatic glycosylation or transglutaminase protein cross-linking. However, distribution of free amino groups between albumins and globulins, as well as small peptides and free amino acids present in such extracts, is less studied. Therefore, the aim of this study was to determine contribution of albumins, globulins, small peptides and free amino acids present in barley extracts in detection of free amino group content.
Albumins, globulins or albumin/globulin protein extracts of six barley varieties, as well as their corresponding non-protein TCA-soluble fractions, were examined for protein and free amino group content.
Results showed that the majority of free amino groups present in barley albumins, globulins or albumins/globulins extracts originate from their non-protein TCA-soluble fractions as follows: 83-89% for albumins, 39-76% for globulins, and 60-84% for albumins/globulins. Free amino groups were found to be 2 to 4 times greater in albumin extracts and their corresponding TCA-soluble fractions than in globulin extracts.
Observed data clearly suggest that when dealing with free amino group determination in barley flour extracts special attention should be given to the contribution of non-protein TCA soluble fractions.

Key words: albumins, barley, free amino groups, globulins, small peptides

CORRELATIONS VALUE AND HERITABILITY OF INDIRECT INDICATORS OF QUALITY AND RHEOLOGICAL PROPERTIES OF REDUCED (N_{80}) AND OPTIMAL (N_{180}) NITROGEN FERTILIZATION LEVELS

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The bread making quality of winter wheat (*Triticum aestivum* L.) depends on the genotype, nitrogen, environment and their interactions. Among the environmental factors, a special place has nitrogen, since it affects the amount and structure of the grain protein content. The aim of this study was to evaluate the effect of two nitrogen fertilization levels on the mean and the heritability of indirect indicators of quality and rheological properties, and to determine the correlation of traits between the two fertilization levels. Research was conducted on 19 winter wheat genotypes planted in eight environments with 80 kg N/ha and 180 kg N/ha. All the studied traits (except gluten index) recorded a higher values at 180 than at 80 kg N/ha. For all indirect indicators of quality (except falling number) and rheological properties the value of heritability was higher at N_{180}. There was a significant effect of genotype and nitrogen level on all properties due to high correlation among traits between the two fertilization levels. In conclusion, the genotypes adapted to reduced nitrogen fertilization could be selected from germplasm included in existing breeding program conducted at the optimal nitrogen level.

Key words: winter wheat, fertilization, bread making quality, correlations, heritability

INTERRELATION OF GRAIN YIELD, QUALITY AND BIOCHEMICAL TRAITS IN WINTER WHEAT GENOTYPES

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Wheat is the major component of most diets of the world and an important source of minerals such as zinc, magnesium and calcium. Also the α-tocopherol (vitamin E) and insoluble fibers are localized in some parts of the wheat kernel. The aim of the study was to evaluate relationship of a dietary important biochemical traits, yield and grain quality (1000 kernel weight, test weight, crude protein, gluten, Sedimentation and starch) of 25 wheat genotypes.

The field experiments were carried out at the State Stende Cereal Breeding Institute during 2011-2012. For estimation of technological and dietary important traits of wheat genotypes the rank-based test of Fox et.al (1990) was used. Anova procedures were used for statistical data analysis. In the analysis of variance, the partitioning of sum of squares ($\eta 2$) due to the relative impact of each single factor was estimated. The significance of effect of factors was determined at probability level of 0.05.

Overall the investigations showed that values of dietary and technological traits of wheat genotypes were variable per years. Highest and most stable dietary values had variety 'Krista,' and breeding lines L-94-5 and L-96-58 in average of two years. Coefficient of correlation confirmed that biochemical traits are very closely connected with content of protein and starch and TGW. There were significant positive correlation between TGW and phenolic content and also content of Mg and Zn (the relative impact of single factor was 31% = 0.5592*100%, 52% and 23.5%). The content of vitamin E was higher in kernels with higher content of fiber. Significant positive correlation found between content of Mg and Zn (60.5%). Higher content of Mg was for genotypes were the protein and phenol was higher.

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Key words: wheat genotypes, yield, quality, biochemical traits

EFFECT OF TRIBOMECHANICAL MICRONISATION AND ACTIVATION TREATMENT ON TEXTURAL AND THERMOPHYSICAL PROPERTIES OF WAXY CORN STARCH GELS

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The main aim of this paper was to investigate in what way tribomechanical treatments effects on thermophysical and textural properties of waxy corn starch suspensions (10%). Samples of waxi corn starch were treated using laboratory equipment for tribomechanical micronization and activation (TMA equipment). Particle size measurements showed that the TMA treatment caused a decrease in particle size and change in particle size distribution of powdered starches. Scanning electron micrography showed that tribomechanical processing of starch resulted in breaking accumulations of starch granules in the form of granules. The texture profile analyses of the TMA treated waxi corn starch gels presented higher hardness, adhesiveness and gumminess; however, cohesiveness and springiness were lower when compared with untreated suspensions. Results of differential scanning calorimetry measurements showed a decrease in enthalpy of gelatinization, but there are no significant changes in gelatinisation point after TMA treatment for model suspension of waxy corn.

Key words: tribomechanical micronization, pasting, thermophysical, textural properties of waxy corn starch

EFFECT OF FLAXSEED GUM ON THE PASTING, THERMAL AND RHEOLOGICAL PROPERTIES OF RICE STARCH

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Replacement of flaxseed gum at 3, 6, 9 and 12% levels was made in rice starch. The objective of replacement was to modify the starch properties as an alternative to chemical and enzymatic modification. Rapid visco analyzer (RVA), differential scanning colorimeter (DSC), Brookfield rheometer and texture profile analysis were used to investigate the different starch properties. In the presence of flaxseed gum, peak and final viscosities were increased significantly as compared to plain rice starch. Although there was no significant difference in the pasting time of different starch mixture, but the pasting temperature was decreased in the presence of gum. The DSC data of different blends showed that peak temperature increased as the level of flaxseed gum was increased. This can be attributed to the slower gelatinization of starch in the presence of gum. ΔH (j/g) of starch blends decreased linearly as a function of gum due to less starch with higher gum replacement. Data obtained from Brookfield rheometer demonstrated as an increase in shear stress as a function of shear rate. Although, all the blends showed psuedoplaciticty of system ($n<1$) but it was higher at 3, 6 and 9% gum levels, respectively. Overall, it can be assumed that flaxseed gum has helped to modify the starch by increasing peak and final viscosities, increasing peak temperature and improving psuedoplaciticty of the system.

Key words: rice starch, flaxseed gum, RVA, DSC

FUNCTIONALITY OF ENZYMATICALLY TREATED CORN STARCHES ABOVE GELATINIZATION TEMPERATURE

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Starch is the major component in the human diet and has also unique functionality that has permitted its wide use in food products and industrial applications. In its native form, does not always fulfill the requirements for certain types of processing. However, enzymatic modification can be an alternative method to meet the specific needs of industrial processes. The aim of this study was to evaluate the effect of two different enzymes, fungal α-amylase (AM) and amyloglucosidase (AMG), on corn starch above gelatinization temperature, with special emphasis on biochemical features and structural analyses of treated starches. Amylase decreased significantly the peak viscosity of the starch, whereas amyloglucosidase reduced the final viscosity and setback. Functional properties of starch are directly influenced by hydrothermal (heat and moisture) treatment or processing conditions. Differences were observed among hydration properties. Specifically, AMG activity has more influence breaking the degree of association between intermolecular bonds, and more soluble compounds are leached out. It was also found through scanning electron microscopy that the gel structure displayed as a network matrix was highly perforated with big cell pores and thick walls when treated with AM, and some elongated structures from gelatinized starch were observed in the AMG treated starch.

Key words: corn starch, enzymatic modification, hydrothermal properties, SEM

STARCH CHARACTERISATION USING SPECTROPHOTOMETRY AND DIRECT POTENTIOMETRY

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Starch consists of two poymer types; amylose and amylopectine. Their ratio is starch origin-dependent. Triiodide ions bind characteristically to the amylose and amylopectin molecules of the starch. This can be monitored using spectrophotometry, but recently also direct potentiometry with platinum redox sensor. The absorbance and electrical potential change of the starch-triiodide complex were measured for wheat, potato, corn, rye, barley, rice, tapioca and commercial starch. The results showed characteristic curves for each starch type, corresponding to the specific amylose/amylopectine ratio. The curves were used to determinate starch type-specific parameter values; for spectrophotometry: starch-triiodide peak wavelength maximum (λmax/nm), maximum absorbance change for λmax (ΔA) and for the direct potentiometry: slope (S) for the linear response region, maximum potential change (ΔE) and relative sensitivity (mV/mg) for potential change in the corresponding starch concentration. Concerning data comparison using these two methods; methods itself are distinguishing starch types based on specific triiodide bounding to starch components, but when compared apsolute data changes between starches are not in correlation.

Key words: spectrophotometry, direct potentiometry, starch triiodide complex

EFFECT OF HIGH INTENSITY ULTRASOUND ON PROPERTIES OF STARCH PASTES

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Starch has an abundant use in the food industry because it is a thickening, stiffening or gluing agent. Also, nowadays there is an emphasis on the need to develop mild non thermal methods for food processing and in this view ultrasound has great potential. Therefore it is interesting to determine the effect of high intensity ultrasound on functional properties of the most common carbohydrate in the human diet. In this study we reviewed the effect of one and two minute treatment of rice and corn starch pastes with 24 kHz probe, 400 W of nominal output power, at 20%, 60% and 100% amplitude. The results showed that 60% and 100% ultrasound treatments increase the swelling power of starch pastes but increase the resistance to refrigeration of only corn starch pastes while leaving the rice starch paste unchanged. Apparent viscosity measured at three different temperatures, as well as the hardness of starch pastes differ depending on the conditions of the ultrasound treatment. By reviewing the influence of ultrasound on the starch pastes, it was determined that no deteriorating effect occurred and this treatment could be helpful for freezing of food stuffs.

Key words: ultrasound, starch paste, swelling, texture, refrigeration, viscosity

EFFECT OF MALTODEXTRIN AND ULTRASOUND ON OSMOTIC DEHYDRATION OF ORANGE PEEL

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As a result of the functional and nutritional characteristics of orange peel, it may be considered to be available ingredient for a wide variety of products such as baked goods, dairy and meat products, etc. In this work, ultrasound pretreatment of orange peel cubes using aqueous solutions of sucrose (45, 55 and 65%) with and without addition of maltodextrins (10 and 20 %) were used to enhance mass transfer during osmotic dehydration at atmospheric pressure (OD) and pulsed vacuum osmotic dehydration (PVOD). Total and soluble solids, colour parameters (L*, a*, b*, C*, h*) and firmness of orange peel cubes (15 x 15 mm) before and after treatments at room temperature were analysed. The water loss and solid gain were significantly increased when the orange peel was treated with vacuum. The combined effects of ultrasound (10 min at 35 kHz) and PVOD (5 min at 50 mbar, and afterward 5 min at atmospheric pressure) in treatments with 45% sucrose and 20% maltodextrin showed the best conditions for dehydrating orange peel, regarding to colour and firmness. Ultrasound and PVOD treatments are recommendable to develop high-quality orange peel products, taking advantage of much shorter treatment times, increasing its sweetness and improving its sensory acceptability.

Key words: orange peel, maltodextrin, ultrasound, osmotic dehydration

A KNOWLEDGE MANAGEMENT MODEL AIMED AT CONTINUOUS QUALITY ASSURANCE IN BAKERIES

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Product quality is one of the dominant factors of survival in the complex economic conditions marked by overabundance of products and keen market competition. Still, it is quite rare to see a systematic approach to the system of quality attainment and maintenance, which is also the case in the baking industry. The issue is usually left to individual technologists in charge of the production process and their capabilities. Consistent quality and efficient production imply a systematic approach to gathering, recording and distributing of knowledge in an organisation, which is the domain of knowledge management. Today, knowledge is not only a characteristic of human beings; it is also a constituent of intelligent computer systems that are responsible for managing production processes. Knowledge management has become more efficient with the development of computer programming systems for knowledge capturing and recording. These systems are not only devices to record and further distribute knowledge through modern computer networks; rather, their function is to help in making important decisions in the production process, based on the information from the environment. The basis of such systems is an ontological model which systematically structures the knowledge on a particular element of the structure or a particular business process. One of the tasks of modern scholarship is to provide systematic knowledge structuring so that it can be efficiently distributed through modern communication channels, and then used in real-life conditions. Accordingly, this research was carried out to create a framework model of knowledge management aimed at achieving continuous quality in the baking industry.

Key words: knowledge management, bakery production, intelligent Web, ontology, knowledge model

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