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Meeting Abstracts

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Keynote Presentations

Scientifically Sound Evaluation of Potential Risks of Food Allergy and Celiac Disease of GMOs and Novel Foods

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Abstract

A process was begun in the mid-1980's to develop methods for evaluating the safety of foods produced in genetically modified (GM), or genetically engineered crops used to produce foods. The potential allergenicity, toxicity and nutritional equivalence of genetically engineered crops used to produce conventional food products was used as the basis for safety evaluation. The United States government (Food and Drug Administration: FDA) is the lead US regulatory agency that works with the Environmental Protection Agency (EPA) and the US Department of Agriculture (USDA) to evaluate food safety. Other countries (e.g., the United Kingdom, countries of the EU, India others who are members of the World Health Organization and Food and Agricultural Organization of the United Nations worked to develop an overall international guideline intended as a model for regulations of each country. The process was formalized through the CODEX Alimentarius (CODEX, 2003) following international debate, with very minor revisions in 2009. The primary risks of GMOs and Novel Foods are the same as to most historically used foods. If you are allergic to a food, you have IgE antibodies to some proteins in the food that you must avoid. Therefore, we have food labeling laws requiring declaration of inclusion of the most allergenic food sources in a given packaged food. Food companies work hard to maintain control of ingredients and labels. Perfect control starts at the farm or seed source, through supply chains to processors and food companies. If you have Celiac Disease (CD), you must avoid glutens (specified proteins) from wheat, barley and rye, for some people oats as well. Foods with glutens must be avoided by those with CD. We have selected foods that have little or no toxicity over hundreds of years. Yet, potatoes can be bred that have high solanine, and plant varieties related to potato and tomato have a number of toxins. Therefore, the safety assessment process considers the source of the gene or of novel proteins. The amino acid sequences are compared to known allergens, glutens and toxins. If there are questions of risk, additional tests are required. Nutritional properties are also important. New GM varieties and novel foods are tested to evaluate the availability of nutrients and anti-nutrients. But we must use rational judgement. There is natural variation in plant varieties due to genetic and environmental factors. We should not seek absolutely identical profiles of constituents across all foods and varieties. The safety of food and the evolution of new, useful varieties requires application of efficient and effective, practical evaluations to ensure our foods are safe and affordable. This presentation will outline the science-based process for GM foods and novel ingredients.

Retention of Carotenoids after Household Cooking of β-Cryptoxanthin Biofortified Maize Flour and Eggs

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Abstract

Biofortification of staple crops to enhance provitamin A carotenoids is a strategy to increase intake where vitamin A deficiency presents a widespread problem. Most efforts to date have focused on β-carotene. However, the carotenoid biosynthetic pathway in maize is conducive to also select for high β-cryptoxanthin varieties. Heat, light, and oxygen cause isomerization and oxidation of carotenoids, reducing retention of carotenoids and overall provitamin A activity. Prior studies have demonstrated that high β-cryptoxanthin maize is efficacious in improving the vitamin A status of Mongolian gerbils and domesticated laying hens when consumed as a major part of the feed. Understanding carotenoid retention is important for assessing efficacy of biofortified foods consumed by humans made with β-cryptoxanthin enhanced maize. Therefore, carotenoid retention (i.e., lutein, zeaxanthin, β-cryptoxanthin, and β-carotene) in high β-cryptoxanthin maize was determined in muffins, non-nixtamalized tortillas, porridge, and fried puffs made from whole-grain and sifted flour. Retention in eggs from the hens fed high β-cryptoxanthin maize was assessed after frying, scrambling, boiling, and microwaving. Boiling whole-grain maize into porridge resulted in the highest retention of all cooking and sifting methods (112%). Deep-fried maize and scrambled eggs had the lowest carotenoid retention rates of 67-78% and 84-86%, respectively. High β-cryptoxanthin maize could be a good source of vitamin A in addition to maintaining the xanthophyll carotenoids, lutein and zeaxanthin, in foods made with maize. These xanthophyll carotenoids have been implicated in maintenance of eye health.

Isoflavones in Modern Soy-food: How to Take the Best Part of them?

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Abstract

Soy isoflavones: genistein, daidzein and glycitein, can exert estrogen-like activities. If glycitein is a pure ERβ agonist the two others exhibit significant transcriptional activities through ERα and ERβ as well as through GPR-30 and ERRα, β, γ at plasma dietary doses. *In vivo* estrogenic effects can be positive or negative depending on the physiological status and the target tissue considered. These estrogenic activities having been confirmed in toxicological studies by the US National Toxicology Program (NTP) were analyzed in clinical studies. No individual study is definitely convincing, however, putting all data together make sense and acute estrogenic effects can be recorded for isoflavone daily intakes ranging from 40 to 60 mg in adults (about 0.75 mg/kg/day). These active doses are in line with the NTP findings on reproduction and mammary and pituitary glands of rat models.

Isoflavones in soy being present as glycosides are soluble in water. This property allows them to leak into water during prolonged cooking or simmering. These cooking steps were common in traditional Asian recipes but are no longer found in modern soy industrial processes. Such steps were shortened or omitted to reduce energy and environmental costs. Therefore, the human exposure to isoflavones rose recently with the development of industrial soy-based-foods.

Estrogenic isoflavones having both beneficial and deleterious effects they should be reserved for specific health issues. Their ubiquitous presence in modern soy-based-foods should be questioned especially for effects on reproduction and several disease developments. Using isoflavones in dietary-supplements should allow targeting the right physiological status.

Direct Derivatization Combined with GC-MS/MS for the Analysis of 2- and 4-Methylimidazole in Cola and Beer

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Abstract

A GC-MS/MS following simple direct derivatization has been developed for the simultaneous analysis of 2 - and 4-methylimidazole (MeI) in cola and beer. Conventional sample preparation technique requires laborious and time-consuming multiple steps including sample concentration, pH adjustment, ion pairing extraction, centrifugation, back-extraction, centrifugation, derivatization, and extraction. Our present sample preparation technique consists of only 2 steps (direct in situ derivatization and extraction with nonpolar solvent) which requires only 3 min. This method provided high linearity of standard calibration curves, low limit of detection, high recovery and repeatability. It was found that internal standard methods

with stable isotope (4-MeI-d6) and 2-ethylimidazole (2-EI) could not correctly compensate the matrix effects. Thus, standard addition technique was used for the quantification of 2 - and 4-MeI. The established GC-MS/MS with standard addition mode was successfully applied to determine the contents of 2 - and 4-MeI in colas and dark beers. The 4-MeI contents in colas and dark beers greatly varied with products ranging 8 – 319 mg/L and trace – 417 mg/L, respectively.

Microbial Proactive Processing of Food during Digestion Supports Health Functions and Balanced Microbiome

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Abstract

As stated by A.I.Kendall and coworkers, the duodenal microflora is the starting point of an intestinal microbiological column, which was designated as the alimentary microbiome by Prof. Joshua Lederberg in 2000. The development of ecological succession of the microbiota and the BIB (Bacteriological Intestinal Balance) is established in the duodenum where the pancreatic bicarbonates neutralize the food into chyme which then traverses through various segments of the intestines. In the duodenum, also digestive enzymes and bile substances are injected into the chyme. They selectively favor many coliforms and enterococci. The final pH of the chyme normally settles close to 6, which is also the final pH of the symbiotic culture of (1) the mixed acid fermenting *Escherichia coli* strains, and (2) the 2, 3-butanediol fermenting Klebsiella/ *Enterobacter* strains, as detected during the growth of their co-cultures in the Portable Microbe Enrichment Unit (PMEU). *In vivo*, the gut ethanol level is kept relatively low by rapid host absorption. During their journey through the intestinal column, the lactic acid bacteria (LAB) attach to the fibrous food. From these "floating vessels" of plant origin, they balance the growth, gas and acid formation of the small intestinal enterobacterial flora, thus helping in relieving the symptoms of the IBS (Irritable Bowel Syndrome), as well as the peak exhaustion of nutrients in any intestinal microbiomic segment. The beneficial butyric acid clostridia in the colon are boosted by the carbon dioxide formed by the LAB. The molecular Hydrogen liberated by colonic anaerobes could shift the redox potential of the body system influencing our health.

A Case Study of Whole Kernel Contamination of Grain: How its Occurrence in Gluten-Free Labeled Oats Complicates Gluten Assessment Affecting Marketplace Compliance

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Abstract

Whole kernel contamination of grain presents a unique circumstance which can affect purity compliance assessments. For instance, gluten rich wheat, barley and rye kernels in otherwise pure oats act like highly concentrated gluten 'pills', intermittently dispersed across servings. These 'pills' present a needle in the haystack scenario since only those servings containing a rogue kernel are contaminated, and within a contaminated serving all contamination remains housed in a single kernel. These unique circumstances necessitate special sampling and testing approaches to adequately detect, assess and mitigate the situation. Being ineffective in doing so can result in non-compliant product in the marketplace, as has been found the case for gluten-free labeled oatmeal. This talk highlights this circumstance and addresses potential remedial actions. The topic is applicable to comparable scenarios like those with mycotoxins and GMO-Free claims.

Featured Presentations

Determination of Inorganic Arsenic in Rice by Hydride Generation, Cryogenic Trapping and Atomic Fluorescence Spectrometry

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Abstract

Hydride generation (HG) is a proven technique that thoroughly eliminates interfering matrix species. Speciation can be fulfilled after HG by cryogenic trapping based on boiling points of resulting arsines. A thermoelectric cryogenic trap was developed that consisted of a polytetrafluoroethylene (PTFE) body sandwiched by two Peltier modules. After the trap was cooled down, the arsines flew along a zigzag channel in the body and reached a sorbent bed of 0.2 g 15% OV-3 on Chromosorb W-AW-DMCS imbedded near the exit of the trap. CH_3AsH_2 and (CH_3) 2AsH were trapped; while AsH_3, that passed the trap unaffected, was detected by atomic fluorescence spectrometry. This simple, rapid, and green method enhanced personnel safety by eliminating hazardous liquid nitrogen. For inorganic as, limit of detection (LOD) was 1.1 ng g^{-1} and recovery was 101.0 ± 1.1% at 100 ng g^{-1}. Monomethylarsonic acid and dimethylarsinic acid did not interfere with 0.2 ± 1.2% and -0.3 ± 0.5% recoveries, respectively.

FlavonQ: An "Expert System" Automated Data Processing Tool for Profiling Flavonoids Using Ultra High-Performance Liquid Chromatography Diode Array Detection High-Resolution Accurate-Mass Mass Spectrometry

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Abstract

Ultra-high-performance liquid chromatography (UHPLC) coupled with diode array detection and high resolution accurate-mass multi-stage mass spectrometry (UHPLC-DAD-HRAM/MSn), have become the tool-of-the-trade for profiling flavonoids in foods. However, manually processing acquired UHPLC-DAD-HRAM/MSn data for flavonoid analysis is very challenging and highly expertise-dependent due to the complexities of the chemical structures of the flavonoids and the food matrices. A computational expert data analysis program, FlavonQ-2.0v, has been developed to facilitate this process. The program uses UV-Vis spectra for an initial step-wise division of flavonoids into classes and then identifies individual flavonoids in each class based on their mass spectra. Step-wise identification of flavonoid classes is based on a UV-Vis spectral library compiled from 146 flavonoid reference standards and a novel chemometric model that uses step-wise strategy and projected distance resolution (PDR) method. Further identification of the flavonoids in each class is based on an in-house database that contains 5686 flavonoids analyzed in-house or previously reported in the literature. Quantitation is based on the UV-Vis spectra. The step-wise classification strategy to identify classes significantly improved the performance of the program and resulted in more accurate and reliable classification results. The program was validated by analyzing data from a variety of samples, including mixed flavonoid standards, blueberry, mizuna, purple mustard, red cabbage, and red mustard green. Accuracies of identification for all samples were above 88%. FlavonQ-2.0v greatly facilitates the identification and quantitation of flavonoids from UHPLC-HRAM-MSn data. It saves time and resources and allows less experienced people to analyze the data.

Development of Predictive Models for Food Safety

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Abstract

Food safety has been recognized by many governments worldwide as a major problem, threatening consumer health and creating trade barriers. Substantial resources have been invested in national and regional initiatives (e.g. research, regulation etc.) to improve food safety standards with the aim of identifying food safety risks and facilitate pro-active intervention.

As many factors, inside and outside the food production chain (such as human behavior, trade, climate, regulation, technology, etc.) may have direct and/ or indirect influence on the emergence and development of food borne hazards a systemic approach that includes these variables may result in a true predictive system for the identification of an emerging food safety risk in an early stage.

In our research, we have explored the potential of Bayesian Network (BN) to integrate factors influencing the food supply chain to predict the occurrence of food safety hazards and to study interrelationships between these factors. Several BN models were developed for prediction of food fraud type, food safety hazards on fruit and vegetables and food safety hazard potential of nanoparticles. In general, high prediction accuracy was obtained (70-95%) and the models allowed scenario studies. The developed BN models demonstrate how expert knowledge and data can be combined within a model to assist risk managers to better understand the factors and their interrelationships.

Innovative Modeling Approaches for the Quality and Microbial Safety of Leafy Greens

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Abstract

Leafy greens are highly susceptible to microbial contamination as they are minimally processed. Also, leafy greens have quality issues as those are of highly perishable commodity. Considering the microbial safety and quality concerns, a computer model was developed to optimize the maximum temperature for leafy greens during the supply chain considering the cost of refrigeration, sensory quality parameters, and microbial safety. Results indicate that pathogen growth is of more concern than loss of sensory quality in fresh-cut Iceberg lettuce when considering a shelf-life of up to two days. Furthermore, to understand the pathway of *E. coli* O157 : H7 in leafy greens production, a complex system model simulating a hypothetical farm was developed consisting of subsystems (soil and plant), inputs to the system model that affect the subsystem (irrigation, cattle, wild pig, and rainfall), harvested crop as the output of the system, and contamination in the soil at the time of harvest as the feedback, i.e., it would affect the soil conditions for the next crop. Results indicate that the seasonality of *E. coli* O157:H7 associated leafy greens outbreaks was in good agreement with the prevalence of this pathogen in cattle and wild pig feces. The developed models have their significance in predicting the optimized storage temperature in the supply chain of leafy greens and in providing a better understanding of the seasonality in *E. coli* O157:H7 outbreaks associated with leafy greens.

Exometabolomics of Tomato Fruit and Identification of Fatty Acids that Impair *Salmonella* Growth

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Abstract

Foodborne illness-causing enteric bacteria can able to colonize plant surfaces without causing infection. We lack understanding of how epiphytic persistence of enteric bacteria occurs on plants, possibly as an adaptive transit strategy to maximize chances of re-entering herbivorous hosts. Plant genotype influences bacterial colonization, and various tomato (*Solanum lycopersicum*) cultivars exhibit differential susceptibilities to colonization by the enteric pathogen *Salmonella enterica*. Plant surface compounds and exudates on *Salmonella* collected at different developmental stages supported growth of *S. enterica* to various degrees in a cultivar and plant organ dependent manner. Correlation of *S. enterica* growth in fruit exudates of various cultivars with epiphytic growth data provides evidence that plant surface compounds drive the pathogen's colonization success. Chemical profiling of tomato surface compounds with gas chromatography time-of-flight mass spectrometry (GC-TOF-MS) yielded information about the metabolic environment on fruit, shoot and root surfaces, revealing quantitative differences in phyto compounds by plant anatomical structures and among cultivars, and changes over a developmental course and by plant organ. Differences in sugar, sugar alcohol, organic acid and fatty acid profiles provide insights on the metabolic interactions between tomato and epiphytic *Salmonella*. An exometabolomic approach can elucidate interactions between human pathogens and plants that could lead to strategies to identify or breed crop cultivars for microbiologically safer produce.

Effect of Cold Plasma Treatment on Cuticle and Microbial Load in Kale (*Brassica oleracea* var. *sabellica*)

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Abstract

Kale leaves are consumed worldwide because of their health promoting and nutritional benefits. However, in the past two decades, there has been an increase in foodborne disease outbreaks caused by microorganisms associated with leafy vegetables. The food industry faces challenges in improving food safety while maintaining quality of the food. Cold plasma technology, an emerging food preservation process, is a fast and environmental--friendly process that operates at a temperature range of 30 - 60 °C and uses an ionized gas comprised of charged ions and free electrons called plasma for treatment of produce. Research has reported that plasma technology kills microorganisms by altering their metabolic pathways. However, this technology may modify biological chemistry and physical surface properties of the food product. Till date very little research has been focused on the effect of cold plasma on the quality of fresh produce. The purpose of this study was to evaluate the efficacy of cold plasma technology on reducing the microbial load and investigate the chemical (fatty acid composition) and physiological changes (cuticular structure and covalent bonding) in cuticle of the treated kale. Results from the study will be presented in this presentation.

Grazing on Mediterranean Shrubland and *Salvia lavandulifolia* Vahl. Byproducts: A Good Combination for Improving Lamb Welfare and Meat Quality

María J. Jordán[1]*, Leticia Mateo[2], Cristina Martínez-Conesa[1], María Qílez[1], Inmaculada García-Aledo[1], José A. Sotomayor[1], Jordi Ortuño[2], Julio Otal[2] and Sancho Bañón[2]

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Abstract

Segureña sheep, a breed from south-eastern Spain, is mainly exploited for meat production in both indoor as outdoor rearing systems. In this geographical area, pasture resources are basically the by-products of cereal crops (straw, fallow lands and poor harvests) and wild shrub communities. At the same time, as a complement to local incomes, the cultivation of aromatic and medicinal plants is a traditional practice in this region, which generates a variety of plant sub-products. The interactions of these factors (sheep, shrub land and aromatic plant by-products) might be considered a good basis of natural feeding and animal wellbeing, which could lead to a differentiated lamb meat quality. Sage (*Salvia lavandulifolia* Vahl.) distillation by-product (SDB) from the essential oil industry is a source of polyunsaturated fatty acids (PUFAs) and polyphenol antioxidants (rosmarinic, salvianic and salvianolic acids, among others). Accordingly, the main goal of the present study was to determine whether the combination of grazing during pregnancy and lactation plus supplementation of the lamb diet with SDB improves the endogenous and exogenous antioxidant systems of the lambs and the subsequent meat quality. The main results pointed to the positive effects of both dietary treatments on the lamb antioxidant enzymatic cascade (SOD; GSH-Px; CAT), the antioxidant capacity of plasma ($ABTS^{\bullet+}$) and meat quality (intramuscular fat, total PUFA and n-6 PUFA). Therefore, exploiting aromatic plant by-products for animal feeding within a natural and sustainable environment seems a promising strategy that could contribute to improving both animal welfare and meat quality.

Designing Novel Technologies to Improve Food Safety and Shelf Life

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Abstract

Designing new approaches to inhibit microbial food contamination while maintaining quality, freshness, and safety are required. In the current era we need to design novel approach to prevent food loss. One potential approach is to design bioactive packaging to extend food shelf life. Microorganisms are among the major causes of food spoilage, which results in food loss

and health risks worldwide. The shelf life of pasteurized bovine milk is limited by microorganism activity. In my talk I will present how we identified pasteurized bovine milk associated mesophilic and psychotropic bacteria using Matrix assisted laser desorption ionization time of flight mass spectrometry (MALDI). The identification was very rapid, accurate and simple. Most frequent bacteria were belong to Bacilli family. Antimicrobial peptides are potential candidates for integration in bioactive food packaging. We have designed inexpensive and easy to synthesize, random cationic peptide mixtures that possess strong antimicrobial activity. These agents were able to eradicate very efficiently the identified pasteurized bovine milk associated bacteria. Currently we are developing chemical technologies to immobilize these active compounds on several surfaces to obtain bioactive surfaces that might be used for food packaging or food processing surfaces. Our findings emphasize the potential use of MALDI as an efficient identification method of food associated bacteria and the use of peptidic agents to prevent bacterial growth to improve food safety and shelf life.

Hardened Beans - One Man's Trash, Another Man's Treasure

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Abstract

Beans supply a significant amount of protein for a great part of the world population, especially in poor countries. Although it's excellent nutritional profile, the common bean (*Phaseolus vulgaris* L.) may deteriorate as a consequence of time and storage under the high temperature and high humidity prevalent in tropical countries. This deterioration is characterized by changes in the texture, flavor and an increase of the cooking time due to the hardening of the bean grains: The Hard-to-cook (HTC) phenomenon. Considering their high global productivity, the amount of hardened beans generated is significant, reaching values near to 500 thousand ton/year in Brazil. In spite of HTC beans preserve part of their nutritional quality; they are normally used as animal feed. To use HTC beans in human nutrition, some approaches have been explored. Extrusion cooking and autoclaving showed to be promising alternatives to recover the nutritional value and bioavailability of proteins and carbohydrates, as well allow the use of HTC beans as component for: culture medium, bread and cookie formulations, and source of bioactive compounds. Although bioactive compounds had been found in HTC beans, the thermal treatments resulted in an enhancement of the bioactivity, mainly those related to antioxidant, metal-chelating and vasorelaxant activities. Considering the high productivity of beans worldwide and their high nutritional value, efforts should be made to reduce their use just as component of feed and promote their reincorporation into the human nutrition, especially facing the perspective of food deficit in the future.

Spectrophotometric Determination of Molybdenum Containing Composition in Aqueous Solutions of Glucose using a Pyrazine 2, 3 Dicarboxylic Acid

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Abstract

In this research work the spectrophotometric determination of molybdenum contents in aqueous solutions of glucose using a pyrazine-2, 3-dicarboxylic acid has been investigated. The reaction proceeds until the formation of an intensive violet solution by the reduction of hexavalent molybdenum in aqueous hydrochloric acid in the presence of a sufficient amount of pyrazine-2, 3-dicarboxylic acid (chelating agent) with tin(II)-chloride solution (reducing agent) resulting in the formation of the complex of pyrazine2, 3 dicarboxylato-tetrachloro-molybdenum (IV) acid [1].

A Hewlett Packard HP 8453 UV-Visible spectrophotometer equipped with a quartz cell was used for absorbance measurements. The determination of the molybdenum complex was performed at λmax = 550 nm. Applying this analysis, the quantitative determination of small amounts of molybdenum in the range of 1 to 22 µg/ml is possible in the presence of glucose.

In aqueous solutions it is possible to obtain the following results: (i) measurement of different molybdenum containing compositions; (ii) the light absorption of the intensive violet complex compound follows Lambert-Beer´s law; (iii) presented method is very sensitive with a molar absorptivity in the range from 4414 to 9020 [l/mol*cm]; (iv) the presented method shows good reproducibility of results for the extinctions values.

Reference

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Acrylamide Mitigation in Chilean Bread "Hallulla" by using Asparaginase Treatments: Effect on its Sensorial Attributes

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Abstract

Foods rich in carbohydrates cooked at high temperatures generate potentially toxic compounds such as acrylamide, which is studied as carcinogenic and genotoxic compound to humans (2A) and whose main precursor is the amino acid asparagine. The aim of this study was to develop "hallulla" bread with added asparaginase in order to reduce the levels of acrylamide after baking while preserving its original sensorial characteristics.

Acrylamide content was determined by gas chromatography-mass spectrometry (GC-MS) in the bread samples in triplicate. It was determined that the level of acrylamide present in the control bread was 108 µg/kg. A concentration range of 20-300 ppm of asparaginase enzyme/kg of flour was evaluated, with the optimum range of 100 to 150 ppm of enzyme/kg of flour, reducing the amount of acrylamide between 80% and 99%, respectively. A trained panel assessed the sensory quality and descriptive profile of bread made with enzyme asparaginase (300 and 150 ppm enzyme/kg of flour) and the control bread formulation.

The results showed that the sensory quality was rated as grade 1, without significant differences ($p \leq 0.05$) between the control bread and bread made with asparaginase for the color, appearance/shape, aroma, flavor and texture attributes. Similar result was obtained with the descriptive profile since there was no significant difference ($p \leq 0.05$) between samples for color crust, fermented aroma, roasted/burnt aroma, touch hardness, elasticity crumb, hardness mouth, taste fermentation / yeast and toasted flavor descriptors. The manufacture of hallulla bread with the addition of asparaginase proved to be a successful method to mitigate acrylamide in the final bread, obtaining almost a complete reduction of acrylamide while maintaining the original sensory characteristics of bread.

Detection of Antibiotic Residues in Animal-derived Food Based on Immunoassays

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Abstract

Antibiotic-overuse is a global problem, especially in livestock industry and hospitals, it leads to antibiotic residues in the host, food and environment, thereby has been considered as serious issue in food safety. Under such conjunction, sensitive, quick, simple detection methods or reagents are needed. Rapid detection means that the results of test can be made out in a short time, including sample preparation. Rapid detection can be divided into three kinds: microbiological detection, chemical and physical testing and immunoassay. Immunoassay, a quick analytical technique for generating and measuring signals related to the presence or concentration of analytes, is applied immunology theory to design a series of determining antigens, antibodies and immune cells and cytokines secreted by experimental method. Different approaches can be used to classify/characterize immunoassays:

1. Enzyme-Linked Immunosorbent Assay (ELISA) is the most widely used immunoassay, including indirect ELISA, Dual-Colorimetric Enzyme-Linked Immunosorbent Assay (DC-ELISA);
2. Chemiluminescent immunoassay: Chemiluminescence enzyme immunoassay, Multiplex chemiluminescent immunoassay, Chemiluminescence Resonance Energy Transfer Competitive Immunoassay.
3. Fluorescence polarization immunoassay (FPIA).
4. Enzyme-multiplied immunoassay technique (EMIT).
5. Lateral flow immunoassay: Multiplex lateral flow immunoassay.
6. Phage display-mediated immune-polymerase chain reaction (PD-IPCR).

The focus of immunoassay is to properly represent, enlarge and record the signal of antigen-antibody reaction in qualitative and/or quantitive way. There is a huge demand for the detection reagent of antibiotic residues on the market, and it gradually becomes the intrinsic driving force of the development of industry.

Analytical Chemistry, Formation, Reduction, Toxicology, Internal Exposure and Chemoprevention of Acrylamide

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Abstract

The analytical chemistry, formation profile, kinetic elucidation, quantitative structure-activity relationship (QSAR), chemoprevention and *in vivo* exposure of acrylamide have been investigated since 2004. The main outcomes include: (i) The simultaneous UHPLC-MS/MS analysis of Maillard reaction products of acrylamide and mercapturie acid metabolites have been established. (ii) The inhibitory effect of flavonoids on the formation of acrylamide and its association with antioxidant properties has been demonstrated. (iii) The impact of flavonoids on the kinetics of acrylamide has been revealed. (iv) Factors contributing to the inhibitory effect of flavonoids, including number and position of aromatic hydroxyls, presence of C-glycosides and spatial topological structure, have been indicated using QSAR modelling. (v) The cardiac developmental toxicity of acrylamide was discovered in zebrafish; (vi) The internal exposure of acrylamide and glycidamide in rats and humans has been investigated. In summary, systematic outcomes on the presence of acrylamide in food have been achieved via our 13-year investigation, which points out the direction of food safety chemistry researches.

Detecting the Lactose Content of Skim Milk Powder using Dielectric Spectroscopy

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Abstract

The US production of nonfat dry milk (NFDM) powder is estimated around 1 million metric tons annually [ThinkUSAdairy.org] and in 2016 the US exported about 15% [nmpf.org] of this amount. The average components in NFDM by weight are 36% protein, 7.9% ash including minerals, 2.8% moisture, 0.5% fat and 52% lactose in other skim milk powder (SMP) forms, the content of the components vary considerably. Milk powder samples were obtained from three suppliers where the lactose content ranged from 1% to 85%. In practice, the lactose content is often determined by the difference method where the content of the other compounds is summed and the remainder ascribed to the lactose content. Standard methods used for determining lactose content are infrared, gravimetry, enzyme and HPLC; these methods are not in routine use because of expense. Thus, there is a need to develop a rapid, low-cost method for determining the lactose content of SMP. A methodology is being developed to determine the lactose content using dielectric spectroscopy. In this method, the peak frequency of the phase angle spectra (or the loss peak) was found to be very sensitive to lactose content. For SMP samples, peak frequencies range from 10 milliHz for the low-lactose samples to 0.5 MegaHz for the high-lactose samples. Key to the method is control of the temperature and relative humidity (water activity) during measurements. Also important is transforming spray dried samples from the amorphous state through glass transition and rubbery state to the crystalline state where they are in a thermodynamically stable state. In the crystalline state, data were analyzed using the Eyring double-potential well model which leads to activation energies (enthalpies) and water-activity coefficients for each sample. The dependence of the lactose content on peak frequency is explained by invoking the thermodynamics of mixing between the lactose and protein components. In this presentation, the apparatus will be described as well as the data and the data analysis.

Antioxidant and *In vitro* Apoptosis of Human hepatocellular Carcinoma Cell Lines (HepG2) of Ethiopian Monofloral Honeys

Samuel Melaku[1*], Abera Belay[2], Gulelat Desse Haki[3], Marc Birringer[4], Hannelore Borck[4] and Kaleab Baye[5]

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Abstract

Honey has antioxidant and anti-HepG2 cancer properties. Nevertheless, there are no reports showing the apoptosis effect of marked and extracted bioactive compounds of monofloral honeys. The objective of this study was to study antioxidant property and examine apoptosis effect on HepG2 cancer using nine monofloral honeys as a tool. Melissopalynology and specific rotation were used to determine botanical origin of honey. Solid-phase extraction was used to separate compounds, and injected into thin layer chromatography (TLC). Marked antioxidant compounds were scrapped from TLC and then extracted. These extracts applied to HepG2 cells in increasing concentrations. Cell viability decreased in a dose-dependent manner. *Syzygium guineense* (0.71 mg/mL) and *Schefflera abyssinica* (3.31 mg/mL) had higher and lower IC50, respectively. Linear regression Collinearity indicated the effect of flavonoid on HepG2 cells. Different monofloral honey showed diverse chemo-preventive effect on Hep G2 cancer cells. Thus, the bio-functionalities of honey depends on honey origin that need further investigation.

Chilean Honey: Botanical Origin Related to their Antioxidant and Antibacterial Activities

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Abstract

Honey chemical composition is related to the plant species where nectar is collected by honeybees. Chilean beekeeping is characterized by a variety of honey types, some unique, due to a high participation of endemic and native species. In Chile, the most emblematic flower honey, both for its abundance and sensory characteristics is ulmo honey (*Eucriphya cordifolia*) and quillay honey (*Quillaja saponaria*). Melissopalynological analyses are used to establish whether a honey is unifloral, where at least 45% or more pollen grains found in it belong to the same species. The antioxidant and antimicrobial activities of Chilean honey have been studied in the last years with excellent results. *Quillaja saponaria*, *Eucriphya cordifolia*, *Azara petiolaris* (corcolen) and *Retanilla trinervia* (tevo) are within the Chilean endemic species that produce unifloral honeys that show antioxidant potential and antibacterial activity against pathogenic gram positive and gram-negative bacteria and also multi-resistant strains. These activities are mainly attributed to the phenolic compounds such as flavonoids. A wide range of phenolic constituents are found in Chilean honey such as caffeic acid, coumaric acids, quercetin, rutin, luteolin, galangin, chrysin, pinocembrin, pinobanksin, and apigenin. Moreover, we found an important presence of abscisic acid, a plant hormone related to the protection of plants in environmental stress conditions, which has been detected in corcolen and quillay honeys.

Manuka Honey: The Hunt for Unique Chemical Markers to Determine Authenticity

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Abstract

Manuka honey from New Zealand commands a high premium on international markets compared to the other honey types. This high premium has resulted in the production of counterfeit Manuka honey where non-Manuka honey is either mislabeled or adulterated. There is therefore an urgent need to develop and implement robust methods for Manuka honey authentication. Unfortunately, levels of the compound, methylglyoxal, the component predominantly responsible for the non-peroxide antimicrobial activity of Manuka honey changes over time and with heat treatment. Consequently, methylglyoxal together with its precursor substrate, dihydroxyacetone, have limited utility as authentication standards. In this presentation I'll describe our research into two other chemical markers, leptosperin and lepteridin, that are specific to nectar harvested from the *Leptospermum scoparium*. Both these compounds are stable in Manuka honey and display unique fluorescent signatures that are not present in non-leptospermum honeys. We have utilized these features together with other quantification techniques to show that these compounds can reliably distinguish Manuka honey from non-leptospermum honeys. Our findings strongly suggest that these compounds can be incorporated into current testing regimes to ensure high quality control standards for Manuka honey.

Flours Produced from Buriti (*Mauritia flexuosa* L.f.) Processing Residues: Evaluation of Dietary Fiber and Antioxidant Capacity

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Abstract

Buriti is a fruit native to Brazil, whose oil is used by the cosmetic industry, generating residues such as shells, endocarp and bran (defatted pulp). The objective of this study was to investigate whether such residues are good raw materials for the preparation of high dietary fiber flours, associated with antioxidant compounds. Flours were produced by drying, milling and sifting the residues. We evaluated the nutritional composition, insoluble and soluble dietary fiber contents, neutral sugars, antioxidant activity (DPPH and FRAP), extractable polyphenol (Folin-Ciocalteu) and nonextractable proanthocyanidins contents of samples. The prepared flours presented moisture lower than 9%, low lipids and protein contents and high total dietary fiber content (50-89 g/100 g). The shells and bran showed higher content of insoluble dietary fiber (81-88 g/100 g). Soluble dietary fiber ranged from 0.9 (shells) to 2.7 g/100 g of dry matter (endocarp). The predominant monosaccharides were xylose (shells), glucose (endocarp) and arabinose (bran). Other monosaccharides were also identified with lower expression, such as manose, galactose, deoxyribose and fucose. The identification of these monosaccharides allows inferring the presence of hemicelluloses (such as xyloglucans and mannans) and pectic polysaccharides. The shells showed the highest antioxidant activity and the endocarp the lowest. Total extractable phenolics ranged from 0.9 (endocarp) to 9.3 (shell) mg EAG/g. The nonextractable proanthocyanidins contents were significantly higher, being only smaller than grape residues. Results show that buriti residues have potential to be utilized in the preparation of fiber-rich flours with antioxidant capacity.

Herbal Discovery Platform Supporting the Chemical Analysis and Natural Analogue Discovery of Food Ingredients

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Abstract

With the global increase in the demand for natural products, there is a call for ensuring the quality and safety of them using several modern analytical techniques. Chemical constituents in plants may vary depending on harvest seasons, plant origins, drying processes, and other related factors. Therefore, it seems to be necessary to determine most of the phytochemical constituents of herbal products in order to ensure the reliability and repeatability of pharmacological and clinical research, to understand their bioactivities and possible side effects so as to enhance the quality of the herbal products. In order to tackle the challenges of molecular synergism in nature, and the lack of experimental data Envision Biotechnology builds Herbal Discovery Platform based on relationships between herbal chemical components and molecular targets, and human effects.

In this presentation we demonstrate the applicability and the development of a unique and novel Herbal Discovery Platform that is dedicated for the analysis of multidisciplinary herbal data and implements state of the art scientific informatics modeling opening new doors for the discovery and development of new natural analogues of food ingredients from herbal resources and offers the understanding of their physiological effects.

Visual Microarray for Multiplexed Antibiotic Residue Detection

Danke Xu

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Abstract

A visualized microarray sensing technique has been developed and applied to the screening of various animal-derived food such as honey, meat, aquatic and dairy products for residues antibiotics. Using a multiplexed approach, antibiotics and internal biological toxins could be detected simultaneously. In this case, the individual antigens were spotted onto 96-well plates and an indirective competitive assay format with visualized signal response was employed. The presented method possesses the

characteristics of being high-throughput, multiplex, intelligent and low cost with proprietary intellectual property rights. This microarray method possesses the potential to be a fit-for-purpose screening technique in the arena of food safety monitoring.

Functional Proprieties and Adsorption Isotherms of Commercial Carrots Fibers Incorporated in Foods Industries

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Abstract

Currently several innovative applications are investigated in foods industries. Among these applications we noted those of natural dietary fibers, both soluble and insoluble, vegetables or fruits origin. The dietary fibers are often introduced in many foods industries. The main objective of this study was to investigate the functional proprieties of commercial carrots fibers. Optimization of the effects of some factors such as temperature, ultrasound power and time on the water and oil absorption capacity, was also investigated using Response Surface Methodology. On the other hand, the adsorption isotherm of carrots fibers was studied at 25 °C and 40 °C to determine the monolayer moisture contents using GAB equation.

The results of Analysis of Variance showed that the ultrasonic power have a significant effect on the oil and water absorption. The GAB equation which showed a good fitting to experiments data (98%; P<10%) was used to calculate the monolayer moisture. The isosteric heat was determined by application the Clausius – Clapeyron equation.

Enhancing the Carotenoid Content of Spaghetti Squash Ten-fold and More

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Agricultural Research Organization, Israel

Abstract

Spaghetti squash, *Cucurbita pepo* L. (Cucurbitaceae), is an increasingly popular low-calorie substitute for pasta. However, the original spaghetti squash, 'Vegetable Spaghetti', is pale in color, both outside and inside, and hence low in carotenoid content. The pale fruit color of this cultivar derives from its being homozygous recessive for four gene loci affecting fruit coloration. With the purpose of enhancing fruit color and carotenoid content, the dominant alleles of these four genes were introgressed from zucchini squash (*C. pepo*) into 'Vegetable Spaghetti', through six backcross generations. These four dominant alleles were B (Bicolor), D (Dark stem), L-1 (Light type 1 coloration), and L-2 (Light type 2 coloration). Subsequently, the various genotype combinations made possible by the introgression of each of these four genes were selected out, to determine the contribution of each gene individually and in various combinations to increased carotenoid content. The total carotenoid content of the fruit flesh of 'Vegetable Spaghetti', b/b d/d l-1/l-1 l-2/l-2, was quite low, 1.6 micrograms per gram of fresh weight. Acting alone, B, D, and L-1 had no significant effects on carotenoid content of the fruit flesh, but L-2 doubled the carotenoid content to 4.0. The combination of B and L-2 resulted in intense orange, instead of pale, fruit-flesh color and an 8- to 15-fold increase in carotenoid content. This effort resulted in the development of the hybrid spaghetti squash, 'Orangetti', genotype *B/B D/d L-1/l-1 L-2/l-2*, which has an orange rind and orange fruit flesh containing 15-fold higher carotenoid content than 'Vegetable Spaghetti'.

Phenolics, Antioxidant capacity and Bioaccessibility of Chicory Varieties (*Cichorium* spp.) Grown in Turkey

Yasemin Sahan[1], Ozan Gurbuz[1*], Metin Guldas[2], Nurcan Degirmencioglu and Aynur Begenirbas[1]

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[3]*Bandırma Onyedi Eylul University, Bandırma Vocational School, Department of Food Processing, Turkey*

Abstract

In this study, the changes in phenolics, anthocyanin, antioxidant capacity, and bioaccessibility of chicory varieties (*Cichorium*

spp.) in Turkey were investigated. A total of 19 phenolic standards were screened in the chicory varieties studied and the most abundant compounds in the samples, extracted with methanol, were phenolic acids, syringic (2.54 mg/kg) and trans-ferulic acid (1.85 mg/kg), whilst (+)-catechin was the major flavanol. The highest flavanol content using either methanol or ethanol was determined in the green chicory samples (0.62 mg/kg). The red chicory variety had higher anthocyanin (12.80 mg/kg), and contained more phenolics, extractable (8855.50 mg GAE/100 g) and hydrolysable (7005.51 mg GAE/100 g), than the other varieties. Also, the antioxidant capacities in this variety, as measured using the CUPRAC assay (570.54 and 425.14 l mol Trolox/g dw, respectively), had a wider range of difference than was found in the other assays used. Total phenolics were more bioaccessible from the white chicory variety (61.48%). However, the bioaccessibility of antioxidants was higher in the green chicory variety.

Spirulina platensis as Food Supplement and its Health Benefits

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Abstract

Spirulina has been used for many years as food supplement since it has high protein content and nutritional value. Cyanobacteria (blue-green algae) are photoautotrophic microorganisms which are widely distributed in nature. Spirulina is the best-known genus of Cyanobacteria because of its unique nutritional properties. It has been proved that consumption of Spirulina is beneficial to health due to its chemical composition including compounds like essential amino acids, vitamins, natural pigments, and fatty acids, especially w-6 representatives such as g-linolenic (GLNA) acid, a precursor of the prostaglandin hormones in the body. In addition to high quality proteins, it contains high amounts of calcium, vitamin B12, Vitamin A, B2, B6, E, K and H, and many essential minerals and enzymes. Spirulina is also very rich in terms of iron content. In addition to nutritive properties, Spirulina as powdered form has been used in the food products as microbial growth factor for probiotic microorganisms in recent years.

Antioxidant Properties of Baby Foods Containing Fruit in Turkey

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Abstract

Antioxidants are both from natural and synthetic compounds that can interact with free radicals and terminate the chain reaction before vital molecules are damaged. The effect of these compounds depends on their chemical characteristics and physical location within a food. Antioxidants have protective effect against diverse disease, such as metabolic, neurodegenerative, cardiovascular, mitochondrial diseases and even cancer. In addition, they play an important role in food preservation by inhibiting oxidation processes. Adequate nutrition is essential to ensure the growth, health and development of children during infancy and early childhood. In recent years, commercial ready-to-eat fruit baby jars have become an important part of baby food due changes in lifestyle. These foods are sometimes the main source of food for consumption by infants and young children. The aim of this study was to investigate total phenolic content, antioxidant activities and their bioaccessibility of ready-to-eat fruit baby foods. Also, the assays of total phenols and antioxidant activity are used two different extraction (extractable and hydrolysable) methods. In addition, for the determination of bioaccessibility, samples were processed by an *in vitro* digestive enzymatic extraction that mimics the conditions in the gastrointestinal tract. *In vitro* digestion procedure was applied using pepsin and pancreatin enzyme solutions after central composite design to optimize enzyme amounts. Total polyphenol content was analyzed using Folin–Ciocalteau assay and antioxidant activities were assessed by CUPRAC, ABTS and DPPH methods. The study showed that ready-to-eat fruit baby foods have good sources of antioxidant compounds. CUPRAC method was more capable of determining antioxidant activity than others methods.

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In vitro Digestion of the Bioactive Compounds of Fermented Vegetable Juice

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[2]*Uludag University, Turkey*

Abstract

An *in vitro* model simulating gastro-intestinal (GI) digestion, was adapted to assess phenolic compounds from watermelon radish (R), red beet (RB) and black carrot (RC) juices fermented using *Saccharomyces cerevisiae* and *Saccharomyces boulardii*.

The total phenolic content, the antioxidant capacity and viability of microbiota was investigated in terms of bioaccessibility, and sensorial evaluation of products were performed. Results indicated that *S. cerevisiae* (78.10-83.87%) and *S. boulardii* (78.40-90.25%) showed higher viability compared with lactic acid bacteria, fermented by *S. cerevisiae* and *S. boulardii*, respectively. Cyanidin-3-O-glycoside chloride was only present at high concentration (1549.86-1774.86 mg/L) in black carrot juice, whereas vanillic acid was detected in all fermented vegetable juices. The high antioxidant activity of RC juices fermented by *S. boulardii* were associated with increased concentrations of total phenolic compounds, whereas higher the bioaccessibility of antioxidant activity was measured for fermented RB juices.

Long-Term Dietary Intake of Kale Extract Attenuates Cognitive Impairment in Senescence-Accelerated Mouse Prone 8

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Abstract

Dietary interventions have been proposed as an effective way to prevent age-related senescence. Here, we investigated the potential preventive effect of a dietary supplementation with kale (*Brassica oleracea* var. *acephala*) extract on age-related cognitive impairment in the senescence-accelerated mouse prone 8 (SAMP8) mouse. SAMP8 mice were fed a diet containing 1.0% (w/w) kale juice powder or its phenolic acid fraction, or a control diet for 32 weeks, and cognitive performance was examined using the Y-maze, step-through passive avoidance test, and Barns maze. Oral administration of the kale-derived phenolic acid fraction for 20 and 28 weeks improved working memory in the Y-maze test compared with a control, whereas the crude extract remained unchanged. Similar result was observed in the passive avoidance test, and the step-through latency was improved by the oral administration of the phenolic acid fraction for 32 weeks. Further, the phenolic acid fraction improved spatial and learning memory performance on the Barnes maze. These findings suggest that long-term dietary kale supplementation can attenuate age-related cognitive decline in SAMP8 mice and the phenolic acids in kale extract contribute to their effects on cognitive performance.

Correlation of Volatile Compound Concentrations with Microbial Counts in Whole Pasteurized Milk under Various Storage Conditions

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Abstract

Off-flavors caused by microbial volatile organic compounds (MVOCs) are often used as early indicators of milk spoilage. The objective of this study was to examine the relationship between increased bacterial counts and VOC formation in whole (3.9% fat) milk for milk stored at 19, 15, 12, 10, and 7 °C (±1 °C). Formation of VOCs was measured using solid-phase micro extraction (SPME) with gas chromatography. Microbes were enumerated using aerobic plate and psychrotrophic counts. Lipolysis activity was monitored throughout the shelf life study. Microbiological data was well correlated with both off-flavors and GC/MS data. The VOCs increased with bacterial counts of 105-107 CFU ml^{-1}. The bacterial counts correlated well with

VOCs such as acetaldehyde, butanone ethanol, hexanal, acetone and fatty acids. Protease and lipase activity increased and correlated well with the VOCs. Formation of VOCs was detectable when lipase activity reached 0.32 to 0.350 meq of FFA/ml.

Microbial Community Analysis of Green Coffee Beans Across Growing Regions and Qualities

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Abstract

Coffee is considered a global dietary staple due to its longstanding cultural significance, ritualistic norms, and stimulating caffeine content. There are many varieties of coffee grown throughout the world, each having its own unique flavor profile determined by the type of seed planted and the subsequent production process. We hypothesize that the fungal and bacterial endophytes present in each bean make a significant contribution to the flavor in the finished product. Further, we hypothesize that the endophyte communities correlate with the location of origin or specific bean defects. Each type of defective bean is partially sorted out during harvest, as the presence of more than a minimal percentage of defective beans can have a negative influence on the coffee's flavor when brewed. We aim to identify differences between the endophyte communities of green coffee beans from three different geographical and varietal sources, and of six different defect categories, to determine which taxa are correlated with each category. We are now using selected microbes in a fermentation and sensory evaluation study to assess their impacts on flavor taste qualities. This study will not only give us a profile of the microbial communities present within green coffee, but will also elucidate potential sources of flavor-altering factors that may be commercially used to enhance coffee quality.

Lipophilic Green Tea Polyphenol (P-EGCG, and EGCG-S) as Potential Food Preservatives

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Abstract

Food safety is an important issue for the food industry and consumers. The increasing use of food additives also has become a matter of public health and administrative concern. Scientists have tried to develop natural food additives to prevent food spoilage and reduce the possible side effects of chemical preservatives. This research study will focus on three potential new food preservatives, epigallocatechin gallate (EGCG), epigallocatechin-3-gallate-stearate (EGCG-S), and polyphenols epigallocatechin (P-EGCG), which are purified and modified from green tea. EGCG, and P-EGCG has been proved to be safe additives for food in China. Therefore, the objectives of this study are as follows: (1) The stability of EGCG, P-EGCG, and EGCG-S at acid and high temperature conditions; and (2) Whether all the extracts can influence the vitamin C content of orange juice. The results indicated that P-EGCG, and EGCG-S were stable across the entire temperature range tested (25 °C - 68 °C) both in nutrient broth and homemade pure orange juice conditions (pH4). EGCG became unstable at 55 °C and inactivated at temperature 68 °C. However, P-EGCG, and EGCG-S inhibited bacterial growth 100% at high temperature and in pasteurized orange juice (acid juice environment). The extract did not affect the vitamin C level in orange juice. The 24 h vitamin C oxidation rate of the juice, with nothing adding, EGCG, P-EGCG and EGCG-S were 18.78%, 10.16%, 3.40%, and 10.00%. In summary, P-EGCG and EGCG-S were stable at high temperature and acid condition. Also, they had better activity than EGCG for reducing the oxidant rate of vitamin C the juice.

Epigallocatechin Gallate (EGCG) as a Food Additive for Chocolate and its Effect on *Streptococcus mutans*

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Abstract

Dental caries is one of the most undermined chronic diseases and *Streptococcus mutans* is its most prominent contributing bacterium. Most processed foods contain a high amount of sucrose. *Streptococcus mutans* metabolizes this nutrient to demineralize the tooth's surface, which leads to tooth caries. This study focuses on whether green tea polyphenols epigallocatechin gallate (EGCG), and/or its modification forms, palmitoyl-epigallocatechin gallate (P-EGCG) and epigallocatechin-3-gallate-stearate (EGCG-S), can reduce the number of *Streptococcus mutans* in different concentrations of sucrose. A viability study was carried out by using a colony forming unit assay. The inhibition rate of EGCG was 71%, EGCG-S was 98%, and P-EGCG was 89%. The results indicated that the three polyphenols were efficient in inhibiting *Streptococcus mutans* up to 0.17 ounces of sucrose per 100 ml of artificial saliva. A further study was also carried out to evaluate if EGCG, P-EGCG and/or EGCG-S could be used as a food additive for cavity-causing foods and if they would be able to inhibit the growth of bacteria on the tooth's surface. Dark chocolate was used in this experiment. The results indicated that the three green tea polyphenols were effective in reducing *Streptococcus mutans* with an inhibition rate of 92%. This study suggests that EGCG, EGCG-S, and P-EGCG have the potential to be used as a food additive for chocolate.

A Grey Forecasting Model of Rainfall in Vietnam

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Abstract

Vietnamese farmers have to deal with increasing difficulties and requirements as agriculture-related economic problems associates with crop over-production, cost increase of energy-based inputs and farmer's income cutback. In addition, the agricultural economy is greatly influenced by key features of climate such as temperature and rainfall, particularly because they contribute to the production of food, conservation of resources, and improvement of soil fertility. Furthermore, requirements of global sustainability such as resource conservation, protection of environment, and farming in partnership with nature are in urgent need since global warming increases the temperature while El Niño on the internal time scale affects the rainfall of the country. The occurrences of natural disasters in Vietnam have increased significantly due to the effect of the climate change, which in turn makes the rainfall unpredictable. Therefore, a design of sustainable agricultural systems is essential at this time. This research proposes a Grey (1:1) model to forecast rainfall in Vietnam. After collecting the data of variables for fifteen meteorological regions of Vietnam during the period of 2012–2015, GM is used to forecast the future values of these variables for the 15 meteorological regions from 2016 to 2019. In this study we present the calibration and validation results from a spatially distributed hydrologic model driven by daily satellite-based estimates of rainfall for sub-basins of the Mekong Rivers flowing to Vietnam. The results of the study will help farmers to develop irrigation plan in order to get best harvest.

Effects of Sun Treatment on the Quantities of Vitamin D and Minerals in Oyster Mushroom (*Pleurotus ostreatus*) Cultivated in Ethiopia

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Abstract

Mushroom consumption is common in South and Southwest Ethiopia but not in central highlands. This study was undertaken to investigate the effects of sun treatment on vitamin D2 and mineral quantities of oyster mushroom (*Plearotus ostreatus*) cultivated in Ethiopia. Vitamin D2 was analyzed using HPLC at Institute of Biological Chemistry and Nutrition. Ca, Mg, Na and Fe were determined by Inductively Coupled Plasma Optical Emission Spectrometry (ICP-OES) but Zn was measured by Inductively Coupled Plasma Optical Mass Spectrometry at Landesanstalt für Landwirtschaftliche Chemie, University of Hohenheim, Germany. Microsoft excel 2013 was used for statistical analysis. In all triplicate measurements, the coefficient of variation (CV) was less than 5%. After sun treatment, the mean (SD) quantity of vitamin D2 was extraordinarily increased from 0 to 3.7 (0.013) mg/100 g. Similarly, the quantity of iron was increased from 104 (4.07) to 221 (6.1) mg/kg. However, the quantities of Mg, Ca, Na and Zn were reduced from 2234 (54.83), 273 (11.72), 131 (3.82) and 95.2 (2.53) mg/kg to 1299 (22.48), 128 (3.51), 100 (1.39) and 50.5 (0.80) mg/kg, respectively. The observed differences in all measurements were statistically significant ($P < 0.05$). In conclusion, sun treatment is the appropriate free energy technology for Ethiopia to synthesize vitamin

D2 from oyster mushroom. Sun treated oyster mushroom has good amount of iron. Despite some loss, the remaining quantities of Ca, Mg, Na and Zn could provide considerable amount of recommended dietary allowances. Therefore, sun treated mushroom has an immense contribution in the fight against hidden hunger in Ethiopia.

Functional Properties of Crackers Supplemented with Turmeric (*Curcuma Longa* L.) and Mahaleb (*Prunus mahaleb* L.) Powders

Elif Yildiz*, Gizem Gungor, Merve Ates, Hatice Yilma and Duygu Gocmen

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Abstract

Due to rapid changes arisen from consumer expectations, the demand on more healthy, natural and functional foods has been increased in recent years. Therefore, different raw materials which have health benefits have been incorporated into cereal products. One of these plant species is turmeric (*Curcuma Longa* L.) containing natural antioxidants and strong yellow pigment. The strong antioxidant activity of turmeric powder derives from the curcumin which is a yellow phenolic pigment. Other remarkable ingredient of bakery products is Mahaleb berries (*Prunus mahaleb* L.) with dark blue or red colors have the highest antioxidant capacities among the common fruits and vegetables. The aim of this study was to determine the possibilities of improving the antioxidant properties of novel snack crackers by supplementing with turmeric powder and mahaleb powder. For this purpose, both powders were used to replace with wheat flour in the snack cracker formulation at two different levels (5 and 7.5%, w/w). In consequence, replacing 7.5% with mahaleb powder increased 3 times, with turmeric powder increased 4 times and multiple incorporation increased 5 times antioxidant activity of crackers. Therefore, turmeric powder and mahaleb powder can be used as an alternative nutritional and functional ingredients in bakery products.

Short-Length DNA Marker for the Determination of Malayan Box Turtle (MBT) (*Cuora amboinensis*) Materials in Food Chain and Traditional Chinese Medicines

Asing* and Md. Eaqub Ali

Nanotechnology and Catalysis Research Center (NANOCAT), Institute of Graduate Studies, University of Malaya, Malaysia

Abstract

Malayan box turtle (*Cuora amboinensis*) (MBT) is a protected species in Malaysia since 2005. It is highly exploited through illegal route for food and medicinal ingredients in Asia. To monitor turtle trafficking, there is a need of a convenient and reliable method for the quantitative tracing of turtle materials in food chain and medicines. For the first time, we developed and validated a short length DNA marker for the quantitative detection of MBT tissues by SYBR green real-time PCR systems. The assay specificity was checked against 20 different species and biomarker stability was tested under various food processing conditions. The target PCR product was validated by sequencing and restriction digestion with Bfa1 endonuclease. The quantification limit (ng) of the assay was 0.00001 for pure meat, 0.0030 ± 0.00001 for binary mixtures, 0.0021 ± 0.00008 for meatball, 0.0042 ± 0.0037 burger and 0.0013 ± 0.00006 frankfurter products. The analysis of 150 reference meat food samples reflected 98.19 to 166.57% target recovery, 92.23-98.15% PCR efficiency and 0.001% LOD under various matrices. A total of 183 commercial meat food products were screened but no turtle contamination was found. Finally, 120 traditional Chinese medicines were surveyed by SYBR Green PCR and 23% of them were found to be MBT-positive (0.00157 to 0.0612 ng/μL), respectively. These authentications provided better security, firstly, through short-length biomarker target which offer extraordinary stability and sensitivity. Thus, the novel assay demonstrated sufficient merit for use in any forensic and/or archaeological authentication of MBT, even under a state of decomposition.

Alternative for Antibiotic uses in Farm Animal Production to Mitigate the Antibiotic Resistance and Make Sustainable Farming

Debabrata Biswas

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Abstract

Due to the consumer's demand and considering the current emerging situation, many countries are in process to withdraw antibiotic use in farm animal production. Before withdrawing the sub-therapeutic antibiotics or restrict the use of therapeutic antibiotics in farm animal production, it is essential to find alternative natural antimicrobials for promoting growth of farm animal and treating animal diseases to make the sustainable farm animal production and produce safer food and measuring the animal welfare. Further, it is also necessary to consider whether that newly developed compound(s) has the potential to trigger the acquisition or loss of genetic materials in zoonotic and any other microbial population in animal gut or in environment. We found that various zoonotic bacterial pathogens gained/developed their ability to survive in the presence of both subtherapeutic and therapeutic antibiotics doses in farm animal gut or farm environment. The mechanism of action of antimicrobial components used in farm animal production in genomic interplay in the gut and farm environment, has also been characterized in my *in vitro* and *in vivo* studies. The risk of promoting the exchange of mobile genetic elements between microbes specifically pathogens needs to control for ensuring sustainable farm animal production, safety of our food and mitigate/limit the enteric infection with multiple antibiotic resistant bacterial pathogens. In my talk, the sustainable poultry farming using berry phenolic extracts (BPEs) from the waste material generated by Juice Company will be focused. Various concentration of BPEs modulate the poultry gut microbiome/microbial ecology, control the colonization of poultry-borne zoonotic pathogens and improve the growth of poultry like synthetic sub-therapeutic growth promoting antibiotics (AGPs) without altering the expression of genes those are related to antibiotic resistance and genomic interplay. In addition, trace amount of BPEs can also trigger more diverse functional genes in the chicken cecum according to the rarefaction plot analysis including genes encoding important metabolic enzymes for carbohydrate and energy metabolism. As we know that berry fruits are native fruits in the US but not available in other countries. In my talk, I will also focus how other countries specifically Asian countries can use their natural resources particularly their common industrial waste and/or agricultural byproducts to replace the synthetic antibiotic uses including therapeutic and sub-therapeutic antibiotic uses in farm animal production, mitigate the emerging antibiotic resistance issue and move forward to sustainable agricultural animal farming.

Early Phases in Consumer-Driven Food Product Development

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Abstract

The traditional scientific method teaches us to understand variables by isolation, by determining how a single variable performs when all other variables are held at a single level for each. This "one-at-a-time" approach works well for many phenomena, but fails to show the dynamics of a compound system when variables influence each other. In our daily lives it is mixtures which rule, mixtures comprising variables at different levels. It may be possible to understand part of our daily reality by isolating one variable and studying it, but we're likely to get a different and perhaps somewhat more valid picture by studying known mixtures of variables in a systematic way.

We can mix ingredients to make a product; cooks and food manufacturers do it all the time. We can mix messages to make an advertisement; companies do that all the time. And the strategy works; companies sell complex food products, mixtures of ingredients, and companies advertise these foods through commercial messages that is, mixtures of words, images, sounds and emotions. Mind Genomics, a statistical procedure from Conjoint Analysis, at its very simplest level, is the study of these mixtures, the study of everyday stimuli, to understand the rules of choice, to discover what is important to a person and what is not. Rather than forcing the person to evaluate stimuli that vary only along one dimension, Mind Genomics studies mixtures of the variables, typically mixtures of messages, in an effort to develop rules of experience. The case histories here reported show some of the rules emerging when we investigate responses to messages about artisanal European-style bread and Italian canned food.

Insights on Bacterial Nanocellulose for Food and Non-Food Applications

José Domingos Fontana

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Abstract

From a quantitative view point, Southeast Asia countries afford most of the world bacterial cellulose (BC) industrial production as the appreciated and soft dessert "Nata de Coco". Qualitatively, several different (bio) technological applications are derived from BC and these examples were exposed in the 2nd Intl. Symp. On Bacterial nano Cellulose, at Gdansk, Poland, 2015. Our previous contributions in the subject were the pioneer report of BC as a skin temporary substitute for burns and other dermal injuries therapy, its covalent Remazoll Brilliant Blue-derivative for a quick monitoring of cellulolytic enzymes and the incipient bioassays with BC-other glucans composites for animal-model wounds accelerated healing (Fontana et al, 1990, Appl Biochem Biotechnlol, idem, Cellulose, 2012). There is now a plenty of BC composites being explored for different commercial purposes from magnetized paper for recreation till tissue repair (dural graft reconstruction) in the case of skull fractures (Laromaine 2014); (Czaja 2007, Goldschmidt 2016).

Regarding its basic properties, BC, besides its strict purity, as a fresh floating membrane from culture media is a remarkable water retainer (> 99%) given its particular and porous fibers network. So, seen as a food, during the mouth touch, squeezing and chewing, it provides a particular and pleasant mouth feel. Its contribution to bolus transit in the gut is to be considered, too.

Here, our group at LQBB-UFPR-UTFPR-Curitiba-PR-Brazil is reporting some nutraceutical improvement of "Nata de Coco" thanks to the inclusion, in the BC fresh and wet network, of natural and deep colored antioxidants extracted from different botanic and safe sources. They encompass oxycarotenoids, flavonoids, anthocyanin-like pigments and their glycosides. These more attractive BC innovative deserts may also be simultaneously sweetened with acceptable pharmaceutical sweeteners like sucralose or aspartame or even preferably, in our view, with a second nutraceutical reinforcement, namely, FOS – Fructo-Oligo-Saccharides from dahlia, yacon potato and/or chicory roots inulin previously and partially hydrolyzed with very diluted phosphoric acid under short and moderate heating (Fontana et al, J. Med. Foods, 2001). The acid catalyst or its surrogate – citric acid – stays in the whole additive mix to be incorporated in BC, since they are acceptable and safe sweetener enhancers as known in colas and other soft drinks.

Thanks to: CNPq, CAPES, FA-SETI-PR, UTFPR for research funding and undergraduate and graduate students for lab support.

Subcritical Water – An Alternative Green Media for Biomass Processing: Influence of Process Conditions on Hydrothermal Reactions of Biomass Constituents

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Abstract

Extraction using subcritical water gained much interest in last decade as a "green", efficient and low-cost procedure for isolation of macronutrients and phytochemicals from natural sources. Advantages using subcritical water are higher yields of extraction and higher extraction rates compared to conventional extraction techniques and the ability to use wet biomass without prior drying. Furthermore, by precise control and regulation of process conditions it is possible to extract oil- and water-soluble constituents simultaneously. Nevertheless, concerns have arisen, because subcritical water is highly reactive media and therefore parallel to enhanced extraction of desired compounds from matrix, hydrolysis and further degradation of extractives can occur.

The main objective of this contribution is to highlight the impacts of process conditions (i.e., temperature, pressure, processing time, water/material ratio, and type of gas for maintaining the pressure in the autoclave) on the extraction kinetics and yield also on the hydrolysis/degradation of extracted bioactive compounds. Furthermore, different extraction methods i.e., batch, semi-continuous and continuous will be presented and compared. The results of subcritical water extraction of lipophilic and hydrophilic compounds (e.g. phenolic compounds, carbohydrates, proteins, triglycerides) from different biomass sources will be presented and the thermal degradation of the compounds will be discussed. Useful information for optimization of subcritical water extraction to recover maximal quantity of biomass constituents will be provided.

Big Data Analytics in Food Technology

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Abstract

The fourth industrial revolution is becoming the main driving force in global economy; hence its importance in food production is one of the key factors. It is based on integrated information systems covering wide scope from agronomy, food raw production, chain supplies; IoT based industrial processing, market needs and preferences, diversity of supplies, food safety, and many other key aspects in food production. The common feature is use of integrated big data sets, cloud computing and wide across systems communication. Generated big data sets potentially contain information on synergistic effects, system sensitivity, supply bottle necks, and stability analysis, hence inference of system key variables are essential for long term planning, strategic optimization, and industrial process level on-line control. In this work is presented analysis of large data sets from study of selection of numerous newly selected and standard wheat cultivars, agronomical data, wheat protein analysis, biochemical data, flour properties, dough physical properties, quality indicators, technological quality data, and image analysis. The focus is on methodologies of data analytics for inference of key parameters on the scale from molecular level to product quality. Applied are sparse methods for principal component analysis and Fisher linear discrimination. The nonlinear effects are elucidated from large variable regularization decision tree forests. Extracted are information on the key parameters, the model global parametric sensitivities and synergistic interactions. The results are viewed in the scope of general methodologies and expected benefits in food production.

Rural Management; Wild Edible Mushrooms as a Healthy Alternative to Meat

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Abstract

Good nutrition is undeniable essential to good health throughout life. Hence, a healthy choice of foods that provides the adequate amount of nutrients in daily needs is vital. However, unhealthy dietary choices are the problem of the consumers nowadays. To address these problems, proper choices and wide knowledge for alternative foods are needed. Moreover, a careful look for nutritional value should be a big consideration. Meat, for example, Meat is one of the most food choices of consumers as a good source of protein and other nutrients. Protein plays an important part in our health. The search for protein and other nutritional foods are not only found in meats but can be found also in edible mushrooms and can be a healthy food alternative for meat because of its richness in protein and other nutritional components that are necessary for the health. Hence, this article summarizes information regarding the nutritional values and some good attributes of mushrooms that could be considered as one of the alternative food for meat. A study conducted in Turkey show the relationship between the consumption of wild-grown edible mushroom (*Lactarius semisanguifluus*) and wild-grown edible mushroom Macrolepiota procera var. procera (Scop.) mushroom with meat consumption during mushroom collection period. Linear regression model was administered to determine the relationship of the variables. Based on the results, R2 = 0.432 has been found. This means that consumption of mushroom accounts for 43.2% of the consumption of meat at the time of mushroom period. There is a linear relationship between consumption of meat and the consumption of mushroom during collection period.

Biodegradable Films Produced of Polysaccharides Extracted from Spent Coffee Grounds

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Abstract

Coffee is one of the world's most popular beverages and its consumption reached about 9.3 million tons in 2016. After

preparation of the beverage, spent coffee grounds (SCG) are left as major residues constituting a serious environmental issue. It is estimated that 7 million tons of spent coffee grounds are generated annually and appropriate treatments or sustainable uses for such residues are yet to be developed. As the largest coffee producer and the second consumer in the world, Brazil have generated almost a million tons of spent coffee grounds in 2016. Spent coffee grounds contain large amounts of organic compounds such as fatty acids, amino acids, polyphenols, minerals and polysaccharides, the latter comprising approximately 50% of the total mass. Therefore, coffee residues must be exploited as a source of value-added products. Coffee polysaccharides are a potential candidate as precursors for biopolymer packaging development, for they are comprised mostly of galactomannans (50%), arabinogalactans (25%) and cellulose (25%). Coffee galactomannans have low degree of branching and high degree of polymerization, which are desirable characteristics for making biopolymer films. In this work, films were developed from delignified spent coffee grounds, treated with alkaline hydrogen peroxide. Solutions with varied concentrations (i.e., 15, 25, 35 and 45% v/v) were used to treat the SCG. The delignified material was characterized and analyzed. A $ZnCl_2$ solution was employed to dissolve the extracted galactomannans and cellulose and $CaCl_2$ used to improve film properties (e.g., water vapor permeability and mechanical strength) by crosslinking. The polysaccharide-rich material from delignified SCG treated with 35% H_2O_2 provided the film with the best properties. That biomaterial presented a tensile strength of 5.971 ± 2.107 N/mm^2, water vapor permeability of 1.44 ± 0.10 g mm/m^2 h kPa and glass transition temperature of 2.26 °C. Spent coffee grounds has proved to be a potential precursor material for the development of polysaccharide-based films.

Poster Presentations

Molecular Lipidomics Analysis in Button Mushroom by High Performance Liquid Chromatography Time-of-Flight Mass Spectrometry

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Abstract

A high-performance liquid chromatography time-of-flight mass spectrometry (HPLC–Tof-MS) method was used for separation of lipid classes and qualitative analysis of individual lipids in button mushroom. The HPLC conditions including column, mobile phase, and modifiers were optimized. High-resolution full-scan Tof-MS in negative ion mode was conducted for the data collection. The identifications of the unknown lipid components were based on the in-house exact mass library with mass accuracy <1.5 ppm. The identities of the compounds were further confirmed by the fragment ions and isotope patterns. The developed lipid profiling method was applied to button mushroom sample after extraction with a solvent mixture of methanol and chloroform. Lipid molecules in the classes of PC, PE, PS, PA, sterol, sterol esters, and TG were characterized. Lysophospholipids, free fatty acids, MAG, DAG, SM were not found in detectable quantity in button mushroom.

Simultaneous Analysis and Cross-Validation of Artificial Sweeteners in Food using HPLC

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Abstract

This study has been carried out to develop a method of analysis of 3 permitted artificial sweeteners (including sodium saccharine, aspartame, acesulfame potassium) in foods by HPLC. The test solution was applied to a Carrez clearing regent. The sweeteners pretreated were determined by high performance liquid chromatograph. Simultaneous analysis of 3 kinds of artificial sweeteners was performed on fatty emulsified foods. Using this method, the recovery of sweeteners was determined in foods such as dairy products, snack and chocolate. The simultaneous analytical method of three sweeteners in foods by HPLC was established through pre-treatment condition of sample. Cross - validation was performed at three institutions with the modified test method. For the pre-treatment of the sample, solvent extraction was performed for remove fats with weak acid reagent also with centrifugation for proteins removal. Ion exchange cartridge was used to capture the sweeteners and to remove residual fats. Separation was achieved on a Reversed-phase C18 column (5 um, 4.6 x 250 mm). Cross-validation results calibration curve showed good linearity with high regression coefficients and the result of recovery test showed satisfactory recoveries within 90~110 %.

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Maillard Reaction in "Dulce de Leche"

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Abstract

The "Dulce de Leche" (DL) is obtained by the concentration of milk and sugar with high commercialization in Latin America. This food develops characteristic aroma, flavor and color as a result of the Maillard Reaction (MR). The aim of this work was to evaluate the chemical composition and the 5-hydroxymethylfurfural (HMF) index in experimentally produced DL. Twelve formulations were produced from the combination of different concentrations of sucrose (18% and 20%), glucose (0% and 2%) and bicarbonate (12 g and 18 g). Compositional, physicochemical, free and total HMF determinations were performed. The average with their respective standard deviations of the compositional and physico-chemical parameters are: moisture (28, 55 ± 3.01% m/m), lipids (6.29 ± 1.3% m/m), proteins (4.57 ± 0.53% m/m), ash (1. 69 ± 0.05% m/m), carbohydrates (58.90 ± 2. 86% m/m), water activity (0.84 ± 0.01), soluble solids content (68.98 ± 1.15 ºBrix). The samples showed low variability for the above attributes, evidencing the standardization and homogeneity of the DL. The HMF analysis showed high free (87 ± 6 µmol. kg^{-1}) and total (1.918 ± 344 µmol.kg^{-1}) HMF index in the final product, which can be attributed to the different formulations used. It is possible to assume that the addition of glucose and the increase in the amount of bicarbonate were the determining factors for the increase of HMF in the product. In order to reach the maximum daily intake of HMF (30 mg/day to 150 mg/ day), it would be necessary to consume 17 to 86 servings (20 g)/day of this DL. The results of this work are relevant for the scientific community and dairy industries in order to obtain a more uniform product (sensorial and chemical characteristics).

Microwave-assisted Extraction as an Alternative Green Technology for Extraction of Chlorogenic Acid from *Cynara scolymus* Leaves

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Abstract

Finding new techniques to enhance the extraction efficiency of bioactive compounds from medicinal and aromatic plants (MAPs) is important due to their potential health benefits. Conventional extraction techniques are running a severe risk of thermal degradation for most of the phytoconstituents with high risk of increased pollution concerns. Green microwave extraction technology is considered as a greener method of extraction when compared to conventional extraction techniques, as it offers, shorter extraction time, great reduction in the power used and high extraction selectivity. The objective of this study was to evaluate extractability of chlorogenic acid form *Cynara scolymus* leaves using microwave energy. Factors affecting extraction method including; extraction time (min) and power used (W) were examined. The extracted solutions were characterized for chlorogenic acid content by HPLC. The highest chlorogenic acid yields were obtained after 5 min extraction time (53.1 and 57.4 mg/5 g DM) using 400 and 800 W power; respectively.

Kinetics of Color Degradation during Storage of Hard Candies with Addition of Coloring of Mastuerzo Flower (*Tropaeolum majus* L.)

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Abstract

Objective: To evaluate the effect of storage temperature on the kinetics of color change of hard candy with addition of dye of the mastuerzo flower (*Tropaeolum majus* L.) under two conditions.

Methods: The anthocyanic extract of the mastuerzo orange petals was obtained using the methodology described by Rodríguez-Saona and Wrolstad (2001), encapsulating with 10% maltodextrin and drying in a Buchi B-290 atomizer at 160 ˚C. The pigment powder and extract were added to the hard candy formulation, which were stored at 20, 25, 30 and 35 ˚C method proposed Mercali et al. (2013) and Maskan (2001), then using the Minolta CR-400 colorimeter; The color parameters a*, b* and L* were determined at exposure times of 1, 7, 14, 21 and 28 days.

Conclusions: The rate of color degradation was appropriately modeled to a first order kinetics in the two pigment addition conditions. The storage temperature has an influence on the reaction rate constants, fitting to the Arrhenius model equation; in this way the activation energy (Ea) was obtained for the pigment degradation reaction.

Evaluation of the Viability of *Lactobacilli* Encapsulated in Maltodextrin as a Probiotic in Aguaymanto Juice

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Abstract

Aim: To evaluate the effect of maltodextrin concentration and atomization's temperature on the efficiency of the encapsulation of *Lactobacilli* in Aguaymanto juice (*Physalis peruviana*) and survival in a simulated gastrointestinal environment.

Methods: The isolated *Lactobacillus* were diluted in Aguaymanto juice to activate them and to obtain concentrations of 10 ^ 10 cfu/mL. The encapsulation was performed in a Buchi B-290 atomizer, the temperatures studied were 120 and 140 ˚C and maltodextrin concentration of 15, 25 and 30% of the juice to evaluate the efficiency of the encapsulation. The tolerance to simulated gastrointestinal tract conditions were evaluated.

Conclusions: Temperature and concentration of maltodextrin had a significant effect on the encapsulation efficiency of *Lactobacilli*. The most efficient treatment was at 120 ˚C and 15% maltodextrin with an encapsulation efficiency of 89.874% and then storage at 4 ˚C for 30 days a survival of 88.231%. After simulated gastric digestion had a survival of 81.76%.

Cocoa Shell Analysis in Cocoa Powder by Near Infra-Red

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Abstract

Existing methods for cocoa shell content determination are either time or resource consuming and difficult to implement as a routine analysis at a factory level. A direct fit method using NIR spectroscopy based on reference cocoa powders with low level shell content and pure shells was developed. The method is suitable to be implemented for routine use. The NIR method was validated by means of the standard addition method using cocoa powders spiked with known amounts of shell content in the range 0-26 g/100 g. Cocoa powder from various geographical origin were analyzed and revealed different behaviors.

The Antioxidant Potential of Cacao Beans across Different Geographies

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Abstract

There is compelling evidence that the consumption of antioxidants can provide important benefit to human health, as they can inhibit oxidation products such as free radicals, which may promote cellular degradation. Chocolate, especially dark

chocolate and cacao beans in their pure form have been shown to demonstrate substantial antioxidant potential. The cacao beans original agricultural producers were located in Central America, however, today, it is being grown and harvested in many locations around the world. The differences of antioxidant potential in cacao according to growing region are a matter requiring further investigation. An evaluation of differences due to growing region could be important to the economy and sourcing of chocolates, and may also provide additional understanding regarding the factors that determine antioxidant potential in agricultural products. The antioxidant potentials of cacao powders from Ghana and Peru were evaluated in triplicate by the Trolox Equivalent Antioxidant Capacity (TEAC) assay. The procedure included the extraction of hydrophilic phenolics with a solvent extraction system, the development of a standard curve, and the determination of Trolox equivalency with spectrophotometry. Statistical significance was evaluated by performance of t-tests with IBM SPSS statistical software. Our preliminary findings have determined the cacao sample of Ghanian origin to demonstrate significantly greater antioxidant potential than the cacao sample of Peruvian origin ($p = 0.029$). Our results suggest growing region of cacao may be a significant factor in the antioxidant potential of the cacao bean. Additional investigations into cacao powders from these regions are continuing.

Lipogenesis Inhibition of Soy Sauce in a Novel Obesity Model *Rhodosporidium toruloides*

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Abstract

There is an increased demand in finding specific compounds, plant extracts or food that inhibit synthesis of lipids from carbohydrate intake i.e., lipogenesis. Small rodents are the most commonly used models of obesity, despite its limitations on efficacy in terms of time and cost. To overcome such limitations, we present a novel model organism for obesity. *Rhodosporidium toruloides* is a triglycerol (TAG) producing yeast that is much studied and widely utilized for biofuel production due to its impressive capability to accumulate TAG compared to other oleaginous yeast species. We argue glycerol-3-phosphate dehydrogenase isoforms to be the most susceptible to inhibition during lipogenesis. The conservation of GPD1 gene (encodes cytosolic glycerol-3-phosphate dehydrogenase) and GPD2 gene (encodes mitochondrial glycerol-3-phosphate dehydrogenase) between human and *R. toruloide*s is as high as 63% sequence identity, suggesting *R. toruloide*s as not only a time and cost-efficient model but also well suited for lipogenesis inhibition studies. We investigate the lipogenesis inhibition of soy sauce (specifically Korean Ganjang) due to the high peptide content of soy sauce and the old, widely known belief in Korean culture that soy sauce prevents weight gain. We cultured *R. toruloide*s in yeast extract peptone dextrose (YPD) broth containing soy sauce that has been diluted to 1% sodium chloride. We found a 33% decrease in TAG content of *R. toruloide*. Comparison study of leptin-deficient ob/ob mouse, the leptin receptor deficient db/db mouse and *R. toruloide*s as obesity models is underway.

Isolation of Ursolic Acid from Apple Peels and the Effect of Heat Treatment on Ursolic Acid in Applesauce Formulation

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Abstract

Applesauce production generates a large amount of residue, comprising of mainly peels. Although this by-product is little explored, it is a rich and heterogeneous mixture, containing interesting phytochemical groups. Among them, ursolic acid (UA) has attracted a lot of attention. UA is a pentacyclic triterpenoid identified in the epicuticular waxes of apples and has shown several functional properties such as antibacterial, antiprotozoal, anti-inflammatory and antitumor. This study investigated the effect of heat treatment on UA concentration in peels. Wax and pesticides were removed from apples by scraping off and then using n-hexane respectively. The correlation between wax removal and pesticides concentration in apple peel was evaluated. UA was extracted from dried apple peels of Red Delicious variety by solvent extraction with methanol, ethanol or petroleum ether and quantified by High Performance Liquid Chromatography (HPLC). Further, an applesauce product was formulated with peels and other ingredients (ginger, SparCs and Oyter beer). The effect of applesauce preparation temperature on UA concentration was evaluated. The formulated product was further tested for sensory attributes. This poster will summarize these results.

The Effect of Heat Treatment on the Total and Individual Polyphenol Compounds in Apple Flesh and Peels

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Abstract

Apple pomace represent about 20-35% of apple fruit and contribute to food waste in apple cider processing industry. Its disposal into landfills without pre-treatment results in environmental concerns and incurs added cost to beverage industries. A potential alternative option must be explored to use this apple waste. Polyphenols are phytochemical compounds present in almost all fruits and vegetables. Research studies have demonstrated that the consumption of polyphenols can reduce the risk of cancer and cardiovascular disease such as of lung cancer, asthma, type -2 diabetes, thrombotic stroke, and ischemic heart disease. Apple is a good source of polyphenols in western countries and generally, three classes of phenolic compounds are available in apple fruit: 1-hydroxycinnamic acid, 2-monomeric acid and oligomeric flavan-3-ols and 3-dihydrochalchones. In this study, the effect of heat treatment at 90°C on the total polyphenol content (TPC) and polyphenol composition in red delicious apple flesh and peel as evaluated. TPC was estimated by Folin-Ciocaltue method and individual polyphenol compounds by HPLC analysis. While TPC was higher in heat treated apple, peels compared to untreated peels, TPC was lower in heat treated apple flesh compared to untreated apple flesh. These findings suggest that there is a good commercial potential use of phenolic extracts from apple peels in the food industry. Results for polyphenol composition will be also be presented in the poster.

Long-Term Dietary Intake of Kale Cultivar with High Content of Glucoraphanin Suppresses Skin Aging in Senescence-Accelerated Mouse Prone 1

Saki Ichikawa[1*], Shigeru Katayama[1], Yuki Uchibori[1], Takakazu Mitani[1], Tomohiro Ohno[2] and Soichiro Nakamura[1]

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Abstract

Glucoraphanin is a stable precursor of sulforaphane that is an activator of the transcription factor Nrf2 and induces phase II antioxidant enzymes. We here investigated whether new cultivar of a kale (*Brassica oleracea* var. *acephala*) containing high amount of glucoraphanin can suppress the age-associated changes in appearance of senescence-accelerated mouse (SAM). SAM prone 1 (SAMP1) was fed with a diet containing 1% (w/w) new cultivar kale juice powder or a control diet for 26 weeks, and the progression of senescence was then evaluated using a grading score system. The oral administration of new cultivar kale significantly suppressed an increase in the grading score of senescence compared with the control group. At the end of the treatment period, significant suppression of the skin thinning was observed in the new cultivar kale group. Furthermore, the collagen content in the skin of mice was increased by feeding with new cultivar kale. Increases in the protein expression level of antioxidant enzymes HO-1 and NQO1 were observed in the kale-feeding group compared with the control group. These suggest that the long-term dietary intake of kale cultivar with high amount of glucoraphanin suppress the age-associated skin aging in SAMP1.

Enzymatic Synthesis of Novel Rutinoside using Rutinase and its Functional Properties

Kanako Matsumoto[*], Shigeru Katayama, Fumiaki Ohno, Takakazu Mitani and Soichiro Nakamura

Shinshu University, Japan

Abstract

Phenolic compounds are known to be efficient antioxidants and immunomodulatory agents. They are used in food, cosmetic and medicinal preparations; however, their use is often limited by their weak solubility either in hydrophilic or hydrophobic formulations. Thus, glycosylation of hydrophilic compound can be a potent strategy to alter their solubility. In the present study, we investigated the synthesis of new phenol compounds using rutinase, derived from tartary buckwheat (*Fagopyrum tataricum*) seeds, as transglycosidative enzymes. Further, the effects of new rutinoside compounds on functional properties was examined.

Rutinase was purified from tartary buckwheat by chromatography on DEAE-Sepharose and gel filtration on Sephacryl S-100 columns. Rutinosides were prepared using the reverse reaction of hydrolysis by rutinase. Rutin, phenolic compounds, and rutinase in 20 mM acetate buffer (pH 5.0) were incubated for 24 h at 40 ˚C, following purification by HPLC. The structure was determined by FAB-MS and NMR analysis. More than 10 kinds of phenolic compounds were successfully glycosylated by the reverse reaction of rutinase. The solubility of rutinoside compounds significantly improved by glycosylation with rutinose. These results suggest that transglycosylation using rutinose is an effective method for preparing novel functional phenolic compounds.

Protective Effects of Amazake Peptides against H_2O_2-Induced Oxidative Stress in SK-N-SH Cells

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Abstract

Oxidative stress has been recognized as one of the major causes of neuronal cell death in a variety of neurodegenerative disorders. Functional foods and their bioactive compounds are gaining popularity nowadays as potential agent for the prevention of neurodegenerative diseases. In this study, we investigated the protective effects of antioxidant peptides derived from Amazake, a traditional fermented rice beverage in Japan, against H_2O_2-induced oxidative stress in human neuroblastoma SK-N-SH cells. Amazake protein hydrolysates were separated into > 10, 5-10, and < 5 kDa sizes by ultrafiltration. In the antioxidant assay, Amazake peptides less than 5 kDa (AP5) showed higher DPPH and ABTS radical scavenging and ferrous ion chelating activities compared to other fractions. Pretreatment with AP5 attenuated SK-N-SH cells death from oxidative damage induced by H_2O_2. AP5 was further separated into three fractions using size-exclusion chromatography. Among them, AP5-F2 exhibited significantly higher antioxidant activities compared to other fraction and upregulated the gene expression levels of nerve growth factor (NGF) and brain-derived neurotrophic factor (BDNF) in SK-N-SH cells. These findings indicated that Amazake peptides could protect the neuronal cells from oxidative stress, suggesting a beneficial effect on the prevention of neurodegenerative diseases.

Effect of Freeze-Drying on Encapsulated Maqui Extract

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Abstract

Maqui (*Aristotelia chilensis* [Mol.] Stuntz) berries, native to central and southern Chile are known for an outstanding content of bioactives that unfortunately start degrading, once the berries are plucked. In this study freeze-drying effect on microencapsulated maqui extract at different proportions of maltodextrin, Arabic gum and inulin has been assessed, based on physical, chemical and biological quality and retention of the bioactives. Color difference of aqueous and freeze-dried extract was evaluated using the CIE-Lab color space. Total phenolics were determined by Folin-Ciocalteu method. Anthocyanin was determined by pH differential method as well as by HPLC method, which was also used to evaluate efficiency of microencapsulation process. Adsorption isotherm at 25 ˚C and glass transition temperature of the dried microcapsules was evaluated and modeled to establish a state diagram. A simplex centroid mixture design was used to evaluate 7 combinations of the 3 encapsulating materials (EM) at 3 different ratios (10-20-30 g/100 mL) EM to maqui extract. Changes in bio-actives contents and antioxidant capacity after 60 d storage at 25 ˚C were also evaluated.

Preliminary results showed that 10 g/100 mL microcapsules were the best preparation; >90% of total phenolics and total anthocyanin can be retained in maltodextrin after 60 d storage. The mixture of maltodextrin-Arabic gum offered better protection to total phenolics, while the mixture maltodextrin-inulin were better for retention of anthocyanin. Color difference ΔE was least for the glossy maltodextrin microcapsules compared to dull colored finer inulin microcapsules. Results also showed that lyophilized microcapsules can be an appropriate method to preserve bioactivity of maqui extract.

Development of Titanium Dioxide Nanotubes by Combination of Electrospinning and Atomic Layer Deposition

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Abstract

In recent years, the rise in foodborne illnesses and nosocomial infections occurred during hospitalization have increased the need and interest in the search for new antimicrobial substances. Some metal nanoparticles such as silver, cooper and magnesium dioxide have been identified to exhibit antimicrobial activity.

In this study, a novel methodology was proposed in order to obtain titanium dioxide nanotubes (TDN) based in two innovative technologies: atomic layer deposition (ALD) and electrospinning (EP). First, polyvinyl alcohol nanofibers (PVN) were fabricated as template. Parameters as needle diameter, distance between needle tip and collector and flow rate were optimized for obtaining uniform, thin and tubular nanofibers. TDN were fabricated using 500 deposition cycles at 150 °C (TDN_150) and 200 °C (TDN_200). In addition, a double deposition at 150 °C and 250 °C was performed (TDN_150/250) with 250 cycles for each temperature in order to observe the effect of temperature. Tetrakis (dimethylamino) titanium (TDMAT) was used as metal precursor and ultrapure water as oxygen source in ALD process. Washing and calcination were used to remove the polymer from the nanotubes. Surface and internal morphology of nanostructures and diameters were analyzed by Scanning Electronic Microscopy (SEM) and Transmission Electronic Microscopy (TEM).

The diameters of PVN nanofibers were approximately (164 ± 3) nm. Total elimination of template and rate deposition was evaluated by thermogravimetric analysis (TGA) and X-ray diffraction. Free calcinated nanotubes of polymer (TDN_calcinated) were observed by TEM. Results of primary analysis revealed that TDN wall thickness obtained were approximately 25 nm with 43.5% deposited material.

Development and Characterization of Low-Density Polyethylene Nanocomposites

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Abstract

Development of nanocomposites, specifically clay-based are considered an emerging and promising research, especially for food packaging area. Improved properties are achieved with clay incorporation in polyolefin to produce nanocomposites, which increase the industrial applications, such as the food packaging industry. In this sense, the aim of this investigation was obtained low density polyethylene (LDPE) nanocomposites for food packaging applications. First, montmorillonita (MMT) clay was modified with Cetylpyridinium Bromide (CPB) by an ionic exchange reaction to obtain an organoclay (OMMT). Then, LDPE nanocomposites were development by extrusion, using two different OMMT contents (1.5% and 3.0% w/w). The optical, thermal and mechanical properties of nanocomposites were studied. Regarding to OMMT, it was evidenced that the surfactant was introduced in the MMT interlayer space formatting OMMT that exhibited improved thermal stability. Thereby, its structure favored the intercalation with LDPE by a melt intercalation method, forming nanocomposites. The concentration of OMMT incorporated affected proportionately the optical properties, obtaining with yellow-green appearance and slightly more opaque than pure polyethylene. Moreover, the OMMT presence in the nanocomposites was able to increase the initial degradation temperature of LDPE from 360 °C to 415 °C. Finally, material reinforcement was achieved, the Young´s modulus increased and elasticity decrease. In conclusion, modified clay with cetylpyridinium bromide enable LDPE nanocomposites formation by melt intercalation, which showed less transparent, highest thermal stability and improved mechanical properties compared with pure polyethylene.

Preservation of Walnut Oil using Walnuts' Polyphenols as Antioxidants

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Abstract

The walnut kernels are appreciated for their flavor and health benefits. Walnuts are susceptible to lipid oxidation because they exhibit high amount of PUFAs. Antioxidants are known to reduce lipid oxidation. The objective of this study was to evaluate the preserving effect of walnut polyphenols on walnut oil. Walnut oil was extracted by cold pressing from the kernels and walnut polyphenols were extracted using alcohol 70%, and separated in to fractions: ethyl acetate (PA) and water (PHO). The treatments consisted in walnut oil control (ANC), walnut oil with PHO (ANPHO), walnut oil with PA (ANPA), and walnut oil with BHT (ANBHT). An oven test (60 °C) was performed on the samples for 11 days. Lipid oxidation indicators were measured on the samples: peroxide value (IP), conjugated dienes (DC) and trienes (TC), carotenoid content (C), and volatile compounds by GC-MS. The results were statistically analyzed (ANOVA y Test LSD-Fisher). Lipid oxidation indicators increased in all the treatments, mainly in the control sample (ANC). On the last storage day, ANPA exhibited the lowest IP (23.49 meqO2/kg), DC (4.99), TC (0.39), while ANC showed the highest values of these indicators (33.48, 5.13, 0.44, respectively). ANPA presented the highest carotenoids content through all the test, while ANC and ANBHT the lowest. Volatile compounds related to lipid oxidation (Hexanal, 2-Heptenal (E)-, Nonanal) exhibited lower content in ANPAC (362221.58, 95048.14, 14864.70 electronic counts, respectively) than in ANC (258032.55, 120080.76, 77584.43, respectively). Walnuts polyphenols are good antioxidant and show protection against lipid oxidation in this product during storage.

Obtaining and Characterization of Acetylated Rice Starch Films and Nopal (*Opuntia ficus-indica*) Mucilage

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Abstract

There are significant losses on postharvest handling of climacteric fruits, mainly through the storage period. Alternative technologies like edible covering films made from sub-products such as broken rice and nopal mucilage species have been developed. The objective of this work was to elaborate edible films from sub-products by casting method. The mucilage (MN) extraction [1], starch isolation and modification (AC) by extrusion [2, 3] were performed. Substitution degree (0.09), water absorption index (10.04), luminosity (90.36) retrogradation viscosity (10.61 Pas) were measurement. Uniform surfaces without bubbles or fissures were obtained on the films. Maximum tensile strength σ max (10.46 MPa) and elongation ε (120.6%) at high AC concentrations were evaluated by surface response analysis. Thickness values varied from 6 x 10^{-04} to 1.3 x 10^{-3} cm. Humidity and density increased 65% at higher MN concentration. Solubility decreased to 18.75% with AC content increasing. At higher plasticizer concentration, luminosity (85.35), a*(-4.12) and PVA (4.73 x 10^{-15} g/Pa.s m) increased. Acetylated starch by extrusion and mucilage addition favored the physicochemical, mechanical and barrier properties of films obtained by casting. Thus, there is a huge potential application of edible films to increase fruits shelf life.

Stabilization of Extracts of *Aloe vera* Gel (*Aloe barbadensis* Miller) by Ultraviolet Radiation

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Abstract

Aloe vera gel has been reported to provide health benefits, so it is used as an ingredient on the preparation of novel food products. However, the poor stability of the gel leads to losses in its biological effectiveness. Heat treatment is used to stabilize

it, nevertheless it causes irreversible modifications on the gel properties. Therefore, the application of non-thermal technologies, such as ultraviolet irradiation that has been successfully used in the pasteurization of juices and beverages is an alternative. The objective of this work was to evaluate the effect of UV-C irradiation on the physicochemical and microbial properties of the *A. vera* gel. The gel was extracted from 4 years old plants. Different doses of irradiation (12.8-54.6 mJ/cm^2) and pH (3.5, 4.5, 5.5) were used Thermal treatment was used as a control. Aloin content, physicochemical, molecular size of acemannan and bacterial, molds and yeast population were evaluated. All treatments achieved a significant reduction ($p < 0.05$) on the microbial load of the gel. Low irradiation doses at any pH evaluated, did not significant changes on color, polyphenol content, antioxidant activity, reducing and totals sugars of the gel. While the heat treatment, caused significant changes in all responses. UV-C treatments did not because structural changes in the acemannan, yielding a high molecular weight of 400 kDa, unlike the heat treatment caused breakdown of the polysaccharide and simple sugars content increased. The results suggested that UV-C irradiation can be applied to stabilize the *A. vera* gel with a superior preservation of physicochemical characteristics compared to conventional treatments.

Biosynthesis of Pigment in Red and Orange Carrots during Development Stages

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Abstract

Orange (Totem and Kuroda) and red (Surbhi and Pusa Rudhira) carrots were grown in the experimental field located in Amritsar. Carrots were harvested 45 days after sowing and at an interval of seven days till roots reached full maturity. Physical and chemical properties of cultivars were examined. Total carotenoids content and Lycopene content of orange carrots (Totem) increased from 0.803 to 27.064 mg/100 g and 0.197 to 5.859 mg/100 g respectively. Same trend was followed in ascorbic acid, reducing and total sugars. Red carrot has higher lycopene content as compared to orange carrot. Moisture content of carrots decreased and total solids increased as the carrots attain maturity. Antioxidant properties of carrots increased from 9.515-16.897%, 3.817-13.944%, 0.796-10.66% and 3.74-11.03% for Rudhira, Surbhi, Totem and Kuroda respectively.

Physical parameters examined were root weight, firmness, length, breadth and length/ breadth ratio. Initially after 45 days of sowing the carrot roots of Rudhira, Surbhi, Totem and Kuroda weighed approximately 0.22, 0.69, 2.099 and 1.40 g and after 108 days of sowing root weight was 133.19, 110.58, 147.67 and 92.28 g respectively. Root length and breadth increased with the growth of roots.

Properties of Kimchi Prepared with *Lactobacillus sakei* HY-11 having GABA Producing Capacity

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Abstract

Kimchi is a traditional Korean dish consisting of fermented vegetables. Cabbage kimchi was prepared with or without *Lactobacillus sakei* HY-11 having γ-aminobutyric acid (GABA) producing capacity and its properties including GABA content were investigated during the kimchi fermentation. After preparing kimchi, we stored it at 10 ˚C in a refrigerator for 17 days. The pH of samples sharply decreased during the 6 days and then slowly decreased. Acidity of samples increased during the 17 days. The number of *Lactobacilli* was the highest on the 6th and 9th day of fermentation. The GABA content of the samples was the highest in the sample with 1% *Lactobacillus sakei* HY-11 on the 6th day. These results suggest that relatively enhanced levels of GABA in cabbage kimchi samples can be produced by adding the *Lactobacillus sakei* HY-11, which may have beneficial health effects. This work (Grants No. C0442012) was supported by Business for Cooperative R&D between Industry, Academy, and Research Institute funded Korea Small and Medium Business Administration in 2017.

Effects of Heat Treatments on the Conversion of Gingerols to Shogaols in Ginger

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Abstract

Shogaols have been reported to exhibit the stronger bioactive activities including antioxidative, anti-inflammatory, and anti-cancer abilities than gingerols. The contents of gingerols and shogaols in the samples were determined by an ultrafast UHPLC-ESI-MS/MS. In fresh gingers, there was only tiny quantity of shogaols. Heat treatments greatly increased the formation of shogaols in ginger through dehydration reaction of gingerols. As the temperature increased, the faster conversion of gingerols into shogaols were observed. Moist heat was greatly more efficient than dry heat for the conversion. The conversion efficiency induced by dry-heat differed with the sample type (fresh sliced or dried powder). The wet-heat treatment at 120 °C for 360 min induced the highest conversion of gingerols to shogaol in ginger. This represents the direct comparative study of the heat and sample types on the heat-induced conversion of gingerols into shogaols in ginger.

Effect of Drying Methods on the Physicochemical Properties and Fatty Acid Composition of Moringa Seeds Oil

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Abstract

Effect of drying methods (sun-drying and cabinet oven drying) on the physicochemical properties and fatty acid composition of oils extracted from moringa seeds was investigated. Oil from the seeds was extracted using solvent (hexane) after drying. Drying increased the yield from 30.30-33.11%. The oil samples were less dense than water with specific gravities of 0.9032, 0.9075 and 0.9030 respectively. A significant difference exists in the moisture contents (0.11-0.21%); smoke point (202-225 °C), flash point (310-317 °C) and fire point (360-369 °C). Sun-drying and cabinet oven drying brought about a decrease in the acid value (1.80-1.08 mgKOH/g), saponification value (174.87-105 mgKOH/g), Iodine value (16.10-13.90wijs) and peroxide value (11.24-2.3-Meq/kg). The decrease is an indication of quality improvement of the oils. More unsaturated fatty acids were present in the samples between 76.61% and 81.66%. Oleic acid was predominant (44.92% raw, 45.71% sundried and 43.60% cabinet oven dried). Sun-drying and cabinet oven drying did not have much significant effect on the physical, chemical and fatty acid compositions of the oil. The results obtained from this study showed that the three oil samples are good as edible oil and for commercial purpose.

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