

41st European Forum on

Food Pathogens and Food Safety

June 20, 2022

Organizational Representations

















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June 20, 2022 — **Conference Agenda**

09:00 — **Introduction**

Keynote Presentations

09:00 - 09:20
Tittle: Foodborne Pathogens
Prakash Kondekar, Hon Director,Indian Institute of Naturopathy,India

09:20 - 10:00
Tittle: Lactic acid bacteria in preservation and improvement of nutrients In fermented foods
Marcela A C de Albuquerque, NEPP – Center for Studies in Probiotics and Prebiotics, Rio de Janeiro, Brazil

10:00 - 10:30
Tittle: Novel health potential of bioactive peptides from egg albumin
Hisham R. Ibrahim, Department of Food Science and Biotechnology, Kagoshima University, Japan

10:30 - 11:00
Tittle: Digital solutions to enhance food safety and sustainability – perspectives from Finnish Lapland
Dele Raheem, University of Lapland, Finland

11:00 - 11:30
Tittle: Pulsed UV light for bacterial reduction: Impact of physical parameters on Aspergillus brasiliensis
Janyce FRANC, STERIXENE, France

Networking and Refreshments Break

Major Sessions:
Foodborne Infections and Disease | Food Processing, Packaging and Preservation | Food Microbiology | Food Safety, Control and Hygiene | Food Technology | Food Engineering

Session Introduction

11:30 -12:00
Title: A new generation of extruded snacks with the addition of cricket flour
Maciej Combrzyński, University of Life Sciences in Lublin, Poland

Lunch Break 12:00 - 13:00

13:00
Title: Selected aspects of the use of sprouted seeds in food production
Beata Biernacka, University of Life Sciences, Poland

13:00 - 13:30
Title: A new generation of extruded snacks with the addition of broccoli
Tomasz Oniszczuk, University of Life Sciences in Lublin, Poland

13:30 - 14:00
Title: Fresh c+hokeberry as valuable additive in extruded snack pellets and crisps
Renata Różyło, University of Life Sciences in Lublin, Poland

14:00 - 14:30
Title: The influence of fresh highbush blueberry addition on the extrusion process of snack pellets
Marcin Mitrus, University of Life Sciences in Lublin, Poland

14:30 - 15:00
Title: Food Safety: An emerging issue of increasing world population
Bhupinder Singh, Kurukshetra University, India

15:00 - 15:30
Title: Quinoa: An ancient Andean grain and its nutritional profile
Muhammad Kamil Fareed, University of Agriculture, Pakistan

Panel Discussions

Food Pathogen And Safety 2022

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Supporting Journal

Supporting Journal

Journal of Nutraceuticals and Food Science



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Keynote Forum
Day 1



Dele Raheem PhD

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Digital solutions to enhance food safety and sustainability – perspectives from Finnish Lapland

Statement of the Problem: There is a need to ensure that our foods are safer and an urgent call to transform the food system to be more sustainable. Food agriculture and processing have impacts on individual and planetary health. Food systems will need to be more resilient in order to adapt to the consequences of climate change, pandemics and other crises. The link between climate change and food security is well established, it is a widely discussed topic with an urgent need to mitigate the impacts of climate on food production. Given that food systems are complex but dynamic, it is important to adopt a more holistic approach that incorporates innovative digital solutions in the food value chain from production to consumption.

Methodology & Theoretical Orientation: A study of different processing methods with considerations on the use of energy and water. Digital solutions can play a significant role on how food products reach consumers in a safe and wholesome form without compromising quality as shown during the COVID era. In the Arctic region context, how the activities of our future food system can affect the climate and vice-versa is an important research area that will benefit from collaborative work. Furthermore, the role of digitalization in the overall food system from production to consumption including the disposal of waste is emphasized with perspectives from Finnish Lapland.

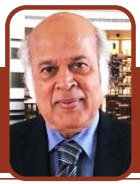
Findings: The digital tools have significant role in contributing to safety. The existing infrastructures in the region are important to support digital tools. The uptake of digital tools by food producers is highly dependent on their size. Micro, small and medium enterprises (MSMEs) often need to catch up with large enterprises.

Conclusion & Significance: There is a need to ensure that the value chain for traditional and local food resources that are abundant in the region is developed with innovative technologies. In this presentation, an analysis of the primary steps that are involved in converting raw traditional foods to the final steps of packaged foods and its marketing with digital solutions is carried out. In addition, it is highlighted how digital solutions will help micro, small and medium enterprises (MSMEs) to provide a means to preserve, protect, merchandise and distribute foods within the local economy. When these resources are valorised by MSMEs, which are significant economic drivers in the Lapland region they need to be sustainable.

Biography

Dele Raheem holds a doctoral degree in Food Sciences from the department of Food and Environmental Sciences at the University of Helsinki, Finland. He is also an Associate Professor, Food Microbiology (University of Helsinki). He obtained the Post Graduate Certificate in Education from the University of Greenwich, London, UK. Dele's research interest is in food bio-processing, preservation and other crosscutting issues related to food security and safety. He has gained extensive research and industrial experience in the last three decades. Currently, he is affiliated to the Arctic Centre at the University of Lapland, Finland as a Senior Researcher.

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Dr Prakash Kondekar

Hon Director,Indian Institute of Naturopathy,Mumbai.

Topic-Foodborne Pathogens

Covid 19,pandemic,has shown that if immune system is weak then person gets problem with the organism like pathogens.More than 250 foodborne diseases have been found caused by pathogens.Most of them are caused by a variety of bacteria, viruses and parasites. Harmful toxins and chemicals.Nausea, vomiting, stomach cramps and diarrhea,are some of the common symptoms. However, symptoms may differ with their categary,like...

Campylobacter bacteria is the most common, in USA. Escherichia coli (E. coli) are a large and diverse group of bacteria. Although most strains of E. coli are harmless, others can make one sick. Some kinds of E. coli can cause diarrhea, while others cause UTI(urinary tract infection, respiratory illness,pneumonia etc. E. coli can be found in drinking water.Six pathotypes are associated with diarrhea and collectively are referred to as diarrheagenic E. coli.Botulism is a rare but serious illness caused by a toxin that attacks the body's nerves with weakness of the muscles that control the eyes, face, mouth and throat.with difficulty in breathing and even death. Listeriosis is a serious infection usually caused by Listeria monocytogenes. An estimated 1,600 people get listeriosis each year and 260 die. Norovirus is a very contagious virus that causes vomiting and diarrhea. Touching contaminated surfaces & putting unwashed hands in mouthSalmonella bacteria cause about 1.35 million infections, 26,500 hospitalizations, and 420 deaths in the United States every year.Shigella bacteria cause an infection called shigellosis. Most people recover without needing antibiotics. Staph food poisoning is a gastrointestinal illness caused by eating foods contaminated with toxins produced by bacterium Staphylococcus.Precautions- Washing hands with soap. Keep veg and nonveg food separately.Food is safely cooked with proper internal temperature.

Biography

BSc (Hons)LLB ND Ayurved -Ratna,FRSH(London)BTER (UK), Consultant Naturopath ,Yoga & Bowen Therapist. He worked with Agro Industries (1970 to 1995). Academia and Medical Practitioner till today.Presented papers & conducted workshops in UK, USA, Germany, Mauritius, Singapore, UAE, Vietnam, Italy & Spain. In India, conducted 675, Health Management workshops. Invited by AICR Washington DC. Most Outstanding Professor Award 2018 & 2020.

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Marcela A C de Albuquerque

NEPP – Center for Studies in Probiotics and Prebiotics, Rio de Janeiro, Brazil

Lactic acid bacteria in preservation and improvement of nutrients In fermented foods

Fermented foods have been consumed over the years by humans and their nutritional and functional aspects are of interest for the development of innovative foods with different added-values (Marco et al., 2021). The biochemistry defines fermentation as "an ATP-generating process in which organic compounds act as both donors and acceptors of electrons" (Kim and Gadd, 2019) however, considering the food producing process, fermentation is characterized by the activity of intentional microorganisms that produce desirable characteristics. Thus, fermented foods are "foods made through desired microbial growth and enzymatic conversions of food components" (Marco et al., 2021) that present an intrinsic and complex microbiota, usually mainly composed by lactic acid bacteria (LAB) and yeasts. In addition, other microorganisms, such as acetic acid bacteria and filamentous fungi, may be also found.

The microbiota of fermented foods may be modulated from one sample to another depending on several factors which includes, but it is not limited to, the raw materials, pH, water activity (Aw), temperature of fermentation and by the initial microbial community itself. In this way, fermenting food using wild starter cultures such as those ones found, for example, in kefir grains or sourdough will hardly address the same microbial and biochemical compositions.

Many studies have been evolved regarding the technological and functional aspects of these microorganisms aiming to develop fermented foods with sensorial, nutritional, and healthy attributes able to meet the expectation of consumers (Albuquerque et al., 2020). In addition, considering that the point of view of the consumers about eating more natural foods has increased, studying the safety aspects of fermented foods is also another role played by some microorganisms that can be explored to avoid using chemical food preservatives.

Lactic acid bacteria are among the microorganisms that have been most studied by their technological and functional aspects. They are an extended group of Gram-positive, non-spore forming, aerotolerant microorganisms that can be classified as homolactic or heterolactic depending on the lactic acid production generated from their carbohydrate metabolism. Lactic acid bacteria have been historically defined as GRAS, which means that they are generally recognized as safe, according to Food and Drug Administration guidelines. The EFSA - European Food Safety Authority also considers the safety history of lactic acid bacteria including them in the list of QPS – qualified presumption of safety.

Different genus belongs to the LAB group such as Lactobacillus, Lactococcus, Pediococcus, Weissella and others. It is important to point out that the genus Lactobacillus was recently updated, and its taxonomy revised into another new genus (Zheng et al., 2020). These bacteria are widely used by the food industry, contributing to produce fermented dairy, meat, cereal and vegetable products (Mathur et al., 2020). Also, LAB can produce several beneficial metabolites such as organic acids, antimicrobial peptides (e.g., bacteriocins),

vitamins, and enzymes besides promoting a positive nutritional implication by limiting the effects of anti-nutrients compounds, such as phytic acid present in cereals, enhancing digestibility of carbohydrates and proteins and improving the bioacessibility and bioavailability of minerals and bioactive compounds such as polyphenols (Arora et al., 2021; Gibson et al., 2017).

Considering the different technological and functional properties of lactic acid bacteria briefly mentioned above, natural preservation to improve the safety aspects of fermented foods and the improvement of nutrients in these products by microbial fermentation will be discussed.

Bio-preservation: During the fermentation process, LAB will consume the available carbohydrates present in the food matrix as a source of energy. This process will increase microbial biomass and at the same time, these microorganisms will release organic acids (> 100mM) as an end-product of their metabolism. Next, it will be observed the decrease of the pH of the food along the process reaching values <4.5 (Marco et al., 2021). Among the different metabolites produced by LAB, organic acids (e.g lactic, acetic, proprionic acids) play an important role both to improve sensory attributes of fermented foods and to enhance its safety aspects as a natural preservative ingredient. Together with other safety strategies aspects as low Aw, salts and antimicrobial compounds, autochthonous lactic acid bacteria or starter cultures contribute to improve the microbiological safety of fermented foods by inhibiting the development of spoilage and pathogenic microorganisms and improving the shelf-life of these products.

Regarding the antimicrobial peptides produced by lactic acid bacteria, these are characterized as bacteriocins and they comprise a heterogeneous family of small ribosomally synthesized molecules of protein origin with strong antimicrobial activity when specific amounts are admnistered (Chikindas et al., 2018). Bacteriocin producing LAB present an auto-protection system to avoid being affected by the antimicrobial peptides produced by themselves. Also, these molecules may have a bacteriostatic or bactericidal spectrum of activity mainly against closest, but not only, related species. Two large classes of bacteriocins have been suggested considering the presence or not of changes in their structure after the translation process. The first group described as class I assemble the modified molecules that are more stable to high temperatures, extreme pHs or proteolytic enzymes. The unmodified bacteriocins belong to the class II. These antimicrobial structures present several advantages for the food industry first because they have no color, odor or taste and second because they are a natural strategy to promote the extension of the shelf-life of the foods as well as decreasing the risk of contamination of food by pathogens and spoilage microorganisms which implicates in less loss of products impacting in the economy aspects of food production (Soltani et al., 2020).

Bacteriocins can be produced by the lactic acid bacteria during the fermentation or the bacteriocin producing microorganisms can be used as bio-factories to produce these molecules which can be further purified into a powder and administered as a food bio-preservative ingredient. Nisin is a bacteriocin produced by some strains of Lactococcus lactis. It is the only bacteriocin approved to be used commercially as a bio-preservative (Alvarez-Sieiro et al. 2016) mostly against Listeria spp contamination in the dairy industry. Several works aim to select new bacteriocin producing lactic acid bacteria (Queiroz et al., 2022) and the antimicrobial potential of different bacteriocins such as pediocins have been also addressed (Khorshidian et al., 2021).

Nutrients improvement: Another aspect regarding the technological attributes of LAB is their ability in producing nutrients such as B vitamins along the fermentation process. Humans do not produce B vitamins themselves, instead they obtain these nutrients from the diet by consuming vegetables (plant metabolism is able to produce B vitamins) or food

supplements. Another way to obtain these nutrients is consuming fermented foods once some LAB can produce natural forms of vitamin B9 (Albuquerque et al. 2016), B1 (Teran et al. 2021), B12 (Torres et al. 2016), B2 (Juarez de Valle et al. 2014) that can be exported outside the microbial cells or remain in the intracellular compartment.

Although the vitamin production by LAB is strain-specific and dependent of intrinsic and extrinsic factors of the food matrix, using vitamin producing LAB is a cheaper strategy to improve naturally the vitamin nutritional content of foods representing an alternative to the use of chemically forms of these nutrients to enrich foods (Albuquerque et al. 2019).

Recent Publications

1. Albuquerque MAC, Bedani R, Vieira ADS, LeBlanc JG, Saad SMI (2016) Supplementation with fruit and okara soybean by-products abd amaranth flour increases the folate production by starter and probiotic cultures, International Journal of Food Microbiology 236:26-32.

2. Albuquerque MAC, Yamacita DS, Bedani R, LeBlanc JG, Saad JG (2019) Influence of passion fruit by-product and fructooligosaccharides on the viability of Streptococcus thermophilus TH-4 and Lactobacillus rhamnosus LGG in folate bio-enriched fermented soy products and their effect on probiotic survival and folate bio-accessibility under in vitro simulated gastrointestinal conditions, International Journal of Food Microbiology 292:126-136.

3. Albuquerque MAC, LeBlanc JG, De Moreno de LeBlanc MA, Bedani R (2020) Lactic Acid Bacteria: a functional approach, CRC Press, Bocca Raton, FL, USA.

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5. Arora K, Ameur H, Polo A, Di Gagno R, Rizzello CG, Gobbetti M (2021) Thirty years of knowledge on sourdough fermentation: a systematic review, Trends in Food Science & Technology 108: 71-83.

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S, Merenstein D, Reid G, Wolfe BE, Hutkins R (2021) The international Scientific Association for Probiotics and Prebiotics (ISAPP) consensus statement on fermented foods. Nature Reviews Gastroenterology & Hepatology 18, 196–208.

14. Mathur H, Beresford TP, Cotter PD (2020) Health benefits of lactic acid bacteria, Nutrients 12, 1679.

15. Queiroz LL, Hoffmann C, Lacorte GA, Franco BDGM, Todorov SD (2022) Genomic and functional characterization of bacteriocinogenic lactic acid bacteria isolated from Boza, a traditional cereal-based beverage, Scientific Reports 12:1460.

16. Zheng J, Wittouck S, Salvetti E, Franz CMAP, Harris HMB, Mattarelli P, O'Toole PW, Pot B, Vandamme P, Walter J, Watanabe K, Wuyts S, Felis GE, Gänzle MG, Lebeer S (2020) A taxonomic note on the genus Lactobacillus: description of 23 novel genera, emended description of the genus Lactobacillus Beijerinck 1901, and union of Lactobacillaceae and Leuconostocaceae, International Journal of Systematic and Evolutionary Microbiology 70, 2782-2858.

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Biography

Marcela Albuquerque is food microbiologist, PhD in Sciences, and she has been studying the technological and functional aspects of lactic acid bacteria (LAB) during the last 13 years aiming the development of foods with high nutritional and health-added values. She founded the company NEPP – Center for Studies in Probiotics and Prebiotics (RJ, Brazil) where she coordinates scientific consulting projects with private and academic institutions. Her research topics are mainly about the production of B group vitamins and proteolytic activity of LAB to improve nutritional properties of fermented foods as well as the safety aspects of foods exploring natural preservation strategies by using LAB-fermentation. Aiming to summarize her academic and professional career and background contributing to prospect the related LAB topics to the industry and scientific communities, she published the book "Lactic Acid Bacteria: a functional approach" (CRC PRESS, FL, USA) in 2020.

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Notes:



Hisham R. Ibrahim

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Novel health potential of bioactive peptides from egg albumin

Bioactive peptides, identified in various foods, have increasingly received scientific attention for the notable broad scope of their positive impact on human health beyond their nutritional characteristics. The most attractive feature of bioactive peptides is their ability to display very few side effects in humans due to their natural sources. Bioactive peptides are inactive within the sequence of the protein molecule and are released during in-vivo processing such as gastrointestinal digestion or in-vitro enzymatic hydrolysis of food proteins. The science of bioactive peptides involves the exploration of physiological activities of food peptides to formulate novel candidates for human health that may reduce the risk of disease as well as contribute to food safety. Egg albumen is a valuable source of bioactive proteins with diverse structural entities and many of them possess specific biological activities that represent potential ingredients of health-promotion. Thus, egg proteins offer tremendous opportunities for the discovery of bioactive peptide with the hope for the treatment of emerging human diseases and formulation of nutraceutical agents. In this work I will introduce an approach, in which new potential bioactive peptides were found encrypted into an egg white protein. This exciting finding explores novel bio-active peptides which heralding a fascinating opportunity for their potential candidacy as anti-microbial, anti-inflammation and anti-cancer therapeutic peptides for the treatment as well as risk reduction of emerging human diseases and for nutraceutical applications.

Key words: Egg albumin, biopeptides, anti-microbial, anti-inflammation, anti-cancer

Biography

Hisham Ibrahim is currently a Professor of Food Biochemistry and Structural Biology at Kagoshima University (Japan). He obtained his PhD degree in Structural Biology and Protein Engineering from Tottori University (Japan) in 1993. He worked as a research group leader in Taiyo Kagaku Central Research Institute (Mie, Japan) from 1993-1995. In 1995, he was appointed to the Department of Food Science and Biotechnology, Kagoshima University from Assistant Professor to full Professor. Dr. Ibrahim pursued research at the Center for Antimicrobial Research (CAR), California State Polytech University, Los Angeles (USA) as visiting scientist from 2000-2001. He is a conference organizer and chair in the American Chemical Society (ACS) and the American Oil Chemists Society (AOCS). He is an Editorial Board of Journal of Developing Drugs, Journal of Insights in Medical Science, Journal of Functional Foods in Health and Disease, and Journal of Food Science and Engineering.

His research focuses most on the discovery and development of bioactive peptides and proteins with therapeutic potential to fight infections, cancers and inflammatory diseases. Other research relates to the development of novel drug-delivery system for specific targeting of drugs into their intracellular targets by using food proteins combined with nanotechnology. Dr. Ibrahim work could lead to new cures for cancers, inflammatory and complicated infectious diseases.

He succeeded in introducing several scientific findings in reputable international journals and in well-recognized books.

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Poster Presentations

A new generation of extruded snacks with the addition of broccoli

Tomasz Oniszczuk

University of Life Sciences in Lublin, Poland, Faculty of Production Engineering, Department of Thermal Technology and Food Process Engineering

There is a growing market for extruded sweet or savory snacks. At the same time, there is a strong focus on the possibility to save water and energy in the food production sector The addition of pulp from fresh vegetables is not only for the development of new types of products, but also allows significantly to reduce the consumption of water and energy during processing what is the result of omitting the drying step. The aim of this work was to investigate the influence of fresh broccoli addition on the extrusion-cooking process of snack pellets. Extrusion-cooking process was performed using the Polish prototype singlescrew extruder-cooker Zamak Mercator type EXP-45-32. Determination of relevant recipe mixtures based on potato or cereal raw materials and the use of fresh broccoli addition in various amount allowed to obtain high-quality snack pellets. The processing efficiency, specific mechanical energy, expansion ratio, bulk density, colour and texture profile were determined. The screw rotation speed had significant effect on processing efficiency, and the interactions between content of broccoli additives and screw speed had significant effect on processing efficiency, physical properties and texture of snack products.

These results are part of the research project LIDER/29/0158/L-10/18/NCBR/2019 entitled "Development of a Comprehensive Technology of Obtaining High-Quality Extruded Snacks Based on Minimally Processed Vegetable and Animal Raw Materials".

Biography

Tomasz Oniszczuk is an associate professor at the University of Life Sciences in Lublin. His scientific activity is focused on processing aspects of new extruded products, both food and feed as well as biopolymers. He is an author and co-author of 119 scientific papers, 74 conference proceedings and 4 patents.

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A new generation of extruded snacks with the addition of cricket flour

Maciej Combrzyński

University of Life Sciences in Lublin, Poland, Faculty of Production Engineering, Department of Thermal Technology and Food Process Engineering

Nowadays more and more consumers are looking for new innovative products that play an important role in nutrition and allow to obtain a proper nutritional balance. The fundamental function of food is to provide the body with energy, nutrients and satisfaction that comes directly from eating it. The changing needs of customers are results of the fast pace of life and the lack of time to prepare meals. Another trend that will also develop at such a dynamic pace is the consumption of healthy snacks. The extrusion-cooking process makes it possible to obtain innovative and healthy products. Already, there are many voices that using insects into the daily diet can largely solve the global problems related to access to food in the poorest parts of the world. This raw materials can be ensure a higher coverage of the daily requirement for valuable nutrients like protein, fats and other nutrients.

Potato and cereal compositions were used for control mixtures and cricket flour was used as nutritionally valuable additive in various amount. The Polish prototype of single screw extruder-cooker Zamak Mercator type EXP-45-32 was used during extrusion-cooking process. Selected chemical analyses were completed as well as protein, fat and fibers content. Additionally, the antioxidant activity was compared. Expanded in hot oil snacks with cricket flour addition showed increased nutritional value and antioxidant activity.

These results are part of the research project LIDER/29/0158/L-10/18/NCBR/2019 entitled "Development of a Comprehensive Technology of Obtaining High-Quality Extruded Snacks Based on Minimally Processed Vegetable and Animal Raw Materials".

Biography

Maciej Combrzyński has completed his PhD at the age of 28 years from University of Life Sciences in Lublin. He is an assistant professor. He is a Head of the research project LIDER X LIDER/29/0158/L-10/18/NCBR/2019 entitled "Development of a Comprehensive Technology of Obtaining High-Quality Extruded Snacks Based on Minimally Processed Vegetable and Animal Raw Materials". He is an author and co-author of over 50 scientific papers and over 40 conference proceedings. His scientific activity is focused on funtional food and ecological biopolymers.

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Notes:

Fresh chokeberry as valuable additive in extruded snack pellets and crisps

Renata Różyło

University of Life Sciences in Lublin, Poland, Faculty of Production Engineering, Department of Food Engineering and Machines

Fruit additives became very popular last years in various food products. In order to exert a beneficial effect on human health, functional food can be enriched with biologically active components present in fruits. In this context, many scientists highlight the highly positive effects of

Components with high antioxidant activity. One of the most nutritionally valuable fruit is chokeberry (Aronia melanocarpa (Michx.) Elliott) known for its antioxidant properties and beneficial impact on human health. Chokeberry fruit contains a wide range of nutrients and health-improving substances, such as: sugars (glucose, fructose), pectins, tannins, calcium and iron compounds, vitamins (A, C, E, PP and others from the B group), flavonoids (hyperoside, quercetin, rutin), anthocyanins (cyanidin derivatives), phenolic acids (ferulic, p-coumaric, protocatech). Chokeberry extracts have proven effective in the prevention of stomach ulcers; besides, they help seal blood vessels, improve vessel flexibility, and reduce permeability. They are administered for colds and in periods of reduced immunity. Except of nutritional benefits, chokeberry gives the product specific purple-violet color due to the presence of natural colorants.

Various compositions based on potato and cereal starches were used as control mixtures and fresh chokeberry was used as nutritionally valuable additive in various amounts. Extrusion-cooking process was made using the Polish prototype of single screw extruder-cooker Zamak Mercator type EXP-45-32. Selected chemical and physical analyses were completed as well as antioxidant activity, amino acids profile and sensory properties. Ready-to-eat snacks supplemented with fresh chokeberry addition expanded by hot oil frying were characterized by increased nutritional value, antioxidant activity and higher sensory characteristics.

These results are part of the research project LIDER/29/0158/L-10/18/NCBR/2019 entitled “Development of a Comprehensive Technology of Obtaining High-Quality Extruded Snacks Based on Minimally Processed Vegetable and Animal Raw Materials”.

Biography

Renata Różyło is a University Professor holding at the University of Life Sciences in Lublin, Poland. Her research focus on the development of innovative functional foods, including gluten-free, high-protein and high-fiber cereal products. She is an author and co-author over 108 scientific papers and over 46 conference abstracts and 3 patents.

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Notes:

Pulsed UV light for bacterial reduction: Impact of physical parameters on Aspergillus brasiliensis

Clara Chamontin
Barbara NIBOUCHE, Janyce FRANC, STERIXENE, France

Foodborne illnesses related to the ingestion of pathogenic microorganisms remain a major cause of morbidity encountered worldwide, with 420 000 deaths each year. To ensure food safety, several processes have been developed to reduce the microbial load of food: thermal, chemical and athermal treatments. With regard to the latter, the use of mercury-based UV for bactericidal action was demonstrated by Bedford (1927) and Gates (1929). Pulsed Light technology was developed in Japan in 1980 and has highlighted the germicidal action of intense light flashes on micro-organisms. This alternative to mercury UV lamps uses xenon gas, which is chemically inert, more environmentally friendly, and more effective. The bactericidal activity of the broad light spectrum (200-1300 nm) is based on its absorption by the DNA double strand, which causes a break in the DNA and the formation of thymine dimers making bacterial replication impossible. Pulsed Light has been shown to be effective on reference micro-organisms for UV decontamination, such as the mould Aspergillus brasiliensis DSM 1988, and other micro-organisms commonly found in the food industry. While many scientific papers have reported on the performance of Pulsed Light, few have highlighted the impact of physical parameters of the light on microbiological activity. This study proposes to establish a parallel between two sciences, that of life and that of physics.

Methods:

Two Pulsed Light devices were used in this study:

• A xenon Pulsed Light device with a lamp patented by the Sterixene company. The frequencies of use range from 0,1 to 7Hz maximum. This device allows the emission of flashes at a voltage of 1500 to 2800V, for a plasma length of 150 mm.

• A high frequency xenon Pulsed Light device, with a voltage varying from 400 to 1000V. The applicable frequency is linked to the voltage used. For 1000V, the maximum frequency is 50Hz; for 400V it is 350Hz. The plasma length is a few millimeters.

The physical parameters directly impacting the decontamination efficiency studied here are the distance of the matrix from the optical source, the applied voltage, the number of flashes or treatment duration, the frequency, and the inoculum concentration.

Tests were conducted on PA66 UV Bio-indicators, which consists in a 15x20 mm coupon on which 100µL of a suspension of spores is deposited in one drop (patented concept). The coupon is then dried for several hours under a microbiological safety post. Bio-indicators are enumerated by inoculum recovering with a sterile swab and successive dilutions in Trypton-Salt solution. The decontamination efficiency is determined with the log reduction of the treated samples (in triplicate) compared to an untreated control sample. All tests were performed on a dry inoculum of Aspergillus brasiliensis which is the reference mould for UV decontamination and considered the most UV-resistant germ

Impact of distance: the Xenon device from Sterixene has been studied. the decontamination efficiency of a light treatment is directly linked to the fluence in J/cm² received by the inoculum. This value was measured with a Gentec UP17P-6S-H5-D0 fluencemeter. At 2800V, the fluence received at a distance of 10mm is 2.345 J/cm². At a distance of 20mm from the light source, the fluence is equivalent to 2.023 J/cm². When the sample is positioned at 100mm from the source, the fluence decreases to 0.212J/cm². In association with the received fluence, decontamination of Aspergillus brasiliensis inoculum

is observed to be 4.7 logs for a single flash at 2800V, at a distance of 10mm. The log reduction under the same conditions is equivalent to 1.7 logs when the Bio-indicator is placed more than 100 mm from the source.

2. Impact of the number of flashes: for a fixed total fluence of

12.55J/cm² received by the sample (maximum applicable fluence mentioned by the FDA), treatments of 9 flashes at 1.4 J/cm² and 5 flashes at 2.5 J/cm² were applied to the samples. Spores reduction obtained with 5 flashes at 2.5 J/cm² is 6.4 logs, compared to 3.6 logs with 9 flashes at 1.4 J/cm², i.e 2.8 logs less.

3. Impact of frequency: for these tests, two devices were studied. The first is the initial high voltage device with limited frequencies it was observed that a treatment of 3 ultra-intense flashes at frequencies ranging from 0.5 to 4Hz resulted in a bacterial reduction from 1.9 to 1.4 logs. To take this further, the high frequency device was used. The maximum voltages are lower than for the 150mm lamp device, but it allows the application of frequencies up to 350Hz. For a given voltage/frequency ratio, the tests aim to determine which parameter is favoured for a satisfying decontamination efficiency. The lowest voltage (400V) and the highest voltage (1000V) were tested. At 400V/350Hz, for a 10mm distance and 10 seconds treatment, the reduction potential is 2.4 logs. For a 1000V/50Hz ratio, at the same parameters, the bacterial reduction is 1.7 log i.e 0.7 log difference.

4. Impact of concentration: For fixed treatment parameters (1.018 J/cm²), 3, 4, 5 and 6 log Bio-indicators of an Aspergillus brasiliensis suspension were treated. At an initial concentration of 3, 4 and 5 log, all or 100% of the inoculum was destructed. However, at an initial concentration of 6 logs, 4.1 log or only 66% were successfully decontaminated.

Discussion:

Treatments parameters applied to a biological sample undoubtedly condition the decontamination efficiency. Distance, number of flashes, applied voltage allow the release of a fluence value in J/cm² directly received by the inoculum. The closer the inoculum is to the light source, the less diffuse it is and the faster it will be effective. The fluence is nevertheless to be correlated with the number of flashes since it has been demonstrated that it is not additive. Indeed, the study of frequency showed that a high-power flash will be more germicidal than two flashes of half the intensity, but whose total fluence received by the sample is equal. This demonstrates a double germicidal impact of Pulsed Light technology related to the UV dose but also to the rise in temperature and pressure of the micro-organism, observable at peak voltages. The peak intensity and the duration of the flash, two factors associated with the physical parameters of the lamp and the electronics are immediately correlated with decontamination. Although this is not discussed here, it has also been shown that high-powered but poorly dimensioned electronics (too long flash duration and too low peak intensity) do not decontaminate effectively. This is an additional point of study on the impact of physical parameters on microbial efficiency currently underway. Compared to conventional mercury-based UV solutions that have continuous illumination, Pulsed Light technology is based on the application of pulses that can have higher or lower frequencies depending on the chosen electronic components. The study of the application of a very high frequency shows a positive impact of the frequency value (350Hz) rather than the high voltage (1000V). The rapid application of a very large number of pulses such as 350 flashes in 1 second would therefore have an equivalent efficiency in terms of bacterial reduction log than a high flash power, as observed with the first xenon lamp device at 2800V.

If physical parameters have a direct impact on decontamination levels, the density of germs per unit aera is also a significant factor in the study of bacterial reduction efficiency. For the

same surface area and inoculation drop, but with increasing concentrations of 3, 4 and 5 logs, Pulsed Light treatment allows the abatement of the whole treated bacterial suspension. However, for similar treatment parameters, and foran inoculum concentration of 6 logs, only 66% were decontaminated. This can be explained by the formation of multi-layers of micro-organisms due to high spores density and more accumulation at the drop-edge. Pulsed Light is a surface treatment, which implies that the sub-layers of micro-organisms protected from the light cannot be reached by light radiation, making destruction difficult or impossible. A light treatment effectiveness is therefore harder to achieve on highly concentrated and aggregated inocula.

Conclusion:

Pulsed Light technology was validated in 1996 by the FDA. In France, it was validated and applied to bread products in 2008. For each food type, European authorities require proof of the absence of negative impact on the treated product (neoformed products, migration of material to food). This technology is already known for controlling contamination levels on food matrices but also on packaging. The difficulty in applying this technology lies in the fact that the targeted micro-organisms must be straightly exposed to the light radiation. However, it can achieve satisfactory levels of abatement on all micro-organisms: pathogens, moulds, yeasts, spore-formers.

It is a real ecological and more efficient alternative to the mercury lamps, which are harmful to the environment. Moreover, it is important to remember that the Minamata convention seeks to reduce the use of mercury over the next 10 years. It is urgent to find alternatives to non-ecological UV light. Minamata conventions is the most global agreement on environment and health, adopted in 2013 and signed by 128 countries.

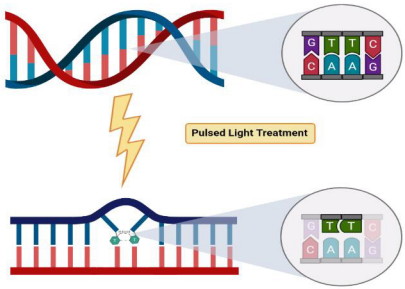
This study seeks to better understand the behaviour of light so that pulsed light technology becomes both, an ecological alternative to chemical disinfection and to mercury disinfection processes. It is necessary to master all the physical parameters applicable to the treatment device in order to determine the optimal conditions for effective microbial destruction while taking into account the industrial context.

Many applications of this technology on various matrices have been reported in the literature considering the production rates, sometimes making the solution effective but inapplicable. These industrial challenges often require a very limited number of flashes and a high intensity, hence the importance of understanding the impact of physical parameters on decontamination. Pulsed Light technology is widely used for packaging decontamination and is only slowly evolving towards food decontamination, even though it is an athermal technology, environmentally friendly and functioning on every type of micro-organism

An in-depth study of the impact of Pulsed Light at the micro-organism level could provide the information needed to understand lethal mechanisms and enable the technology to be adapted to the situation particularly on food products.

There are also other promising and environmentally friendly optical technologies, such as LED-UV, which use light as a decontamination source.

Image



Notes:

Recent Publications

1. Elmnasser N. (2007): Pulsed-light system as a novel food decontamination technology: a review
2. Fang (2020): Progress of pulsed light sterilization technology in the food field
3. Chen (2015): Pulsed light sterilization of packaging materials
4. Slieman, Nicholson (2000): Artificial and solar UV radiation induces strand breaks and cyclobutene pyrimidine dimers in Bacillus subtilis spore DNA
5. Gomez-Lopez (2005): Factors affecting the inactivation of micro-organisms by intense light pulses

Biography

After a DUT in Biological Engineering with a food industry option, a degree in Biotechnology and a Master's degree in Microbiology applied to the food, biomedical and environmental sectors, Clara Chamontin joined the Sterixene team to focus on the issue of micro-biology control for safety in the food, medical and cosmetic sectors. As Microbiology Project Manager, and through the management of Research and Development projects, she is interested in the mechanisms involved in decontamination by Pulsed Light and LED-UV technologies, and the use of light treatments for bacterial destruction.

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Selected aspects of the use of sprouted seeds in food production

Beata Biernacka

University of Life Sciences in Lublin, Poland, Faculty of Production Engineering, Department of Thermal Technology and Food Process Engineering

The sprouted seeds of many plants are among the potential natural sources of substances that can be used to supplement food and increase its functionality. They are a rich source of vitamins as: vitamins A, B, C, E, H, minerals and antioxidants, and their production is relatively easy. They contain large amounts of calcium, iron, sulfur, magnesium, potassium and zinc, selenium, as well as micronutrients - lithium, chromium. In addition, germinated seeds are characterized by an intense metabolism that can be modified to produce specific ingredients or compounds. The constantly growing technological possibilities allow the use of this type of raw materials not only as functional food intended for consumption. An innovative solution is the production of snacks enriched with the addition of sprouted seeds with the use of barothermic treatment. Extrusion-cooking process is based on HTST (High Temperature Short Time). According to increase in consumer awareness about well-being and healthy lifestyle some new types of snacks products were developed supplemented with addition of sprouted soybean. Potato-based and cereal compositions were used as control mixtures and fresh sprouted soybean was used as nutritionally valuable additive and natural colorant in various amount. Selected physical and chemical analyses were performed as well as texture and structure evaluation. Expanded snacks supplemented with sprouted soybean showed increased nutritional value, improved taste and visual attractiveness.

These results are part of the research project LIDER/29/0158/L-10/18/NCBR/2019 entitled “Development of a Comprehensive Technology of Obtaining High-Quality Extruded Snacks Based on Minimally Processed Vegetable and Animal Raw Materials”.

Biography

Beata Biernacka has completed her PhD at the age of 30 years from University of Life Sciences in Lublin. She is an assistant professor. Her scientific activity is focused on food fortification, and particular interests are focused on enriching pasta products with natural additives derived from plants. Scientific and research achievements include 35 scientific papers and 22 conference proceedings.

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Notes:

The influence of fresh highbush blueberry addition on the extrusion process of snack pellets

Marcin Mitrus

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In many countries, mainly Europe and the United States, a limited consumption of fresh fruit and vegetables has been observed. The lack of a balanced diet can lead to many civilization diseases such as cardiovascular disease, diabetes, obesity, or colon cancer. In order to minimize this undesirable trend, fresh fruit and vegetables can be added to a variety of meals, including snacks.

The aim of this work was to investigate the influence of fresh highbush blueberry addition on the extrusion-cooking process of snack pellets. Extrusion-cooking process was performed using the Polish prototype single screw extruder-cooker Zamak Mercator type EXP-45-32. Determination of relevant recipe mixtures based on potato or cereal raw materials and the use of fresh highbush blueberry addition in various amount allowed to obtain high-quality snack pellets. A low level of moisture content of blends and high screw rotational speed allowed to increase the efficiency of the extrusion-cooking process at a relatively high energy consumption during processing. The increased initial moisture content of processed blends and higher percentage of highbush blueberry content in recipies affected the lower consumption of specific mechanical energy during the extrusion-cooking process. These results are part of the research project LIDER/29/0158/L-10/18/NCBR/2019 entitled "Development of a Comprehensive Technology of Obtaining High-Quality Extruded Snacks Based on Minimally Processed Vegetable and Animal Raw Materials".

Biography

Marcin Mitrus is an Assistant Professor of technical sciences at the University of Life Sciences in Lublin. His scientific activity last years is focused on technological and nutritional aspects of functional foods, especially starch and starchy products. He is an author and co-author of 110 scientific papers and 60 conference proceedings.

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