GLOBAL SUMMIT ON THE FUTURE OF FUTURE FOOD

ASEAN-ASSET 2023

E-BOOK OF ABSTRACTS & PROCEEDINGS

ASEAN-ASSET 2023: GLOBAL SUMMIT ON THE FUTURE OF FUTURE FOOD

GLOBAL PROTEIN INTEGRITY

14 - 15 NOVEMBER 2023
QUEEN SIRIKIT NATIONAL CONVENTION CENTER (QSNCC), BANGKOK, THAILAND

ORGANIZED BY: Queen's University Belfast; PMU-B; The International Joint Research Center on Food Security; มหาวิทยาลัยธรรมศาสตร์ Thammasat University; BIOTEC a member of NSTDA; TAST

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PLENARY TALKS

PLENARY TALK-1

How Fragile is Our Food System?

Chris Elliott[1,2]

[1]Thamassat University, Thailand
[2]Queen's University, Belfast, United Kingdom

ABSTRACT:
While the world's population continues to increase rapidly and ever increasing amounts of food are required to feed all global citizens the challenges to our food system have never been greater. The impact of our climate crisis becomes more evident on a weekly basis with ever increasing evidence of crop failures and disease occurring. The impact of wars such as the conflict in Ukraine, the reverse of globalisation and changing geopolitics are all adding to the uncertainties of how are food will be produced and where shortages are likely to occur in the future. We must give much more thought to how countries can become much more resilient to all of these shocks and change our thinking about how the global food supply system will operate in the future. The lecture will outline the major challenges we face but also look towards how we can produce solutions which will reduce some of the vulnerabilities we face.

PLENARY TALK-2

Policy and Strategy Considerations for Future Foods

Aman Wirakartakusumah

International Union of Food Science and Technology (IUFoST)

ABSTRACT:
In 2021, the UN Food Systems Summit has awakened the world to the fact that many of the world's food systems are fragile and not fulfilling the right to adequate food for all. Various factors contribute to food insecurity and malnutrition, including conflict, climate extremes, and economic volatility, are exacerbated by poverty and high levels of inequality. The ultimate solution for food security is a sustainable food system that the economic, social, cultural, and environmental bases to generate adequate nutritious foods for future generations are safeguarded. The International Union of Food Science and Technology (IUFoST) acknowledges the crucial roles of agriculture, food science and technology and nutrition in driving the food system transformation. Integrated technology and innovation offer solutions to address the unpredictable challenges posed by vulnerable natural resources, climate change, and conflicts. The policy roadmap, which will be presented at ASEAN-ASSET 2023, is the outcome of the first "IUFoST Future of Food Summit: Resilient and Innovative Food Systems" (November 13th, 2023, Bangkok, Thailand), hosted by IUFoST in partnership with United Nations Industrial Development Organization (UNIDO), Food Science and Technology Association of Thailand (FoSTAT), the Office of National Higher Education Science Research and Innovation Policy Council (NXPO), Program Management Unit for Competitiveness (PMU-C) and Thailand Science Research and Innovation(TSRI), with the ultimate aim to guide global food policies on development towards sustainability and resilience of food systems.

PLENARY TALK-3

Nurturing the Future: Novel Alternative Proteins and Traditional Animal Sourced Foods

Scollan, N.D.

Institute for Global Food Security, School of Biological Sciences, Queens University Belfast, United Kingdom

ABSTRACT:
As global population continues to grow the demand for access to affordable, safe and nutritious food increases and the need to radically reduce food waste is paramount. Our agricultural and food system needs deep reduction in greenhouse gas emissions against the backdrop of the climate emergency and major pressures on land including soil degradation and biodiversity loss.

Much momentum is placed on novel food proteins in addition to traditional animal sourced proteins from meat and milk. Novel or alternative food proteins includes cultivated meat, fermentation systems for algal, bacterial or fungal fermentation, plant based alternative proteins, novel aquaculture systems, insect production, seaweed cultivation and other alternatives to traditional animal production systems. While alternative proteins hold promise key issues include sensory expectations, food allergies, protein quality, digestibility and bioavailability, regulatory hurdles, public perception and cost and economic barriers.

Animal-sourced foods, meat and milk, are considered nutrient dense, protein-rich and essential for human nutrition due to enhanced bioavailability of many beneficial nutrients and superior protein quality. Sustainable livestock systems are essential to human and planetary existence, helping secure populations especially in areas where fortification and/or supplementation is not feasible, as well as delivering land management and biodiversity.

In relation to animal sourced foods, consumers are placing increased attention to (1) environment and climate change, (2) animal welfare, (3) food, nutrition, and health and (4) integrity of product. Large emphasis is placed on deep mitigation of the environmental impact of animal agriculture, enhancing animal welfare and increasing nutrient density. Progressively different approaches are needed to evidence, verify and report “quality of animal sourced foods” and there is a need for continuous assessment of quality to maintain market access nationally and globally.

KEYWORDS:
Agriculture, climate change, novel proteins, meat, milk

PLENARY TALK-4

Safety Assessment of Plant-based Food: Does the Shift to Alternative Dietary Pattern Pose a Threat?

Chiara Dall'Asta*, O.A. Mihalache, S. Cutroneo, L. Calcinai, B. Prandi, L. Dellafiora, T. Tedeschi

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ABSTRACT:
Human and environmental health is strictly interconnected, representing the pillars of diet sustainability. In agreement with international guidelines, substantial dietary shifts are needed to move toward sustainable diets. The consumption of plant-based minimally processed food should be doubled in the coming years, replacing part of the animal source food, to lend both health and environmental benefits. Although the analysis of health and environmental impact of more sustainable diets have been widely investigated in the last years, to the best of our knowledge, there is no consensus on the impact of shifting towards more sustainable dietary models on the risk of reaching unsafe levels of specific contaminants. Contaminant levels in food are continuously monitored on the market to ensure food safety from farm to fork. However, changing the dietary patterns into more sustainable ones may lead to new health challenges referred to possible higher exposure to plant-based food contaminants. The originated emerging risk has not been fully assessed so far.

This work will give an overview of the safety assessment workflow applied to plant ingredients intended for the preparation of plant-based food alternatives. It will also present some preliminary results on the occurrence of natural contaminants, allergens and inherent antinutritional factors in legumes and bean as the major source of plant-based ingredients, and on the potential mitigation by processing.

KEYWORDS:
Natural contaminants, allergens, mycotoxins, antinutritional factors, alternative diets, novel food

PLENARY TALK-5

Natural Precision Fermentation: Looking for Specific Glycolytic Activities from Bacteria

Yves Waché[1,2]

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ABSTRACT:
Precision fermentation is deriving from classical biotechnology processes of production of pharmaceutical/chemical building blocks and food ingredients. Although a diversity of processes can be related to this concept, a dominant use of this term comes from technologists believing that Nature can be completely modified to serve humans. In this idea, precision fermentation's application can be to produce meat, milk or food oils from reactors using unrelated substrates and highly genetically modified organisms (GMO). However, precision fermentation can also be employed in a more Nature-friendly way that can be used also when catalysts are consumed by humans. In this concept, biotechnological processes and biocatalysts are used to simplify transformation steps, making them more sustainable. In this part of biotechnology, especially for food, screening of natural biodiversity is preferred to GMO construction although, through a "precision screening", very specific starters are expected. This presentation will give some applications of "natural-precision fermentation" showing the numerous demands around glycoside hydrolysis to clean products from their antinutritional factors and off flavors or to increase the amount of some flavoring compounds. It will insist on the strategies of screening of these specific starters as this screening step is often the limiting step of this technology, especially when the biochemical and genetic characterizations of enzymes and glycosides are not very developed.

KEYWORDS:
Lactic acid bacteria, glucosidase, antinutritional factors, flavoring compounds, off flavors

PLENARY TALK-6

Roadmap of Global Proteins & Alternative Proteins at Local and Global Scales: Partnership of Academia, Research, and Industry

Visit Limlurcha

The Thai Chamber of Commerce, Thailand

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PLENARY TALK-7

Old Enemies, Novel Challenges: Food Safety in the 21st Century

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ABSTRACT:
In times of still steadily increasing world population, reoccurring disruptions of supply routes e.g. due to conflicts or catastrophes and, at the same time, misbalance and limitations of global resources, strategies to maintain/enable food security are of utmost importance. However, the utilization of alternative nutrient sources, novel production technologies, strategies towards sustainability and circular economy will inevitably be associated with new challenges for food safety. Persistent contaminants in the food chain might be accumulated or novel process-related contaminants be formed. With changes in the consumption pattern, the exposure of the consumer to bioactive food constituents, material- and/or process-related contaminants might substantially change with potential relevance for human health. Thus, it is crucial to closely link food technological developments to respective food safety assessments. But not only novel food technology might change the exposure of the consumer to undesired food constituents. The climate change is already affecting the growth conditions of microorganismus such as microalgae, bacteria and fungi. Mycotoxins, fungal metabolites with toxic potential, represent a class of contaminants which are found in food worldwide. However, due to climate change, the growth conditions of the organism will change, thus affecting the occurrence of respective toxins. The structural spectrum of mycotoxins is as broad as the array of toxic effects associated with respective exposure. A famous example is aflatoxin B1 (AFB1) formed by certain *Aspergillus* and *Penicillium* species. AFB1 is a known liver carcinogen in humans. Originally found predominantly in regions with higher temperature and humidity, the occurrence of AFB1 forming strains has recently be recorded in regions of Europe which were formerly considered as “moderate climate”. A limited spectrum of well-studied mycotoxins is regulated and monitored in many countries. But recent studies indicate that further, so called “emerging” mycotoxins might also be of toxicological relevance. Among these, *Alternaria* toxins and enniatins are currently in the focus of research. Genotoxic, immunosuppressive and endocrine disruptive activities of some of these toxins are discussed. Fungi of the genus *Alternaria* occur ubiquitously and grow under a wide range of conditions. They can infest crops designated for human food production and thereby their toxic secondary metabolites can be found in feed and food. The high chemical diversity among the produced toxins results in a complex toxicological profile which is still not entirely elucidated. The composition of the produced toxin mixtures largely depends on both the fungal strain and the growth conditions. Further research on occurrence and toxicity of these potential contaminants is urgently needed. Taken together, novel strategies towards food security are of utmost importance but it is crucial to harmonize respective approaches with adequate food safety assessment.

KEYWORDS:
Emerging mycotoxins, exposure assessment, toxicity, climate change, alternative protein sources

PARALLEL SESSIONS

SUB-THEME 1:
FRONTIERS IN FUTURE FOOD

The Landscape of Alternative Protein: Global and Regional Perspective

Wasamon Nutakul

APAC's SciTech Manager, Good Food Institute (GFI), Singapore

ABSTRACT:
Dive into the latest developments of key alternative protein technologies. This talk will cover scientific and technological advancements as well as the industry landscape for plant-based protein, fermentation-derived protein/ingredients, and cultivated meat both at the global level and in the Asia-Pacific region.

Tapping the Potential of Pulse Proteins: From Refinement Extraction to its Protein Functionality

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ABSTRACT:
It is estimated that about 70% more food will be required to feed the growing world population, which is predicted to reach almost 10 billion by 2050. The challenge will be how to meet this increasing global food demand, particularly the consumption of proteins that are essential components for human life, while still achieving environmental sustainability. Pulses are recognized as complementary ingredients to tackle this challenge. Proteins extracted from these materials play a vital role as functional ingredients and are key drivers to creating a sustainable food future. Nonetheless, using these proteins can present challenges, especially when they are to replace the functionalities of animal-based ingredients, such as milk or eggs. Hence, it is pertinent to understand the functional properties of these proteins in order to utilize them efficiently in plant-based food products. In this presentation, properties of proteins extracted from two underutilized pulses, i.e., mung bean (MB) and pigeon pea (PP), which are largely cultivated in Thailand, will be presented and discussed. A conventional wet extraction method through alkaline-acid precipitation process was used. The protein extracts are classified into the globulin-rich and albumin-rich fraction – the former is mainly a product from this type of extraction while the latter is normally regarded as side stream and less utilized. The results showed that the globulin extract had protein contents of 80.50 ± 0.19 and 76.12 ± 0.27% (w/w), while the albumin extracts had lower protein purities of 18.32 ± 0.23 and 43.81 ± 0.81% (w/w) for MB and PP, respectively. Both fractions exhibited good functionalities. Specifically, the albumins from both pulses showed higher solubility than those of the globulins. Their foaming properties were also higher than those of the globulins and even superior to those of egg white and whey proteins. The poorer foaming property of globulins is likely related to their aggregated structure, making them less efficient to create strong interfacial layer around air bubbles. On the other hand, the globulins showed better emulsion properties than those of the albumins, likely due to their higher surface hydrophobicity. The secondary structure of these protein fractions was prominently with higher β-sheets and lower random coil, α-helix, and β-turn. It is shown that the functional properties of plant proteins are directly linked to the protein refinement fractions. Such concept can allow us to control the functionality of these plant proteins which is viewed as a useful tool in assisting the food industry in developing more targeted and high quality plant-based food products.

KEYWORDS:
Pulse protein, extraction, functionality, globulin, albumin

Leaf-based Protein from Biofortified Rice: A Game Changer

Apichart Vanavichit

Rice Science Center, Kasetsart University, Thailand

ABSTRACT:
Increasing the incidence of non-communicable diseases (NCDs) among the senior and elderly populations in the developing world has now become a significant public health concern. Consuming low-nutrient-dense, reduced protein intake and high glycemic index foods combined with a sedentary lifestyle are the leading cause of obesity and type-2-diabetes. In particular, low-protein diets have been a leading cause of muscle loss and weakness among older adults. Nonetheless, plant-based proteins developed from legumes, beans and seed nuts are rich in protein and antinutritive factors such as trypsin inhibitors and phytate that block nutrient bioavailability and set plant-based protein quality lower than animal proteins. Economic sustainability relies on the availability and price of raw materials with high protein content. Among the top five rice exporters with 10 million hectares of paddy, Thailand should consider utilising high-protein rice as a reliable source of plant-based protein. Although rice grains have approximately 6-8% protein content, their low in Lysine, Methionine, and Cysteine make rice quality lower than soybean. However, plant-based protein from antioxidant-rich pigmented rice varieties may confer higher therapeutic potential against chronic diseases than non-pigmented rice.

We first isolated protein hydrolysate from raw rice bran and germinated Riceberry, a cultivated nutrient-rich pigmented rice. The enzymatic protein hydrolysates from Riceberry bran (RBPH) contained 19% highly absorbable protein showing highly anti-inflammatory, antidiabetics, and antioxidants. RBPH also showed potently suppressed the survival of specific cancer cell lines derived from the liver, breast, and bile duct and protection against Lipopolysaccharide (LPS)-induced inflammation. Nonetheless, RBPH is still costly for those in need. Here, we found rice leaf lacks caloric starch, rich in dietary fibre, protein, and micronutrients, similar to rice bran but economical for large-scale production. We have focused on Rainbow Rice, producing innovative highly-pigmented leaves, as the first model. Fresh Rainbow Rice leaves showed powerful antioxidants, high protein content (14-20%), rich in micronutrients (Fe, Mg, Mn) and minimum antinutritive factors (Phytate). In particular, some Rainbow Rice whole grains contain exceptionally high protein (14%). Therefore, both leaves and entire grains have strong potential to develop functional ingredients for various therapeutic products and functional plant-based proteins against chronic diseases. We will broaden research into the nutritional benefits of green-leaf rice grown in pesticide-free farming. Farmers can gain significantly more income from producing high-quality leaves instead of burnout and causing air pollution. Therefore, rice leaves and whole-grain can become a significant supply chain for plant-based protein industries.

Future Protein: Nutritional Quality Assessment

Wantanee Kriengsinyos

Institute of Nutrition, Mahidol University, Thailand

ABSTRACT:
Novel alternative protein sources (e.g., legumes, insects, algae, fungal, cultured meat) have gained increasing popularity over the past decade because of their sustainability. Due to protein's vital function in the human body, priority should be given to alternative protein innovations that mimic meat texture, flavor, and, most importantly, quality.

Protein quality depends on amino acid composition as well as bioavailability or digestibility. The conventional score, known as the protein digestibility-corrected AA score (PDCAAS), compares the first limiting amino acid in a test protein with that of a reference essential amino acid pattern, and correcting for true fecal nitrogen digestibility. However, true fecal nitrogen digestibility does not consider the essential amino acids that are not absorbed in the ileum and are lost into the colon. Consequently, FAO/WHO/UNU expert consultations on protein requirements and quality in 2011 emphasized the need for the Digestible Indispensable Amino Acid Score (DIAAS) as a measure of protein quality. Digestibility is measured using standard oro-ileal balance methods, which can only be achieved by invasive naso-ileal intubation in healthy participants or fistulation at the terminal ileum. AA digestibility is determined based on AA disappearance under the assumption that unaccounted AAs have been absorbed.

An advanced method using stable isotopes (labeled foods) has been developed to measure human AA digestibility. Food proteins isotopically labeled with stable isotopes, usually via nitrogen or carbon, are given to an animal or human in an acute feeding study. With the dual isotope approach, two proteins (the test protein and a reference protein with known ileal AA digestibility) are given together in a mixed meal to a subject. AAs in the test protein and reference protein are labeled using different isotopes (commonly ^{2}H,^{15}N, or ^{13}C), such that plasma ratios (test diet isotope/reference diet isotope) of the isotope can be related to the known digestibility of the reference protein. The dual isotope tracer method measures small intestinal digestibility of multiple amino acids at once and is suitable for use in vulnerable groups.

The noninvasive indicator amino acid oxidation (IAAO) technique, which is routinely employed to measure indispensable amino acid requirements, has been modified by determining the slope ratio for estimating the metabolic availability (a sum of digestibility and utilization) of limiting amino acids in test proteins.

The isotope method has already been applied to a number of foods given to humans. Most of these foods are plant-based proteins with minimal processing. Various food processing procedures can improve protein digestibility by removing food constituents that reduce digestibility (e.g., dietary fiber), breaking down poorly digestible vegetable cell membranes, destroying or neutralizing antiphysiological factors, and increasing the food surface area that can come into contact with gastrointestinal enzymes. For example, soy protein isolate and refined wheat flour have higher protein digestibility than soya flour and whole wheat, respectively. In contrast, food storage and processing in adverse circumstances can reduce protein quality by making some amino acids unavailable for use in the human body. The assessment of protein digestibility is typically considered at the level of ingredients, but novel alternative proteins are blended and processed to formulate palatable foods, which have limited protein quality data. Further studies on the digestibility of novel proteins are needed.

Regulating the Plate: Policies in the Age of Innovative Food Technologies

Ankur Chaudhary

Policy Specialist (APAC), Good Food Institute, Singapore

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Milk Reinvented: Creating Dairy Proteins through Precision Fermentation with MUU

Chanapol Tantakosol

CEO & Founder of Regene Bio Pte. Ltd, and MUU, Thailand

ONLY TITLE SHOW

Cultured Meat: Trends & Update

Chenphop Sawangmake[1,2]

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[2]Bio ink Co., Ltd, Thailand

ABSTRACT:
Cellular agriculture has been an interesting trend of technology for future food innovation. With the advancement of stem cell technology and bioengineering tools, several cultured meat commercialized and prototype products have been launched into the market. The up-to-date knowhow allows the development of crucial technologies for cultured meat production pipeline, including multi-species cell line establishment, specific culture and induction media, edible bio-scaffold, and upscaling production platform. Another challenge of cultured meat product development is the national and international regulation on cultured meat product authorization. Once all stakeholders have a consensus regulation and well-developed production technology, the commercialization of cultured meat food will be more feasible.

A Continual Building Block of the New Formations of Protein - Because Eating Healthy Can Be More Fun!

Natawan Panachuenvongsakul, and **Isreya Liangkobkit***

Eatvolution Co., Ltd, Thailand

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ABSTRACT:
A hand-on food ecosystem is requisite to be a key driver in achieving sustainable and enjoyable diet. The two main figures are the consumers and the producers. For consumers, they must enjoy the foods they consume daily, and the producers must not only initiate transparency in a production process but also produce goods that create a positive impact to humans and the world as a whole. As food industrial and technological progress, consumers nowadays are getting insufficient amounts of life essential nutrients, specifically in protein content. On the other hand, growing up as Asians, we are all familiar with eating rice, but our rice has more to offer - not only provide more nutrients but also a solution for medical restrictions and treatments. We - EATVOLUTION - would like to take on a challenge with our first product spearhead 'Chickpea Rice', a functional based and performance focused alternative rice.

Within 100 g of Chickpea Rice, it consists of 12g of protein, 8g of fiber, 50% lower in carbohydrate when compared to white rice, and it's top-14 allergen free. Our rice is made from Chickpea and this tiny seed is a superfood and packed with vital nutrients, especially protein, to address the frontier of the future of protein supply. With 83.8% of the PDCAAS, it contains amino acids that the human body cannot produce, having a good amount of complex carbohydrate and many more. Furthermore, our future food is not only practical for achieving better health but also heuristic for the on-going food scarcity crisis. One of the longest cultivated and nutrient dense legumes, chickpea is known to be a versatile crop that is capable of addressing this aspect. They are great crops to feed the world! Also, we attempt to create an ecosystem by practicing a green supply chain through below-market-standard ingredients locally.

Above all, we - as a producer - would like to take a stance to be one of the sustainable solutions for not only the consumers' health but also the health of the world. EATVOLUTION proudly presents "Chickpea Rice" as one of the key drivers in this space to allow consumers to create their own creative and enjoyable journey to achieve a healthier body and better mind.

Future Foods: An Industry's Perspective on the Path to Sustainable and Nutritious Food

Sunisa Chatsurachai

Open Innovation Manager, CPF Food Research and Development Center Co., Ltd., Thailand

ABSTRACT:
CP Foods emphasizes a three-fold philosophy of sustainability, which involves conducting business for the benefit of the nation, people, and the company. Our mission is to ensure global food security. CP Foods places great importance on the development of "Future Food," aiming to provide diverse, high-quality, safe, and affordable food while simultaneously enhancing their business processes for increased sustainability. To address the need to feed the world and combat the effects of climate change, CP Foods is not only focused on improving current animal production but also on finding alternative solutions that can meet the needs of customers, society, and the environment.

To achieve this, CP Foods has established a Research and Development Center, dedicated to innovating and developing alternative protein products under the brand "Meat Zero." These products closely mimic the taste and texture of animal meat. In addition to "Meat Zero," the company is exploring different technologies such as mycoprotein and cultivated meat. By employing open innovation approaches, CP Foods can leverage technology and strategic partnerships with startups, universities, academic organizations, and more. These approaches help CP Foods' R&D team accelerate new product development and research.

In summary, CP Foods sees "Future Food"-related technologies as a growing and promising field with the potential to reduce the costs of alternative protein products. We also want to emphasize that food sustainability goes beyond ensuring food security; it also includes offering nutritionally rich, health-conscious choices that cater to the unique needs of consumers, including dietary supplements and medical foods.

PARALLEL SESSIONS

SUB-THEME 2:
SAFETY OF FUTURE FOOD

Food Safety Aspects of Cell-based Food

Sridhar Dharmapuri

Food and Agriculture Organization of the United Nations, Regional Office for Asia and the Pacific, Thailand

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Future of Food Safety: Aspect from Policy Maker

Vanida Khumnirdpetch

Bureau of Foreign Agricultural Affairs, Office of Permanent Secretary, Ministry of Agriculture and Cooperatives, Thailand

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The WHO Updated Globe Food Safety Strategies (2023-2035) and National Implementation Roadmap

Yongning Wu

CFSA/WHO, PR. China

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Natural Alternaria Mycotoxins Production in Pathogen and Endophyte Fungi

Yanshen Li

Yantai University, PR. China

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Allergenic Risk Assessment and Management of Novel Foods

Hongbing Chen

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ABSTRACT:
The prevalence of food allergy is consistently on the rise. The emergence of novel foods has led to the introduction of unfamiliar allergens into our dietary patterns, thereby prompting concerns regarding the potential hazards associated with novel food allergy. The objective of this report is to critically examine the present state and anticipate future developments of risk assessment of novel foods. It provides an overview of novel foods, including their definition, common variants and consumer reception. Moreover, it aims to elucidate the strategies employed in evaluating risks of novel food allergens, as well as the assessment of allergenic risks associated with novel food constituents. Furthermore, it states the existing regulations governing the management of food allergens in novel food products, while also outlining potential avenues for future research.

Key Technology Research and Food Safety Risk Analysis of Cell-cultivated Meat

Yingying Li

China Meat Research Center, PR. China

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How Food Emulsifiers Increases Toxicity of Process Contaminants

Kevin WH Kwok

Department of Food Science and Nutrition Research Institute for Future Food (RiFood), The Hong Kong Polytechnic University, Hong Kong SAR

ABTSRACT:
Emulsifiers are common food additives that are employed extensively in the food industry. They are primarily used to promote formation and stability of emulsions in processed food. Food emulsifiers were generally regarded to have low toxicity. Recent studies showed that emulsifiers can promote inflammation, colitis, metabolic syndrome and even carcinogenesis through altering gut microbiota community. Food emulsifiers often can be found in the same ultra-processed food products as another common food contaminant acrylamide. Recently acrylamide has been found to upset lipid metabolism, induce adipocyte differentiation and potentially obesity. It is also known to be immunotoxic, harming the spleen and inducing inflammation in various cell types. Given that they occur together in many food products, their co-exposure can be anticipated. Interestingly, acrylamide and food emulsifiers can create similar toxicity but with different mechanisms, suggesting that they may interact synergistically and increase in resultant toxicity. In this presentation we will present data showing that food emulsifiers Tween 80 and glycerol monostearate increased absorption and toxicity of acrylamide in cells and mice model, contributing to increased chemical uptake, increased gut permeability, higher inflammatory cyktokines, higher oxidative stress and higher weight gain. These data suggested that emulsifiers and acrylamide interact in a complex manner that requires further study.

Food in the Future: Evolution to Safety, Security and Sovereignty

Racha Tepsorn

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ABSTRACT:
Food is an important basic factor for human life as well as an important export product. Therefore, food without acceptable quality and unsafe is a cause of loss in terms of public health, economics, and is an important cause of food waste. Food safety refers to the safe management of food and agricultural products intended for human consumption, which is an important consideration in food production. Potentially contaminated food was a major cause of food waste throughout the food chain as it was unsafe for consumption and eventually ends up as waste. This caused food to disappear from the supply chain and became a problem of food insecurity. Both food safety and food security affected human life. Although food production systems appeared to be able to respond to all consumer needs, in the midst of global change there was a relationship between food safety, food loss, and food security. However, the current industrial food system failed to provide enough food for people around the world. This was caused not by food shortages but by wide inequality, unnecessary food production, commercialization and promotion by companies with monopolies in the food and agriculture industries or even the pandemics of disease. That demonstrated the food security problem that aroused when those with authority to procure food played a role that outweighed the right to access food. Addressing this issue of food insecurity relied on the concept of food sovereignty in which food systems were socially collaborative and environmentally sound. The inhabitant community possessed the freedom to control or determine their own production, pricing, and access to food. This was to be able to restore the community to be better than before and be able to cope with any crises that might occur in the future. Therefore, future food production systems must not only meet consumer needs but also consider safety, security, and sovereignty over their food. In order for global society to function in balance under these limited food resources.

Harnessing Algal Nutrients while Curtailing Toxin Risks: A Path Toward Sustainable and Safe Algal Food Products

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ABSTRACT:
The burgeoning human population coupled with the exigencies of climate change necessitates innovative, sustainable, and safe food solutions. Algae, with its robust nutritional profile and low-resource cultivation requirements, emerges as a promising candidate to augment future food security. However, the occurrence of algal toxins poses a significant safety concern that needs addressing to realize algae's full potential as a viable food source. This presentation delves into the dual challenge of maximizing the nutritional bounty of algae while mitigating the risks posed by algal toxins. We will explore various algal species, the spectrum of toxins they may harbor, and the implications for food safety. A critical review of current methodologies for toxin detection and quantification will be presented, alongside a discourse on existing regulatory frameworks governing algal food products. Furthermore, we will discuss viable mitigation strategies, including selective cultivation, genetic modifications, and novel toxin removal processes, to ensure the safety of algal food products. The presentation aims to foster a comprehensive understanding of the challenges and opportunities in integrating algae into our food systems, thereby contributing to the broader discourse on the safety of future food. Through a synergistic approach encompassing rigorous safety assessments, technological innovations, and consumer education, we can navigate the path toward harnessing algae's nutritional benefits while ensuring food safety, thus making a stride toward a sustainable food future.

Development of Modern Fluorescent Sensors and Sensitivity Enhancement by Plasmonic Nanoparticles for Environmental and Food Security Protection

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ABSTRACT:
The novel hazardous sensors have been developed and are essential tools for endorsing the well-being of mankind and environmental sustainability. Accordingly, the detecting methods for toxic ions, which can provide high sensitivity, easy visualization and high selectivity, are required to prevent these undesirable circumstances. Herein, several fluorescent and near-infrared sensors were designed and prepared based on [5]helicene, NBD, fluorescein, rhodamine, aza-BODIPY and cyanin. Under aqueous conditions, these sensors exhibited high selectivity for detection of hazardous heavy metal ions and anions in visible and near-infrared spectra windows. Importantly, the detection limits of these sensors were lower than the recommended values of the heavy metal and cyanide contaminants in drinking water, specified by U.S. EPA and WHO. In addition, the practical uses of the developed sensors were demonstrated in real samples such as foods, vegetables, pharmaceutical products, drinking water, river water, and sea water. These newly developed sensors are essential tools for endorsing the well-being of mankind and environmental sustainability, which are the crucial global agendas for implementing the Sustainable Development Goals (SDGs) outlined by UN.

KEYWORDS:
Fluorescent sensors, heavy metals, cyanide, near-infrared sensors, sustainability

Study on Authenticity Detection of Animal-derived Food Based on CRISPR/Cas12a System

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ABSTRACT:
Economically motivated adulteration has become the focus and difficulty of food authenticity supervision. Currently, the most effective detection technology is DNA analysis. However, the existing DNA detection methods mainly rely on sophisticated instruments and strict operating environments for nucleic acid amplification, and on-site rapid detection technologies are scarce. The bottleneck is how to identify and convert trace adulterated DNA in complex matrices into portable and readable signals. Inspired by the target specific recognition and efficient trans-cleavage activity of CRISPR/Cas12a system, we first introduced it into authenticity detection of animal-derived food. Through innovative design and signal encoding of non-target nucleic acid substrates, the trace adulterated DNA signals were cleverly transformed into highly sensitive fluorescence, Raman signals, or portable colorimetric signals, achieving effective detection of low adulteration rates in complicated food matrices. The developed technologies not only meet the demands of portable food authenticity detection, but also provide novel approaches for on-site rapid detection of other biomarkers.

Rising to the Challenge of Future Food Analytics

Robin Philp

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ABSTRACT:
The global development of food technologies that provide greater sustainability, utilize alternative proteins, and incorporate smart packaging, bring new challenges to ensure consumer safety, nutrition as well as improved health. This requires new analytical approaches and workflows that address those needs.

FCC Dietary Proteins Expert Panel – Overview, Workplan, and Accomplishments

Eric Schwartz

United States Pharmacopeia (USP) and Food Chemicals Codex (FCC), USA

ABSTRACT:
Consumer demand for dietary protein ingredients continues to increase and the global protein market is both evolving and expanding. Animal-based proteins remain dominant; however, consumers are becoming increasingly interested in the use of alternative protein sources due to several economic, environmental, health, and ethical concerns. The surge in the popularity of these ingredients makes them particularly vulnerable to economically motivated adulteration. Several advancements in analytical methodologies have been made to characterize, detect adulteration, and establish the authenticity of protein ingredients, but challenges exist. The Food Chemicals Codex (FCC), a compendium of internationally recognized standards for the identity, purity, and quality of food ingredients, is actively working to develop standards, test methods, and guidelines to advance and overcome challenges in this area. The work and advancements presented in this talk were driven by the efforts and recommendations of the FCC Dietary Proteins Expert Panel (DPEP), working under the guidance of the Food Ingredients Expert Committee. This presentation will include an introduction to the FCC, DPEP initiatives, and an overview of developed methods for the identification and detection of adulteration in dietary proteins.

PARALLEL SESSIONS

SUB-THEME 3: INDUSTRIAL AND EDUCATIONAL PARTNERSHIP FOR FUTURE FOOD

Assessing Food System Risk and Fragility

Richard Friend

University of York, United Kingdom

ONLY TITLE SHOW

Capacity Building in the Field of Food Safety, Authenticity, and Origin

Christina Vlachou

Laboratory Head, Food Safety and Control Laboratory (FSCL), Joint FAO/IAEA Centre of Nuclear Techniques in Food and Agriculture, Department of Nuclear Sciences and Applications, Seibersdorf, Austria

Strengthening Member States' capabilities to assess the safety, authenticity, and origin of food:
The activities of the Joint FAO/IAEA Centre's Food Safety and Control Laboratory

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ABSTRACT:
Food safety is of paramount importance to safeguard public health, ensure food security, and facilitate market access and international trade. Apart from the occurrence of toxic contaminants and residues in food commodities, food fraud is another major challenge to the food supply, which not only is deceiving the consumer, but can also have serious safety implications.

The activities of the Food Safety and Control Laboratory (FSCL) will be presented. FSCL is located at the FAO/IAEA Agriculture and Biotechnology Laboratories of the Joint FAO/IAEA Centre of Nuclear Techniques in Food and Agriculture, in Seibersdorf, Austria. The laboratory assists Member States to improve laboratory and regulatory practices and methodologies in the areas of food safety, authenticity, and origin. This is achieved through applied research and method development, technology transfer and the provision of data and expertise to support the development of international standards and guidelines, as well as providing necessary tools for response to emerging and emergency food safety issues affecting Member States.

FSCL develops and transfers rapid screening and confirmatory analytical methods, based on nuclear and complementary techniques, to support Member States to produce analytical data, which are essential to provide feedback to regulators, farmers/producers, and post-production industry, on the effectiveness of the regulations and practices put in place to ensure food safety and authenticity.

Duckweeds as Future Food: Reinvention of ASEAN's Local Wisdom

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ABSTRACT:
Around the world, duckweeds have recently emerged as a future source of sustainable protein and healthy diet. Duckweeds refer to a group of small, aquatic, fast-growing flowering plants that can be abundantly found floating in a wide range of freshwater habitats throughout Southeast Asia. Common duckweed plant species in this region include *Lemna aequinoctialis*, *Spirodela* polyrhiza, *Landoltia punctata*, and *Wolffia globosa*. Whereas the duckweed plants can generally be applied as feed for many animals and fish, Wolffia has particularly been consumed as traditional food in several ASEAN countries such as Thailand and Laos. Locally referred to as "Khai-nam" or "Phum" in Thailand, Wolffia is rich in protein, vitamins, and minerals. The protein productivity per land area of Wolffia has been reported as several folds greater than soybean. However, the actual potential of Wolffia and the other duckweeds as the future food source will need to be substantiated under large-scale cultivation. The reinvention of duckweeds from traditional food and feed into new agricultural crops will also require consorted efforts from academia, governmental agencies, and food industries to further develop the cultivation technology and applications into food products that meet the standards and expectation of the industries and modern-lifestyle consumers.

Mitigating Off-flavor Nots in Rapeseed and Pea Protein Isolates by Means of the SENSOMICS Approach

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ABSTRACT:
As food bottlenecks encourage political unrest and drive conflicts, a lasting supply of safe, tasty and high-quality protein-rich food for the population is of key importance. Due to the growing world population and individual consumer needs, the global demand for sustainable, nutritional and functional plant-derived food proteins increased during the last decade. Next to the most common plant protein, soy, which contains sufficient quantities of the essential amino acids, other vegetable proteins from e.g. pea or rapeseed are known and seems to be promising protein sources for the future. Although these proteins offer an alternative to vegans, and people who live in regions where animal proteins sources are scare, their grassy-beany and bitter-astringent off-flavor is often the reason for consumer complaints and, therefore, is causing a major problem for plant protein processors and user.

The presentation will highlight analytical strategies to identify key flavor compounds and off-flavor stimuli in plant-based proteins by means of the Sensomics approach. The knowledge of such chemosensory key molecules then opens new avenues towards a better understanding of their sensory activity by correlating functional data from human psychophysics studies and taste receptor activation patterns. Moreover, these results can be taken to effectively navigate breeding plans or technological processes and to improve application studies toward the production of preferentially pleasant and least grassy/beany smelling and bitter/astringent tasting plant derived protein isolates.

Collaboration, the Secret to Building a Vibrant Foodtech Ecosystem

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ABSTRACT:
Food is an integral part of an individual's cultural identity. Food serves a central role in society with its ability to bring people together and bridge cultural divides. As food serves such an important role in society, and the global challenges being placed on the food system, the people working to bring new innovation to the food system must work with earnest and respect. Limitations on world's food resources are becoming clearer, the food of the future will be driven by innovations that reduce environmental impact, i.e cultured meat, single cell proteins, or byproduct upcycling to healthier products. Transition of the food system to a sustainable path will create new opportunities and require collaboration across industries and sectors. The aspiring entrepreneurs who are willing to take the risk of bringing transformational innovations to market, can emerge from anywhere, including academia or industry. These entrepreneurs will need a supportive environment to thrive, which can be achieved through the collaboration of industry, academia and government. An example of a successful collaboration is illustrated by SPACE-F, Thailand's first global foodtech incubator and accelerator program. SPACE-F was formed as a collaboration between the National Innovation Agency of Thailand (NIA), Thai Union Group PCL, and Mahidol University, leveraging the strengths of each partner to create a supportive startup ecosystem. The program brings together domestic and international startups with deeptech solutions in the foodtech space. Annually a cohort of startups is selected that are at various stages of development, ranging from early stage (incubator) to scale-up candidates (accelerator). We have created a community where entrepreneurs teach one another about the local culture, advise on how to grow their businesses and this community has led to cocreation of new products amongst the startups. SPACE-F has built a collaborative environment for startups over the past four years, with 55 startups graduating from the program, that have gone to raise over $65 Million USD in funding. The success of the startups in the program has attracted additional corporate partners to participate in the program including Thai Beverage PCL, Lotte Fine Chemical with more to be announced. SPACE-F will continue to grow this collaborative ecosystem, bringing together government, industry and academia to support innovative entrepreneurs' journey to their concepts of the future of food to your plate.

KEYWORDS:
SPACE-F, startups, sustainability, future food, innovation

Human-centric for Digital Transformation

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ONLY TITLE SHOW

A Case Study: From Academic Research to Practical Commercialization

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ABSTRACT:
At present, consumers are thinking carefully about the health benefits of the foods they consume. Future food trend is another factor forcing food manufacturers to adapt and transform their products to innovative food products in order to satisfy customer needs. The partnerships between educational institutions and food industry are importance to transfer research knowledge into new commercial goods. Each community in Thailand often has its own distinctive local product. “Nan Golden Orange” or “Som Si Thong Nan” is one of Geographical Indications (GI) products in Nan province, Thailand. Functional processed cheese cube fortified with Nan golden orange juice is a case study product proves how academic research has helped a local company to understand trend, consumer need, commercial production, food safety, marketing, and branding. From this collaboration, local food processing company can produce an innovative product from homegrown raw material and improve sustainable local business.

Translational Research: From Lab to Commercial Scale in the Case Study of White Mugwort (*Artemisia lactiflora* Wall.) Extracts

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ABSTRACT:
Natural extracts are becoming more interesting nowadays due to their potential bioactive benefits as antioxidant, anti-tumor, anti-cancer, anti-adipogenesis, anti-diabetes and other functional properties. However, there is still a lack of extraction technology in commercial scale and the knowledge of translational research from small to larger scale. This talk will reveal some of the important parameters, factors and strategies that can lead to a better understanding through a case study of the research with “white mugwort”.

Case Study: Research to Commercialization of Cricket Protein

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ABSTRACT:
Cricket protein is emerging as a promising and sustainable alternative to traditional animal-based proteins. As the world grapples with food security and environmental concerns, crickets offer a compelling solution due to their high nutritional value, efficient feed conversion rates, and minimal ecological footprint. However, it has some limitations such as poor functional properties and consumer acceptance. Therefore, this research aims to enhance the characteristics of cricket protein by utilizing conjugation with saccharides via the Maillard reaction. To supplement the traditional Maillard reaction, a new technique involving ultrasound and microbubble is implemented. Moreover, the study delves into the effects of the conjugation of cricket protein-saccharide on emulsion stability, vitamin D integration, and cytotoxicity, as well as its practical application in the production of imitation mozzarella cheese. The application of this research can be expanded and used in real industry. The commercialization process will be discussed.

Assessing Bangkok Food System: from Research to Practice

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ONLY TITLE SHOW

Translational Research for Food Innovation Program in Thailand

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ABSTRACT

Program Management Unit for Competitiveness (PMUC) has a mission to administer research fund to enhance the nation's competitiveness by fostering collaboration between the public and private sectors in Thailand as well as enhancing international collaboration to advance research outputs to global market. PMU creates a sustainable and balanced development by utilizing biological and cultural capitals into manufacturing and service businesses, creating economic value with the focus on Thailand's strategic sectors, including agriculture, food, medicine, energy, and tourism, as well as promoting technology uptake in SMEs to achieve higher value goods and services. The supporting under PMUC includes projects that will lead to new businesses of superior quality and higher value, a development of standards and national quality infrastructure (NQI) to certify and build consumer confidence in innovative products, using engineering design and information technology to expedite the research commercialization process, as well as utilization of biological and cultural capitals in the manufacturing and service sectors and increase waste utilization to support the circular economy. PMUC's food innovation program emphasizes on production of health and functional food products which meeting the market demand by employing advanced technologies, development of biological processes to produce food ingredients and natural products, upcycling of agricultural and agro-industrial wastes, and circular agricultural and food production as well as development of equipment and machines to support farmers and food processing SMEs.

ORAL PRESENTATION

SUB-THEME 1:
FRONTIERS IN FUTURE FOOD

OP-ST1-01

Improving Printing Performance and Textural Properties of Pea Protein-Based Meat Analogs by Using Rice Protein and κ-carrageenan

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ABSTRACT:
3D printing has increasingly been used to produce plant-based meat analogs. Several challenges remain, however, especially in terms of nutrient and texture of printed product. The present study aimed to prepare plant-based meat analogs with protein content and textural properties similar to those of real meat. A mixture of pea protein and alginate gel was used as base printing materials, while rice protein (RPI) at 5 - 15% (w/w) and κ-carrageenan (κc) at 0.3 - 0.9% (w/w) were used to improve printing performance as well as protein content and texture of printed product. Protein contents, rheological properties and printing performances of all printing materials were measured. Textural properties of raw and cooked printed meat analogs were determined and compared with those of selected animal meat, namely, pork tenderloin, chicken breast and salmon. Cooking losses of printed meat analogs were also determined. All printing materials exhibited pseudoplastic behavior with gel-like characteristics ($G' > G''$). Increasing RPI content increased print fidelity and stability of printing materials. Increasing RPI increased hardness of cooked meat analogs. Texture of raw and cooked meat analogs treated with κc also improved and became more similar to that of real meat.

KEYWORDS:
Animal meat, cooking loss, print fidelity, rheological properties, texture modifier

OP-ST1-02

The Potential of Dried Noodles using Koro Peanut (*Canavalia ensiformis* L.) Tempeh Flour and Oyster Mushroom (*Pleurotus ostreatus*) Flour, as Functional Staple Food

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ABSTRACT:
Dried noodles are popular due to long durability, but the nutrient content is considered not sufficient and the main source for dried noodles is wheat, the imported source since it is could not cultivated in Indonesia. Therefore, it is important to develop dried noodle with main ingredients are available in Indonesia as well as increase the nutrient content with other protein source. In this study we used koro tempeh and oyster mushroom powders as alternative substitutes which make this dried noddle become potential as functional food to address the problem relevance in nutritional imbalance and to fulfill food security. The purpose of this study was to formulate dried noodles from koro sword tempeh flour and oyster mushroom flour and determined their physical, sensory, and proximate properties. Before being made into powder, koro beans first go through a soaking and fermentation process to reduce cyanide acid levels which are toxic. Koro tempeh were dried using a traditional drying method using sunlight while oyster mushrooms were dried through the freeze drying method and mixed with other ingredients which are then formed into noodles, steamed, and dried based on six treatments with a ratio of wheat flour, koro tempeh, and oyster mushrooms of 100:0:0 (F1), 50:45:5 (F2), 55:35:10 (F3), 60:25:15 (F4), 65:15:20 (F5), and 70:5:25 (F6). The analysis was carried out in the form of sensory analysis, proximate, physical properties, and antioxidant test. The sensory results showed that formulation F4 was the most selected by panelists, but based on the analysis of physical properties, F5 was considered the best formulation. The addition of the two types of powder also increased the protein content with the values of 16-17% and contained antioxidants of 51%, both of which were above ordinary commercial dried noodles available in the markets. Among other things, the water content obtained was 6%, which is lower than the criteria decreed by SNI (Indonesian National Standard), but the lower the water content is, the better the products are, with other contents are in accordance with SNI standard, except for ash content which results in 4%, while in SNI a maximum of 3%. Formulation of dried noodles using koro peanut, tempeh and oyster mushroom are potential as functional staple food.

KEYWORDS:
Dried noodles, functional food, koro tempeh powder, oyster mushroom powder

OP-ST1-03

Properties of Clindamycin HCl loaded Wound Healing Hydrogel Film from Waste Gelatin

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ABSTRACT:
This research was preparation of gelatin/PVA hydrogel as a wound healing using waste gelatin. The hydrogel was chemical crosslinking technique using the glutaraldehyde as crosslinking agent. The clindamycin hydrochloride, a board spectrum antibiotic for antimicrobial activity, was added in hydrogel. The effect of glutaraldehyde content (0, 200, 300, 400 µL) on various properties of hydrogel was monitored. The hydrogel was measured their moisture content, swelling ratio, gel content, morphology, FTIR spectrum and drug release efficiency. It presented the higher amount of glutaraldehyde led to the higher gel content value. The higher gel content indicated the dense crosslinked network and caused the lower swelling ratio. The optical microscope images and FTIR results confirmed the crosslinking of gelatin and PVA in synthesized hydrogel. The drug release characterization presented the higher content of glutaraldehyde led to the slower releasing of clindamycin HCl. It can be summarized that waste gelatin can be used for synthesis of hydrogel for being alternative wound healing film and drug release control material.

KEYWORDS:
drug release, hydrogel, waste utilization, chemical crosslinking, soft capsule

1. INTRODUCTION

Gelatin is derived from the protein collagen using partial hydrolysis process of skin, bone and connective tissue of animal. It has almost no taste and smell, slightly yellow to colorless. Gelatin is one of the most important natural biological macromolecule materials, it has been widely used in food, chemical and medicine industries. Gelatin has several versatile properties for example: gelling agent, foaming agent, film formation, emulsifier and water holding agent. It may be used as a flavor encapsulation, crystalline inhibition in food industry. Moreover, gelatin is a highly useful ingredient for pharmaceutical applications such as capsules, tablets, and more. Gelatin is widely used in medicines and dietary supplements production processes as a shell of both hard and soft capsules, it provides an effective protection against the light contents, atmospheric oxygen, contamination and microbial growth.

Waste gelatin from soft capsule process is a pharmaceutical gelatin grade but it is unable to re-process. Thus, it can be reused for other purposes. In this research, waste gelatin was incorporated with polyvinyl alcohol using chemically crosslinking agent, glutaraldehyde for preparing the wound dressing hydrogel film. The clindamycin hydrochloride, a board spectrum antibiotic was also added into hydrogel film to improve the antimicrobial activity of the hydrogel.

2. MATERIAL AND METHODS

2.1 Materials

Waste gelatin was obtained from local factory. Polyvinyl alcohol, PVA (degree of hydrolysis 86-90%, approximately MW~100,000 g/mol) was purchased from Chem-Supply, Australia.

2.2 Synthesis of Waste gelatin/PVA Hydrogel

The waste gelatin was washed and eliminated the contaminant using ethanol alcohol 95%v/v for 5 times and incubated at 50°C for 72 h. The prepared gelatin was cut and collected in the vacuum bag, kept the gelatin in -2°C refrigerator for later used. Waste gelatin contained 75.08% of protein, 0.25% of fat, 0.06% of ash and 24.61% of others.

A 10%(w/v) PVA solution was prepared by dissolving PVA in deionized water under continuous mechanical stirring at 80 °C for 1 h. Waste gelatin and HCl were added into the solution in the content of 5%(w/v), 0.1%(v/v) in the total solution, respectively. The solution was continuously stirred at 70 °C for 30 min. Clindamycin HCl was added in the content of 0.1%(w/v) in the total solution and then stirred at 70 °C for 10 min. The solution was cooled to 50°C and slowly added 8% glutaraldehyde in 1% acetic acid by varying the amounts (0, 200, 300, 400 µL). The final solution was casted on L13xW10xD0.4 cm acrylic plate and incubated at 60°C for 18 h. The obtained hydrogel was freeze-dried to obtain the final film.

2.3 Characterization of Waste gelatin/PVA Hydrogel

Moisture content. The moisture content dry basis of the hydrogel samples was determined using AOAC method 984.25 (AOAC, 2000) at 105 °C. The moisture content was calculated using the following equation. Triplicate test was averaged and reported.

$$\% \text{ Moisture content} = \frac{(W_t - W_d)}{W_d} \times 100 \quad (1)$$

where W_d and W_t is the weight of the dry and anytime hydrogel, respectively.

Swelling ratio. Each sample in the size of 2x1 cm^2 of each sample was immersed in 200 mL of deionized water at room temperature for 6 h. The swollen hydrogel was weighted and calculated the swelling ratio by using the following equation:

$$\% \text{ Swelling ratio} = \frac{(W_{after} - W_{before})}{W_{before}} \times 100 \quad (2)$$

where W_{before} and W_{after} is the weight of the hydrogel before and after immersing in DI water, respectively.

Gel content. Each sample in the size of 2x1 cm^2 of each sample was immersed in 200 mL of deionized water and then autoclaved at 121°C for 4 h. The remained hydrogel was dried at 105 °C, 24 h. The dried sample was weighted and calculated the gel content using the following equation:

$$\% \text{ Gel content} = \frac{\text{Dry weight of hydrogel after immersing}}{\text{Dry weight of hydrogel before immersing}} \times 100 \quad (3)$$

Optical microscope. Each sample in the size of 2x2 cm^2 was observed using LEICA DM 2700M microscope with 20x and 50x.

Fourier Transform Infrared Spectrometer (FTIR). FTIR spectra was obtained using the attenuated total reflectance (ATR) mode on the FTIR spectrometer (Tensor 27 IR, Bruker, Germany). The dried hydrogel was scanned in the range 4000-400 cm^{-1} with the resolution of 4 cm^{-1} and sample scan of 64.

Clindamycin HCl releasing test. Each sample in the size of 2x1 cm^2 of each sample was immersed in 50 mL of phosphate buffer pH 6.8. 2 mL of solution was collected at a predetermined time intervals. The collected solution was filtered through a syringe filter (Nylon,13 mm, 0.22 µm) into an amber glass HPLC vial. The concentration of clindamycin HCl was determined using

high performance liquid chromatography (HPLC) with Gemini-NX 5µm C18 110A (size 250×4.60 mm) column, degasser (SCM1000, Spectra-SYSTEM, Thermo Fisher Scientific), pump (P2000, Spectra-SYSTEM, Thermo Fisher Scientific), auto-sampler (AS3000, Spectra-SYSTEM, Thermo Fisher Scientific) and UV detector (UV 6000LP, Spectra-SYSTEM, Thermo Fisher Scientific). UV detector was set on 210 nm and the system was kept at room temperature. The mobile phase was consisted of 55% phosphate buffer pH 7.5 and 45% acetonitrile with flow rate 1 mL/min and injection volume 50 µL. The concentration of clindamycin HCl was calculated using a calibration curve with known concentration range 0-500 µg mL^{-1} of the drug in phosphate buffer pH 6.8.

3. RESULTS AND DISCUSSION

The hydrogel films were successfully prepared, their physical appearance was presented in the **Figure 1**. The film approximately contained 4.55 mg of clindamycin HCl per cm^2.

Moisture content, swelling and gel content. The hydrogel formulation and their characterization were presented in **Table 1**. GA-0 sample presented low gel content and totally dissolved within 6 h. The higher glutaraldehyde content led to the lower swelling ratio but the higher gel content. It indicated that the higher content of crosslinking agent led to the higher structure crosslinking. The higher gel content inhibited the water penetration and presented the lower swelling ratio.

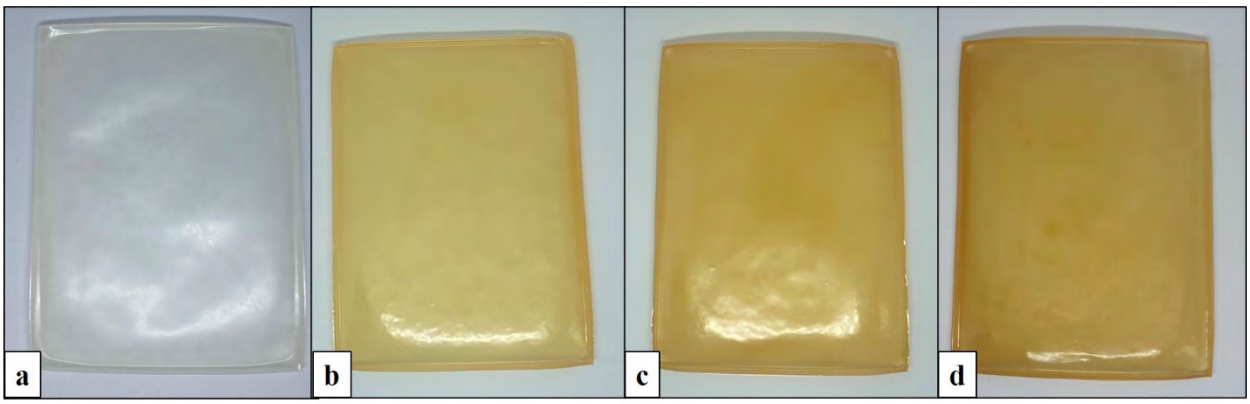

Figure 1. The prepared hydrogel GA-0 (a), GA-200 (b), GA-300 (c) and GA-400 (d)

Table 1. Formulation, moisture content, swelling ratio and gel content of the prepared film sample.

Sample	Glutaraldehyde Content (µL)	Moisture content (%)	Swelling ratio (%)	Gel content (%)
GA-0	0	4.42 ± 0.38^{b}	Dissolve	1.74 ± 0.21^{c}
GA-200	200	$4.91 \pm 0.04^{a,b}$	324.28 ± 20.83^{a}	3.27 ± 0.05^{b}
GA-300	300	$4.65 \pm 0.20^{a,b}$	316.14 ± 10.03^{a}	14.31 ± 0.26^{a}
GA-400	400	5.19 ± 0.17^{a}	247.29 ± 33.61^{b}	15.27 ± 0.33^{a}

Optical microscope. Figure 2 obviously showed that the content of glutaraldehyde affected the morphology of hydrogel film. Sample GA-0, GA-200 and GA-300 (**Figure 2**a-f) demonstrated the particles of clindamycin HCl dispersed in hydrogel film. The great homogenous and fibril structure was observed in case of GA-400 (**Figure 2**g-h). It demonstrated the amount of glutaraldehyde affected to the effectively crosslinking.

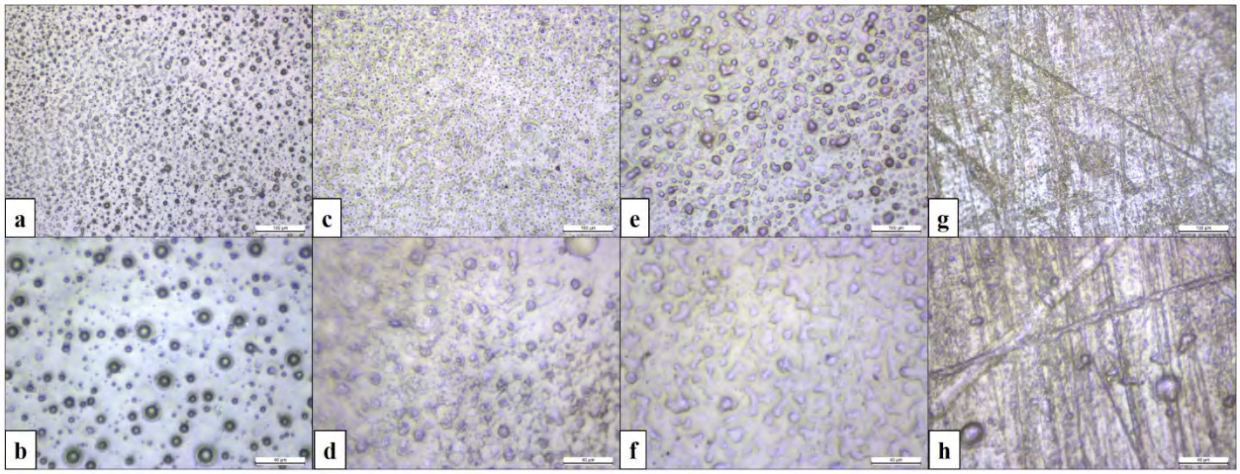

Figure 2 The optical microscope of the GA-0 at 20x (a), GA-0 at 50x (b), GA-200 at 20x (c), GA-200 at 50x (d), GA-300 at 20x (e), GA-300 at 50x (f), GA-400 at 20x (g) and GA-400 at 50x (h)

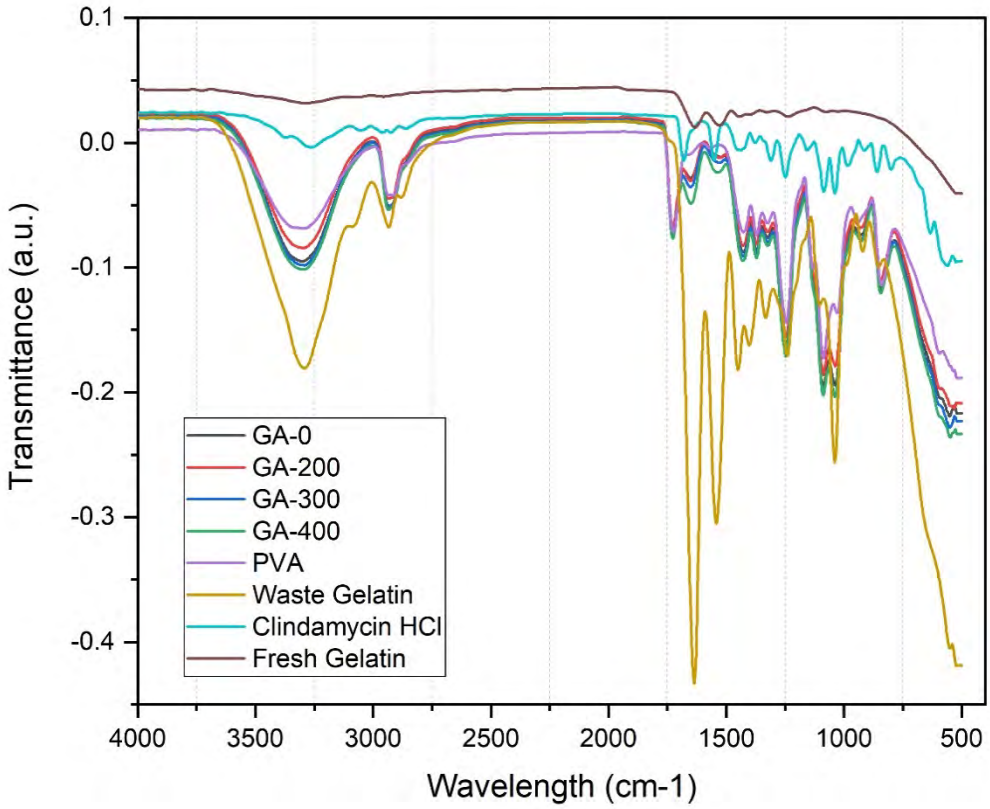

Figure 3 FTIR spectra of the prepared hydrogel

FTIR. The FTIR spectra was presented in the **Figure 3**. The FTIR spectra of waste gelatin exhibited a board peak at 3300 cm^{-1} that represented the stretching of O-H in hydroxyl group and the stretching of N-H in amide group. The peaks occurred at 2930, 1630 and 1540 cm^{-1} indicated to the stretching of C-H, the stretching of C=O and the bending of N-H, respectively. The FTIR spectra of PVA was also exhibit a board peak at 3300 cm^{-1} that represented the stretching of O-H in hydrogen bond. The peak at 2930 cm^{-1} implied the stretching vibration of C-H in alkyl group. The peak at 1720 cm^{-1} indicated the C-O and C=O of acetate group remaining from the saponification reaction in the PVA production process (Long *et al*, 2019). The stretching vibration of C-O and C-C occurred at 1085 and 840 cm^{-1}, respectively. The FTIR spectra of hydrogel sample GA-0, GA-200, GA-300 and GA-400 were exhibited the stretching vibration of O-H at 3300 cm^{-1}.

The peak at 2930 indicated to the stretching vibration of C-H. The peak at 1720 cm^{-1} implied the vibration of C-O and C=O. Moreover, it could be observed the peak at 1630, 1539, 1035 and a board band around 780-530 cm^{-1} that confirmed the existence of waste gelatin in the hydrogel sample.

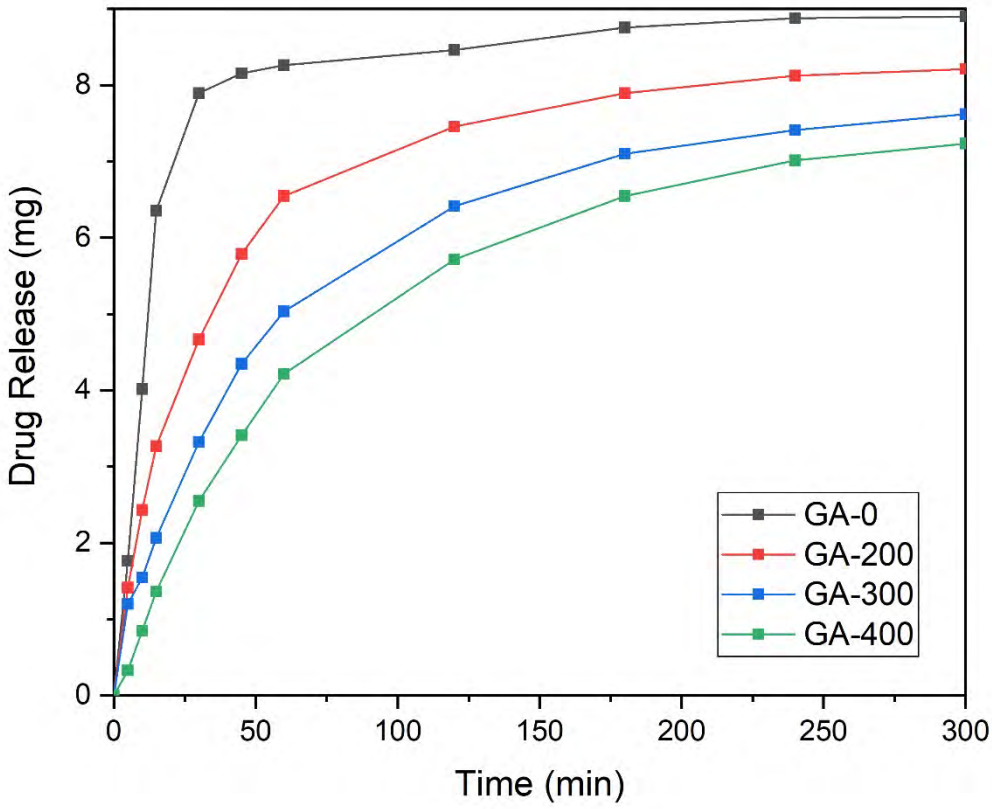

Figure 4 Clindamycin hydrochloride release of the prepared hydrogel

Clindamycin HCl release. The clindamycin HCl release was presented in **Figure 4**. GA-0 showed the fastest release of the clindamycin HCl. GA-200, GA-300 and GA-400 was slower released, respectively. The results exhibited that the hydrogel sample with higher crosslinking agent showed the decelerate releasing trend. The possible reason could be that the good water permeability of GA-0 led the hydrogel film dissolved and the clindamycin HCl in the hydrogel film released out to the solution. Whereases GA-400 presented the high gel content and low swelling ratio, so the water permeability to dissolve the clindamycin HCl was slower than other hydrogel formula.

4. CONCLUSIONS

Waste gelatin was successfully incorporated with polyvinyl alcohol for preparing the hydrogel as a wound healing material. The hydrogel was chemically crosslinked using the different amount of glutaraldehyde. The higher amount of glutaraldehyde led to the high gel content but lower swelling ratio. The optical microscope also confirmed the greatest crosslinking and then resembled to the fibril structure in case of the hydrogel with the highest amount of crosslinking agent hydrogel sample. For the clindamycin hydrochloride releasing test, the higher amount of glutaraldehyde led to the slower release of clindamycin HCl. All of the characterization summarized that GA-400 presented the better properties comparing to other formula for being an alternative choice as a wound healing film.

5. ACKNOWLEDGEMENTS

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OP-ST1-04

Effect of *Cannabis sativa* Leaves on Kombucha Fermentation toward Microbial Community, Volatile Compounds, and Physicochemical Properties

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ABSTRACT:
In recent decades, there has been a notable shift in consumer preferences towards fermented beverages due to their perceived health benefits for digestive health and cognitive function. In Thailand, the legal status of *Cannabis sativa* leaves has created an opportunity toward innovative applications in kombucha to promote the growth of beneficial microorganisms and enhance its functional attributes. This study was investigated the effect of fermentation duration (0, 3, 5, and 7 days) and the concentration of *Cannabis sativa* leaves (0%, 15%, and 30%) on kombucha involving changes in quality characteristics, volatile compounds, and the microbial community. The total acetic acid content was relatively low at 4.42±0.08 g/L, consistent with a pH value of 3.33±0.01. Additionally, there was a higher solids content of 11.53±0.05°Brix. The viability of lactic acid bacteria and yeast in the kombucha was measured of 5.53 log CFU/mL and 7.04 log CFU/mL, respectively. These findings were supported by an elevated turbidity reading of 6.24±0.43, indicating the presence of live microorganisms in kombucha formulated with *Cannabis* and Assam Green Tea. Importantly, this viability was superior to that observed in the control formula after a 7-day fermentation period. A total of 110 volatiles were identified using headspace-solid phase microextraction-gas chromatograph mass spectrometry (HS-SPME-GC-MS) was elucidated lower levels of acetic acid, carbon dioxide, and ethanol during fermentation. Metagenomic analysis revealed that substrate modification significantly impacted the microbial community align with fermentation time. Kombucha containing *Cannabis* leaf substrate exhibited greater bacterial diversity, whereas fungi exhibited more consistency in kombucha with Assam green tea substrate. The obtained study would better to understand substrate modification and microbial composition that impacted kombucha fermentation in terms of quality changes and food safety.

KEYWORDS:
Kombucha, metagenomics, volatiles, *Cannabis sativa*

OP-ST1-05

Metabolomic Analysis Reveals Phenolic and Flavonoid Accumulation Induced by Salt Stress in *Morus* sp. Leaves to Ensure Food Security

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ABSTRACT:
In recent years, metabolomics has become an accepted and valuable tool in life sciences. Metabolomics studies can reveal the tolerance strategies of mulberry plants under salinity stress conditions. Soil salinization seriously threatens food security. Plant metabolites and their associated metabolic pathways can be affected by abiotic stresses. The induction of secondary metabolites in mulberry leaves increases the potential of mulberry leaves as a candidate for phytopharmaca and as a food ingredient. This study aims to obtain metabolite profiles of selected samples as a response to NaCl stress and to obtain candidate metabolites as markers of NaCl stress. Metabolomics analysis approach using UHPLC-Q-Orbitrap HRMS with mulberry leaf extract samples, namely untargeted metabolomics. In this study, samples 2-0, 2-1, 2-2, 2-3, 4-0, 4-2, and 6-3 were selected from the NaCl treatment using seven selected samples based on the value of α-glucosidase enzyme inhibition activity, phenol content, and high flavonoids, as well as high proline content. The results showed that the marker metabolites of samples 2-3 were octadecanoic acid, kuwanon G, ferulic acid, eugenitin, gingerdion, coniferyl ferulate, and myristoleic acid. The marker metabolites of samples 4-2 are 4-O-(α-D-glucopyranosyl) moranoline and shikimic acid, while the marker metabolites of samples 6-3 are α-tocopherol. The concentrations of flavonoids, phenols, carboxylic acids, and lipids increased at the highest salt concentration in samples 2-3. The erucamide metabolite from the lipid class was the dominant compound expressed in this study. Lipids protect the cell and chloroplast membranes and maintain the membranes' structure and function from damage. Interactions of flavonoids, phenols, carboxylic acids, and lipids play a role in tolerance to salinity stress.

KEYWORDS:
Metabolite, flavonoid, food security, phenol, salinity stress

OP-ST1-06

Functional Edible Film Incorporated with JAVA Spent Coffee Ground Extract to Extend Shelf-life of Strawberries

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ABSTRACT:
In order to utilize the spent coffee ground (SCG), phenolic extraction was undertaken and its incorporation with Konjac Glucomannan (KGM)-based functional coatings were prepared. This study aimed to (1) determine the optimal solvents for extracting bioactive compounds from SCG, (2) identify and decide the suitability of which coffee variant has better properties to be incorporated with KGM as functional coating materials (3) assess the impact of the KGM-SCGO coatings to the shelf-life of strawberries (*Fragaria × ananassa* Duch.). Java robusta and arabica SCG were selected as the samples. Low-cost extraction through Maceration process and Rotary evaporation were applied. Various analyses such as Total phenolic content, DPPH Scavenging assay, Ferric reducing antioxidant power (FRAP), and Total flavonoid content were performed to identify which oil will be used for the coating materials. Strawberries' shelf-life aspects through kinetics modeling were also investigated to test the coatings, such as mass loss rate, total color changes, total ascorbic acid content, Color analysis, total soluble solid (TSS), and acidity. In the end, Statistical Analysis, Mathematical Modeling, as well as Triangular Fuzzy AHP were done to analyze all the obtained data.

The results show that Java Robusta SCGO extracted using Ethanol 50% provided the highest phenolic content (6.32 mg GAE/g) compared to other solvents (Hexane, Ethanol 100%, and Ethanol+Hexane) (p<0.05). Antioxidant Activity (0.92 mM TE/ml (DPPH) & 369.73(mM TE/ml (FRAP)) and Flavonoid content (35.68 mg QE/mL) were also higher in Java Robusta SCGO (p<0.05).

Some findings revealed that KGM-SCGO Java Robusta Coatings were then prepared to study its activity towards strawberries' shelf-life. The results show that mass loss in the control condition (-0.1432 g/day) was higher than that of the coated Strawberries (-0.0944 g/day) ($p \geq 0.05$). The Coefficient of Ascorbic Acid Content, during the first 3 days, in coated Strawberries was 0.077 ppm/day, which was higher than that of Control (0.015 ppm/day) ($p \geq 0.05$). The Coefficient of Ascorbic Acid Degradation during the last 3 storage days, in Coated Strawberries was -0.1338 ppm/day, better than that of Control (-0.1597ppm/day) ($p \geq 0.05$). The color analysis showed that KGM-SCGO coatings effectively mitigated lightness degradation, retained more redness and blueness, and slowed the total color difference($p \geq 0.05$). TSS and acidity of the coated strawberries remained stable during the storage. Though statistically there was no significant difference between coated and uncoated strawberries, it is suggested that broader variations in concentration in the future studies needs to be considered to find the best formulations.

KEYWORDS:
Spent coffee grounds, Extraction, Konjac glucomannan, Antioxidant activities, Edible coating

1. INTRODUCTION

The increasing of coffee consumption has led to an increase of waste product of coffee or spent coffee ground. According to data from the International Coffee Organization (ICO) in 2023, coffee consumption has been growing at an annual rate of 1%, resulting in a higher volume of SCG. SCG is a significant waste product of the coffee industry, containing approximately 15% Spent Coffee Ground Oil (SCGO) by weight. (Obruca et al., 2014), This presents another opportunity to repurpose this coffee waste, particularly through phenolic extraction, to acquire more food-grade and bioactive compounds, offering numerous benefits. Another concern about environment is that product shelf-life is currently becoming one of the significant challenges. For instance, fruits and fresh produce are highly perishable, and unconsumed portions contribute to organic waste accumulation. Though it will eventually decompose and becomes organic, the contribution to the global warming is still significant. The development of functional edible coatings can address this issue by not only prolonging shelf-life but also enhancing the nutritional value of coated goods.

Konjac Glucomannan (KGM) is a primary renewable fiber-rich substance which possesses abilities to be applied as edible coating material (Zhang et al., 2005). The incorporation of KGM-Based film and certain oil or phenolic compounds, which are components of non-volatile extracts (Ramalakshmi et al., 2011), it can be advantageous to amplify product shelf-life which eventually improve both environmental and nutritional aspects.

The Incorporation of SCGO with KGM-based edible film is aimed to utilize the spent coffee ground to, not only increase its value by extracting the oil, but also apply the bioactive compounds of spent coffee ground oil to the KGM-based Edible Coating in Strawberries. In a nutshell, this research will be conducted to (1) determine the optimal solvents for extracting bioactive compounds from SCG, (2) identify and decide the suitability of which coffee variant has better properties to be incorporated with KGM as functional coating materials (3) assess the impact of the KGM-SCGO coatings to the shelf-life of strawberries (*Fragaria × ananassa* Duch.).

2. MATERIAL AND METHODS

2.1 Materials

Konjac glucomannan (KGM) 95% purity was obtained from Lamphun Province, Thailand. Java arabica coffee beans were purchased from Salatiga Central Java, Indonesia. Java robusta coffee beans were purchased from the farmer from Temanggung, Central Java, Indonesia. All of the obtained beans were roasted in medium roasted condition and were ground coarsely. These Roasted Coffee Ground (RCG) were then steamed using Oxygen Coffee Maker Art. 3c-2892 (220-240V-50Hz;400W) to acquire The Spent Coffee Ground (SCG). Before acquiring the extract of Spent Coffee Ground (SCGO), Oven drying process was performed under 50°C, for 24 hours using convective oven (ED400, Binder, Germany) to reduce around 70% humidity contained in SCG. Fresh strawberries for KGM-SCGO Application were obtained from Mahanak Market, Bangkok, Thailand.

2.2 Chemicals

Solvents such as Ethanol 100%, Ethanol 50%, Hexane, and Combination of Ethanol Hexane were used in this study. Some other goods such as Distilled Water, Glycerol 99.9%, 1,1-diphenyl-2-picryl-hydrazyl (DPPH), Trolox, Na_2CO_3 Solution 20% (w/v) Gallic Acid, NaCl solution RH 75%, Folin-Ciocalteu Reagents, Buffer (0.1 M Citric Acid+ 0.1 M Sodium Citrate (66/34) (v/v)) was added as well as 2,6-Dichlorophenolindophenol (DCPIP) reagent, and L-Ascorbic Acid.

2.3 Moisture Content Determination

Moisture Content (MC) analysis is done using gravimetric method through oven drying. Beforehand, the samples were weighed in triplicate and dried in an oven set at 110°C until a constant weight was achieved. For RCG or dry coffee grounds samples, the drying process took 2

hours, while for SCG, it took 4 hours, following the guidelines set by Ramón-Gonçalves et al. (2019).

2.4 SCGO Preparation

Java SCG acquired from steamed Java RCG coffee, was dried under 50°C for 24 hours using oven before used. SCG is then macerated using various solvents (1:10 w/v) for 24 hours under 500 rpm stirring process in a room temperature with 3 replications of maceration, using Magnetic Stirrer (IKA C-MAG HS 7, IKA, USA). Samples are then filtrated using vacuum filtration and Whatman paper number 1, before separated from its solvents using rotary evaporator (BUCHI, Switzerland) at 40°C of the bath temperature. The SCGO is then acquired and used further in estimating the compounds as well as in the coating application alongside KGM.

2.5 SCGO Total phenolic content determination

Total phenolic content (TPC) was determined following the method of Waterhouse (2002) using SPECTRONIC 20 GENESYS UV-Vis Spectrophotometer (Spectrum, USA), with a slight modification. Beforehand, Sodium Carbonate (Na_2CO_3) and 5000 ppm Gallic Acid (GA) were prepared to make Gallic Acid standard curve from 100 to 500 mg/L. Afterwards, a volume of 50 µL of SCGO from various solvent, is diluted to Ethanol 100% in a 5 mL Microtube. Afterwards, 20 µL of the diluted sample was then pipetted into separate Microtubes in three replications. To each tube, 1.58 mL distilled water was then added, before adding 100 µL Folin-Ciocalteu reagent. Tubes are then closed and vortexed until well-mixed. Sodium Carbonate, which had been prepared 24 hours before, was then added at 300 µL in each tube and mixed well. Finally, the solutions in all prepared tubes were incubated under 40°C water-bath for 30 minutes, before determine the absorbance using cuvette and UV-Vis Spectrophotometer at 765 nm.

2.6 SCGO Total flavonoid content estimation

Total Flavonoid content (TFC) was estimated following the methods by Ennaifer et al. (2018) using SPECTRONIC 20 GENESYS UV-Vis Spectrophotometer (Spectrum, USA) at 430nm wavelength, with a slight modification. Firstly, 1000 ppm Quercetin standard was prepared to make a standard graph from 40 to 200 mg/L. After that, 0.5 mL of each diluted extract was prepared onto microtubes and mixed with 0.5 mL of 2% $AlCl_3$ methanol solution. Mixture was then vortexed and incubated at room temperature for 30 minutes, before conducting absorbance reading.

2.8 SCGO Antioxidant Activity Through DPPH Radical Scavenging Assay

Free radical scavenging ability of both, RCG and SCG extracts, against DPPH (1,1-diphenyl-2-picrylhydrazyl) free radical, was conducted following the method outlined by Brand-Williams, et al. (1995), with certain adaptations made. 1000µM Trolox® standard was prepared to express the absorbance from 50 to 250 µM of Trolox® in ethanol absolute (r^2 = 0.95). A volume of 200 mL DPPH solution was prepared by adding 5×10^{-3} gr of DPPH on an ethanol 100%. Afterwards, 0.2 mL sample was prepared in a black microtube in triplicate. DPPH was added to each sample at a volume of 2 mL before 30 minutes incubation in a dark place. The absorbance measurement of each sample was done at 515 nm using SPECTRONIC 20 GENESYS UV-Vis Spectrophotometer (Spectrum, USA).

2.9 SCGO Antioxidant Activity Through Ferric Reducing Antioxidant Power (FRAP) Assay

The FRAP assay was performed following the method described by Thaipong et al. (2006) (for sample ratio) and Tomasina et al. (2012)(for reagent preparation). The FRAP reagent was prepared by combining 2.5 mL of 10 mM TPTZ solution in 40 mM HCl, 2.5 mL of 20 mM ferric chloride hexahydrate in deionized water, and 25 mL of 0.3 mM acetate buffer (pH 3.6). The resulting solution was subsequently incubated at 37 ◦C for a duration of 30 minutes. Phenolic extract (150 µL) was mixed with 2.85 FRAP solution before incubated in the dark. The absorbance was measured at 593 nm using SPECTRONIC 20 GENESYS UV-Vis Spectrophotometer (Spectrum,

USA). The reducing power was expressed in mg Trolox® Equivalent (TE)/ml by referring to a standard curve, prepared from 50 to 250 µM of Trolox® in methanol (r^2 = 0.99).

2.10 KGM-SCGO Coating Solution Preparation

Coatings were prepared following the methods of Wiset et al. (2014) by mixing 1% w/v konjac flour with 100 ml of distilled water using magnetic stirring at room temperature for 3 hours. Then, a solution of 0.5M KOH (0.14% w/v) was added to the mixture, and stirring was maintained for 15 minutes. Afterward, the mixture was left at room temperature for 1 hour. Finally, 0.3% w/v glycerol, which acts as a plasticizer, along with 1% (w/v) of the selected SCGO (yield around 0.3 mg Gallic Acid Equivalent) was added while stirring continuously for 30 minutes.

2.11 Fresh-Keeping Capacity of KGM-SCGO Robusta Java Edible Coating on the Shelf Life of Strawberry

The Kinetics of Shelf-life aspects were studied through testing KGM-SCGO coating on strawberries. Variables observed including mass loss, total soluble solid (TSS), acidity, ascorbic acid, and color changes. Two trays were prepared for the control group, and two trays were set up for the coated group. Each group included both destructive and non-destructive samples. For the destructive measurement, new strawberries (3 replications) were used daily. Meanwhile, non-destructive measurements, such as mass loss and color changes, were conducted on the same strawberries from day 0 to day 7. Strawberry mass loss was measured daily using a Mettler Toledo Analytical balance. Color aspects were assessed using the CIE Lab method with a KONICA MINOLTA Colorimeter directly on strawberries on day 1 and day 2, and an alternative analysis was performed using the Color Analyzer Android Application by KAMUSOFT Japan for image analysis of strawberries taken using the PULUZ Photo Light box. The outcome will be represented to Total Color Difference(ΔE) (see equation (1))

$$\Delta E = \sqrt{\Delta L^2 + \Delta a^2 + \Delta b^2}\,, \quad (1)$$

Where:

- ΔL is the Lightness (L) difference of the strawberries in each day
- Δa is the green-red axis (a*) difference in the of the strawberries in each day
- Δb is the blue-yellow axis (b*) difference in the of the strawberries in each day

For the other measurements, hand blender BOSCH ErgoMixx was used for destructing the samples before centrifuged using KUBOTA Centrifuge (10.000 rpm for 15 mins). As for ascorbic acid, the supernatant from the centrifuged samples was measured. Buffer (0.1 M Citric Acid+ 0.1 M Sodium Citrate (66/34) (v/v)) was added as well as DCPIP for reagent. Beforehand, L- Ascorbic Acid was prepared for Standard Curve (5-30 µg/mL) and measured both samples and standards using a UV-Vis Spectrometer at 520 nm, following the method by Davies & Masten, (1991) with a slight modification. TSS were measured using a Master Refractometer from ATAGO, and strawberry acidity was assessed using a Mettler Toledo digital pH Meter.

2.12 Mathematical Modeling, Statistical Analysis, and Fuzzy AHP for decision making

A first-order kinetic function (n=1) was utilized for mathematical modeling (France J., Thornley, 1985). This approach revealed of how specific dependent variables are affected by KGM-SCGO. SPSS Statistics 29.0 with a 95% confidence interval was also used, particularly for the Shapiro-Wilk normality test, to assess the distribution of data (n<50) and determine the appropriate analysis method for the study. If normality was not achieved, data transformation via logarithmic or reciprocal methods was applied. To examine differences in the data and assess their significance, ANOVA (One-Way) or Kruskal-Wallis (mean) tests were utilized based on the normality distribution. Additionally, Analytical Hierarchy Process (AHP) with a Triangular Fuzzy approach was employed for decision-making, following the method of Chang, (1996).

3. RESULTS AND DISCUSSION

3.1 Moisture Content Determination

The obtained percentages of MC were 4% for Java Arabica RCG, 3% for Java Robusta RCG. For the SCG the obtained value of MC was 70% for both Java Robusta and Java Arabica. Distribution of the data was known to be not normal and reciprocal transformation did not work to normalize the skewness. Therefore, One-Way ANOVA could not be conducted. Eventually, Kruskal-Wallis test was performed to analyze the means and resulted in p-value<0.05, which means there is a significant difference.

3.2 Estimation of total polyphenol content, total flavonoid content and antioxidant capacity of spent coffee ground and coffee extracts

Table 1. Antioxidant Activities, Flavonoid, and Phenolic Content of SCG

Solvents	SCG Variants	TPC (mg GAE/g)	TFC (mg QE/mL)	DPPH (mM TE/ ml)	FRAP (mg TE/ml)
Ethanol (Absolute)	Java Arabica	2.40	9.72	0.84	148.43
Ethanol 50%	Java Arabica	5.46	35.68	0.85	287.80
Hexane	Java Arabica	1.58	3.32	0.20	101.33
Ethanol + Hexane	Java Arabica	2.67	11.04	0.97	308.70
Ethanol (Absolute)	Java Robusta	3.93	9.84	0.96	138.10
Ethanol 50%	Java Robusta	6.32	40.45	0.82	369.73
Hexane	Java Robusta	1.23	1.70	0.16	26.81
Ethanol + Hexane	Java Robusta	2.76	7.60	0.92	346.59

Both coffee variants showed the highest phenolic content when extracted with Ethanol 50%, with Robusta coffee yielding the highest phenolic content as indicated in Table 2 above. Ethanol 50% was also the most effective in extracting flavonoids in both variants. Amongst the two, Robusta Java had the highest TFC. Ethanol + Hexane proved to be the most efficient combination for antioxidant activity in both variants, through a hydrogen/electron transfer mechanism. Arabica Java appears to have the higher antioxidant activity than Robusta in all solvents. Ethanol + Hexane also gives the best antioxidant activity, while Ethanol 50% showed higher activity in ferric reducing mechanisms, particularly in Robusta Java. Robusta Java with Ethanol 50% yielded in the highest antioxidant activity. Some compounds with hydroxyl bonds (OH) but lacking conjugated double bonds were more likely make SCG detectable in FRAP than the DPPH assay. As the normality data was reached ($p>0.05$), All data were statistically significant ($p<0.05$) as confirmed by One-Way ANOVA.

3.3 Analytical Hierarchy Process

Table 1. Evaluation of Choices using Triangular Fuzzy AHP

SCG-Solvent	SCORES
Arabica-Ethanol 99.5%	0.110
Arabica-Ethanol 50%	0.176
Arabica-Hexane 95%	0.050
Arabica-Ethanol & Hexane	0.148
Robusta-Ethanol 99.5%	0.130
Robusta-Ethanol 50%	0.201
Robusta-Hexane 95%	0.030
Robusta-Ethanol & Hexane	0.154
checksum	1.000

The importance of criterion was selected in this Analytical Hierarchy Process (AHP), using pairwise comparison based on the purpose of study, which is to develop a functional edible coating. The results indicate that Robusta SCGO extracted with ethanol 50% received the highest

score among all options (0.201). For our future research, we will be using Robusta-SCGO extracted with Ethanol 50%.

3.4 Impact of KGM-SCGO Java Robusta to Mass Loss, Total Soluble Solids, and Acidity of Strawberry

As the mass loss coefficient was generated, it can be understood that the rate of mass loss of the control (-0.1432) is higher than that of the coated Strawberries (-0.0944). This implies that the coating can provide protection to the strawberries against factor contributing to mass loss. Statistically, there is no significant different between coated and control strawberries (p≥0.05)

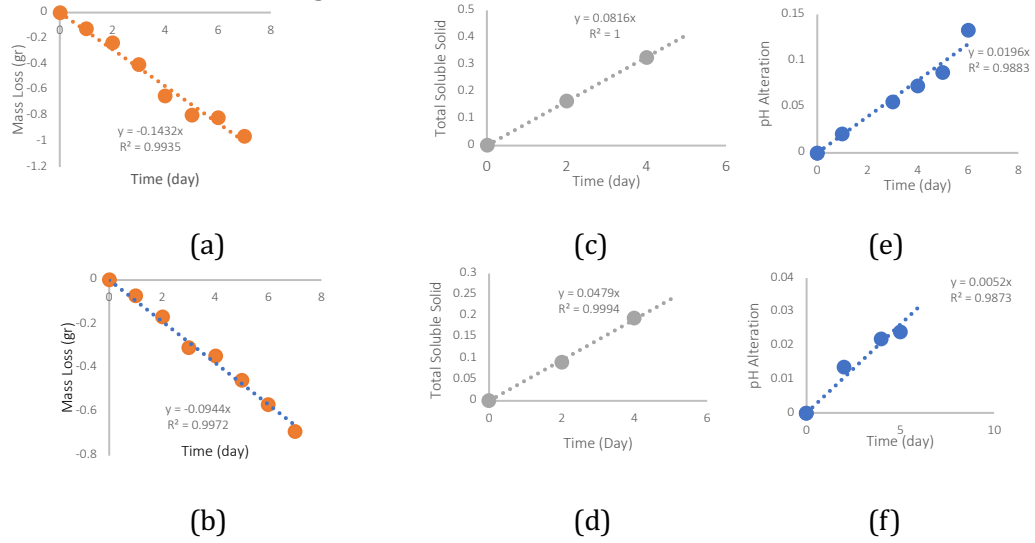

Figure 4. (a) Rate of Mass Loss in control strawberries, (b) Rate of mass loss in coated strawberries, (c) Rate of TSS in control strawberries, (d) Rate of TSS in coated strawberries, (e) Rate of Acidity in control strawberries, and (f) Rate of Acidity in coated strawberries.

Rate of Changes in TSS according to the Figure 4, is lower whenever the coating is applied to the strawberry. The rate of daily addition in TSS of coated strawberry is 0.0479 % brix per day which is lower than that of the control berries. Acidity of Strawberry can be retained using the coating, proven rate of changes coefficient in coated strawberry (0.0052) which is lower than that of the control one (0.0196). Results of ANOVA test indicated no significant differences in all data of TSS, and acidity between each treatment (p≥0.05)

3.5 Impact of KGM-SCGO Java Robusta to the color of Strawberry

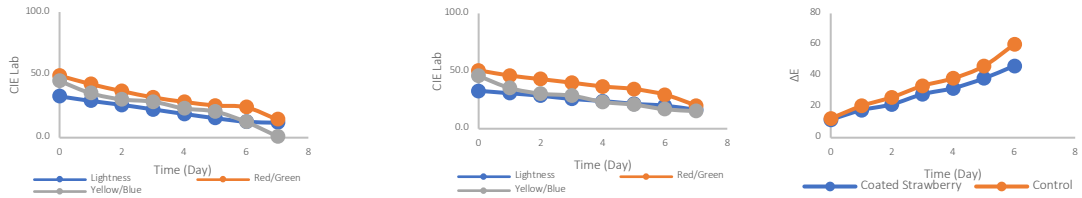

Figure 4. (a) Rate of CIELAB Changes in Control Strawberries, (b) Coated Strawberries, and (c) Actual ΔE (Total Color Difference) of both Control and Coated Strawberries

Figure 5. (a)Rate of CIELAB Changes in Control Strawberries and (b) Coated Strawberries.

ΔE can be an indicator of the changes in physical and chemical properties in certain biomass. The graph informs us that Total Color Difference (ΔE) in Control Strawberry changed more rapidly than that of the Coated one. Mathematical modeling confirmed this, with the rate of ΔE changes in Control Strawberries at a higher value of 0.2912, while Coated Strawberries had a rate of ΔE changes also at 0.2912. Importantly, the ANOVA analysis revealed no significant differences in color data among the various treatments ($p \geq 0.05$).

3.6 Impact of KGM-SCGO Java Robusta to Total Ascorbic Acid of Strawberry

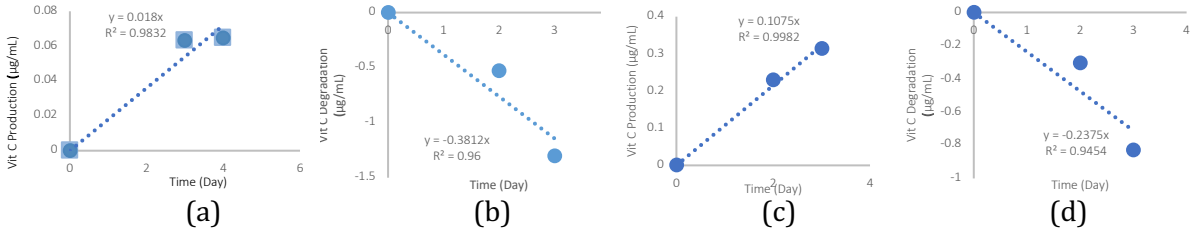

Figure 7. (a) Rate of Vitamin C production in Control Strawberries, (b) Rate of Vitamin C degradation in Control Strawberries, (c) Rate of Vitamin C production in Coated Strawberries, and (d) Rate of Vitamin C degradation in Coated Strawberries.

Daily measurement of strawberries was performed in triplicate, by using the method in the Section 2.9. Overall, the trend tends to be reduced yet there is a slight addition during the first 4 days. The Coefficient of Changes in the Ascorbic Acid, within the first 3 days, in Coated Strawberry is 0.1075 µg/ml per day or ppm/day which is higher than that of Control (0.018 ppm/day). The Coefficient of Changes in the Alteration of Ascorbic Acid, during the last 3 storing days, in Coated Strawberry is -0.2375 ppm/day which is higher than that of Control (-0.3812 ppm/day). This indicates that the KGM-SCGO Robusta coated in strawberries retain more ascorbic acid during the storage period. This results support Sapei & Hwa (2014) studies in the past that Vitamin C, or often known as ascorbic acid, is an essential nutrient for maintaining human health which ranging from 40 to 70 mg per 100 g of strawberries, and very prone to degradation, especially during storage. ANOVA test indicated that there is no significant difference in vitamin c in both coated and control strawberries.

4. CONCLUSIONS

In conclusion, the most effective SCG variant is Java Robusta when extracted with Ethanol 50% for phenolic extraction. When it comes to the fresh-keeping capacity, KGM-SCGO Java Robusta offers better protection for strawberries in terms of mass loss, total soluble solid, ascorbic acid, acidity, and color preservation. Despite no significant statistical differences, the KGM-SCGO coating still provides some level of protection against strawberry deterioration. Reformulation by adjusting the oil concentration as its bioactive compounds and or KGM concentration is suggested for future studies, for further improvement.

5. ACKNOWLEDGEMENTS

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ORAL PRESENTATION

SUB-THEME 2:
SAFETY OF FUTURE FOOD

OP-ST2-01

The Occurrence of Six Regulated Mycotoxins in Different Rice Varieties and Processing Types from Thailand and Cambodia

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ABSTRACT:
Rice was the staple food for global population. Southeast Asia is one of the main rice producers to supply the global demand. With increasing consumption of rice for the last ten years, deoxynivalenol (DON), aflatoxin B1 (AFB_1), ochratoxin A (OTA), fumonisin B1 (FB_1) and zearalenone (ZEA) were mycotoxins that can be contaminated in rice. In this study, an analytical method for simultaneous determination of six regulated mycotoxins (DON, AFB_1, OTA, FB_1, ZEA and T-2 toxin (T-2)) in rice was developed using dilute and shoot (DnS) approach followed by LC-QQQ-MS/MS detection. Methanol:water (70:30, v/v) acidified with acetic acid (pH3) was the optimal solvent for extraction of mycotoxins in rice. Analytical performance was validated giving acceptable recovery (73% – 118%) and precision (2.1% – 11.3%) with LOD and LOQ ranging from 0.1 – 1 ng/g and 0.5 - 10 ng/g, respectively. The developed method was successfully applied for occurrence analysis of 282 rice samples. The rice samples were collected from both Thailand and Cambodia with different varieties, processing types and geographical regions. Result revealed that, 38 of 282 samples showed positive for at least one of these mycotoxins (DON, AFB_1, FB_1, T-2, and OTA). FB_1 was the most frequently found in rice samples (36 of 282 samples, 12.77%) with a concentration range of 5.96–74.94 ng/g. However, there were no samples exceeding the maximum regulatory limits (1,000 ng/g) for FB_1 in cereal intended for direct human consumption according to the European Commission. On the other hands, AFB_1 was detected in 5 of 282 samples (1.77 %) with exceeding the maximum regulatory limits (2 ng/g) for AFB_1 in rice according to the European Commission. Focusing on positive samples, Riceberry (35.71%) and RD6 (19.12%) showed the highest incidence of mycotoxins contamination compared to other rice varieties. Among the geographical regions, rice samples cultivated from South region (25.71%) was more susceptible to mycotoxins contamination than those from North, Central and Northeast regions, implying that high humidity might be a key factor for the fungal growth leading to enhance the mycotoxin contamination. Interestingly, the positive rate of mycotoxin contamination in white rice (3.23%) was significantly lower than that in brown rice (24.41%), suggesting that a polishing process could reduce the mycotoxin contamination. These findings pinpointed the effect of variety, geographical region and processing type on the occurrence of mycotoxins contamination in rice, which could be further applied to agricultural practice as well as for risk assessment.

Abbreviated title: Multiple mycotoxins detection method in rice

KEYWORDS:
Mycotoxins contamination, occurrences, multi-mycotoxin analysis, processing type, rice variety

OP-ST2-02

Challenges and Pathways to Resilient Shrimp Production

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ABSTRACT:
Often overlooked in policy and research landscapes, aquatic foods are a vital component of food systems. They supply around 20% of global animal protein and have lower environmental impacts than many other food sources. Beyond protein, they are a critical source of micronutrients, especially important to vulnerable populations, and are a cornerstone of global cultures, diets, economies, and livelihoods. Despite this, the climate and biological emergency, disease outbreaks, precarious supply chains, economic insecurity and social shifts pose significant challenges to the future of this industry.

As one of just four internationally traded aquatic foods, our project looks at shrimp as an exemplar to develop pathways to more resilient production by unpacking the complex and overlapping challenges of climate, disease, economics, supply chains, and waste. Led by Professor Chris Elliott of The Institute of Global Food Security at Queen's University, Belfast, we have partnered with research institutions and companies in the ASEAN region to develop a transdisciplinary working group to understand how technologies might mix with landscape, business, economic, and policy interventions to address these challenges.

One clear conclusion so far is that despite the extensive challenges faced by the shrimp industry, many solutions already exist. What is less clear is how this wide mix of solutions might overlap to address multiple resilience challenges in a way that fosters more benefits than trade-offs. How these solutions might be incentivised and implemented across a huge network of small, resource-constrained farms is our focus. We use a Living Lab framework to put farmers and processors at the centre of our project to collectively design new model shrimp farms of the future, with a view to shaping policy and practice relevant to the global shrimp industry and beyond. As our project progresses, we are enlisting companies, researchers, and non-profit organisations to join our project and support us to co-create research-driven solutions that can be applied across different scales, timeframes, and contexts.

OP-ST2-03

Feed Additives for Sustainable Shrimp Production: Harnessing the Power of the Gut Microbiome

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ABSTRACT:
Shrimp production is crucial for global food security by providing high-quality protein and nutrients, but it faces challenges such as disease outbreaks and environmental degradation that can lower productivity and yield. In addition, the intensive use of antibiotics and other antimicrobials in shrimp farming can contribute to the development and spread of antimicrobial resistance (AMR), which can have negative consequences for both human and animal health. Unlike in terrestrial animal production, the use of antimicrobial chemicals in aquaculture can have significant environmental impacts, as they can be distributed through water and affect the microbiome of the ecosystem, posing a significant public health risk.

To mitigate the spread of AMR and chemical contaminants in aquaculture, implementing measures to reduce antibiotic use, improve biosecurity practices, and promote responsible antimicrobial use is crucial. Prebiotics as immunostimulants have been widely studied in aquaculture and can enhance growth and immune responses, reducing production losses due to diseases. Our previous research has shown that using feed additives such as mannan oligosaccharides extracted from copra meal can improve the survival of economically important shrimp species. In addition, potential probiotic strains have also been isolated, which can be used synbiotically with prebiotics to improve feed efficacy. We have also developed and optimized nutrient encapsulation platforms to reduce the loss of shrimp nutrients when applied in aquatic environments.

Our project aims to revolutionize the shrimp aquaculture industry by investigating the essential roles of microbiomes in shrimp health and aquaculture. By understanding the interactions between the microbiomes of shrimp and their environments, we can achieve targeted approaches to shrimp feed development. The next-generation sequencing platforms are employed to evaluate the efficacy of shrimp prebiotics and probiotics in farming ecosystems, providing valuable insights into developing environmentally friendly and sustainable aquaculture systems.

KEYWORDS:
Aquaculture, shrimp, functional feed, host-gut microbiome, probiotics, prebiotics

OP-ST2-04

A Halal-Plant-Based Egg Substitute: Development, Nutritional Profile, and Potential Consumer Appeal

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ABSTRACT:
The current food trend is waving towards "future food." Ethical consumer concerns regarding food arise due to its contribution to their beliefs. Halal is a special meal that is not only for Muslims but is also considered safe for everyone. In the development of plant-based food, food additives are usually applied to the master formula, some of which may be derived from animal origins or contain animal hormones. This study focuses on the development of an egg substitute made from legume protein. A concentration of 6.0 - 8.0% of legume protein isolate was used, along with 2.0% of a plant-based food hydrocolloid mixture. Soy lecithin was employed as an emulsifier to ensure that the developed egg substitute contains a similar amount of lecithin as a real egg. Fiber, which is beneficial for health and is not naturally present in eggs, was found at a concentration of 0.51%. A reduced calorie content of 65.30 kcal/100g was achieved while maintaining a total fat content of 3.26 g/100g. However, the fatty acid profile analysis demonstrated a notable concentration of unsaturated fatty acids. Therefore, this halal-plant-based egg substitute has the potential to appeal to consumers, especially Muslims and all ethical consumers.

KEYWORDS:
Halal-Plant-Based, egg substitute, nutritional profile, consumer acceptance, fiber-enriched food alternatives

OP-ST2-05

Eco-Friendly Materials and Smart Sensors: Flexible Electrodes on a Glove and a Decomposable Electrodes

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ABSTRACT:
We introduce strategies to enhance food safety through modern electrochemical analysis, emphasizing the use of miniaturized technologies and food-based materials. The first approach focuses on developing a wearable electrode using copper nanoparticles for rapid paraquat detection, a toxic compound found in food contamination. By combining copper-based nanoparticles synthesized through green methods with a flexible glove-based electrode, we create a lab-on-a-finger sensor. Utilizing a copper precursor and *Citrus reticulata* orange extract, we synthesize an electrocatalytic material for selective and sensitive paraquat detection. This sensor delivers results within 10 seconds, with a wide detection range (0.50 to 1000 μM) and acceptable sensitivity (0.31 μM). It also offers selectivity and can operate at fast scan rates up to 6 V s^{-1}, enabling direct assessment of food surfaces for paraquat contamination and enhancing on-site food safety. The second approach explores the utilization of food-based materials, specifically egg white proteins, in biosensing technology. We engineer functional microparticles by combining egg white proteins, glucose oxidase, and a redox molecule. Applied to electrodes, these microparticles provide a biocompatible and eco-friendly platform. The system exhibits a linear range of 0.125–40 mM, with a maximum current of 0.2 μA and a Michaelis–Menten constant of 4.6 mM. Additionally, a decomposable electrode composed of carbon nanotubes and edible oil, conjugated with functional enzyme microparticles, degrades under gastric conditions. This use of food-based proteins for enzyme accommodation and redox-active microparticle formation presents a promising avenue for affordable and sustainable bioelectrodes, with potential applications in biosensors and bioelectronics. In summary, our work introduces miniaturized lab-on-a-finger platforms revolutionizing food quality assessment by providing rapid, on-site analysis of toxic compounds and glucose. These platforms leverage copper nanoparticles and food-based materials to enhance electrochemical analysis in the context of food safety and sustainability. These innovations hold significant promise for advancing biocompatible electrodes and contribute to the development of biosensors and self-sustaining energy devices, aligning with the overarching theme of food safety and sustainability.

KEYWORDS:
Paraquat, glucose, green materials, food-based materials, food safety

OP-ST2-06

Rapid Mass Spectrometry for the Safety Assurance of Future Foods

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ABSTRACT:
Foods represent one of the most challenging matrices for analysis, for which many and varied analytical strategies have been developed over several decades. The rapid development of future foods, in particular alternatives to animal protein sources has resulted in the twin requirements of needing to update existing analysis strategies for established safety issues whilst simultaneously understanding and developing strategies to meet new and emerging safety challenges resulting from the production methods used for future foods and their incorporation into the wider food supply chain.

This talk will introduce several rapid mass spectrometry methods which can be used to speed up existing analytical tasks on current and future foods, starting with rapid liquid chromatography mass spectrometry (LC-MS) based screening methods that can be used on industry standard LC-MS hardware, before introducing the opportunities and benefits that can be achieved by moving to separation free ambient mass spectrometry interfaced with a variety of different mass spectrometry platforms, including triple-quadrupole (QqQ), quadrupole-time of flight (QToF) and ion-mobility time of flight (IM-ToF) systems.

Data analysis, including chemometric and machine learning based modelling will then be demonstrated as a quick and cost effective way to make best use of the resulting data, and to enable the rapid decision making that is needed on whether food samples may have safety issues that require either further testing or to be withdrawn from circulation in order to best protect public safety. Artificial intelligence and data fusion techniques will then be introduced at the end of the talk as a future opportunity to enable better target limited testing resources and enable even greater analysis of the resulting mass spectrometry data.

KEYWORDS:
Mass spectrometry, data fusion, artificial intelligence, ambient ionization, screening

OP-ST2-07

Geographical Region Traceability of Riceberry using a Metabolomic Approach

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ABSTRACT:
Rice (*Oryza sativa* L.) is one of the important global food crops serving as a stable food for more than half of the world population. Not only is rice an important source of energy, but several rice varieties also provide valuable nutrients becoming an inexpensive and readily available functional food for humankind. Riceberry, crossbred from fragment Thai Jasmine rice (KDML105) and high-antioxidant black Kao Hom Nin rice, offers unique characteristics including aroma, soft texture, low glycemic index and high contents of nutritional compounds such as polyphenols, anthocyanin, vitamin E and gamma-oryzanol. These key compounds are found in surface layer of rice grain and/or rice bran, which were proven to have antioxidant activities and nutritional properties for human health. Although it is known that geographical regions depict the quality of agricultural goods, no one has explicitly studied this effect on Riceberry before. If geographical regions play effects on the quality of Riceberry, it is important to be able to 'trace' the origin of Riceberry so that the quality can be maintained, and the fraud issue can be prevented. In this study, we employed untargeted metabolomics using liquid chromatography-high resolution mass spectrometry (LC-HRMS) coupled to multivariate statistical analysis in Riceberry from different cultivated geographical area (14 locations in North, Northeast, Central and South of Thailand). Principal component analysis revealed that metabolite profiles from different locations were found to be different. A supervised model, Random Forest, could discriminate 10 groups from different provinces, and a total of 740 metabolite features showed significant differences among each other. The significant metabolites were annotated and selected as potential biomarkers for tracing the Riceberry origin. Additionally, understanding distinct chemical characteristics will generate knowledge crucial for creating values to the rice as functional foods for the future and therefore to prevent mislabeling of the authentic Riceberry, providing safe and high quality future food to the consumers.

KEYWORDS:
Oryza sativa, riceberry, metabolomics; LC-HRMS/MS, geographical discrimination

OP-ST2-08

A Quantification of Δ^9-tetrahydro-cannabinol (THC) in Cannabis-infused Food Using Electrochemical Detection

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ABSTRACT:
Cannabis Sativa is widely used as an ingredient in food, beverages, and supplementary medicine for recreation and treatment of various diseases. It is composed of a high Δ^9-tetrahydrocannabinol (THC) content, which is the main psychoactive compound. This compound has been reported to have beneficial effect on human health, such as pain reducing and relaxation. However, there are also have some adverse effects associated with long-term use and inappropriate consumption. In addition, the European Union (EU) and Thailand have announced the illegality of THC in cannabis products that contain less than 0.2%. Thus, the amount of THC should be determined to certify the quality of cannabis-infused food, beverages, and supplementary medicine before distribution to customers. In this work, we propose a novel quantification of THC based on electrochemical detection using square-wave voltammetry (SWV) technique and a screen-printed carbon electrode. Under the optimal conditions, it has a wide analytical detection range between 0.50 and 10 μg/mL of THC compound. The limits of detection (LOD) and the limits of quantification (LOQ) were 0.35 μg/mL and 1.08 μg/mL, respectively. Moreover, the method was successfully applied for THC detection in cannabis products, including tea, extract, and cannabis oil without sample separation. Therefore, the developed method is easy to use, rapid within 5 minutes, and practical as an alternative screening test for cannabis food safety.

KEYWORDS:
Δ^9-tetrahydrocannabinol, cannabis-infused food, screen-printed electrode, electrochemical detection

OP-ST2-09

Novel High-Throughput Multiplex Detection for Bacterial Genes for Food Safety Using Peptide Nucleic Acids-Based Bead Array Platform

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ABSTRACT:
Foodborne pathogens are a major threat to food safety. *Bacillus cereus* is one of the commonly found foodborne bacteria present in a variety of foods such as instant food, starch, and dairy products, causing a wide range of symptoms. While a conventional method based on culturing and biochemical confirmation is effective and acceptable, it is time-consuming and labor-intensive. Therefore, this work developed a multiplex and high-throughput detection method for *B. cereus* using highly specific pyrrolidinyl peptide nucleic acids (PNA) as a probe together with bead array technology. To identify *B. cereus*, PNAs bearing the prolyl-2 aminocyclopentanecarboxylic acid (ACPC) backbone with the *groEL*, *motB*, and *16S rRNA* sequences were covalently coupled with three sets of fluorescently barcoded paramagnetic carboxylated beads. Each test sample was biotinylated during multiplex PCR step with the three primer sets of the target genes. A fluorescent reporter, R-Phycoerythrin labelled streptavidin (SAPE), was used to detect the positive signal of each bead. Thus, the method utilizes dual-lasers: one to identify the bead set and the other to measure the signal of SAPE. The developed method was found to exhibit high selectivity to *B. cereus* and not other six other foodborne species tested. The sensitivity of the developed acpcPNA-based bead assay in detecting genomic DNA was at 0.038, 0.183, and 0.179 ng for *groEL*, *motB*, and *16S rRNA*, respectively. Additionally, the developed method was used to detect *B. cereus* in artificially spiked milk and pickled mustard greens with minor interference from food metrics. As a result, this acpcPNA-based bead array was demonstrated to be an excellent proof-of-concept method which can be further applied to not only for detecting foodborne pathogens but also other diagnostic applications.

KEYWORDS:
Foodborne pathogen, peptide nucleic acid, bead array

OP-ST2-10

Bacteriophage Control Foodborne and Food Spoilage Bacteria: Alternative Approach in Food Safety

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ABSTRACT:
1.Introduction: Food-borne Pathogen especially Diarrheagenic *Escherichia coli* are considered major food-borne pathogen which can cause foodborne illness event. While food spoilage bacteria are responsible for causing spoilage in food. The interest of natural antimicrobe is increasing due to consumer alteration toward chemical preservative, therefore it is important to explore natural antimicrobe, and bacteriophage fits the characteristics of natural antimicrobe based on their capability to control pathogens contamination in food. 2.Materials and Methods: Bacteriophage was isolated from lake water using Enterohemorrhagic *E. coli* (EHEC), Enterotoxigenic *E. coli* (ETEC); and *Bacillus cereus* as reference strains. After isolation, phage were purified, enriched and assayed for their titer determination; host range; miMOI and application of bacteriophage to control pathogens in various food as well as scanning electron microscopy for phage determination. 3.Results: In this study we found BC-VP with the titer of 1.16 ± 0.18 x 10^9 PFU/mL and BC-AJ with 1.72 ± 0.19 x 10^8 PFU/mL while the titer of ETEC-phage-TG 1.27 ± 1.52 x 10^8 and EHEC-phage-VP 1.92 ± 1.20 x 10^8. Host range determination assays performed that both phage which infect *B. cereus* also capable to lyse Enteropathogenic *E. coli* (EPEC) and ETEC. Phage ETEC-phage-TG is also capable to lyse EHEC. While phage EHEC-phage-VP can also control ETEC and EPEC. The bacteriophages miMOI were tested using various concentrations, it was found that phage BC-VP and BC-AJ miMOI was determined to be 0.01 and 1, respectively, while miMOI of ETEC-phage-TG was 0.001 while EHEC-phage-VP was 0.01. Phage BC-VP and ETEC-phage-TG morphology were analyzed using Transmission Electron Microscope (TEM) and was categorized as Myoviridae family from the order of Caudovirales. Application of all phages through artificially contamination assays using cooked rice; pasteurized milk; lettuce and chicken meat showed reduction of *B. cereus* was higher in pasteurized milk at 28°C, using phage BC-VP with the value of 93% bacterial reduction and BC-AJ with the value of 90% reduction. EHEC bacteria reduction showed highest when infected with EHEC-phage-VP on chicken meat at 28°C with the value of 93.55% reduction. 4.Conclusion: All of the recovered phage from lake water are potential to be used in controlling EHEC, ETEC and *B. cereus* in food.

KEYWORDS:
Bacteriophage, foodborne pathogen, spoilage, control

ORAL PRESENTATION

SUB-THEME 3:
INDUSTRIAL AND EDUCATIONAL PARTNERSHIP FOR FUTURE FOOD

OP-ST3-01

Evaluation of an Ecosystem-builder Accelerator Program to Drive Research Translation

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ABSTRACT:
A significant gap exists between academic research and its translation into impactful marketable innovations. In particular, food innovation is critical to the future of healthy people and the planet, but less than 4% of all EU startups are in the agri-food sector. Also, many Intellectual Property (IP)-active universities and research-intensive institutions across Europe lack the internal capacity, knowhow, partnerships or appropriate platforms to validate new technologies and create spin-out companies. EIT Food Seedbed Incubator Program is an example of a sector-based partnership between industry, research and education, blending the best elements of market discovery methodologies with multidisciplinary challenge-led innovation programs and tailored educational training to upskill on entrepreneurship and venture creation. It is managed by innovation groups (industry, universities and RTOs) from 8 countries in Europe and organized around 3 strategic Missions, namely (1) Healthy Living through Food (2) Net Zero Food System and (3) Reducing Risks for a Resilient and Fair Food System. A key part of the program involves a scouting process across the world resulting in over 400 applications yearly (half being already set-up as a company and half applying as a team, often from universities). This is followed by a thorough selection process to identify the top 40 teams. A 6-month market discovery program follows using our extensive network with the help of coaching and business experts. Seedbed has supported 131 IP-driven DeepTech innovations in the agri-food sector to date, many from universities across Europe. As a result, Seedbed has supported 66 market-driven startups in the agri-food sector since 2019, of which 31 have female CEO's, who have attracted over €10 million Euro funding and investment within 3 years of graduating from Seedbed. The EIT Food Seedbed Incubator Program has developed a core methodology that is easily adaptable across sectors, providing a leading validated solution to building an innovation ecosystem. In summary, Seedbed has leveraged the strength of its network (over 200 partners) to help build a capacity in innovation and create new companies.

KEYWORDS:
Incubator program, partnership, research translation, agri-food start-ups, EIT food

POSTER PRESENTATION

SUB-THEME 1:
FRONTIERS IN FUTURE FOOD

PP-ST1-01

Metabolomics-based Holistic Analysis of Microbial Cultures Fermenting Pea Protein-based Milk for Enhanced Flavor Profile

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ABSTRACT:
Pea-based milk alternatives have gained widespread popularity as a source of nutrition, and the global market for these products has increased. However, a common issue with plant-based milk alternatives is their lack of balanced nutrition and limited flavor options. To create more desirable and nutritionally sound products, fermentation can enhance these beverages' sensory qualities, nutritional value, texture, and microbial safety, thereby eliminating the need for additional food additives.

The study aims to provide an empirical holistic screening and selection platform for culture collection performances, explicitly targeting the flavor improvement of pea protein-based milk via microbial fermentation. Initially, representative strains from the collection's species were selected and tested on pea milk using metabolomics, sensory analysis, and growth monitoring techniques to evaluate the impact of fermentation. Three major consecutive screening rounds led to the selection of strains that improved the sensory profile. *L.* j*ohnsonii* was selected as the best-performing species. This bacterium increased the umami perception and decreased the perceived bitterness of pea milk after 48 hours of incubation. Sensoproteomics analysis was employed to decode the chemosensory stimuli responsible for the observed change. Literature known and unknown taste active peptides and metabolites upregulated during fermentation were identified and quantified. Six newly identified taste-active umami-enhancing peptides formed by this bacterium during enzymatic proteolysis of *Pisum sativum* storage protein were discovered, and their human taste thresholds were determined. As proof of principle, a gap-filling sensory experiment was carried out to check the impact of adding the differential concentrations of the deconvoluted sensometabolites on the unfermented protein extract. This experiment showed that the selected taste-active analytes were responsible for the increased perceived umaminess and decreased perceived bitterness of the fermented product.

In conclusion, peptidome-proteolytic genes correlation was investigated by comparing differences in BLAST identification scores with observed proteolytic activity between strains from the *L.johnsonii* species. Results from this analysis point at cell-wall-bound proteinases as candidate genes which activate the proteolytic cascade and the flavor-forming fermentation pathways.

The findings of this research hold significant implications for the formulation of pea protein-based food products, particularly in relation to enhancing their taste profile. Ultimately, these insights can enable the development of tastier, more palatable pea protein-based food products that can contribute to a more sustainable and health-conscious food system.

KEYWORDS:
Sensoproteomics, pea protein, fermentation, screening, flavor

PP-ST1-02

Muscle Food Protein Integrity: Influence of Growth-related Myopathies on *in vitro* Protein Digestion of Cooked Chicken Meat

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ABSTRACT:
The objective of this study was to investigate the influences of growth-related myopathies on *in vitro* protein digestibility of cooked chicken meat. A total of 18 chicken breast meat was classified into three groups, based on growth-related myopathies, i.e., normal, WS and WS+WB. The samples were cooked following water-immersion method. Protein content of raw and cooked samples were determined. The cooked samples were then subjected to *in vitro* protein digestion using the mixture of digestive enzymes mimicking the action in gastro-intestinal track at oral phase, gastric phase and intestinal phase. The results showed that growth-related myopathies did not significantly affect protein content in raw chicken breast meat ($p \geq 0.05$) but the cooked samples with WS+WB condition exhibited significantly lower protein than the other cooked samples ($p < 0.05$). As for *in vitro* digestion, normal samples exhibited lower free NH_2 content and degree of hydrolysis (DH) than the others at all digestion phases ($p < 0.05$). While WS and WS+WB at oral and gastric phases were not different from each other ($p \geq 0.05$), at the intestinal phase, free HN_2 content of WS was lower than that of WS+WB samples ($p < 0.05$). Amino acids released during *in vitro* digestion was also monitored using gas chromatography-mass spectrometry (GC-MS), the results showed that growth-related myopathies significantly affected the content of free alanine, glycine, valine, leucine, phenylalanine, aspartic/aspartate and tyrosine ($p < 0.05$). In conclusion, the findings suggested that cooked breast meat with WS and WS+WB abnormalities was susceptible to *in vitro* protein digestion at a greater extent compared with normal chicken breast. However, contents of essential amino acids, particularly valine, leucine, phenylalanine and tyrosine, were reduced from cooked WS samples.

KEYWORDS:
Chicken meat, growth-related myopathies, *in vitro* protein digestion, muscle food protein

1. INTRODUCTION

The world population has been estimated to reach over 9 billion by 2050. In this regard, food shortage, especially food protein, under a wide concern. Currently, many studies have focused on the use of alternative proteins [1-4]. However, it is expected that chicken meat will continue to play an important role as food protein due to its high-protein quality and affordable price for all classes of consumers. However, within the past decade, commercial broilers, the meat-type chickens, have developed meat abnormalities, namely white striping (WB) and wooden breast (WB). The two abnormalities can be found individually or together. The abnormalities are consistently detected on chicken breast cut with an average occurrence of 70%

per flock. The occurrence and severity of the defects are linked with rapid growth rate of the broilers [5,6]. Therefore, the meat abnormalities have been recognized as "growth-related myopathies". An occurrence of growth-related myopathies has raised a wide concern among broiler industry due to their adverse effects on technological properties (i.e., water holding capacity and texture) of the meat [5, 7-8]. In contrast, the impacts on nutritional quality was limited. Previous studies reported that the meat with growth-related myopathies consistently exhibited decreased proportion of protein, and increased fat [8-12]. Soglia et al. [13] recently reported an increase in concentration of free amino acids was observed in raw WB meat, suggesting the breakdown of muscular protein due to myodegeneration within the abnormal muscle. The released amino acids could be lost with dripping fluids and during cooking. In addition, protein oxidation was addressed in the affected chicken breast [12] which might intervene digestive proteases. To assure the nutritional quality of the already existing high-quality protein, therefore, the objective of this study was to investigate the influences of growth-related myopathies on *in vitro* protein digestibility of cooked chicken meat.

2. MATERIAL AND METHODS

2.1 Sample preparation and in vitro protein digestion

Chicken breast samples were purchased from a local slaughterhouse (Pathum Thani, Thailand). The meat was classified as "normal", "WS" or "WS+WB" according to classification criteria described elsewhere [8]. A total of 18 breasts (n = 6 for each treatment) were individually vacuum-packed in a plastic bag and cooked at 95°C in water bath until temperature of the sample reached 75°C. The samples were then cooled in an iced water bath until the temperature reduced to 15°C and were left to rest at 4°C for at least 1 h. The cooked samples were then ground using a household blender. Protein content of both raw and cooked samples was determined following Kjeldahl method.

In vitro protein digestion was conducted according to the method of Tritavisup et al. [14]. All steps of the enzymatic digestion were performed in a 50-mL centrifuge tube, stirred in a trayster digital (IKA® TRAYSTER digital, IKA Works, Inc, Staufen, Germany) at 10 rpm in an incubator set at 37°C. To simulate oral digestion, 2 g (dry basis) ground cooked samples were mixed with 4 mL of buffer solution (120 mM NaCl, 5 mM KCl and 6 mM $CaCl_2$, pH 6.9) containing 75 U/mL α-amylase. After amylase digestion for 5 min, 8 mL of the buffer was added and pH of the mixture was then decreased to pH 2.0 by adding 6N HCl. Pepsin was then added to a final concentration of 2000 U/mL to simulate gastric digestion. The reaction was carried out for 60 min. Subsequently, 8 mL of the buffer solution was added and pH of the solution was then increased to pH 5.0 using 1.5M $NaHCO_3$ to stop pepsin digestion. Pancreatin (final concentration of 100 U/mL based on trypsin) and bile salt (10 mM final concentration) were added to simulate intestinal digestion. The pH of the reaction was then adjusted to pH 6.0 with 1.5 M $NaHCO_3$, and the digestion was conducted for 300 min. During the digestion, 2 mL of the mixture was collected at the end of each digestion phase. Enzymatic reaction was stopped by pH adjustment. All samples were centrifuged at 3000 ×g for 30 min. Supernatant was filtered through a 0.2-mm membrane. The filtrate was used in determination of free NH_2 content and profile of free amino acids.

2.2 Free amino (NH_2) content

Free amino (NH_2) content was determined using trinitrobezenesulfonic (TNBS) acid method [15]. Briefly, supernatants from *in vitro* digestion were diluted 1:200 with 1% SDS solution. A series of leucine solutions (0, 0.075, 0.15, 0.3, 0.6, 0.9 1.2 and 1.5 mM) diluted using 1% SDS was prepared for standard curve construction. The assay was performed, in duplicate, in 96-well plates where 15 µL of samples or standard solutions were mixed with 45 µL of 0.21 M sodium phosphate buffer (pH 8.2) and 45 µL TNBS solution (0.05% w/v in water). The plate was incubated at 50°C for 1 h. Then, 90 µL of 0.1N HCl was added to stop the reaction. The absorbance at 340 nm was read in a microplate reader (SpectraMax Plus 384, Molecular Devices, USA). Free NH_2 content was expressed in the unit of micromoles per gram protein, as leucine amino equivalents, after

subtraction of a blank. The degree of protein hydrolysis (%DH) was calculated using equations as follows.

$$\%DH = \frac{h}{h_{tot}} \times 100\%$$

$$h = \frac{(leucine\ NH_2 - \beta)}{\alpha}$$

where α = 1.00, β = 0.40 (Adler-Nissen, 1986), h_{tot} = 7.6 mmoL/g protein [16].

2.3 Profile of free amino acids

The filtrate from the intestinal phase was subjected to free amino acid profiling using a gas chromatography-mass spectrometry (GC-MS, Agilent Technologies, Palo Alto, USA) [14]. The sample (400 mg) was mixed with 4 mL of 25% acetonitrile in 0.1N HCl and sonicated at room temperature for 20 min. After centrifugation at 9,000 rpm for 20 min, 150 µL of supernatant was transferred into a GC vial. Norleucine (50 µL) was added into the vial as an internal standard. The solution then was dried for 2 h and derivatized with 50 µL of N-tert-butyldimethylsilyl-N-methyltrifluoroacetamide containing 1% tert-butyldimethyl chlorosilane and 50 µL acetonitrile at 100°C for 4 h. The derivatized samples were subsequently analyzed using a GC 7890A-MS 5975C System (Agilent Technologies, Palo Alto, USA) following the condition described elsewhere [14]. Standard mixture of amino acids with known concentrations were prepared to generate standard curves where peak areas of each amino acid were plotted against the known concentrations for each amino acid in the standard mixture. The amino acid content was calculated and expressed as milli-gram per 100 grams sample.

2.4 Statistical analysis

Differences in free amino content and profiles of free amino acids at each digestion point among treatments were assessed using one-way analysis of variance. Mean differences were then analyzed using Duncan's new multiple range test. Significant level was set at $p < 0.05$.

3. RESULTS AND DISCUSSION

As shown in Table 1, growth-related myopathies did not significantly affect protein content in raw chicken breast meat ($p \geq 0.05$). However, the cooked samples with WS+WB condition exhibited significantly lower protein than the other cooked samples ($p < 0.05$). The findings agreed well with previous studies showing reduced proportion of protein in the affected breasts [7-12]. Previous studies have consistently reported myodegeneration in the affected breast muscles, leading to degradation of muscle proteins [8, 17]. The WB condition exert more adverse effects on the muscles [8].

Table 2. Protein content (g/100 g sample) in raw and cooked chicken breast

Sample	Normal	WS	WS+WB
Raw meat	23.9 ± 0.8	22.9 ± 3.5	22.7 ± 5.3
Cooked meat	27.3 ^{a} ± 0.6	27.1 ^{a} ± 0.7	26.2 ^{b} ± 0.5

Mean ± standard deviation.
Different superscripts in the same row indicate significant difference ($p < 0.05$).

In this study, cooked breast meat was subjected to *in vitro* protein digestion. Free amino (NH_2) content was monitored as an indicator of hydrolysis of peptide bonds and release of NH_2 group [14]. Free NH_2 content was then converted into DH. As shown in Figure 1, normal samples exhibited lower free NH_2 content and DH than the others at all digestion phases ($p < 0.05$). Such values of WS and WS+WB at oral and gastric phases were not different from each other. However,

at intestinal phase, free HN_2 content of WS was lower than that of WS+WB samples, suggesting that WS condition might affect pancreatic proteases.

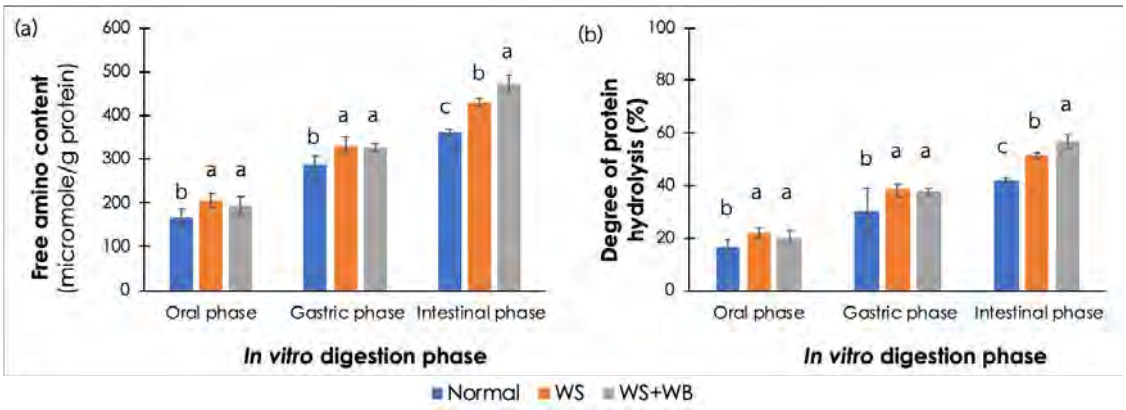

Figure 1. Influences of growth-related myopathies, i.e., white striping (WS) and wooden breast (WB) on (a) free amino group, and (b) degree of protein hydrolysis (%) resulting *in vitro* protein digestion of cooked chicken breast meat. Bars and error bars depict mean and standard deviation, respectively. Different letters above bars indicate significant difference ($p < 0.05$) due to growth-related myopathies within each digestion phase.

Profile of free amino acids released during *in vitro* digestion was determined using GC-MS (Figure 2). The results showed that growth-related myopathies significantly affected the content of free alanine (Ala), glycine (Gly), valine (Val), leucine (Leu), phenylalanine (Phe), aspartic/aspartate (Asp) and tyrosine (Tyr) ($p < 0.05$) released during *in vitro* protein digestion. Altered amino acid profile due to growth-related myopathies was previously addressed in raw breast muscles [12]. The alteration was linked with myodegeneration and aberrant metabolic pathways in the affected chicken [13, 17-19]. To our knowledge, this is the first study reporting amino acids profiles in the digested cooked breast meat. The findings showed that growth-related myopathies, particularly WS, could reduce the availability of essential amino acids (i.e., Val, Leu, Phe, and Tyr) from consumption of breast meat.

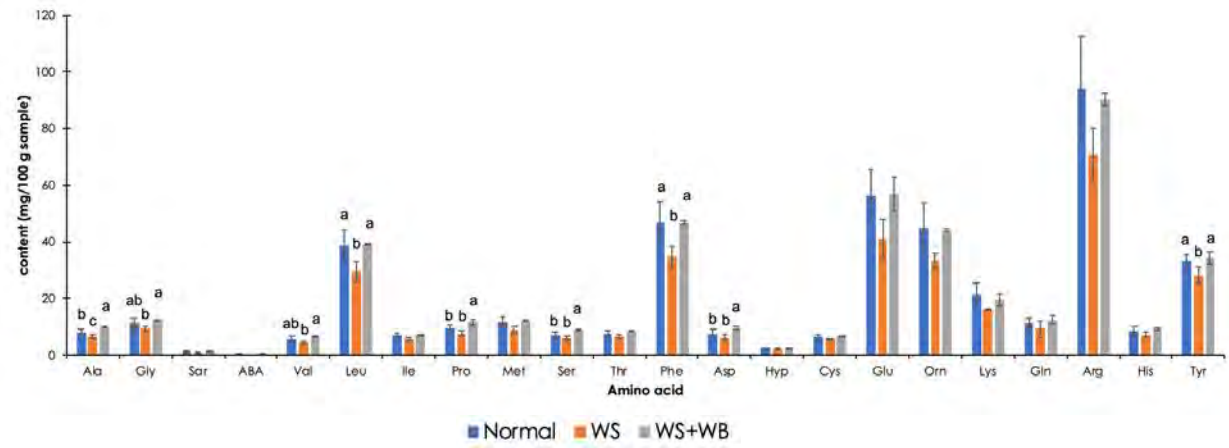

Figure 2. Influences of growth-related myopathies, i.e., white striping (WS) and wooden breast (WB) on profiles of free amino acids released from in vitro protein digestion of cooked chicken breast meat. Bars and error bars depict mean and standard deviation, respectively. Different letters above bars indicate significant difference ($p < 0.05$) due to growth-related myopathies within each digestion phase.

4. CONCLUSIONS

The findings indicated that cooked breast meat with WS and WS+WB abnormalities was susceptible to *in vitro* protein digestion at a greater extent compared with normal chicken breast. However, contents of essential amino acids (i.e., Val, Leu, Phe and Tyr) in the filtrate of intestinal digestion phase obtained from cooked WS samples appeared to be lower than those of normal and WS+WB samples. Further investigation is underway to explore the explanation of this aspect.

5. ACKNOWLEDGEMENTS

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POSTER PRESENTATION

SUB-THEME 2:
SAFETY OF FUTURE FOOD

PP-ST2-01

Microbial Diversity and Changes during Karanda Juice Kefir Fermentation

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ABSTRACT:
Water kefir is a product of microbial fermentation of fruit juice with kefir grains which consist of a variety of microorganisms such as lactic acid bacteria and yeast. Typically, the product has a unique sour, sweet and fizzy characteristic. Moreover, microbial differences in kefir grains pose a great importance and influence kefir's features and tastes. However, there are limited research on microbial diversity in karanda juice kefir. Therefore, the purpose of this research was to investigate the microbial diversity and changes during karanda juice kefir production using next generation sequencing technique. Results on microbial counts using spread plate technique indicated that the optimum condition for kefir grains activation was the ratio of brown sugar content of 15 %w/v and the duration of 48 hours. The activated kefir grains were further used to produce karanda juice kefir. Moreover, the effect of the concentration of karanda juice on microbial counts in karanda juice kefir were determined. Results showed that the increasing concentration of the juice led to decreasing of pH value and microbial counts. Additionally, when increasing the fermentation time from 24 to 48 hours, microbial counts also increased. The sample with the concentration of karanda juice of 60 %v/v with fermentation time 48 hours showed the highest number of viable microorganism counts. DNA has been extracted to further study of microbial diversity using next generation sequencing technique.

KEYWORDS:
Water kefir, karanda, DNA Extraction, microbial Diversity

PP-ST2-02

Safety Properties of *Lactobacillus plantarum* BCC 47723 as a Promising Probiotic Strain

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ABSTRACT:
Nowadays, the use of probiotic has been increasing interested and has evolved as an alternative approach to promoting animal and human health. Prior selection of the probiotic strains to human and animal use, several criteria must be investigated. Safety of potential probiotics should be first criteria such as biological barrier resistance, antimicrobial activity, antibiotic susceptibility, significant role in health and physiology without potential harm towards the host. In our previous study, *Lactobacillus plantarum* BCC 47723, which isolated from the wild spider flower pickle (Pag-sian-dorng), appears to be a promising probiotic species due to its antibacterial activity, mucin adhesion ability, acid and bile tolerance, auto-aggregation and co-aggregation, when compared to the commercial strain (*Lactobacillus plantarum* NCIMB 8826). Moreover, it also exhibited *in vitro* mycotoxin reduction activity. However, there is a need for additional research to further clarify the knowledge of its safety and efficiency. Therefore, the aim of the current study is to investigate the antibiotic susceptibility, hemolytic activity and prebiotic utilization. The growing ability of *L. plantarum* BCC 47723 on the 4 commercial prebiotics including short-chain fructo-oligosaccharide (FOS), galacto-oligosaccharide (GOS), lactulose, and inulin was measured by observing the optical density (OD_{600}) and viable cell count. Results indicated that there is a significant growth rate in lactulose and GOS compared to positive control (glucose). its growth rate was increased from 6.5 x 10^6 to 6.85 x 10^9 cfu/ml in lactulose during the 0 – 24h and 7 x 10^9 cfu/ml in GOS. While, the growth in inulin was lower when compared to glucose during 0-24h (at 1 x 10^9 cfu/ml), and the ability to utilize FOS was the lowest (4.8 x 10^8 cfu/ml). For antibiotic susceptibility, the result showed that *L. plantarum* BCC 47723 was only resistant to kanamycin out of the seven tested antibiotics (ampicillin, chloramphenicol, clindamycin, erythromycin, gentamicin, kanamycin, and tetracycline) following the guideline of the European Food Safety Authority. However, *L. plantarum* BCC 47723 exhibited alpha hemolysis , as it partially hemolyzed the blood agar. Overall, *L. plantarum* BCC 47723 revealed to be safe and to possess similar or superior probiotic characteristics compared to the reference strain.

KEYWORDS:
Probiotic properties, safety, lactic acid bacteria, *Lactobacillus plantarum*, prebiotic, antibiotic susceptibility

PP-ST2-03

A Fluorimetric Method for Formaldehyde Detection in Seafood Samples

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ABSTRACT:
Formaldehyde is often illegally used to maintain food freshness and storage time. It can be accumulated in the body via ingestion which induces harm to human health. To ensure food safety, the Food and Drug Administration (FDA), the Ministry of Public Health in Thailand has set the maximum formaldehyde contaminated level in seafood at ≤ 5 mg kg^{-1}. To monitor formaldehyde residue, 4-hydrazine hydrate-N-butyl-1,8-naphthalimide was synthesized as a fluorescence probe for its detection, in which the fluorescence intensity increases with the concentration of formaldehyde. Under optimum conditions, i.e., incubate time at 15 min, the concentration of dye at 7.5 mg L^{-1}, pH of buffer at 5.8 and concentration of buffer 0.10 M, the method provided good linearity in the range of 2.5 to 37.5 µg L^{-1} with a low limit of detection at 1.51 ± 0.29 µg L^{-1} and limit of quantitation at 5.02 ± 0.66 µg L^{-1}. Good selectivity, accuracy (recoveries 95%-106%) and precision (RSDs $\leq 1.5\%$) were achieved. When applied for the determination of formaldehyde in seafood samples, formaldehyde was detected in pomfret and octopus at the concentration of 53.2±5.6 pg kg^{-1} and 77.0±2.4 pg kg^{-1}, respectively. These values were much lower that values provide by the FDA.

KEYWORDS:
Formaldehyde, 4-hydrazine hydrate-N-butyl-1,8-naphthalimide, fluorescence technique, optimum conditions, seafood

PP-ST2-04

Modification of Poly(*o*-phenylenediamine)-Zn Composite on Plaswood Propeller as Sorbent for the Extraction of Polycyclic Aromatic Hydrocarbons in Coffee Drink

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ABSTRACT:
Coffee beans can be contaminated with polycyclic aromatic hydrocarbons (PAHs) during the roasting process, and some have been classified as carcinogens. Although PAHs contamination is at a trace level in real sample, concerns for human health is arising. Therefore, the simultaneous determination of these compounds in coffee drink samples is important. Benzo(a)anthracene (BaA), chrysene (Chry), benzo(b)fluoranthene (BbF), and benzo(a)pyrene (BaP) were chosen as models of PAHs in this study. One-step electrodeposition of poly(*ortho*-phenylenediamine) (P*o*PD) and Zn (P*o*PD-Zn) composite on the surface of a propeller-like plaswood substrate was developed as an extraction device for PAHs determination. It can extract six samples at the same time, thus reducing analysis time and providing high throughput. Scanning electron micrograph (SEM) of the extractor showed a large nanoporous structure of the P*o*PD-Zn. The device was applied for the extraction of PAHs before quantification by a gas chromatograph coupled with a flame ionization detector (GC-FID). Under optimal conditions, the method provided good linearity in the concentration range of 0.10 to 2000 μg L^{-1} for BaA and Chry, and 0.05 to 1500 μg L^{-1} for BbF and BaP. Limits of detection for BaA, Chry, BbF, and BaP were 39.5±1.0, 30.8±1.2, 26.6±1.0, 17.0±0.6 ng L^{-1}, respectively. The detected concentrations of PAHs in coffee drink samples were 1.4±0.4 to 16.5±0.8 μg L^{-1} for BaA, 0.5±0.2 to 2.1±0.5 μg L^{-1} for Chry and 2.2±0.6 for BbF and 6.2±1.0 μg L^{-1} for BaP. Good recoveries ranging from 82.7±1.9% to 99.0±0.5% were obtained.

KEYWORDS:
Plaswood propeller, poly(*o*-phenylenediamine)-Zn composite, polycyclic aromatic hydrocarbons, sample preparation

PP-ST2-05

Polyvinylpyrrolidone-graphene-chitosan Porous Composite Beads for the Analysis of Parabens in Beverage Samples

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ABSTRACT:
Parabens are widely used as preservatives in many ways, such as in personal care products, pharmaceuticals, foods, and beverages. Parabens have good properties such as broad antimicrobial spectrum, efficacy in a wide pH range and stability. However, they also have genotoxicity, disrupts the endocrine system and increases the risk of human breast cancer. According to the Food and Drug Administration of Thailand (FDA Thailand), methylparaben and ethylparaben should not be contained in wine, alcoholic beverages, or juice at concentrations higher than 200, 1000 and 250 mg kg^{-1}. Thus, the determination of parabens is necessary to protect consumer health. In this work, a simple, rapid, and reliable method was developed for the simultaneous determination of parabens, including methylparaben (MP), ethylparaben (EP), propylparaben (PP), and butylparaben (BP). The polyvinyl pyrrolidone and graphene chitosan beads (PVP-G-CS beads) were easily prepared by applying air bubbles to the composite mixture to increase the porosity before generating the composite beads. These porous beads were used to extract parabens via the vortex-assisted solid phase extraction (VA-SPE) procedure. The developed method demonstrated good linear responses in the range of 5.0–1000 μg kg^{-1} for MP and EP, 10–1000 μg kg^{-1} for PP, and 10–500 μg kg^{-1} for BP, with $R^2 > 0.998$. The limits of detection (LOD) and limits of quantification (LOQ) for four parabens ranged from 4.30–7.28 μg kg^{-1} and from 14.3–24.3 μg kg^{-1}, respectively. The developed sorbent provides good preparation reproducibility with an RSD of 0.44 to 3.64% (n=6). The porous PVP-G-CS beads were applied for the extraction and preconcentration of four parabens in beverage samples. They were analyzed using a high performance liquid chromatography-diode array detector (HPLC-DAD). EP was found in two alcoholic beverages, including red grape wine and sparkling fruit juice, at 14.2 and 10.0 μg kg^{-1}, respectively. EP at 9.4 μg kg^{-1} in mixed fruit and green vegetable juice; EP at 7.2 μg kg^{-1} in mixed vegetable and fruit juice with beetroot juice; MP, EP and PP at 7.7, 12.3 and 12.0 μg kg^{-1}, respectively in mixed vegetable and fruit juice with lychee juice; and EP and PP at 11.1 and 7.8 μg kg^{-1}, respectively, in tomato juice with mixed fruit juice. The %RSD of method precision ranged from 1.95 to 5.81%. In addition, the developed sorbent was easy to fabricate and could be reused up to 15 times with an acceptable RSD of 3.6 to 5.9 %.

KEYWORDS:
Paraben, porous chitosan beads, vortex-assisted solid phase extraction, beverage sample, high performance liquid chromatography

PP-ST2-06

Solid Phase Extractor Based on Polypyrrole-coated Rubber Foam for the Determination of Carbendazim in Orange Juices

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ABSTRACT:
Carbendazim is the most generally used fungicide to control fungal diseases in agriculture. It is a synthetic chemical compound that can accumulate in many crops, especially oranges. Moreover, carbendazim could be found in orange products such as orange juices. The contamination of carbendazim in food has effects on human health, for instance, mutations, carcinogenesis, and reproductive disorders. Thus, the European Union has set the maximum residue limit of carbendazim at 0.2 mg kg^{-1} in oranges. The contaminated concentration was found at a low level. Therefore, the sample preparation technique is required prior to instrumental analysis. In this study, the Ppy (polypyrrole) coated rubber foam was fabricated as a solid phase extractor for the determination of carbendazim in orange juices. The chromatographic analysis was performed using high performance liquid chromatography with a diode array detector (HPLC-DAD). Under optimal conditions, the developed method provided good linearity in the concentration range of 50 – 2000 ng kg^{-1}. The limit of detection (LOD) and limit of quantification were obtained at 48.3 ± 0.7 ng kg^{-1} and 161.0 ± 2.4 ng kg^{-1}, respectively. The Ppy-coated rubber foam had an efficient reproducibility with a %RSD of 2.5 and a good reusability of more than 10 times at a %RSD of 3.8%. Moreover, Ppy-coated rubber foam was exploited as a sorbent in the determination of carbendazim in orange juices, and the recoveries were in the range of 81.6 ± 0.1% to 104.8 ± 2.6%. Carbendazim was found in seven orange juice samples at a concentration range of 5.2 ± 5.0 ng kg^{-1} to 202 ± 17 ng kg^{-1}. The developed Ppy-coated rubber foam could be a potential solid phase extractor for the detection of organic compounds in food and the environment.

KEYWORDS:
Carbendazim, polypyrrole, solid phase extraction, orange juices

PP-ST2-07

Development of a Poly(*o*-phenylenediamine) Coated Aluminum Garter Spring Micro-solid Phase Sorbent for the Analysis of Pyrethroids in Chili Samples

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ABSTRACT:
Pyrethroids are commonly used synthetic insecticides developed from natural pyrethrin-modified molecules. It has outstanding efficiency, such as a broad spectrum, and biodegradability. Due to their common use in agriculture, trace amounts of pyrethroids can be found in various environmental samples, including human urine, breast milk, water, vegetables, and fruits. The results of several studies showed that pyrethroid affects the nervous and reproductive systems and is hazardous to the immune system. Gas chromatography (GC) is frequently used for analyzing trace pyrethroids due to pyrethroids are easily volatilized because of their low boiling point and relatively weak polarity. The electron-captured detector (ECD) is sensitive to electronegative functional groups like halogen atoms, which are present in many pyrethroids. Therefore, the GC-ECD method is widely used to analyze pyrethroids. Nevertheless, the analysis is still challenging because of the interference from the complicated matrix and the trace concentration level of pyrethroids. For pyrethroid residue analysis, a suitable sample pretreatment thus becomes required. Micro-solid phase extraction (μ-SPE) is extensively used for sample preparation due to its quick, easy, cheap, and effective. In this study, a simple low-cost aluminum garter spring coated with poly(*o*-phenylenediamine) (P*o*PD) via electro-polymerization was developed as a sorbent for the μ-SPE of seven pyrethroids, bifenthrin, fenpropathrin, lambda-cyhalothrin, cyfluthrin, permethrin, cypermethrin and deltamethrin from fresh chili samples. The extract was qualified by a gas chromatograph coupled with an electron capture detector (GC-ECD). Under optimal conditions, the method provided good linearity in the range of 10–3000 μg kg^{-1} and low limits of detection (LODs) ranged from 9.3 to 23.1 μg kg^{-1} respectively. Good reusability was obtained over 12 extraction cycles with an average %response of 92.3±2.4% (RSDs ≤ 4.2%). The sorbent reproducibility was achieved with ≤ 2.1 %. A sorbent from each batch was used to extract seven pyrethroids under the same conditions. The extraction recoveries of seven pyrethroids were in range of 85.2±2.3%–91.4±0.6% with RSDs ≤ 2.1%. The developed method was then applied for the determination of seven pyrethroids in fresh chili samples. The target analytes bifenthrin at a concentration of 30.2±1.1 μg kg^{-1} and fenpropathrin at a concentration of 24.0±2.1 μg kg^{-1} were detected in two out of three real samples. Good accuracy (recoveries 84.3%–103.4%) and good precision (RSDs ≤ 4.8%) were also obtained.

KEYWORDS:
Pyrethroids, aluminum garter spring, micro-solid phase extraction, chili sample, gas chromatography

PP-ST2-08

A Portable Histamine Sensor Using PVA@NDA Sol-gel Coupled with Smartphone Image Processing for Fish Quality Determination

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ABSTRACT:
A smartphone-based colorimetric sensor was invented for quantifying histamine (HA). The colorimetric detection of HA was based on the simple reaction between 2,3-naphthalenedicarboxaldehyde (NDA), as a chromogenic substrate, with and HA, which resulted in a visible color change from colorless to blue. NDA was embedded on polyvinyl alcohol (PVA) sol-gel through the self-assembly of PVA and benzene-1,4-diboronic acid crosslinker via boronate ester linkages, resulting in PVA@NDA sol-gel sensor coating on the microtube. This proposed sensor could be conducted by the naked eye and improved by integrating a smartphone device with the Color Lab® application employing RGB analysis. Under the optimal conditions, the developed sensor demonstrated linearity in the range of 6.0 – 75.0 ppm of HA with a detection limit of 0.31 ppm. In addition, exceptional stability and reproducibility were achieved. Notably, the selectivity of the developed sensor was excellent against possible interference in fish samples. Therefore, this developed sensor could be utilized for simple and efficient detection of HA in food safety.

KEYWORDS:
Histamine, sol-gel based colorimetric sensor, smartphone colorimetric sensor, fish sample

PP-ST2-09

Simple and Rapid Determination of Borax in Processed Food Products Using an In-Tube Determination base on the Colorimetric Technique

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ABSTRACT:
Borax or sodium tetraborate is a harmful substance to health. It is prohibited for human consumption due to its toxicity. Nevertheless, borax has been illegally used for food preservatives and additives and is found in processed food products. A rapid and environmentally friendly method for on-site borax determination in food is essential. Therefore, this study has developed an in-tube determination in a 1.5 mL microtube, composing curcumin film in the lid for detection and glycine film in the bottom for condition adjustment. The curcumin film was fabricated by mixing homogenized starch solution (1 mL) and 0.006 M curcumin in ethanol (100 µL) and loading the mixture in the lid (70 µL) before incubating at 70°C for 30 minutes. The finished yellow film had high selectivity for borax at pH 9 to form a rococyanin complex. The yellow film was changed to a red-brown color depending on the increasing concentration of the complex. The curcumin solution was prepared by the sonochemical method at 80^0C for 30 minutes to enhance its solubility. The method was validated in food samples. A piece of food sample was cut into small pieces and put into a plastic bag before shaking in drinking water (20 mL) for 1 minute and transferring into microtube. Glycine was used to adjust the solution by inverting the tube to determine borax by curcumin film for 5 minutes. A preliminary test in processed food products, namely, 8 meatballs, 5 pickles, and 6 sausages for sale in Phuket, Thailand, revealed that no borax contamination was found in the examined samples, which correlated to result obtained from Government Pharmaceutical Organization (GPO) test kit. Furthermore, this developed in-tube determination can be applied to quantify borax quantification in food by combining a smartphone digital image colorimetry to assess the uses, safety, and regulatory control of borax in a variety of foods.

KEYWORDS:
Borax, curcumin method, processed food products

PP-ST2-10

A Novel High-Performance [5] Helicene Fluorescence Sensor for Selective Detection of Fe^{3+} in Fertilizers and Agricultural Products for Food Safety

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ABSTRACT:
Iron ions (Fe^{3+}) are essential for biological processes in humans. However, an imbalance of iron contents can be toxic to the human body. Therefore, developing a simple method for detecting Fe^{3+} is necessary. In this work, **M201P**, a derivative of [5] helicene fluorescence dye, exhibited a high sensitivity to detect Fe^{3+} in an aqueous acetonitrile solution with a fluorescence quenching response. **M201P** could distinguish Fe^{3+} from other interfering ions, such as Hg^{2+}, Zn^{2+}, Cu^{2+}, Cr^{3+}, Ag^{+}, Pb^{2+}, Cd^{2+}, Mn^{2+}, Ni^{2+}, Co^{2+}, Al^{3+}, Mg^{2+}, Ca^{2+}, Ba^{2+}, K^{+}, Li^{+} and Na^{+}. The sensor showed high performance as a fluorescence tracker for Fe^{3+} in live cells with low toxicity. Also, it could determine Fe^{3+} in hydroponic fertilizer solutions and drinking water by visualizing fluorescence decrease under UV light. Therefore, this sensor is not only a promising method for Fe^{3+} detection but also a potential tool for screening an excessive level of iron contents in fresh vegetable products and drinking water, which is useful for food safety control.

KEYWORDS:
[5] helicene, fluorescence sensor, Fe^{3+} sensor

PP-ST2-11

Identification of Sea Cucumber Species in Raw and Dried Food Product in Thailand Using Mitochondrial DNA Markers

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ABSTRACT:
Sea cucumbers are widely consumed in Asia including Thailand. This research attempts to identify and validate marketable sea cucumber species in Thailand using the mitochondrial rRNA gene. To distinguish between the three sea cucumber species *Holothuria leucospilota*, *Holothuria scab*ra, and *Stichopus horren* in raw and dried products, a PCR-RFLP targeting the mitochondrial 12s and 16s rRNA region was developed. For PCR amplification, two primer sets were designed and used, resulting in product sizes of 550 bp for the 12s rRNA gene and 500 bp for the 16s rRNA gene. PCR amplicons were then digested with *Dde* I restriction enzyme to obtain characteristic restriction maps. In addition, to identify commercially available *Holothuria* sp., a newly designed primer pair called sHOL16-F/sHOL16-R was used to produce the amplicon size of 345 bp. The result indicated that two candidate sea cucumbers were closely related to *Holothuria scabra* with 99.56% identity and *Bohadschia argus* with 92.42% identity. This result may imply that one of the two sequenced products had a mislabeled product. According to our findings, the mitochondrial 12s and 16s genes could serve as a helpful molecular marker to support species identification for raw and dried products of sea cucumber.

KEYWORDS:
Sea cucumber, species identification, processed product, 12s rRNA gene, 16s rRNA gene

POSTER PRESENTATION

SUB-THEME 3: INDUSTRIAL AND EDUCATIONAL PARTNERSHIP FOR FUTURE FOOD

PP-ST3-01

Analysis of Nutritional Composition and Chitosan Content in Crickets (*Acheta domesticus*) from Laos

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ABSTRACT:
Introduction: Crickets have been consumed as a nutritious food source for a long time in Africa, Latin America, and Asia. Recently, the food industry has been showing a growing interest in crickets globally due to their abundance of protein, healthy fats, fiber, and minerals. During the extraction process, chitin is transformed into chitosan, a polymer known for its various beneficial properties. This study aimed to determine the nutritional composition and chitosan content. **Materials and Methods:** The cricket samples were obtained from Cricket Lao Farm, Ban Hatxay, Thoulakhom District, Vientiane Province, Laos. Standard methods were used to determine the nutritional composition, and the chitosan content was extracted using both enzymatic and chemical methods. **Results:** The protein content of nondefatted, defatted, and cricket protein concentrate were 67.35%, 82.68% and 88.64%, respectively. Total lipids were found to be 19.46% and 22.78% from Shoxhlet and supercritical fluid carbon dioxide extraction, respectively. The cricket had a moisture content of dry matter of 3.72%, crude ash of 4.62%, and crude fiber of 12.63%. According to the dry matter analysis, the mineral content of Na, K, Fe, Cu, and Zn were found to be 50.28, 854.04, 1.02, 0.47, and 120.42 mg/100g, respectively. Chitosan content was determined to be 3.62% and 0.53% of dry matter using enzymatic and chemical extraction methods, respectively. **Conclusion:** This study demonstrates that crickets are a rich source of protein and cricket protein concentrate can enhance the protein content. The enzymatic extraction yields higher chitosan content than chemical extraction. Future studies should focus on utilizing crickets as a protein ingredient in food systems.

KEYWORDS:
Cricket, *Acheta domesticus*, Nutritional composition, Chitosan

POSTER PRESENTATION

SUB-THEME 4:
CURRENT AND FUTURE TRENDS

PP-ST4-01

Development of the Nutrient Rich Rice Porridge for Dysphagia and Elderly from the Mixed Dough and Mature Whole-Grain Rice

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ABSTRACT:
A rapid increase in population with the age over 60 at global and local scales has accelerated development and innovation of the texture-modified food with nutritional balance for dysphagia and elderly. Rice porridge is considered a comfortable and healthy food for whom has a swallowing limitation. Whole-grain rice contains higher nutrients, particularly protein, and shows lower glycemic index than milled rice. Nutritional properties in the selected rice cultivars at two development stages, days after flowering: dough (15 days) and mature (22 days), were observed in our preliminary study. We found that dough rice has higher phenolic compounds, but lower carbohydrate digestibility compared with mature rice among pigmented rice with soft texture, i.e., low amylose rice and waxy rice. Conversely, non-pigmented rice with hard texture, i.e., high amylose rice at mature stage showed lower carbohydrate digestibility than that at dough stage. This study aims to develop the nutrient rich rice porridge from blended whole-grain rice between pigmented soft rice and non-pigmented hard rice to achieve the international dysphagia diet standardisation initiative (IDDSI) level 4. In this study, M2313 dough rice with 7.95% amylose (AC) which has the highest values of phenolic content and dietary fiber but the lowest value of carbohydrate digestion rate among pigmented soft rice, was selected to blend with Chainat1 (CHN) mature rice with 30.31% AC, having the lowest value of carbohydrate digestion rate among non-pigmented hard rice. Therefore, the blended ratios between M2313 dough rice and CHN mature rice and their texture profiles were investigated. The results showed that the appropriate concentration was 20% broken rice. The blending ratios between M2313 and CHN, classified as IDDSI level 4, were 1:1 and 1.5:0.5. All texture parameters of rice porridge with 1:1 was higher than those with 1.5:0.5: firmness 139.9 ± 9.9 g and 97.2 ± 2.6 g; consistency 948.9 ± 31.3 g.sec and 595.9 ± 11.1 g.sec; cohesiveness -154.9 ± 10.0 g and -85.3 ± 5.3 g; and viscosity index -210.4 ± 17.6 g.sec and -133.6 ± 3.8 g.sec, respectively. Besides texture, the blended rice porridge showed slower digestibility and higher protein (1.83 g), with other nutrients, including phenolic compounds (122 mg), dietary fibre (1.05 g), and fat (3.53 g) of 100 g blended rice porridge at 1.5:0.5 ratios. The findings indicated the potential of the mixed rice porridge as future food for dysphagia and seniors.

KEYWORDS:
Nutrient rich rice porridge, future food, dysphagia, pigmented rice, dough-mature rice

PP-ST4-02

Development of Karanda Kefir Sorbet Ice Cream

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ABSTRACT:
Water kefir is a fermented beverage produced from fruit or vegetable juices. It is rich in nutrients, contains antioxidants and beneficial bacteria for the gut. However, it is not consumed widely and there is a lack of variety. Thailand ranks as the number one ice-cream exporter in ASEAN and the fourth in the world. Moreover, the ice-cream market value in Thailand is about 1.2-1.7 billion Thai baht (year 2020). Hence, researchers would like to develop water kefir into a popular and easy-to-eat ice cream by using fermented kefir Karanda juice and substitute with maltitol sweetener. Kefir grains were activated with brown sugar solution at a concentration of 15 %w/v and incubated at 37 °C for 48 hours. The activated grains were further mixed with brown sugar solution and Karanda juice in the ratio of 40:60 at 37 °C for 48 hours. The obtained Karanda kefir juice was mixed with sucrose or maltitol sweetener (0% (control), 50%, 75% and 100% of using maltitol instead of sucrose) and made into a sorbet ice cream using an ice cream maker. The results of chemical, microbiological, and sensory study showed that replacing sucrose with 100% maltitol sweetener decreased the total dissolved solids while increased the pH value. The total phenolic content and antioxidant activity were not significantly different from the control ($p \geq 0.05$). Additionally, the use of maltitol sweetener in sorbet ice cream exhibited a higher overall liking score compared to the control (0% of using maltitol instead of sucrose). Moreover, the number of probiotics in Karanda kefir sorbet ice cream was 6 log CFU/g which is in accordance with the approval of the Food and Drug Administration (The Notification of the Ministry of Public Health (No. 346) B.E. 2555 regarding the use of probiotics in food).

KEYWORDS:
Water kefir, karanda juice, ice cream, sorbet, maltitol

PP-ST4-03

The Effect of Fermentation Duration on the *in vitro* Antioxidant Activities and Total Phenolic Compound Properties of Fermented Sweet Black Rice *(Oryza sativa L.)*

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ABSTRACT:
Khao-mak is a traditional Thai fermented sweet rice dessert made with glutinous rice. Black sticky rice *(Oryza sativa L.)* is more preferable over white sticky rice due to its higher dietary fiber and antioxidant content, making it a healthier choice. Black sticky rice is abundant in bioactive compounds like phenolic acids, flavonols (rutin and quercetin-3-O-glucoside), and anthocyanins (such as cyanidin-3,5-O-diglucoside, cyanidin-3-O-glucoside, cyanidin-3-O-rutinoside, and peonidin-3-O-glucoside). Anthocyanins, in particular, offer various health benefits, including anti-inflammatory effects, and cardiovascular support. Fermentation enhances health-promoting properties through its probiotic potential and antioxidant properties. The fermentation process also has a well-established impact on the levels of anthocyanin pigments, phenolic compounds, and antioxidant efficacy. This study aimed to investigate the antioxidant activity of black sticky rice Khao-mak at different fermentation times (0 to 3 days). The analysis utilized the total monomeric anthocyanin pigment assay and the Folin-Ciocalteu method. The antioxidant activities were evaluated using the FRAP assay, DPPH• scavenging activity, and $ABTS^{+\bullet}$ scavenging activity. Results revealed that a decreased in anthocyanin pigment content from 347.4±5.2 to 46.9±0.3 mg cyanidin-3-glucoside equivalents/g FW from Day 0 to 3, while Total Phenolic Acontents (TPC) increased from 10.4±0.5 to 20.5±0.2 mg gallic acid equivalents per gram of fresh weight (mg GAE/g FW). During fermentation, the enzymes produced by microorganisms have the ability to degrade, modify, and suppress the bioactivity of complex compounds. The antioxidant activity exhibited notable fluctuations throughout the fermentation process, with the FRAP value increasing from 1.6±0.1 mg Trolox equivalents per gram of fresh weight (mg TE/g FW) to 4.5±0.1 mg TE/g FW on Day 3. Additionally, the Radical Scavenging (RS) activity of DPPH• initially decreased in the early stages of fermentation but later increased. Similarly, the $ABTS^{+\bullet}$ activity showed an initial decline and a slight recovery on Day 3. In conclusion, prolonged fermentation durations resulted in decreased concentrations of specific anthocyanin pigments and antioxidants but led to an increased total phenolic content.

KEYWORDS:
Oryza sativa L., fermented sweet rice dessert, antioxidant activity, anthocyanin

PP-ST4-04

Multi-bioactive Functions of Chicken Hydrolysate

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ABSTRACT:
Non-communicable diseases (NCD) which is a disease that is not transmissible directly from one person to another cause 41 million people deaths each year (74% of all deaths worldwide). The NCDs including cancers, cardiovascular disease, diabetes, and chronic lung illnesses, are mainly from unhealthy behaviors (unhealthy diets, stress, smoking, the harmful use of alcohol, and physical inactivity). Of all NCD deaths occurred in low- and middle-income countries (77%) including Thailand. Hydrolysate and peptides have attracted extensive worldwide as natural alternatives to promote human health and wellness. Chicken hydrolysate is one of the most popular in Southeast Asia due to the abundance of nutrients which were believed to improve cognitive function. This study aims to determine the biological properties of chicken hydrolysate and compare the bioactivities of hydrolysate produced from laboratory-scale and pilot-scale. Our study demonstrated that the ACE inhibitory activity exhibited IC_{50} values of the lab scale were 33.71 ± 5.12 µg Leucine/mL and 35.25 ± 3.32 µg Leucine/mL from the pilot scale. In terms of the antioxidant activities, the lab scale showed EC_{50} values of ABTS scavenging and ferric reducing power activities were 61.04 ± 3.02 and 0.53 ± 0.13 µg Leucine/mL, respectively while the pilot scale had EC_{50} values of 55.30 ± 7.68 and 0.45 ± 0.07 µg Leucine/mL, respectively. In addition, this study revealed the cytoprotective effect of the pilot scale process against H_2O_2-induced HepG-2 cell damage at concentrations between 0.21-3.42 mg leucine/mL and reduced reactive oxygen species in the cells. These results indicated that chicken hydrolysate showed the potential as functional foods ingredients. Moreover, the up-scale process of chicken hydrolysate did not affect their bioactivities which could be applied to the food industry.

KEYWORDS:
ACE inhibition, antioxidant, chicken hydrolysate, pilot scale production

PP-ST4-05

Sustainable Shrimp Farming through Genomic Advancement

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ABSTRACT:
While food demand is drastically increasing with growing global population, aquaculture production significantly contributes to supplying nutritious food source. For instance, shrimp aquaculture provides a good source of protein, vitamin and minerals. However, shrimp farming was confronting problems such as disease outbreak, low maturation in captive and slow growth making reduced production. To ensure the sustainability of shrimp farming, in-depth functional of genomics, genetics and changing transcriptome response to climate change was necessary. Currently, genome sequence of the black tiger shrimp Penaeus monodon was successfully decided at the chromosome level which serves as a good reference database to enable genomic advancement to improve shrimp production. In term of molecular marker for genetic selective breeding program, SNP-sex marker of P. monodon (SNPs loci P19_27360532) was identified using RADseq, with significant different genotypes between male (G/G) and female (A/G). This finding may allow mono-sex culture selection. In addition, four SNP loci were correlated significantly with body weight of fast-growing and slow growing of P. monodon shrimp. Moreover, the reference genome data facilitate finding of novel miRNAs regulated growth genes of P. monodon shrimp. This knowledge led to genetics improvement for sustainable shrimp farming in the future. Ultimately, we can apply this whole genome sequencing and genomic advancement approach for other economic aquatic species.

KEYWORDS:
Genomic advancement, Molecular marker, SNP marker, selective breeding program

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