PRIMESOFT

Development of innovative priming technologies safeguarding yield security in soft fruit crops through a cutting-edge technological approach

Topic: **Workshop ´Cutting-edge technologies in the agri-food value chain and LCA as a decision support tool´**

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Cutting-edge technologies in the agri-food value chain

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School of Chemical Engineering

Lab. of Process Analysis and Design

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Title: Laboratory of Process Analysis and Design – Opening Remarks

Laboratory of Process Analysis and Design, LPAD (former Laboratory of Unit Operations) is essentially the evolution of the Laboratory of Inorganic Chemical Technology (due to the update of its objectives), which was founded in 1908 long before the establishment of the School of Chemical Engineering at 1917. LPAD has been involved (since the 90's) with the design and optimization of processes and systems (from simple processes up to large productive plants / systems). Among others, the processes that have been extensively studied are drying, reverse osmosis, extraction, gas purification processes, food processing in oily environment, integrated complex systems related to metallurgy and refineries, energy integration, management of utility systems. Nowadays, the research activity of the Laboratory is continued (participating in Greek and European research programs and article-books writing) and customized to the current technological developments concerning Physical Processes. The research activity of LPAD is focused to Food Processing and Engineering, including the sustainability assessment of processes and products, as well as to Design and Energy Integration. LPAD currently has over 50 (small and large) laboratory devices and a continuous effort is made to supply new devices according to the current trends in the fields of its activity.

Prof. Dr. Maria Giannakourou

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Title: Edible Coatings: Enhancing Food Preservation and Quality

Edible coatings have a crucial role in increasing the shelf life of agricultural and processed food products and arise as a feasible, environmentally friendly option that aims to redefine the benchmarks of food preservation. They are being developed by using a combination of proteins, carbohydrates, lipids, or natural polymers, offering versatility in their properties. Application methods such as dipping, spraying, brushing, or rolling are employed based on the specific food product and desired outcome. Edible coatings represent an innovative and sustainable approach, utilizing organic and biodegradable ingredients to tackle environmental challenges effectively. They present several technical advantages, including enhanced barrier properties and precise release mechanisms. Moreover, the applications of these coatings are diverse, ranging from extending shelf life to addressing nutritional requirements and enhancing visual appeal. The evolving landscape of edible coatings underscores their pivotal role in reshaping traditional notions of food packaging, preservation, and consumption by combining scientific progress with culinary creativity. Ongoing research focuses on developing innovative materials, incorporating bioactive compounds for health benefits, and creating environmentally friendly packaging solutions to enhance the functionality and sustainability of edible coatings.

Dr. Efimia Dermesonlouoglou

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Title: Advancements in Post-Harvest Treatment: Innovations in Dehydration Techniques

Food dehydration should be energy- and cost- efficient and should maintain the quality attributes of the product. During dehydration, reduction of the free water extends the shelf life of the product. Drying techniques, such as oven drying, freeze drying, fluidized bed drying, vacuum drying, and solar drying, used on industrial scale for drying of fruits and vegetables, face challenges related to energy and product quality. Advanced dehydration technologies include microwave drying, electro-hydrodynamic drying, infrared drying, radio frequency drying, etc. Apart from these methods, new hybrid dehydration technologies and various pre-treatment methods have been employed to enhance the drying rate and product quality. Currently, there is high concern about the final quality (referring to physical, chemical, nutritional and sensory characteristics) of dehydrated products, for which the use of hybrid dehydration technologies has become more dominant. Osmotic dehydration, a mild technique used for the partial removal of water from foods (mainly fruit and vegetables) by immersion in highly concentrated sugar or salt solutions, has been applied as a pre-treatment to conventional air drying of vacuum drying (combined also with other novel non-thermal techniques such as pulsed electric fields). High-quality dehydrated food products may impact the reduction of energy consumption and the reduction of food waste losses as well as the commercialization of innovative ready-to-eat food products.

Dr. Marina Stramarkou

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Title: Novel extraction techniques for efficiency and yield enhancement

This talk delves into cutting-edge methodologies designed to maximize efficiency and optimize yield in extraction processes. The latest innovations in extraction technology, from novel solvent systems to innovative equipment designs, will be presented. LPAD has a great expertise and infrastructure related to extraction techniques, from well-known technologies, such as microwave- or ultrasound-assisted to cutting-edge methods, such as Pressurized Liquid Extraction (PLE). This talk will help you gain valuable insights into how these techniques can enhance productivity, reduce environmental impact, and elevate product quality.

Title: Smart Packaging: Innovations, Applications, and Future Prospects

Traditional packaging encounters challenges arising from evolving consumer expectations, product complexity, sustainability concerns, and the imperative to reduce carbon footprint. In response, the domain of functional smart packaging has emerged as a burgeoning research area. Smart packaging integrates interactive technologies and is developed predominantly for food products, in order to decrease waste due to degradation during handling, shipping, storage, and biochemical reactions or microbial spoilage. Several mechanisms and utilization potentials exist within the domain of smart

packaging, encompassing pH and gas indicators, oxygen (O_2) and carbon dioxide (CO_2) scavengers, time-temperature indicators (TTI), gas sensors, biosensors, and freshness indicators.

Dr. Maria Katsouli

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Title: Encapsulation technologies for the development of novel formulations

Encapsulation is widely recognized as an effective approach for the entrapment of bioactive compounds within a polymer matrix to ensure their protection and targeted delivery. Various encapsulation methods have been developed, each with its own advantages and limitations. Spray-drying isa commonly employed technique due to its simplicity and scalability. However, high drying temperatures can lead to heat-induced degradation, compromising the stability and efficacy of sensitive ingredients. On the other hand, novel methods, such as electrospinning, have emerged as a promising alternative for the encapsulation of bioactive compounds. Unlike traditional methods, electrospinning operates at lower temperatures, preserving the structure and efficacy of encapsulated substances.

LCA as a decision support tool

Assoc. Prof. Dr. Aggelos Tsakanikas

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Title: From Concept to Commerce: Navigating the Journey of a Spin-off Company

This talk explores the essential steps and challenges encountered in transforming a novel idea into a successful commercial venture. This process involves innovation, entrepreneurship, and strategic decision-making. Beginning with the inception of the concept, the journey encompasses critical phases such as market research, product development, funding acquisition, and business model refinement. Additionally, the presentation delves into the key considerations for building a strong team, fostering partnerships, and navigating regulatory frameworks. attendees will gain valuable perspectives on the intricacies of commercializing innovation and the dynamic landscape of entrepreneurship.

Dr. Georgia Frakolaki

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Title: Sustainability: Evolution, Standards, and Ecolabelling

Life Cycle Assessment (LCA) evaluates the environmental impacts of products or services across every phase of their life cycle, spanning from resource extraction, through all manufacturing and transportation processes, to product usage and eventual disposal. Life-Cycle Costing (LCC) entails the comprehensive consideration of all expenses expected over the lifespan of a product, project, or service and is progressively adopted by numerous public authorities throughout the EU and across various sectors. The application of Life Cycle Assessment (LCA) is governed by a series of ISO standards, offering comprehensive guidelines and requirements for conducting LCAs across various contexts. These standards, such as ISO 14047, 14049, and 14071, are developed with input from diverse stakeholders to ensure robust methodology and prevent dissemination of inaccurate information. In addition to these overarching standards, recent initiatives like ISO 14025 focus on specific applications of LCA, such as environmental labels and declarations. These standards aim to provide tailored guidance for different products and industries, facilitating comparative analysis for informed decision-making by consumers and businesses.

Title: Application of LCA methodology in LPAD projects

LPAD is engaged in several EU-funded projects by taking over the LCA and/or LCC analysis of the developed processes or products. Projects that are relevant to the Primesoft project will be presented, where novel approaches, such as cutting-edge technologies or Climate Smart Agricultural practices are involved. Each project presentation will focus on the sustainability assessment of these processes or products, by presenting the respective LCA framework and highlighting key findings, methodological approaches, and implications for sustainable decision-making. Attendees will gain insights into the depth of LCA applications across various industries. Furthermore, the presentations offer valuable opportunities for knowledge exchange, collaboration, and innovation, fostering a deeper understanding of LCA principles and their practical implementation in real-world scenarios.

Dr. Tryfon Kekes

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Title: LCA/LCC methodology: Tools, inventory & product systems analysis

This talk focuses on the methodologies of Life Cycle Assessment (LCA) and Life Cycle Costing (LCC), exploring their tools, the importance and the aggregation of a comprehensive Life Cycle Inventory (LCI), and the design of the product system. It highlights the complexities involved in evaluating environmental and economic impacts across various life cycle stages, from raw material extraction to end-of-life disposal. The discussion navigates through key components such as data collection, allocation methodologies, and system boundary delineations, elucidating their significance in ensuring comprehensive and accurate assessments. Furthermore, the talk addresses challenges associated with handling co-products and waste streams within LCA/LCC frameworks, emphasizing the need for robust methodologies to account for their impacts effectively. Through insightful analysis and practical examples, the presentation provides valuable insights into optimizing LCA/LCC methodologies to support informed decision-making and sustainable practices across industries.

Dr. Christos Boukouvalas & Angeliki Petridi

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Title: Life Cycle approaches: Test case

A detailed examination of a test case involving LCA for the evaluation of the environmental impact of products or processes throughout their entire life cycle will be presented. The test case explores the application of LCA in assessing the sustainability of a specific product or process, highlighting the methodology, data collection technique, and analysis tools utilized. Through the examination of this test case, attendees will gain insights into the practical implementation of LCA, including the identification of key environmental hotspots, the quantification of environmental impacts, and the interpretation of results. Additionally, the challenges encountered during the LCA process and strategies for addressing them will be discussed, providing valuable lessons for future LCA studies. Attendees will leave with a deeper understanding of how LCA can be effectively applied to support sustainable decision-making in various industries.

Dr. Sofia Papadaki

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Title: Discussion on the LCA & LCC tools and concepts

This discussion will aid you to gain insights into how LCA and LCC contribute to sustainability assessments, product development, and decision-making processes. Whether you're a seasoned professional or new to the field, this interactive session offers a valuable opportunity to deepen your understanding and exchange ideas on harnessing these powerful tools for informed environmental and economic analysis.

Training in LCA

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Title: LCA – Training activity

This activity is designed to equip participants with skills to evaluate the environmental impacts of products or processes from cradle to grave. The session typically covers key LCA concepts, including goal and scope definition, inventory analysis, impact assessment, and interpretation. Participants engage in hands-on exercises using LCA software tools, analyze case studies, and learn how to apply LCA findings for decision-making and sustainability improvements. The training emphasizes practical

application, enabling attendees to integrate LCA methodologies into their environmental management practices effectively.