Use of by-products for the production of pullulan for postharvest management of strawberries

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Plastic-based materials have been widely used for fruit packaging, but their production results in the emission of substances harmful to the environment and human health. Pullulan, a polysaccharide produced by *Aureobasidium pullulans*, could therefore represent a sustainable alternative for use as a fruit coating to limit the development of postharvest fungal diseases. *A. pullulans* AP1 strain was tested for its ability to produce polysaccharides using different culture substrates: EPS (esopolysaccharide medium) and three different media based on by-products of mushroom basal bodies, molasses and grape skins. After ten days of fermentation, different results regarding pullulan production were observed. Of the by-product substrates, molasses produced the best results for pullulan production. The polysaccharide obtained was tested on strawberries cv 'Agnese' as coating. Before and after storage, the following quality parameters were evaluated: hardness, pH, soluble solids and weight. The potential of the coating as an antifungal treatment was also evaluated against *Botrytis cinerea*. The treatment showed promising results in terms of fruit quality and protection. This study demonstrates that developing a biopolymer such as pullulan with an optimal chemical composition and optimising costs could be a significant step forward in the management of food and fruit after harvest.

Keywords: Postharvest – Fruit Quality – *Botrytis cinerea* – Polysaccharide - Molasses

Quiescence in Postharvest Pathogens

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Fruits and vegetables are highly perishable commodities, and improper handling during harvesting, transportation, or storage can result in significant postharvest losses and waste. The Food and Agriculture Organization (FAO) of the United Nations estimates that about one-third of global food production—roughly 1.3 billion metric tons—is lost or wasted each year (Sagar et al., 2018). In the case of horticultural products, losses can reach up to 60%, occurring at various stages of the supply chain, from harvest to household consumption (Prusky & Romanazzi, 2023). Postharvest fungal infections may be initiated before, during, or after harvest, but often remain dormant in a quiescent stage until fruit ripening and senescence (Prusky, 1996; Prusky et al., 2013). This is different from fungal pathogens that show a complete full cycle in living tissue e.g. Ustilago (Yu et al., 2023) which are not studied here. Disease prevention is typically achieved through a combination of fungicide treatments and optimized storage conditions (Adaskaveg et al., 2023). Symptoms usually become visible only after prolonged cold storage or during shelf life, just before consumption. Notably, while most freshly harvested fruits and vegetables harbor quiescent infections, the mechanisms governing fungal quiescence and host resistance in unripe fruits remain poorly understood (Adaskaveg et al., 2000; Prusky et al., 2013). Although recent advances have introduced stable and robust sensing materials with high sensitivity for detecting fruit infections by pathogens, no practical applications have been implemented to date (Archana et al., 2024). This knowledge gap underscores the importance of investigating the factors that regulate quiescence and its activation, as such insights could inform the development of novel disease management strategies aimed at reducing reliance on postharvest fungicides while preserving fruit quality over time (Guan et al., 2018).

Identification, detection and management of seedborne squash pathogens

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Squash is one of the most important vegetable crops, and it can be affected by several fungal pathogens. Samples of asymptomatic and symptomatic squash fruits were collected from Tunisia and Italy. Following blotter test, seedborne fungi were identified in seeds extracted from these fruit samples. The most frequent fungi in Tunisia seed samples were *Alternaria alternata*, and *Stagonosporopsis cucurbitacearum*. For the fruits from Italy, the most frequently identified fungal species in seed samples were *A. alternata*, and *Stemphylium vesicarium*. Seedborne fungi were identified in all fruit samples tested, including asymptomatic fruit. Considering that *S. cucurbitacearum* can cause medium-high economic losses in the field, even with low seed infection, our research focused on setting up a rapid and sensitive protocol, based droplet digital polymerase chain reaction (ddPCR). Blotter and ddPCR tests showed a high degree of correlation ($R^2 = 0.986$, $p \leq 0.01$). Our ddPCR protocol provided rapid detection and absolute quantification of *S. cucurbitacearum*, offering a useful support to the standard procedure. To control these fungi, antifungal activity of seven essential oils was studied by tests performed *in vitro* and *in vivo* conditions. Both assays showed that *Cymbopogon citratus* essential oil was the most effective to reduce seedborne fungi and to control transmission of *S. cucurbitacearum* from seeds to plantlets.

Keywords: *Cucurbita* spp., fungal pathogens, pathogen detection, techniques

Sustainable technologies for reducing postharvest fruit losses and improving quality

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Reducing postharvest losses and maintaining fruit quality are critical for sustainable fruit production and supply. Our research focuses on integrating innovative technologies and preharvest strategies to minimize losses and enhance fruit quality in key crops such as kiwifruit, peaches and sweet cherry. In kiwifruit, accurate prediction of optimal harvest time is essential to reduce postharvest losses, while preharvest factors, including effective pollination and targeted hormone treatments, significantly influence fruit storability, particulaky fruit softening. We evaluated the use of ozone (O_3) application in kiwifruit, demonstrating its potential to delay ripening and reduce decay during storage. In peaches, ultraviolet-C (UV-C) irradiation was applied to improve postharvest quality by enhancing antioxidant activity and delaying senescence. Additionally, we explored the use of priming agents, such as melatonin and nitric oxide, which effectively reduced postharvest losses and promoted the accumulation of health-beneficial compounds in stored cherries fruit. Overall, our findings highlight the importance of combining precise preharvest management with sustainable 'green' postharvest technologies to enhance fruit quality, extend shelf life, and reduce food loss, contributing to more sustainable horticultural production systems.

Keywords: Fruit quality, postharvest losses, priming agents, sustainable technologies.

Inhibitory effect of soluble metabolites of *Trichoderma afroharzianum* on the mycelial growth of postharvest pathogens

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FAO estimates that 14% of global crop production is lost due to plant diseases, 42% of which are caused by molds, resulting in significant economic losses. Pesticides remain one of the most effective tools for controlling post-harvest diseases of fruits and vegetables. One of the main objectives of the European Green Deal is to reduce pesticide use by 50% by 2050. Ideal solutions could include the development of biological control agents from different biocontrol agents. Effective antagonistic capabilities of *Trichoderma spp.* include mycoparasitism, production of extracellular lytic enzymes, and production of secondary metabolites, including volatile and non-volatile substances.
In our experiment, we tested non-volatile secondary metabolites of *Trichoderma afroharzianum* strain *in vitro* against several postharvest pathogens (*Colletotrichum godetiae, Botrytis cinerea, Fusarium oxysporum, Alternaria solani*). We applied the filtrate at a concentration of 30% to the PDA agar, and then measured the colony diameter of the cultures to determine the inhibitory effect of the soluble metabolites of *T. afroharzianum*.
In our results, with the exception of *Colletotrichum godetiae*, the filtrate of *Trichoderma afroharzianum* inhibited the development of mold colonies to varying degrees at a concentration of 30%.

Keywords: *Trichoderma afroharzianum*, Postharvest pathogen, secondary metabolites, *in vitro*

Control efficacy of a new SIGS-based biofungicide against *Penicillium digitatum* on citrus fruits.

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Penicillium digitatum (Pd) is one of the most important post-harvest pathogens affecting citrus worldwide. This study aimed to develop a new biofungicide based on Spray-Induced Gene Silencing (SIGS) to control *Pd* infections in oranges. The approach involved exogenous application of double-stranded RNA (dsRNA) designed to silence key fungal genes related to RNA silencing mechanisms (*Pd_ds1, Pd_ds2, Pd_ds3, Pd_ds4*) and pathogen development (*Pd_ds5*). To evaluate their effectiveness, dsRNAs were applied to wound sites on orange fruits prior to artificial inoculation with Pd. Disease severity and incidence were assessed seven days after infection. Among the tested dsRNAs, those targeting *Pd_ds1, Pd_ds2*, and *Pd_ds3* significantly reduced disease severity and incidence compared with the control ($p < 0.05$). Gene silencing of *Pd_ds1, Pd_ds2, and Pd_ds3* inhibited disease development by 84.2%, 89.8%, and 84.2%, respectively. These results demonstrate that SIGS can effectively suppress *Pd* infection when applied preventively. The study highlights the potential of SIGS technology as an environmentally friendly strategy for developing biofungicides and offers a promising new approach for managing post-harvest citrus diseases.

This research titled "Innovative Solutions for Sustainable and Environmentally Friendly Crop Protection of Greece's Horticultural Crops in the Europe of the Future" (TAEDR-0535675), was implemented within the framework of the National Recovery and Resilience Plan "Greece 2.0", with funding from the European Union – NextGenerationEU.

Keywords: RNAi, Green Mold, Postharvest, Disease Management

Management of Postharvest Decay of Fresh Citrus Fruits without Using Conventional Chemical Fungicides

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Postharvest decay caused by fungal infections is among the most important causes of economic losses for the fresh citrus fruit sector worldwide. Major diseases are green and blue molds, caused by *Penicillium digitatum* and *Penicillium italicum*, respectively, which are currently controlled by postharvest conventional chemical fungicides such as imazalil, orthophenylphenol, pyrimethanil, etc., and sour rot, caused by *Geotrichum citri-aurantii*, with no effective fungicides available in the EU. The continuous use by the industry for many years of these agrochemicals has arisen important health and environmental problems, and the development of novel safe and sustainable alternatives is increasingly needed. According to their nature, alternative postharvest antifungal treatments can be physical, low-toxicity chemical, and biological. Hot water, ozone, food preservatives or GRAS salts, essential oils and other natural extracts, antagonistic microorganisms as biocontrol agents, and edible coatings formulated with antifungal agents that could replace the conventional fungicide-amended waxes applied in packinglines, are among the most studied alternatives. However, due to the inherent limitations of these alternative methods, their use should be part of the so-called nonpolluting integrated disease management (NPIDM) programs, a broader control strategy based on considering appropriate nonpolluting actions before, during, and after harvest to minimize decay impact.

Keywords: 3-5 keywords

Broad-Range Trichoderma-Based Biocontrol to Reduce Preharvest Fruit Loss Caused by Walnut Fruit Rot Pathogens

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Walnut fruit rot represents a significant source of preharvest food loss, driven by a complex pathogen spectrum affecting the hull, shell, and kernel. Across our recent studies, multiple fungal species have been identified as major causal agents, including *Botrytis cinerea sensu lato*, *Diaporthe eres*, and *Botryosphaeria dothidea*, all capable of infecting immature fruits and initiating kernel decay. These pathogens pose increasing risks under production conditions that favor prolonged moisture retention and asymptomatic early-season infections. Our work has systematically assessed broad-range *Trichoderma* strains as biological control agents, demonstrating strong in vitro antagonism, with several isolates achieving 76–100% inhibition against *B. cinerea* and substantial suppressive effects against other fruit-rotting taxa. The results indicate that *Trichoderma*-based protection can disrupt pathogen establishment at multiple infection courts, including bud, shoot and hull tissues, thereby reducing the inoculum load and mitigating subsequent fruit loss. Integrating these biocontrol agents with cultural measures that limit humidity and remove latent infection sources provides a viable strategy to reduce waste at the production stage. Overall, the findings highlight that broad-spectrum *Trichoderma* formulations represent an effective and sustainable tool for minimizing preharvest walnut losses, supporting global efforts to reduce food waste along the horticultural supply chain.

Keywords: Trichoderma biocontrol, Walnut fruit rot, Preharvest fruit loss

Physico-Chemical Characterization and Antifungal Activity of Tunisian Marine Macroalgae Against *Botrytis cinerea*

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The use of marine macroalgae in agriculture has gained increasing attention due to their richness in bioactive compounds and their potential as natural alternatives to chemical pesticides. Macroalgae have demonstrated effectiveness as biofertilizers, bio stimulants, and biological disease-control agents. In this study, four marine algal species collected from the Tunisian coastline *Ulva* sp.(Sfax), *Cladophora* sp.(Mahdia), *Hypnea muciformis* (Sfax) and *Hypnea muciformis* (Mahdia), were evaluated for their physico-chemical characterization (moisture, ash, lipid, fatty acids cotent, protein, pigment composition) and some functional proprieties, , (swelling capacity, water solubility index , water holding capacity , and oil holding capacity).Cold and hot macroalgae extracts were prepared and assessed *in vitro* using two complementary methods: direct contact essays on solid media and volatile-mediated inhibition assays to evaluate their anti-fungal activity against *Botrytis cinerea*. The physicochemical characterization of macroalgae revealed variability in parameters such as powder color, water activity, dry matter content, ash, proteins, fatty acids, and mineral composition. Analysis of their functional properties indicated that all the studied parameters were temperature dependent. The *in vitro* antifungal assays revealed that cold extracts exhibited stronger inhibitory effects in the direct contact method compared with hot extracts. Furthermore, volatile organic compound (VOC) assays performed with the cold extracts confirmed the presence of volatile metabolites in the algae, although detectable antifungal interactions occurred only at high concentrations. The physico-chemical composition and functional properties highlight the richness of macroalgae in bioactive compounds and a potential antifungal effect for sustainable biocontrol applications.

Keywords: Macroalgae, Physicochemical proprieties, Antifungal activity, *Botrytis cinerea*

Quantifying Food Loss and Waste in Turkey: A Critical Step Towards Achieving Climate Targets

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Achieving Turkey's ambitious net zero climate targets necessitates a sharp focus on mitigating methane emissions from the waste sector, where preventing food loss and waste is a critical priority. However, developing effective mitigation strategies is currently hampered by the absence of a comprehensive, nationwide study. Existing data is fragmented, with the primary official source-Turkish Statistical Institute (TÜİK) household waste statistics-providing an incomplete picture that overlooks significant losses across the supply chain. This study aims to fill this critical data gap by conducting the first systematic quantification of food loss and waste across the entire Turkish food system. By establishing this baseline, the study will identify the key "hotspots" of food loss and waste within the Turkish context. These evidence-based recommendations are designed to inform national policy, optimize resource use, and significantly curb methane emissions from decomposing organic waste. We firmly believe that the findings of this research will provide the indispensable data foundation required to integrate food loss and waste reduction as a central, actionable component of Turkey's net zero climate-neutral roadmap, turning a pressing environmental challenge into a tangible opportunity for sustainable development.

Keywords: Net zero, Climate change, Food waste, Food loss

FoodWaStop Guidelines for valorisation of fruit, vegetable, cereal and animal product processing side-streams - an update

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Within the framework of the FoodWaStop COST action, we have undertaken to develop a practical guideline that can be used as a starting point for developing a valorization strategy for various stakeholders. Key pillars of the strategy are as follows: treat by-products as food-grade products from the point of origin with hygiene and traceability; stabilise promptly and make resulting products visible and attractive to potential downstream users. It is foreseen that, facilities operating under formal food safety systems are best placed to capture side streams or by-products suitable for food/feed valorisation. Proposed strategy follows a multipurpose, hierarchical logic: recover multiple products from one feedstock and route each fraction to the highest feasible tier – food upcycling (top), feed, plant/soil applications, packaging/biomaterials, with energy recovery as the final step. Current policy misalignments can bias biomass toward energy; programmes should reward higher-tier routes and discouraging premature energy recovery. The guideline therefore promotes cascading biorefineries that preserve complexity where it adds value, prioritise food/feed uses. It is also noted that regulatory clarity is pivotal: primarily distinguishing waste from by-product/side stream to enable by-products/side-streams to retain and reuse in food chain and maintain traceability.

Keywords: side-stream, by-product, strategy, multipurpose valorisation

Interaction of polyphenols with a biomimetic membranes system

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Polyphenols exhibit a wide range of interactions with biological membranes, with some inducing membrane aggregation and others enhancing membrane fluctuations. In this study, we investigate how structural features of polyphenol extracts influence their effects on biomolecules and cells, with a specific focus on interactions with biomimetic lipid membrane assemblies containing cholesterol (DMPC/25% chol). Even minor variations in polyphenol structure significantly modulate membrane properties such as fluidity and fluctuation behavior. These effects were quantified using a synergistic combination of neutron reflectometry (NR) and small-angle neutron scattering (SANS). NR enabled sub-nanometer resolution characterization of solid-supported lipid bilayers, whereas SANS provided insights into polyphenol–liposome interactions and low-resolution structural changes in solution.

We examined polyphenol extracts obtained from the viticulture waste (1) vine canes of red (Pinot Noir), and white (Fetească albă) *Vitis* sp. varieties, and from the mushroom (2) *Boletus edulis*. Vine cane extracts were rich in shikimic, ellagic, gallic acids, catechin and quercetin, while *Boletus* extract contained high levels of flavonoids, with all extracts comprising diverse polyphenol classes. NR data reveal that *Boletus* extract does not significantly alter membrane structure or composition but interacts with membranes via hydrogen bonding, showing affinity for lipid headgroups. In contrast, Fetească albă and Pinot Noir extracts penetrate the bilayer interface, displacing lipids and, at higher concentrations, promoting multilayer formation. SANS measurements demonstrate that at a polyphenol-to-membrane ratio of 1:10, both Pinot Noir and Fetească albă extracts strongly interact with liposomes, inducing aggregation and phase separation. Such fundamental insights are highly relevant to applied sciences, informing food science on the stability and delivery of polyphenols in functional foods and guiding pharmacological design by predicting encapsulation efficiency, protective effects, and interactions within liposomal or nanoparticle carriers.

Keywords: Polyphenols, Membraines, Structure, drug delivey

Trials for Scaling Up Valuable Compound Recovery from Distillery Vinasse (Times New Roman 14 font; Bold, centered)

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This study presents the technical work required to transition the lab-scale valorization of distillery vinasse into an industrial process, bridging the gap commonly referred to as the "valley of death" in Technology Readiness Level (TRL) progression. Our study focused on defining industrially compatible thermal extraction conditions. We used a pressure-assisted system to test vinasse across different solids concentrations, temperatures, and durations. Crucially, the achieved high extraction yields eliminated the need for 121 °C processing. This key finding means the operating pressures remain below 1.5 bar, successfully circumventing EU pressure equipment regulations. This avoidance of high-pressure mandates significantly reduces machine costs, making the technology economically viable. Using RSM, we modeled the extraction yield of target high-value compounds, including proteins, fibers and different fractions of saccharides. A key contribution of this work is the characterization of vinasse's physical properties—specifically its viscosity, density, and specific heat—at various process conditions. These measurements provide the essential pre-engineering data needed for the design and sizing of industrial transport and heat exchange systems. The final outcome is a proposed, integrated plant configuration featuring a crossflow filter and an industrial cooker, providing a clear and scalable design for distilleries to adopt a sustainable biorefinery model.

Keywords: distillery vinasse, TRL, plant scale-up, valuable compounds, biorefinery

Green valorization of quince (*Cydonia oblonga*) waste using Natural Deep Eutectic Solvent by ultrasonic-assisted extraction

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This study evaluates the sustainable valorization of *Cydonia oblonga* processing waste utilizing natural deep eutectic solvents (NADES) combined with ultrasonic-assisted extraction (UAE). To assess the effectiveness of recovering polyphenolic compounds and antioxidant capacity, a choline chloride/glycerol (ChCl/Gly) system was developed and compared to traditional 75% ethanol extraction. Using ChCl/Gly NADES resulted in a considerably greater total phenolic content (TPC) of 897.93 mg GAE/dm³ compared to ethanol extraction (437.76 mg GAE/dm³). This indicates the NADES-UAE system's enhanced solvation and cell wall breaking capabilities. The DPPH and ABTS assays revealed a significant correlation ($R^2 > 0.95$) between antioxidant activity and TPC, indicating the NADES extract's capability for radical scavenging. The findings indicate the efficacy of green extraction technologies in converting quince waste into bioactive components for nutraceutical and functional food applications. This technique promotes circular bioeconomy initiatives by reducing solvent toxicity and energy consumption while increasing extraction yield and functional value.

Keywords: *Cydonia oblonga*; NADES; ultrasonic-assisted extraction; food waste valorization

Citrus by-product bioformulation (Bioact-LM) to control blue mold and brown rot in postharvest value chain

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This study reports the development and evaluation of Bioact-LM, a citrus by-product bioformulation, aiming at reducing postharvest losses caused by fungal and oomycete pathogens while valorising citrus by-products within a circular bioeconomy. Bioact- LM, obtained by fermenting lemon peel with Lactiplantibacillus plantarum strains N3B2 and M2B2, was assessed in vitro against a broad panel of postharvest pathogens from multiple genera, including Alternaria, Aspergillus, Cladosporium, Colletotrichum, Fusarium, Mucor, Penicillium, Plenodomus, Rhizopus, and several Phytophthora species. In vitro assays demonstrated antifungal and anti-oomycete activity through direct inhibition and via the release of volatile organic compounds (VOCs). Chemical analyses indicated that acids produced by lactic acid bacteria, including lactic, acetic, and salicylic acids, contributed to the activity. In vivo tests on apples and oranges reduced the severity of blue mold caused by Penicillium italicum and limited brown rot caused by several Phytophthora species, extending shelf-life. Overall, Bioact-LM effectively reduced postharvest losses and valorized citrus by-products within a circular bioeconomy framework, offering a sustainable and biodegradable alternative to synthetic fungicides.

Keywords: Blue mold; Phytophthora brown rot; Bioformulation; Lactiplantibacillus plantarum; Antifungal activity.

Turning Pomegranate By-Products into Sustainable Protein Sources

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Pomegranate, valued for its taste and nutritional benefits, has experienced growing production and consumption. However, its processing generates by-products such as peels and seeds that can cause environmental issues if not properly managed. This study investigated the use of pomegranate by-products for sustainable mycoprotein production using filamentous fungi (*Aspergillus oryzae*, *Rhizopus oligosporus*, and *Neurospora intermedia*). Both fresh and expired pomegranate juice supported fungal biomass growth (up to 0.024 g/mL), though fresh juice was more effective for protein production. Cultivation of *A. oryzae* on pomegranate peel yielded 0.39 g biomass/g peel and increased protein content from 30.89 to 85.41 g/kg. Supplementing the medium with yeast extract further boosted biomass yield (0.49 g/g peel) and protein content (198.63 g/kg). Overall, pomegranate peel shows strong potential as a substrate for fungal biomass production, contributing to sustainable food and feed development.

Keywords: Agro-Food waste, Waste management, fruit waste, sustainability

From waste to value: the use of black soldier fly larvae in agrofood waste management to produce protein and promote circular bioeconomy

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Food loss and waste management is a crucial challenge worldwide, especially in Morocco where significant losses occur along the food supply chain. Black soldier fly (*Hermetia illucens*, BSF) larvae provide a sustainable and green solution by converting organic loss and waste into valuable and exploitable biomass and frass biofertilizer. Our study assessed the effects of five diet formulations (D1–D5), including locally available by-products such as bread waste, maize, alfalfa, potato waste and livestock feed pellets, on BSF larval growth performance, feed conversion, survival, proximate composition and bioconversion efficiency. Our results highlighted that the diets with balanced protein–energy profiles, particularly D4 (consisting of poultry feed pellets, alfalfa and maize) and D1 (with bread waste, alfalfa and potato waste), reached the highest larval growth, feed conversion and bioconversion efficiency. D1 supported lipid-rich larvae with high gross energy, while D3 and D4 enhanced high crude protein and ash contents, suitable for animal feed. These findings revealed that diet optimization using locally available food waste promoted both the benefits of BSF larvae rearing in organic waste decrease and production of targeted larval biomass, supporting circular bioeconomy strategies for sustainable food systems.

Keywords: *Hermetia illucens*, By-products, nutritional composition, growth performance

Ultrasound-assisted extraction of oils from berry seeds: A sustainable approach to agrofood waste valorisation

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The recovery of valuable compounds from fruit processing by-products represents an important step toward sustainable resource utilization and the development of a circular bioeconomy. This study investigated the extraction of oils from chokeberry (*Aronia melanocarpa*) and blackcurrant (*Ribes nigrum*) seeds using ultrasound-assisted extraction (UAE) as an alternative to conventional solvent extraction and cold pressing. The influence of UAE on oil quality parameters was evaluated, including carotenoid and chlorophyll content, oxidative stability, total phenolic content (TPC), and antioxidant activity determined by DPPH and ABTS assays. Fatty acid composition was analyzed using gas chromatography (GC). The application of ultrasound significantly enhanced extraction efficiency while reducing time and solvent consumption. Oils obtained by UAE exhibited higher concentrations of carotenoids, chlorophyll and phenolic compounds, greater antioxidant capacity, and improved oxidative stability compared with those extracted conventionally. GC analysis confirmed that the oils were rich in polyunsaturated fatty acids, particularly linoleic acid. These effects are attributed to the cavitation phenomena generated by ultrasound, which promote better mass transfer and protect thermolabile bioactive components. Overall, the results demonstrate that UAE is an efficient and eco-friendly technology for obtaining high-quality oils from berry seed waste, supporting the sustainable valorisation of agro-food by-products.

Keywords: chokeberry seeds; blackcurrant seeds; oil; ultrasound-assisted extraction

Optimizing Fig Preservation and Valorising Pruning Biowaste: Drying Performance and Bioactivity of Ficus carica L. Extracts

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Figs (*Ficus carica L.*) are highly perishable, leading to significant postharvest losses. This study integrates two approaches to reducing waste and enhancing value: improving fig drying and exploring bioactive compounds from pruning residues.

Hybrid solar drying was compared with traditional sun drying using "Pingo de Mel" figs. Hybrid drying reduced processing time from 5–7 days to 3 days while achieving similar moisture, water activity, and texture. It produced figs with slightly darker colour and markedly improved microbial safety, remaining free of fungal contamination for at least four weeks. Hybrid-dried figs also retained higher contents of phenolic compounds, including rutin and 5-O-caffeoylquinic acid, and showed superior antioxidant activity.

Pruning biowaste was valorised through leaf extracts prepared with different solvents. The 70% ethanolic leaf extract showed the highest phenolic content, while the 96% ethanolic leaf extract had the strongest antioxidant activity; considering yield, the 70% ethanolic leaf extract was most promising. Bioassays against *Tuta absoluta* revealed insecticidal potential only for the 70% ethanolic fig-leaf extract (43% mortality at 72 h). Additional in vivo grape assays and in vitro antifungal tests showed no significant activity.

Hybrid drying and targeted extraction offer complementary pathways for reducing waste and generating value from fig production.

Keywords: Hybrid solar drying, Ficus carica L., Phenolic compounds, Biowaste valorisation, Insecticidal activity

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Sustainable Alternative Food Resources for Future Food by Widening Innovation into New Composites with Improved Health-Promoting Properties

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In 2009, FAO predicted an increase of around 34% of the world population by 2050, associated with an increase of 70% in food production demand; however, only in the last 10 years, we experienced an increase of around 12.5% in the world population. Therefore, providing food security to all people, whereas assuring safety and nutritionally optimized foods is a big challenge. Important goals should be considered for the Agenda 2030, such as providing good health and well-being, responsible consumption and production, climate action, local economy and income generation, among others. Therefore, globalization, accelerated economic development, urbanization, modernization of agricultural and food-processing techniques are emerging aspects that led to profound changes in dietary patterns, raising important health and sustainability concerns. In order to overcome undernutrition and obesity, large-scale shifts towards healthier and more sustainable diets are necessary across socioeconomic, cultural, and geographical background. The main purpose of this paper is to present an overview of the national project, funded by The Executive Unit for Financing Higher Education, Research, Development and Innovation (UEFISCDI), project 9PCE/2025, entitled ***S**ustainable **A**lternative **F**ood resources for future food by widening **I**nnovation into new composites with improved health-promoting p**R**operties* (SAFIR). SAFIR aims to provide enough scientific results and knowledge to support innovation in Romania, thus contributing to the development of sustainable food systems. At scientific level, SAFIR exploits the synergy between plant secondary metabolites and postbiotics as strategic combination designed to improve human health. SAFIR statement is to provide reliable answers for economy, environmental and societal problems, focusing on the development of food you can trust, by eco-functional uses of underutilized resources, in order to improve bioactive recycling. SAFIR is a project engaged in designing easy to use and economically viable technologies, by using three key elements resulted from side streams (apple and grape pomace, whey and brewery spent grains) and the ability of probiotics to produce postbiotics. The project aims to produce different powders as alternative for synthetic additives, whereas two approaches will be used to reformulate food, by replacing meat and/or fat from meat products and wheat flour from bakery products.

Keywords: underutilized food resources, bioactive, postbiotics, microencapsulation, functional food

From waste to functional materials: Biopolymer materials synthesis in the framework of a circular economy

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We are witnessing a continuous accumulation of waste generated across various sectors, creating significant environmental and economic challenges. To address this growing problem, it is essential to reduce waste and implement the principles of the circular economy, which emphasize resource recovery, reuse, and value retention. In this context, converting waste into biopolymer materials represents a promising strategy for waste valorization through sustainable material development. Biopolymers can be produced from a wide range of renewable sources, including agricultural waste, food industry by-products, and other organic residues. Their inherent biodegradability and versatility make them suitable candidates for developing eco-friendly films capable of replacing conventional plastics. Among various sectors, the food industry generates one of the largest proportions of waste. Of particular importance are waste streams rich in biologically valuable components that can be converted into value-added products. Owing to their rich chemical composition, agro-wastes represent a promising source for biofilm synthesis, offering biomaterials with properties comparable to those of synthetic polymers. Additionally, when properly refined and evaluated for health safety, they can even be used as edible materials that nutritionally enhance the packaged product and preserve/prolong product's shelf life.

Keywords: waste valorization, biopolymers, edible films and coatings

Intelligent systems for food waste management

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Food waste remains a major challenge for sustainability, resource efficiency, and climate goals. This study proposes a cross-cutting strategy combining system dynamics modelling with smart bin technology to improve household and commercial food management. The approach models the entire food supply-consumption-waste system, capturing dynamic feedback loops between purchasing, storage, consumption patterns, and waste generation. Smart bins, equipped with sensors and AI-enabled monitoring, provide real-time data on food types, quantities, and expiry, enabling predictive analytics and behavioural nudges to reduce waste. By integrating these data into system dynamics simulations, stakeholders can test policy interventions, optimise food redistribution, and design targeted awareness campaigns. The framework demonstrates how digital sensing, modelling, and feedback systems can work synergistically to minimise waste, enhance circular economy practices, and promote sustainable consumption patterns across households, retail, and institutional food systems. This paper will present recent outcomes of international collaboration project between UK, Norway and China

Keywords: Smart waste bin, sensor systems, systems thinking, food waste analytics

Sustainable Food Awareness Network (S-FAN): Study design

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The Sustainable Food Awareness Network (S-FAN) is a 24-month project aimed at reducing food waste in Greece through education, community engagement, and innovative communication technologies. S-FAN develops an integrated set of interventions, including educational videos, a social media campaign, podcasts, infographics, community workshops, webinars, research kit for educators, AR/VR technology and a documentery film that illustrates the journey of food "from farm to plate" and emphasizes sustainable dietary patterns. These actions target diverse groups, general public, educators, students, health professionals, and apprentice chefs, providing practical skills in meal planning, food storage, and waste reduction. Collaboration with schools, libraries, and community centers enhances outreach and ensures long-term sustainability. In addition, food waste will be measured in 100 families in Athens and Peloponnese while assessing the nature of food waste and the degree of food processing. By generating scientific data, digital strategies, and fostering community-based change, S-FAN aspires to serve as a model for future food-waste prevention initiatives and to contribute to national and international sustainability goals.

The Project is running in the framework of the 6th Call for Action, "Science and Society" of the Hellenic Foundation for Research and Innovation (HFRI), under the title "Current Nutritional Awareness" (Number: 17205)

Keywords: food waste, educational videos, sustainable food education, technology

Sustainable Food Awareness Network (S-FAN): Study design

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