AGRIMA

Agri-food Waste Management for Sustainable bio-economy through Higher Education curricula and upskilling

Project code: 2024-1-PT01-KA220-HED-000243242

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FIRST SUMMER CAMP HANDBOOK

Deliverable Factsheet

Project acronym	AGRIMA
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Abstract	This Handbook corresponds to the deliverable of WP2A5 - First Summer Camp on Waste Valorisation, in Marseille, France. It provides the program and a summary of the content of the event, including the results of experiments by students and contributions from invited experts. The summer camp welcomed 42 participants from the consortium and a dozen guests, primarily on July 10.
Keywords	Summer camp, Agri-food waste valorisation, Basic tools, Health applications, Food applications, Implementation, Sustainability concerns
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Consortium

	Name	Short Name	Country
1	Instituto Politécnico do Porto (Coordinator)	IPP	Portugal
2	Panepistimio Aigaiou (University of the Aegean)	UA	Greece
3	Web2Learn	W2L	Greece
4	Université D'Aix Marseille	AMU	France
5	Univerzitet u Novom Sadu	UNS	Serbia
6	Associação de Viticultores do Concelho de Palmela	AVIPE	Portugal

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1. Introduction

The AGRIMA project expresses the EU's initiatives to accelerate the reinforcement of sustainability in the food sector. The project is innovative since it brings together teachers, researchers, and students to develop robust tools for this purpose, and industry and citizens to implement these tools.
The first AGRIMA summer camp in Marseille will serve to discuss the results of the student experiments (18 oral and 8 poster presentations), and the discussions will be expanded and enriched by contributions from invited experts (10 oral communications) from the academic and industrial sectors. This scientific event is divided into four sessions:
1- Basic tools
2- Health applications
3- Food applications
4- Implementation examples and sustainability concerns

2. Summer Camp Program

July 8-11, 2025, at the Villages Clubs du Soleil, 23 Rue François Simon, 13003, Marseille, France.
https://www.villagesclubsdusoleil.com/fr/nos-destinations/sejour-a-la-mer/marseille

Arrival

Monday July 7, 2025, from 14:00, room available at 17:00.

18:30	**Welcome aperitif**	
20:00	**Dinner**	

Tuesday 08/07/2025

8:45	**Welcome**	E.H. Ajandouz – AMU Senior

Session 1: Basic tools. Chairman: M. Maresca – AMU Senior

9:00	**The battle of the bin: confronting food waste through innovation, education, and bioeconomy**	C. Soares - IPP Senior
9:30	**Catalytic applications of copper systems in recalcitrant biomass valorisation**	M. El Nmeir - AMU Student
9:50	**Impact of the endogenous flora on the development of *Polyporus brumalis* during Solid-State Fermentation on miscanthus**	C. Denhadji - AMU Student
10:10	Break	
10:40	**Shaping the future through biotechnology: student innovations from the University of the Aegean**	E. Naziri - UA Senior
11:20	**Bacterial cellulose production by the bacterium *Komagateibacter rhaeticus* using different nitrogen sources, and different C/N ratios**	V. Chonta - UA Student
12:00	Lunch	

Session 2: Health applications. Chairman: J. Svarc-Gajic

14:00	**Nutritional value of cookies enriched with extruded food industry by-products.**	B. Pajin - UNS Senior
14:30	**Development of facial nourishing serum with bamboo leaves extract**	N. Kustudić - UNS Student
14:50	**Valorisation of agri-food waste for the production of microbial melanin-based bacterial cellulose and melanin-enhanced single cell protein films**	F. Gala - UA Student
15:10	**Development of cosmetic products with aubergine peel extracts**	M. Maričić - UNS Student
15:30	Break	
16:00	**Extraction of aubergine peel by subcritical water: chemical characterization and bioactivity assays**	M. Čobanov - UNS Student
16:20	**Development of sports electrolyte drink with prebiotic properties based on beetroot skin fractions**	A.-M. Vujković-Bukvin - UNS Student
16:40	**Greening agriculture: investigating hidden risks in basil-waste biochar**	M.E. Marques - IPP Student
20:00	Dinner	

Wednesday 09/07/2025

Session 3: Food applications. Chairman: E.H. Ajandouz

9:00	**The fabulous destinies of spent grain**	V. Robert - AMU Senior
9:30	**The hidden treasure in grape stalks: a green extraction quest**	M. Gonçalves - IPP Student
9:50	**Evaluating the lipid and carotenoid production capability of novel *Rhodotorula* strains cultivated in crude biodiesel-derived glycerol**	M. Karpeli - UA Student
10:10	**RedWine - Increasing microalgae biomass feedstock by valorising wine gaseous and liquid residues**	S. Pinto - AVIPE Senior
10:40	Break	
11:10	**Citizen Science in biotechnological innovations**	C. Megagianni - W2L Senior
11:40	**Leveraging online data sources to evaluate food losses**	S. Rossos - UA Student
12:00	Lunch	
14:00	**Visit to the Confiserie and Museum du Roy René** https://www.calisson.com/en/content/17-musee-du-calisson	
20:00	Dinner	

Thursday 10/07/2025

Session 4: Implementation examples and sustainability. Chairman: H. Nouws

9:00	**Welcome**	H. Nouws - IPP Senior
9:10	**Potentials of composting. Tools and facts for using agro-industrial by-products**	V. Walker - OVINALP, Invited Industrial Expert
9:45	**Production of biochars from agro-food wastes for environmental applications**	A.R. Alves - IPP Student
10:05	**Research into remediation methods for mycotoxins using biochar**	N. Benbernou - AMU Student
10:25	Break	
10:45	**Physico-chemical characteristics of biochars for remediation and sustainable economy: main challenge on pyrolysis process development – Study case with the Cronus European Project**	A. Napoli - BioWooEB/CIRAD - Invited Academic Expert
11:20	**Life Cycle Assessment (LCA) of waste valorisation processes**	A. Alves- IPP Student
11:40	**From chestnut waste to biocomposite prototype candle holder**	S. Silva - IPP Student
12:00	Lunch	
14:00	**Towards sustainability in education and research laboratories. Examples of initiatives in ISM2 - AMU**	O. Iranzo - AMU Senior
14:30	**Bioinspired copper catalysts for biomass valorisation: insights from LPMO chemistry**	S. Sutradhar - AMU Post Doc
15:00	**Miditerranée - Innovative valorisation of recycling plastics in cutlery for students**	L. Hagege, F. Frichot, J. Du Cheyron - AMU Students
15:30	Break	
16:00	**Aeroponic coupled to hydroponic, to make safe food**	J. Guedje, M. Garcia-Mesa - AMU Students
16:30	**Conclusion**	H. Nouws - IPP Senior
18:00	**Petanque competition**	
20:00	Dinner (with service)	
22:00	Dance party	

Friday 11/07/2025

9:00	**Transnational Staff meeting (TM2)**
12:00	Lunch
	End of the AGRIMA's First Summer Camp

3. Summer Camp Abstracts

ORAL COMMUNICATIONS

Tuesday 08/07/2025

Session 1 - Basic tools. Chairman: M. Maresca

9:00 - C. Soares - IPP Senior

The Battle of the Bin: Confronting Food Waste through Innovation, Education, and Bioeconomy

Cristina Soares*, Manuela Moreira, Henri Nouws, Cristina Delerue-Matos

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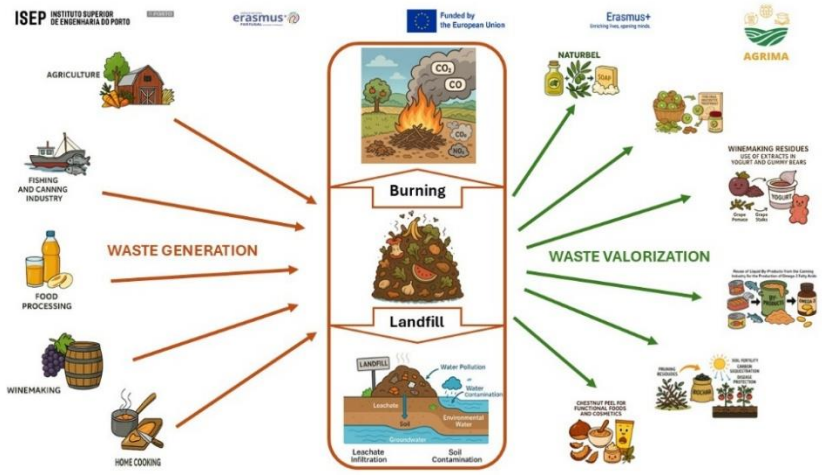
Food waste is one of the most pressing and overlooked global challenges, affecting both the environment, the economy, and ethics. One-third of global food production, sufficient to feed 2 billion people, is wasted or lost before it reaches consumption [1]. The 12th United Nations Sustainable Development Goal aims to halve per capita global food waste at the retail and consumer levels, as well as cut food losses in production and supply chains, by 2030 [2]. To promote food sustainability, the management of waste valorisation has gained importance. Traditional disposal methods, such as open burning and landfilling, significantly contribute to environmental issues, including soil degradation, water pollution, and deterioration of air quality. Real-world examples and scientific initiatives in agri-food waste valorisation contribute to a broader strategy of transforming by-products into valuable resources within sustainable food systems. Several parallel projects—from the reuse of canning industry residues for omega-3 extraction to the development of bio-based films from chestnut and nut waste—illustrate the growing potential of waste streams as sources of bioactive compounds, functional ingredients, and biodegradable materials. Together, these efforts highlight the importance of education, innovation, and applied research in unlocking the full value of agro-industrial by-products.

References

[1] Food and Agriculture Organization of the United Nations (FAO) Overview | Sustainable Development Goals, Food and Agriculture Organization of the United Nations. Available online: https://www.fao.org/sustainable-development-goals/overview/en (accessed on 22/06/2025).

[2] S. Corrado, et al., Glob. Food Secur. 20 (2019) 93-100.



9:30 - M. El Nmeir - AMU Student

Catalytic Applications of Copper Systems in Recalcitrant Biomass Valorisation

Maria El Nmeir*, Subhankar Sutradhar, Jalila Simaan
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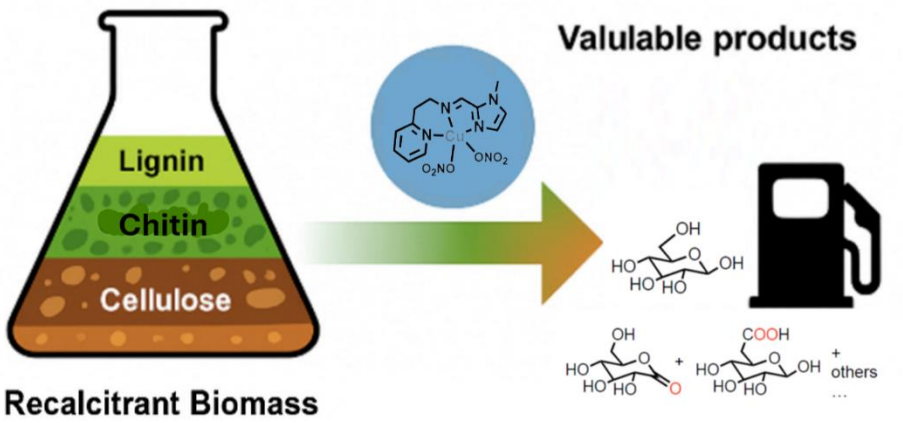
The sustainable conversion of biomass from agri-food waste into value-added chemicals is a major objective in bio-economy. However, the valorisation of recalcitrant lignocellulosic material, remains a significant challenge due to complex, rigid, and chemically resistant structures. The major components of agri-food biomass are polysaccharides (such as cellulose, chitin, pectin or starch etc.). Among the strategies explored, copper-based catalytic systems have emerged as promising tools for activating and transforming biomass polysaccharides under mild conditions.[1] This work investigates the behaviour and reactivity of several bio-inspired copper catalysts in the oxidative depolymerization of oligosaccharides and polysaccharides, facilitating the release of smaller, functionalized molecules suitable for biofuels or biobased chemical synthesis. In this work, three copper-containing molecular catalysts were synthesized and characterized using various techniques (NMR, HRMS, EPR, X-ray diffraction). The catalytic activity of these catalysts was then evaluated on substrates of increasing complexity from soluble model substrates (p-NPG, cellobiose) to polysaccharides, under mild conditions and in the presence of hydrogen peroxide. This study aims to contribute to the development of efficient, economical, and environmentally friendly methods for the valorisation of underutilized biomass resources, advancing both fundamental knowledge and industrial applications in the bioeconomy sector.

References

[1] R. Leblay, et al., ChemCatChem 15 (2023) e202300933.



Valorisation of polysaccharides from agri-food wastes for bioeconomy.

Inorg. Chem. 59(21) (2020) 15842-15854. https://doi.org/10.1021/acs.inorgchem.0c02115

9:50 - C. Denhadji - AMU Student

Impact of the endogenous flora on the development of *Polyporus brumalis* during Solid-State Fermentation on miscanthus

Chaima Denhadji*, Isabelle Gimbert, Marie-Noëlle ROSSO

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Solid-state fermentation (SSF) is a biotechnological process particularly suited to the cultivation of filamentous fungi on plant biomass, including the residual by-products of agriculture and forestry. FMS is of industrial interest for various markets such as food, green chemistry and cosmetics. FMS processes are relatively simple to set up at laboratory scale. However, scaling up presents a number of difficulties, notably linked to the presence of endogenous flora. Our study aimed to analyse the impact of endogenous flora on the colonization of the biomass by the fungal strain. We have chosen the fungus *Polyporus brumalis*, a high producer of ligno- and cellulolytic enzymes, and miscanthus, a model biomass whose cultivation does not impact the use of land for food agriculture. After 17 days of cultivation at 25°C, we observed that the endogenous flora did not prevent the growth of the fungus. On the other hand, *Polyporus brumalis* seemed to have an impact on the development of endogenous fungal flora.

10:40 - E. Naziri - UA Senior

Shaping the Future through Biotechnology: Student Innovations from the University of the Aegean

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The Department of Food Science and Nutrition at the University of the Aegean stands at the intersection of sustainability, biotechnology, and circular bioeconomy. Located in Lemnos, the Department fosters interdisciplinary research that addresses global food system challenges through innovative, hands-on projects. This year, students from the Department showcase a range of research endeavours driven by the principles of environmental responsibility and resource valorisation.

Current student research explores how food industry by-products, such as wine lees, cheese whey, citrus waste, and crude glycerol, can be transformed into new, functional food products, bio-based packaging materials, and valuable microbial compounds like bacterial cellulose, lipids, and pigments. Through biotechnological methods including fermentation and microbial cultivation, students demonstrate practical approaches to waste reduction and the creation of value-added products. Consumer perception studies, sensory analysis, and data-driven tools such as machine learning complement technical work, providing broader insight into the impact and acceptance of sustainable innovations.

These student-led efforts highlight the department's dedication to applying scientific knowledge in ways that foster innovation, sustainability, and a more circular future for the food sector.

11:20 - V. Chonta - UA Student

Bacterial cellulose production by the bacterium *Komagateibacter rhaeticus* using different nitrogen sources, and different C/N ratios

Viktor Chonta, Danai Ioanna Koukoumaki, Dimitris Sarris*

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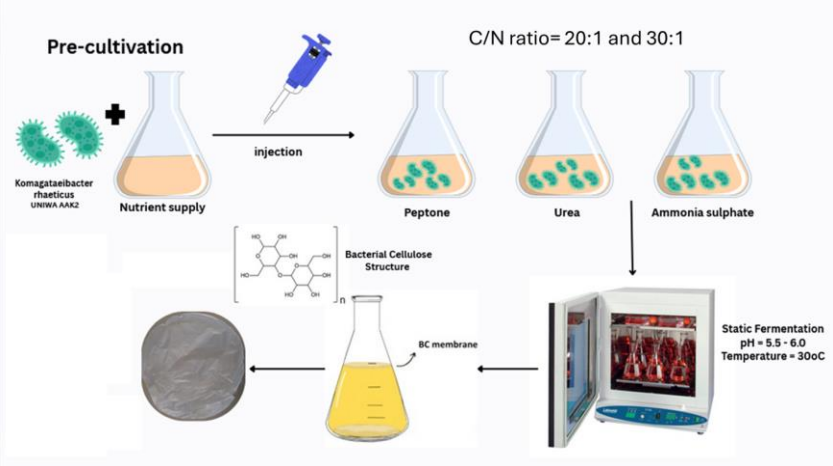
Bacterial cellulose (BC) refers to a biopolymer which can be extracellularly produced in the form of a thin membrane or thicker flexible surface by plethora of bacterial species and can be the perfect candidate for the development of green functional materials. In this research the production of bacterial cellulose by the *Komagataeibacter rhaeticus* strain UNIWA AAK2 was studied using three different nitrogen sources (peptone, urea, ammonium sulphate) and different C/N ratios (~20:1, 30:1). In trials using peptone and ammonium sulphate, BC production and substrate consumption were satisfactory, however, urea did not favour BC production. Maximum BC production was achieved in trials using peptone in C/N ratio of 30 and ammonium sulphate in C/N ratio of 20:1. In conclusion, *Komagataeibacter rhaeticus* strain UNIWA AAK2 could be described as a promising candidate for BC production and also its use could be studied for the valorisation of plethora of agro-industrial by- products, enchasing circular economy and sustainable practices.



Session 2 - Health applications. Chairman: J. Svarc-Gajic

14:00 - B. Pajin - UNS Senior

Nutritional value of cookies enriched with extruded food industry by-products

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The fast-growing population and the depletion of food sources do not allow throwing away such a large amount of food. The amount of food lost and by-products that occur along the supply chain of processed products is around 46% for some products. In our country, as well as worldwide, during the processing of wheat, apples, and beer production, a significant amount of by-products remains, which are rich in protein, dietary fibre, and minerals. The large presence of cookies in the daily meal structure enables the replacement of their raw materials with nutritionally valuable components, allowing them to be successfully introduced into the human diet. The task of this work was to examine the influence of replacing a part of wheat flour with extruded flour enriched with the addition of wheat germ, beer pomace and apple pomace on the characteristics of cookies (nutritional, sensory, microbiological). Extrudates of corn grits with the addition of wheat germ, beer pomace and apple pomace in proportions of 15, 30 and 45%, milled to obtain three fractions with different particle sizes (<250 μm, 250 - 1000 μm and 1000 - 2000 μm) were used as a substitute for wheat flour in quantities of 5, 10 and 15%. The addition of wheat germ and beer pomace extrudates significantly increased the protein content in cookie samples, and all three by-products caused an increase in the content of minerals and fibre. In all samples with the addition of extrudates enriched with by-products, the content of hydroxymethylfurfural (HMF) increased with the increase of the amount of extrudates in cookies and with the increase of the amount of the by-product in the extrudate. All cookie samples had an HMF content less than 25 mg/kg. Samples with the addition of apple pomace received the best taste ratings, while the particle size of the extrudates had a significant effect on the colour and texture of cookies. The addition of extrudates enriched with by-products did not affect the microbiological stability of the final product and all samples were safe for consumption.

14:30 - N. Kustudić - UNS Student

Development of facial nourishing serum with bamboo leaves extract

Jaroslava Švarc-Gajić*, Tanja Brezo-Borjan, Lana, Kisić, Kristina Čupić, **Nina Kustudić**, Milica Dostanić, Milana Maričić, Marina Čobanov, Ana-Marija Vujković-Bukvin
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Dry bamboo leaves were extracted by subcritical water applying the following conditions: extraction temperature 130°C, extraction time 30 min, convection 500 rpm, nitrogen atmosphere 20 bars, sample-to-solvent ratio 20. Cosmetic products with bamboo extracts are popular, however in this research for the first time bamboo extracts for cosmetic applications were prepared with pure water in its subcritical state. Based on previous investigations, subcritical water extraction provides superior bioactivity in extracts and content of relevant compounds in comparison to other modern extraction techniques, such as microwave

or ultrasound-assisted extraction. In addition, using pure water ensures safety and compatibility with cosmetic products. Prepared extracts were screened for phytochemicals presence, revealing tannins, gallic tannins, coumarins, alkaloids, O- and C-heterosides presence. Total phenols (117.10±2.37 mg/l) and flavonoids (52.68±0.83 mg/l) were quantified in extracts spectrophotometrically. The extracts exhibited great antioxidant potential (712.5±24.75 mg AAE/l), important for cosmetic applications. Anti-wrinkle, hydrating facial serum for daily use, containing 0.3% of lyophilized bamboo leaves extract was formulated. The product was additionally enriched with two molecular weight hyaluronic acids, namely of 130 kDa and 3.2 kDa, and emollients. The serum provided long-lasting skin hydration and elasticity.

Formulated facial serums with bamboo extract and hyaluronic acid.

14:50 - F. Gala - UA Student

Valorisation of Agri-Food Waste for the Production of Microbial Melanin-Based Bacterial Cellulose and Melanin-Enhanced Single Cell Protein Films

Eirini Tolia, **Freideriki Gala**, Danai Ioanna Koukoumaki, Katerina Petridi, Dimitris Sarris*

Laboratory of Physico-Chemical and Biotechnological Valorization of Food By-Products Department of Food Science and Nutrition, School of the Environment, University of the Aegean

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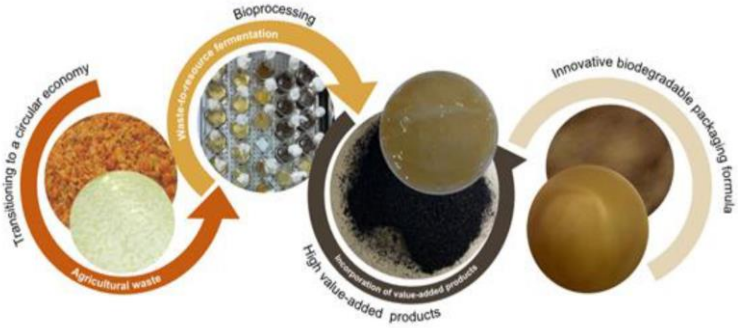
This research explores the sustainable production and application of biodegradable films enhanced with microbial melanin, offering a promising alternative to synthetic packaging materials. Agricultural waste streams—cheese whey and citrus waste—were valorised for the biotechnological production of single cell protein (SCP), bacterial cellulose (BC), and microbial melanin (MM). SCP refers to dry cells of microorganisms rich in protein, while BC is a biopolymer which presents an excellent candidate for the development of sustainable materials due to its physicochemical characteristics. MM is a biopolymer with high environmental interest, derived from “black yeasts”. SCP and BC were produced using *Kluyveromyces marxianus* EXF-5288 and *Komagataeibacter rhaeticus* UNIWA AAK2, respectively, while *Exophiala phaeomuriformis* EXF-6108 was used to produce melanin from citrus waste. Two melanin extraction methods were evaluated: autoclave-based and ultrasound-assisted. Although the autoclave method led to higher yields of pigment, the ultrasound method preserved melanin’s functional properties more effectively and proved more sustainable. The incorporation of melanin into SCP- and BC-based films improved UV-blocking capacity, particularly in the UVC and UVB ranges, and altered other properties including colour, solubility, and mechanical strength. Glucose was found to be the most effective carbon source for BC production compare to lactose obtained from cheese whey. SCP films with 20% melanin showed complete UVC/UVB blockage and improved opacity, however mechanical analysis showed poor results for tensile

strength. These findings support the development of functional, bio-based packaging materials aligned with circular economy principles.



15:10 - M. Maričić - UNS Student

Development of cosmetic products with aubergine peel extracts

Jaroslava Švarc-Gajić*, Tanja Brezo-Borjan, **Milana Maričić**, Marina Čobanov, Dragana Kovačević, Milan Stokrpa

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Aubergine peel is an excellent source of phytonutrients, dietary fibres and minerals. In addition, this biomass is high in anthocyanins, phenolic acids and flavonoids, β-carotene and other compounds with antioxidant, antiradical and antimicrobial properties. In this research dry aubergine peel was extracted with subcritical water in nitrogen atmosphere (40 bars), applying 130°C for 30 minutes and agitation (500 rpm). After extraction the extract was lyophilized and further used in the development of two types of cosmetic products: day face cream with SPF 20 (Picture 1), and aftershave gel for men (Picture 2). In both cosmetic products dry aubergine peel extract was incorporated in 0.3% fraction. Other active ingredients used for manufacturing of face cream included allantoin, panthenol, propylene-glycol, tocopheryl acetate, elastin and micro collagen, with propylene-glycol and glycerine as humectants, and isopropyl-myristate as emollient. Developed aftershave gel was formulated to have antiseptic, soothing and cooling properties. Besides aubergine peel extract, other active ingredients used in the formulation of aftershave gel, included camphor, menthol, allantoin and salicylic acid.

Face cream with aubergine peel extract.

Aftershave gel with aubergine peel extract.

16:00 - M. Čobanov - UNS Student

Extraction of aubergine peel by subcritical water: chemical characterization and bioactivity assays

Tanja Brezo-Borjan, Jaroslava Švarc-Gajić*, **Marina Čobanov**, Milana Maričić, Dragana Kovačević, Milan Stokrpa
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Chemical composition of aubergine peel indicates that this biomass is high in pectin, with galacturonic acid having high degree of esterification, delphinidin and it`s glycosides, as well as phenolic compounds. Rich phytochemical profile of this biowaste makes it an interesting source for food, cosmetic and other applications. Chemical characterization of aubergine peel extract was carried out after extraction with hot compressed water, applying an extraction temperature of 130°C for 30 minutes. Total phenols quantified in extracts were 355.6±2.02 mg GAE/l, whereas total flavonoids and anthocyanins were 136.3±3.5 mg RE/l and 8.2±0.9 mg C-3-G, respectively. Extract exhibited good antioxidant and antiradical properties. Total antioxidant activity was 905.25±18.03 AAE/l, while activity against DPPH radicals was 532.36±0.02 AAE/l, and for ABTS radicals IC_{50} was 7.69±0.5. Pectin represented 3.99±0.2% in extract. Phytochemical screening of aubergine peel extract indicated the presence of free flavonoids, tannins, gallic tannins, O- and c-heterosides, coumarins and alkaloids.

16:20 - A.-M. Vujković-Bukvin - UNS Student

Development of sports electrolyte drink with prebiotic properties based on beetroot skin fractions

Jaroslava Švarc-Gajić*, Tanja Brezo-Borjan, **Ana-Marija Vujković Bukvin**
Faculty of Technology, University of Novi Sad, 21 000 Novi Sad, Serbia
*jaroslava@tf.uns.ac.rs

Beetroot is a root vegetable renowned for its high nutritional value. Large portion of commercially produced beetroot is processed into food products, such as pickles or canned boiled vegetable. Commercial importance of this crop lies in the fact that the root is also used for the production of natural red food colorant used in different food products. Industrial processing of beetroot leaves its skin as a waste, not being used for any purpose. Conducted research demonstrated that the skin of the vegetable, considered as a biowaste, contains valuable phytonutrients that were able to be extracted by subcritical water. The content of betalains in subcritical water extract was 6.35±0.31 mg/l, betacyanins 6.60±0.36 mg/l and anthocyanins 10.16±0.90 mg/l. The extracts exhibited high antioxidant (898.88 ± 9.02 mg AAE/l) and antiradical (ABTS: IC_{50} = 7.19 mg±0.51 dry extract/ml; DPPH = 289.03 ± 3.57 md AAE/l) activities. Beetroot skin is high in dietary fibre cellulose and modified cellulose exhibits prebiotic properties, stimulating growth and activity of beneficial gut bacteria. This prebiotic effect is similar to other well-known prebiotics like inulin and fructo-oligosaccharides. In this research a cellulose fraction from the beetroot skin was hydrolysed by high hydrolytical potential of subcritical water, what was confirmed by quantifying total sugars in obtained extracts (6.6 ± 0.2 mg GE/l). Beetroot skin treatment with subcritical water under adequate operational parameters (130°C, 20 bars N_2, 40 min) assured simultaneous extraction of beneficial health-protecting compounds from this biowaste, and obtention of prebiotic fractions.

Since pure water was used for beetroot peel treatment it was lyophilized and the dry extract (0.5%) was used in the formulation of sugar-free soft drink for sportsmen. The drink was enriched with 85 mg/l Mg^{2+}, and 1 g/l of L-ascorbate 2-monophosphate, and aromatized with food grade cherry flavour. In preliminary sensory tasting, the beverage was denoted as refreshing, pleasantly flavoured, light and overall energizing.

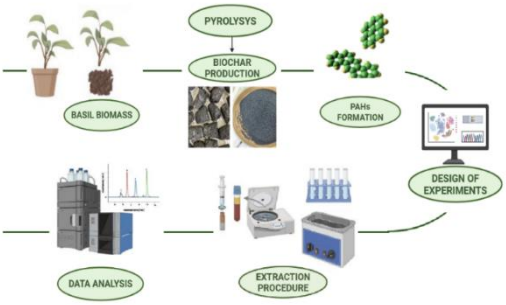
Formulated sugar-free electrolyte drink with beetroot peel extract.

16:40 - M.E. Marques - IPP Student

Greening Agriculture: Investigating Hidden Risks in Basil-Waste Biochar

Maria Eduarda Marques*, Tanara Motta, Cristina Soares, Antón Puga, Ana Rita Alves, Henri Nouws, Cristina Delerue-Matos

REQUIMTE/LAQV, Instituto Superior de Engenharia do Porto, Instituto Politécnico do Porto, Porto, Portugal, *1100831@isep.ipp.pt



Biochar is a carbon-rich material widely recognized for improving the physicochemical properties of soils that can be produced via pyrolysis of agri-food residues [1]. However, during biomass pyrolysis, polycyclic aromatic hydrocarbons (PAHs) are commonly formed, mainly due to incomplete combustion of organic material or through transformation reactions [2]. PAHs are toxic environmental pollutants with carcinogenic, teratogenic, and mutagenic properties. This study aimed to assess the occurrence of 16 priority PAHs listed by the US EPA in biochar derived from basil (*Ocimum basilicum L.*) waste, evaluating its suitability as a soil conditioner and its hidden risks to food safety and the environment [3]. Slow pyrolysis was conducted at 500 °C for 14 h under oxygen-limited conditions. A Central Composite Design (CCD) experiment was performed to investigate four factors—solvent type, solvent-to-biochar ratio, extraction time, and temperature—and identify the most influential variables on PAHs extraction. Extractions employed greener solvents (acetone and acetonitrile) assisted by ultrasound. Optimal conditions predicted by the fitted model were validated through two replicate trials. Finally, a comparative *Soxhlet* extraction was conducted. The resulting extracts were analysed by HPLC with fluorescence detection to quantify the target 16 PAHs. Basil biochar showed concentrations of PAHs such as phenanthrene, fluoranthene, and pyrene below the standard regulatory limits, according to the criteria defined by the European Biochar Certificate (Σ16 PAHs ≤ 6.0 ± 2.4 mg/kg) [4]. Strict quality control of biochar is essential, especially in agricultural food applications, due to the toxicity of these contaminants.

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Wednesday 09/07/2025

Session 3 - Food applications. Chairman: E.H. Ajandouz - AMU Senior

9:00 - V. Robert - AMU Senior

The Fabulous Destinies of spent grain

Viviane Robert*
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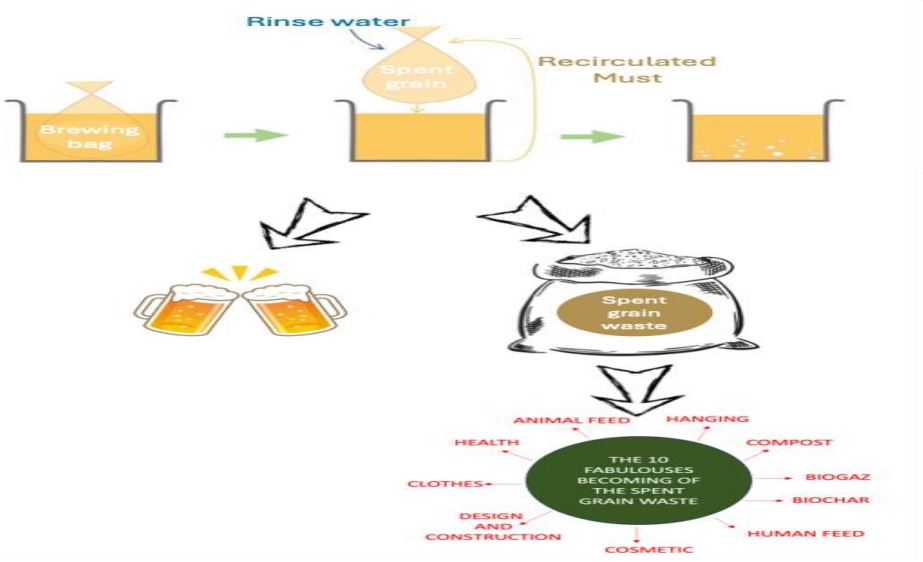
Beer is one of the most consumed drinks all over the world and its highly impactful production process. It releases a large quantity of wastes, such as spent grains (BSG). In the first part of this work we will see how theses wastes are made. In the second part we will focus on the most quantitative waste produced: the BSG. The large numbers of ecological destinies of spent grain will be assessed.



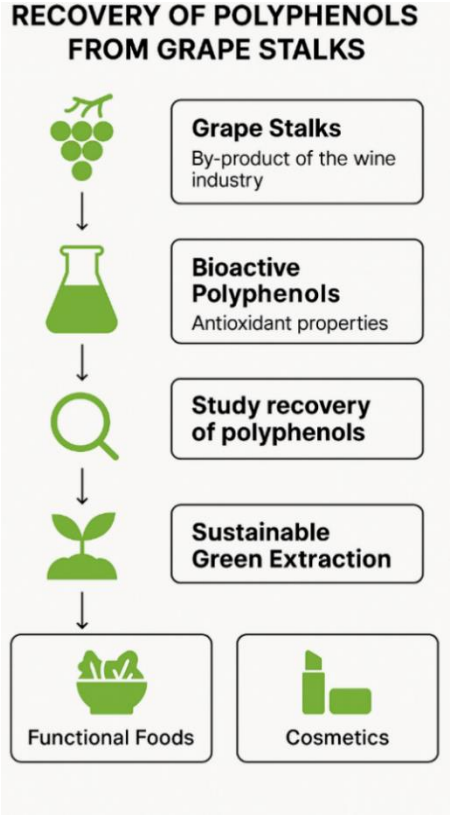
9:30 - M. Gonçalves - IPP Student

The Hidden Treasure in Grape Stalks: A Green Extraction Quest

Mariana Gonçalves, Matisse Dewever, Cristina Soares, Cristina Delerue-Matos, Henri Nouws, Manuela M. Moreira*
REQUIMTE/LAQV, Instituto Superior de Engenharia do Porto, Instituto Politécnico do Porto, Porto, Portugal,
*mmdsm@isep.ipp.pt

The winemaking industry generates significant by-products, such as grape stalks, which pose environmental challenges [1]. Rich in polyphenols with recognized health benefits, these by-products offer potential for sustainable applications [2]. This study investigates grape stalks from *Tinta Miúda* variety as a source of bioactive polyphenols for functional food use. Solid–liquid extraction (SLE) was optimized by evaluating ethanol concentration, temperature, mass-to-solvent ratio, stirring speed, and time.

A two-level fractional factorial design (2^{5-1}) identified key variables, followed by optimization using response surface methodology (RSM) through a central composite design (CCD). To benchmark SLE against other sustainable methods, three green extraction techniques—ultrasound-assisted extraction (UAE, 10 and 20 min), microwave-assisted extraction (MAE, 40 and 60 °C), and subcritical water extraction (SWE, 120 and 150 °C)—were applied to stalks from red and white grape varieties. Extraction performance was assessed using total phenolic content (TPC), ABTS radical scavenging activity, and ferric reducing antioxidant power (FRAP). TPC analysis indicated that temperature and biomass-to-solvent ratio were the most influential SLE factors. RSM allows for identifying optimal conditions (60◦C, 1:150 w/v, 75 min, 44% ethanol, 250 rpm). Among green techniques, UAE (20 minutes at 70% amplitude) yields the highest TPC and antioxidant activity (TPC: 78.9 mg GAE/g dw; ABTS: 123.5 mg AAE/g dw; FRAP: 106.2 mg AAE/g dw). These findings support the sustainable valorisation of grape stalks through green extraction, promoting their integration into functional food systems. Ongoing work focuses on incorporating these extracts into food matrices to assess their bioactivity and functional potential.



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[2] E. Tapia, et al., Foods 13(12) (2024) 1795.

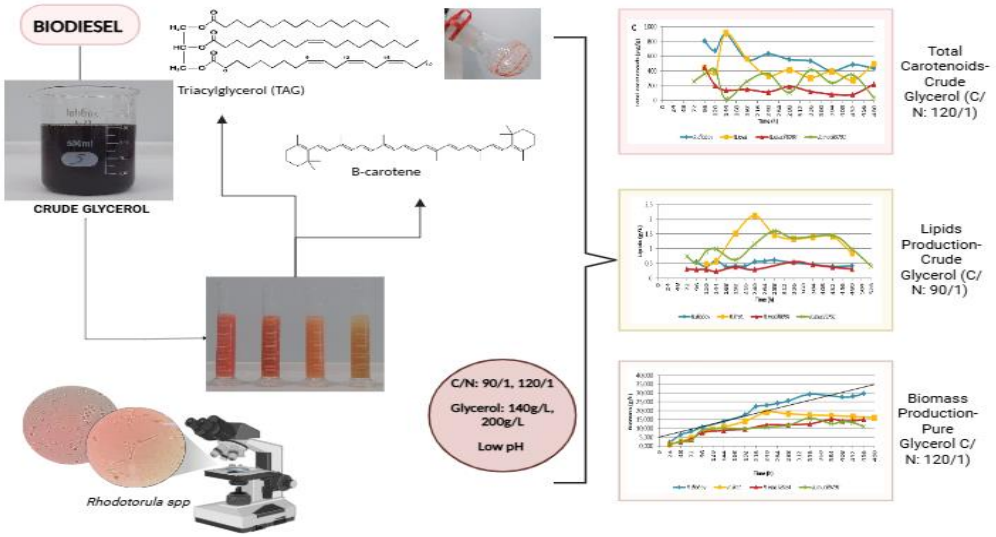
9:50 - M. Karpeli - UA Student

Evaluating the lipid and carotenoid production capability of novel *Rhodotorula* strains cultivated in crude biodiesel-derived glycerol

Maria Karpeli, Eleni Naziri, Dimitris Sarris*
Laboratory of Physico-Chemical and Biotechnological Valorization of Food By-Products Department of Food Science and Nutrition, School of the Environment, University of the Aegean
*dsarris@aegean.gr

The rapid expansion of biodiesel production has resulted in the accumulation of substantial quantities of crude glycerol, posing a significant challenge for biofuel industry, due to its low viscosity and associated environmental concerns. Oleaginous microorganisms have gained attention in recent years, owing to their ability to utilize a wide spectrum of industrial by-products, including crude glycerol, for the synthesis of intracellular lipids and other high-value secondary metabolites. In this study, the potential of four novel *Rhodotorula* strains to exploit crude glycerol for the concurrent production of intracellular lipids and carotenoids was examined. Key parameters affecting microbial growth were assessed, including waste purity, tolerance to low viscosity, varying carbon-to-nitrogen (C/N) ratios (90:1 and 120:1) and high glycerol concentration (140g/L). All strains were able to grow on unrefined crude glycerol, without pH adjustment,

under both elevated glycerol levels and low C/N conditions. Biomass accumulation, intracellular lipid content and total carotenoid production were quantified across all conditions. Under pure glycerol conditions, maximum biomass, lipid and carotenoid yields reached 29.74 g/L, 13.97g/L and 931.98 µg/g respectively. In contrast, crude glycerol supported enhanced carotenoid biosynthesis under both C/N ratios, with peak values reaching 1214.81 µg/g, while the 90:1 C/N ratio favoured higher biomass and lipid production. These findings highlight the potential of *Rhodotorula* spp. in valorising crude glycerol through a low-input, multi-product bioprocess. Optimization of cultivation parameters could further improve yields, contributing to both the economic feasibility and environmental sustainability of biodiesel industry by-product management.



10:10 - S. Pinto - AVIPE Senior

Red Wine - Increasing microalgae biomass feedstock by valorising wine gaseous and liquid residues

Miguel Cachão*, Ana Chambel, **Sergio Pinto**, Goreti Trindade

Associação de Viticultores do Concelho de Palmela – AVIPE, R. D. João de Castro, 12 loja, 2950-206 Palmela, Portugal

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Global warming due to greenhouse gases (GHG) has become a serious worldwide concern. The new EU Green Deal aims to achieve GHG emissions reduction by at least 55% by 2030 and a climate neutral EU economy by 2050. The deal strongly encourages GHG reducing measures at local, national and European levels. The REDWine project will demonstrate the technical, economic and environmental feasibility of reducing by, at least, 31% of the CO_2 eq. emissions produced in the winery industry value chain by utilizing biogenic fermentation CO_2 for microalgae biomass production. REDWine project, funded by BBI-JU, is establishment of an integrated Living Lab demonstrating the viability of the system at TRL 7. The Living Lab will be able to utilize 2 ton of fermentation off-gas/year (90% of total CO2 produced in the fermenter) and 80 m3 of liquid effluent (100% of the liquid effluent generated during fermenter washing) to produce 1 ton (dry weight) of Chlorella biomass/year. This biomass will be processed under a downstream extraction process to obtain added-value extracts and applied in food, cosmetic and agricultural end-products and to

generate a new EcoWine. REDWine is focused on the recovery of off-gas from a 20.000L fermenter of red wine production existing in Adega Cooperativa de Palmela (ACP, located in Palmela, Portugal). REDWine's microalgae were tested since 2022 with 4 purposes in vineyard, improve flowering stages, contribute to high temperature resistance, biofungicide against downy mildew and increasing in nitrogen content in ripening to help fermentation and improve aromatic compounds, and on winemaking, clarificant or anti-oxidant. The project has already developed food solutions with *Chlorella Vulgaris* and it's expected to have its first cosmetics prototypes by September 2025.

11:10 - C. Megagianni - W2L Senior

Citizen Science in biotechnological innovations

Stefania Oikonomou[1], **Chara Megagianni**[2]*, Katerina Zourou[1]

[1]Web2Learn, Thessaloniki, Greece; [2]Department of Agriculture & Agrotechnology, University of Thessaly, Greece

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Citizen science, the active involvement of amateur scientists in conducting research, has been a game-changing approach in biotechnology. This presentation examines how citizen action can contribute to innovation in biotechnology, encompassing data collection, experimental collaboration, and open-source initiatives. Through the collective knowledge and passion of the people, biotechnology is extended to new ideas, diverse data sets, and additional problem-solving pathways.

Through a series of case studies, we highlight the impact of citizen science in synthetic biology, environmental monitoring, and agri-biotechnology. We also address the challenges inherent in public-driven research efforts, such as ensuring the quality of data.

The role of facilitator, enabled by community labs and online platforms, is highlighted as a key enabler, uniting scientists and citizens in collaborative efforts. Such a confluence of professional research in the traditional sense and societal need democratizes science in general and, in that case, biotechnology, bridging the research-public needs gap.

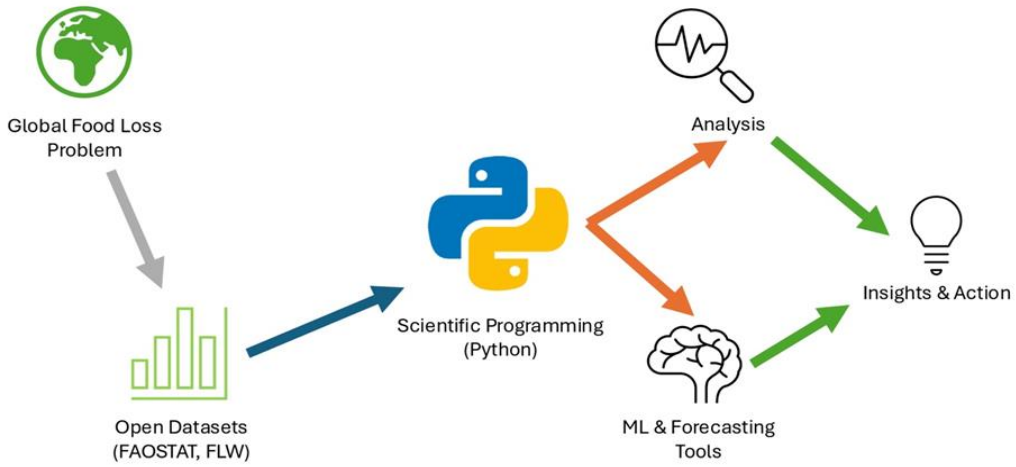
Ultimately, this presentation advocates for the strategic integration of citizen science in biotechnology R&D, imbuing transparency, innovation, and responsible scientific citizenship

11:40 - S. Rossos - UA Student

Leveraging Online Data Sources to Evaluate Food Losses

Stavros Rossos, Efstathios Kaloudis*
Computer Simulation, Genomics and Data Analysis Laboratory, Department of Food Science and Nutrition, University of the Aegean, Myrina, Lemnos, 81400, Greece
*stathiskaloudis@aegean.gr

Food loss is a critical global issue that undermines sustainability efforts across environmental, economic, and social domains. Despite growing awareness and policy initiatives, progress toward reducing food losses remains uneven, largely due to fragmented, outdated, or inaccessible data. The emergence of open-access platforms such as the FAO Food Loss and Waste (FLW) database, FAOSTAT, and complementary national or regional repositories offers a promising foundation for a more systematic, data-driven approach to food loss assessment. This study explores how online data sources can be leveraged to evaluate food losses at different stages of the agri-food supply chain, across diverse commodities and regions. Python-based tools are used to preprocess and analyse the data, employing exploratory methods such as time series decomposition, trend analysis, and forecasting techniques including Prophet models. In parallel, unsupervised machine learning techniques such as k-means clustering are explored to identify patterns and groupings among countries, crops, or supply chain stages with similar loss characteristics. The aim is not only to quantify food loss trends but also to provide a methodological framework for turning complex, multidimensional datasets into actionable insights which can support sustainability assessments, inform targeted interventions, and guide strategic decision-making by policymakers, researchers, and industry stakeholders.



Thursday 10/07/2025

Session 4- Implementation examples and sustainability concerns. Chairman: H. Nouws - IPP Senior

9:10 - V. Walker - OVINALP - Invited Industrial Expert

Potentials of composting. Tools and facts for using agro-industrial by-products

Vincent Walker*
Ovinalp Haute Fertilisation
*r.i@ovinalp.fr

Founded in 1988, OvinAlp is a French agricultural company specializing in the production and distribution of fertilizers and biosolutions. The company combines tradition with innovation to support sustainable farming and use mainly for its organic fertilizer a large diversity of agricultural by-product. OvinAlp's core strength lies in its unique **Active Ingredient Ov**, derived from composted sheep manure sourced within an 80 km radius of Sisteron. This raw material, certified with a Protected Geographical Indication (PGI), undergoes a 10-month composting process on an ISO 14001 platform. The result is a product rich in organic matter, microbial biodiversity, and humic substances—key to improving soil health and plant nutrition. The company offers a wide range of fertilizers built around four pillars: organic matter derived from agroindustrial by products, root and foliar biostimulants technologies, and bioprotection. These include soil improvers, organo-mineral fertilizers, and natural pest control solutions.

OvinAlp is committed to environmental responsibility, using biodiesel-powered trucks, reducing packaging, and investing in research. It collaborates with academic institutions to study microbial diversity of its final products and develop innovative solutions like biostimulant bacteria.

Through its local, traceable, and eco-friendly approach, OvinAlp transforms agricultural by-products into high-performance biosolutions—enhancing soil fertility, supporting biodiversity, and protecting both people and the planet.

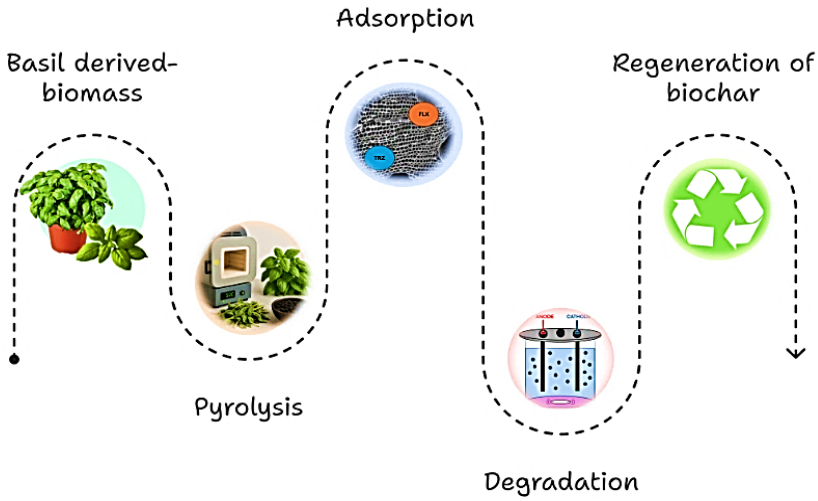
9:45 - A.R. Alves - IPP Student

Production of biochars from agro-food wastes for environmental applications

Ana Rita Alves*, Cristina Soares, Sónia Figueiredo, Cristina Delerue-Matos, Antón Puga
REQUIMTE/LAQV, Instituto Superior de Engenharia do Porto, Instituto Politécnico do Porto, Porto, Portugal
*1210610@isep.ipp.pt

Emerging contaminants, especially pharmaceuticals, have become a growing concern due to their long-term ecological impacts. These compounds are not effectively removed by conventional wastewater treatment technologies and persist in the environment. The European Union introduced a directive requiring the implementation of quaternary treatment in large-scale wastewater treatment plants capable of removing at least 80% of harmful organic micropollutants, namely pharmaceutical compounds [1-3]. In this study, biochar derived from agro-industrial basil (*Ocimum basilicum*) residues were used as a low-cost and sustainable adsorbent for removing antidepressants (trazodone and fluoxetine) from water. Particle size was found to significantly influence the biochar performance in different ways, with finer fractions (<0.5 mm) achieving over 70% for trazodone, and the largest size (>2 mm) reaching over 90% for fluoxetine.

Additionally, the biochar was investigated as a catalyst in an electro-Fenton system for the degradation of antidepressants, showing a strong removal efficiency. Notably, pharmaceutical-loaded biochar was also successfully treated using the electro-Fenton process, enabling degradation of the adsorbed contaminants and minimising secondary environmental risks. The results confirm the dual functionality of basil-derived biochar as an effective adsorbent and catalyst. This approach supports circular economic practice by valorising agricultural waste.



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10:05 - N. Benbernou - AMU Student

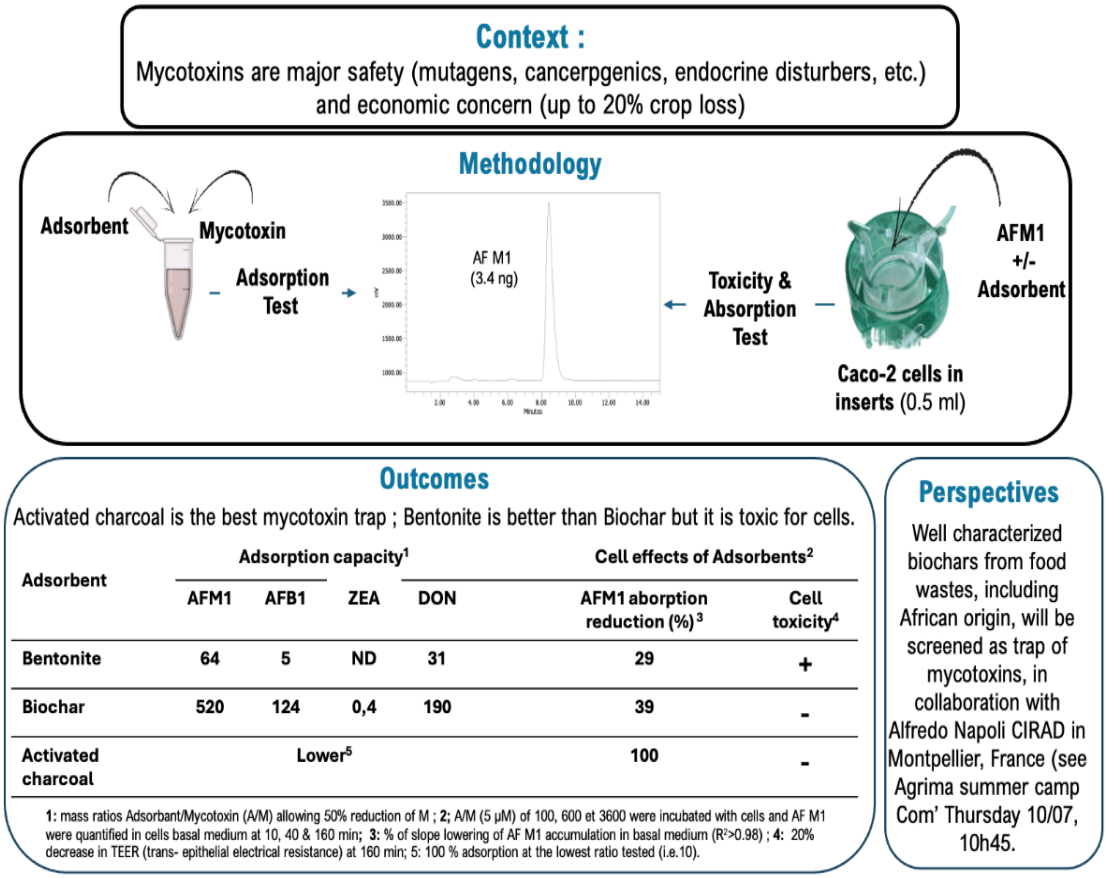
Research into remediation methods for mycotoxins using biochar

Nardjes Benbernou*, El Hassan Ajandouz, Marc Maresca, Viviane Robert

Aix Marseille Univ, CNRS, Centrale Marseille, iSm2, 13013 Marseille, France

*nardjes.benbernou@gmail.com

Mycotoxins constitute a major heath and economic concern. We installed HPLC/UV or HPLC/fluorescence methods for quantification of mycotoxins A aflatoxins (AF B1 & M1), Zearalenone (ZEA), and Deoxynivalenol (DON)). The method was used for screening dose/response trapping capacity of adsobents (Bentonite, activated charcoal and a biochar obtained from pine). Caco 2 cells ware used for evaluating toxicity and effects of the three adsorbents, at wide mass ratios, on AF M1 intestinal absorption. Bentonine and the biochar sample exhibited saturation curves with all the mycotoxins over mass ratios from 10 to 3000. The effects on AF M1 absorption by Caco-2 cells behaved accordingly, but bentonite was found to be toxic to Caco-2 cells. Activated charcoal exhibited a much higher capacity to trap mycotoxins (100% adsorption of the 4 mycotoxins at the lowest mass ratio here tested (10:1, Adsorbent/M); and it is not toxic to Caco-2 cells at the tested doses. Biochars from biomass byproducts in general, and from food waste in particular, therefore seem to be valuable sustainable remediation materials against mycotoxins. The investigations will be continued following the same methodology, improved if needed, and using well characterized food waste biochars.



Adsorbent	Adsorption capacity[1]				Cell effects of Adsorbents[2]	
	AFM1	AFB1	ZEA	DON	AFM1 aborption reduction (%)[3]	Cell toxicity[4]
Bentonite	64	5	ND	31	29	+
Biochar	520	124	0,4	190	39	-
Activated charcoal	Lower[5]				100	-

1: mass ratios Adsorbant/Mycotoxin (A/M) allowing 50% reduction of M ; 2; A/M (5 µM) of 100, 600 et 3600 were incubated with cells and AF M1 were quantified in cells basal medium at 10, 40 & 160 min; 3: % of slope lowering of AF M1 accumulation in basal medium (R^2>0.98) ; 4: 20% decrease in TEER (trans- epithelial electrical resistance) at 160 min; 5: 100 % adsorption at the lowest ratio tested (i.e.10).

10:45 - A. Napoli - CIRAD - Invited Academic Expert

Physico-chemical characteristics of Biochars for remediation and sustainable economy: main challenge on pyrolysis process development – Study case with the Cronus European Project

Alfredo Napoli[1]*, Nicolas Brun[2], Nabila Boutahar[2], Philippe Gallet[2]

[1]BioWooEB Unit Research, French Agricultural Research Centre for International Development, Montpellier, France, [2]ICGM, CNRS, ENSCM, Univ. Montpellier, France

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This presentation will describe the main challenges facing the development of pyrolysis processes to meet the issues of climate change and the reduction of greenhouse gases through the use of biochars. Biochars are the subject of numerous studies for their potential uses in various applications such as agronomy, decontamination and energy. Each application requires specific characteristics of biochars in terms of physical, chemical and structural properties in order to achieve the required performance. These properties can be controlled to some extent by the nature of the biomass used and the pyrolysis parameters employed. Nevertheless, the development of clean and sustainable pyrolysis processes, integrated into a circular economy system, remains a challenge. We will present the activities carried out as part of the European Cronus project (https://cronushorizon.eu), the aim of which is to simultaneously produce biochar for agronomic applications and biofuels. The methodology will be detailed, specifying the biomasses selected, the pyrolysis parameters employed and the characteristics of the biochars studied. The initial results will

be presented, focusing on the mass and energy balances carried out at laboratory scale and on the physicochemical and structural characterization of the biochars for future agronomic trials. The results highlight the significant influence of pyrolysis temperature on the chemical properties of biochars, as well as on pH, while the pyrolysis atmosphere plays a major role in the textural properties of biochars at temperatures of 800°C.

11:20 - A. Alves - IPP Student

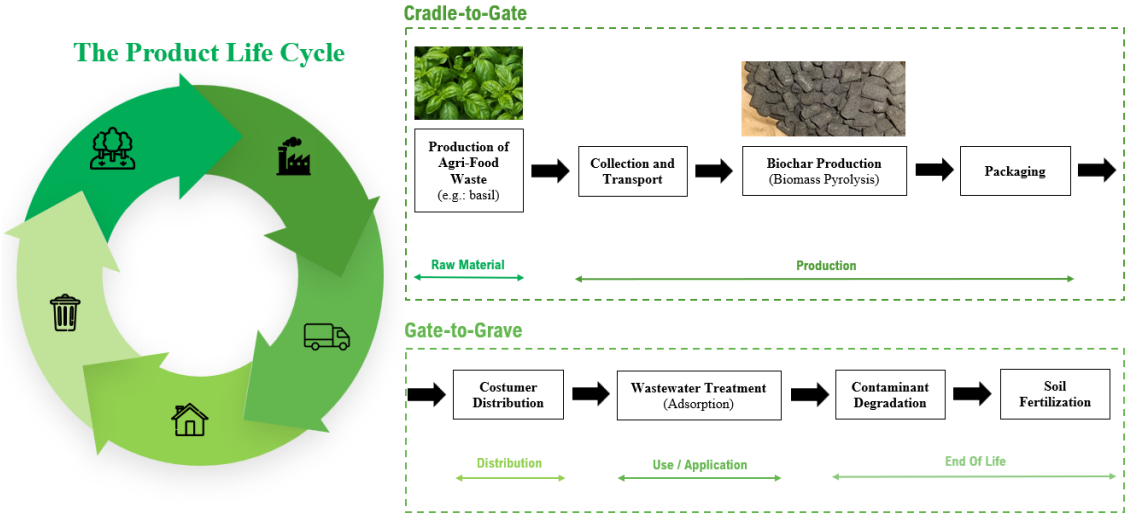
Life Cycle Assessment (LCA) of waste valorisation processes

Adriana Alves*

REQUIMTE/LAQV, Instituto Superior de Engenharia do Porto, Instituto Politécnico do Porto, Porto, Portugal

*1242186@isep.ipp.pt

In the context of sustainability and circular economy, waste valorisation is often assumed to be inherently beneficial. However, not all processes that incorporate waste materials are necessarily more environmentally friendly, and what seems sustainable at first glance may not be when examined through a full life cycle perspective. Life Cycle Assessment (LCA) is a scientific methodology that allows for the quantification of environmental impacts across all stages of a product's or process's life cycle, from raw material extraction to end-of-life. As such, LCA provides a powerful framework for informed decision-making, particularly when comparing alternative scenarios, and plays a crucial role in the sustainable design of products and processes. This presentation aims to provide a brief introduction to LCA methodology and its relevance, especially in the case of waste valorisation processes. To illustrate its practical application, a case study will be presented on the production of biochar from agri-food waste and its use in wastewater treatment. Although the life cycle inventory is still under development, this example can provide preliminary insights into the potential environmental trade-offs involved in transforming agro-industrial residues into value-added products. Ultimately, this work highlights the importance of incorporating LCA in the early stages of research and reinforces the message that sustainability is not just a feeling, but a calculation.



11:40 - S. Silva - IPP Student

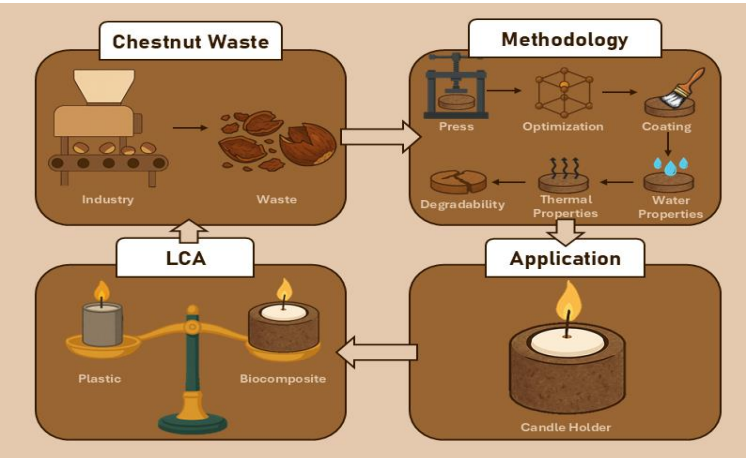
From chestnut waste to biocomposite prototype candle holder

S.B. Silva[1]*, O.M. Freitas[1], E.F. Vieira[1], A. Gomes[2], A.R. Carreiras[3], D.C. Moreira[3], P. Esfandiari[3], J.F. Silva[3], C. Delerue-Matos[1], V.F. Domingues[1]

[1]REQUIMTE/LAQV, Instituto Superior de Engenharia do Porto, Instituto Politécnico do Porto, Porto, Portugal, [2]CICECO - Aveiro Institute of Materials, Department of Chemistry, University of Aveiro, Aveiro, Portugal, [3]M4S - Materials for Sustainability, Instituto Superior de Engenharia do Porto, Instituto Politécnico do Porto, Porto, Portugal

*1181156@isep.ipp.pt

Plastic pollution remains a significant barrier to global sustainability efforts, urging the search for eco-friendly alternatives. In Portugal, the chestnut industry generates large volumes of waste, including shells and non-commercial chestnuts, that are largely underutilized [1]. This research explores the potential of converting this agro-industrial waste into biodegradable and functional biocomposites, offering a sustainable solution aligned with circular economic principles. Non-commercial chestnuts provided by Sortegel, the largest national producer, were used to produce composites via hot compression moulding. Chestnut shells and starch formed the matrix, while fibres from the shells served as reinforcement. A Box-Behnken Design model identified the optimal composition (70% chestnut, 0% glycerol, at 120 °C) balancing mechanical strength and sustainability. To improve water resistance, natural shellac coating was applied, significantly reducing water absorption. Thermal analysis confirmed the material's insulating properties, and the addition of glycerol was shown to increase flexibility [2]. To demonstrate practical application, a prototype candle holder was developed using the optimized formulation. A Life Cycle Assessment (LCA) compared chestnut-based products to conventional polyethylene (PE) items and the prevailing practice of incinerating chestnut waste for energy recovery. The results showed that producing biocomposite candle holders leads to a lower environmental impact in key categories, particularly when using 73% chestnut without glycerol or shellac. This study demonstrates that chestnut waste can be upcycled into biodegradable, high-performance products offering a viable alternative to traditional plastic materials.



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14:00 - O. Iranzo - AMU Senior

Towards sustainability in education and research laboratories. Examples of initiatives in ISM2 - AMU

Olga Iranzo*

Aix Marseille Université, Centrale Méditerranée, CNRS, iSm2 UMR 7313, 13397, Marseille, France

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Since the Paris agreement on climate change in 2015, and the Intergovernmental Panel on Climate Change Special Report on Global Warming of 1.5˚C [1] more than 190 states have committed to set stringent policies of greenhouse gas reduction. The goal is to hold global average temperature increase to well below 2°C above pre-industrial levels and preferably limit the increase of the temperature to 1.5°C. To achieve this demanding goal, greenhouse gas emissions should be reduced as soon as, and as much as possible, reaching net zero emissions (i.e., global balance between emissions and removals) by 2050. Although this is a global and common objective, actions to achieve it are driven at the national level. In this context, the French higher education and research institutions have committed to reduce the environmental impact of their academic and professional activities. Important actions have been and are being taken not only to open debate and raise awareness but also to engage the scientific community and students in a more responsible and sustainable research.

Following these guidelines, the Institute of Molecular Sciences of Marseille (ISM2) at Aix-Marseille University created in 2021 a sustainable development committee dedicated to promoting specific actions to reduce the footprint of its professional and academic activities (https://ism2.univ-amu.fr/fr/developpement-durable). An overview of these actions as well as of the initiatives taken will be presented.

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14:30 - S. Sutradhar - AMU Senior

Bioinspired copper catalysts for biomass valorisation: insights from LPMO chemistry

Subhankar Sutradhar*, Rébecca Leblay, Maria El Nmeir, Marius Réglier, Bruno Faure, A. Jalila Simaan
Aix Marseille Univ, CNRS, Centrale Marseille, iSm2, Marseille
*subhankar.sutradhar@univ-amu.fr

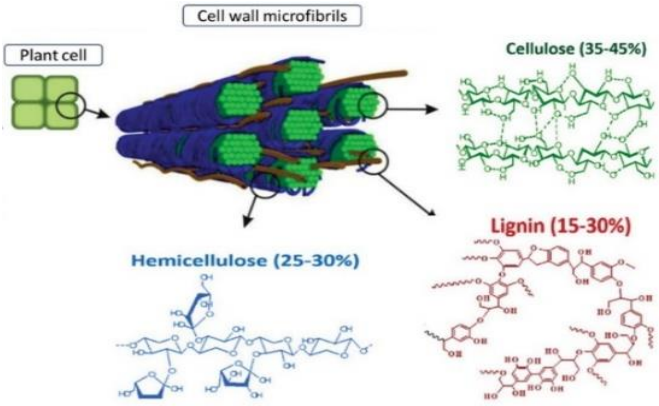

Fig. 1. Representation of the structure and of the main components of lignocellulose.

The use of non-edible plant parts from agricultural or forestry residues (lignocellulosic biomass) for producing advanced biofuels or chemicals is highly desirable to avoid competition with food and water resources. Lignocellulosic biomass, which forms the structure of plant cell walls, consists of three main polymers (Fig. 1): cellulose (35-45%), hemicellulose (25-30%), and lignin (15-30%), which are intricately bound together into a solid, recalcitrant structure [1]. Among these components, polysaccharides such as cellulose and hemicellulose can be converted into monomeric sugars (e.g., glucose and xylose), which are used for bioethanol production via fermentation. A crucial step in the valorisation of lignocellulosic components into bioethanol or chemicals is reducing the size of the polymers, particularly cellulose, the most abundant component. Oxidative depolymerization of polysaccharides is highly desirable for efficient valorisation of recalcitrant biomass. Until 2010, no enzymes were known to break down polysaccharides through oxidation. However, the discovery of Lytic Polysaccharide Monooxygenases (LPMOs), copper-containing enzymes, changed this by enabling the breakdown of C-H bonds in glycosidic linkages, aiding polysaccharide degradation. LPMOs can use either O_2 with an electron source or H_2O_2 to carry out this process and can act on crystalline polysaccharides, making them more accessible to other enzymes for further breakdown. This discovery has spurred increased research into C-H bond activation and has opened new possibilities for biofuels and biobased chemicals. Inspired by the recently discovered LPMOs, mononuclear copper complexes have been developed and studied in the literature [2,3]. However, their activities have been evaluated on different substrates and under various conditions. In this study, we aimed to develop more robust and sustainable molecular catalysts for reproducible activity assays in aqueous solutions at near-neutral pH and mild conditions.[4] We tested several complexes on substrates of increasing complexity: the model substrate para-nitrophenyl-β-D-glucopyranoside (p-NPG), cellobiose (glucose dimer), and more complex substrates such as chitin, cellulose, and agave bagasse. After comparing the assays, proof-of-concept was achieved, demonstrating that bioinspired copper complexes can effectively promote oxidative polysaccharide depolymerization. Overall, it is likely that different mechanistic pathways are involved when various systems are used, depending on the nuclearity and/or redox properties of the complexes. Ongoing research aims to further understand these mechanisms and optimize the catalyst's stability.

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15:00 - L. Hagege, F. Frichot, J. Du Cheyron - AMU Students

Miditerranée - Innovative valorisation of recycling plastics in cutlery for students

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The objective of our project being to promote recycling in close collaboration with associations along the Marseille coastline, we must therefore adapt to the materials they make available to us. The association Sauvage Méditerranée is dedicated to recycling plastic bottle caps, boat sails, and fishing nets. We are therefore planning to design cutlery from bottle caps, which we will extrude into flat sheets. The cutlery will then be cut using a laser cutter or milling machine. A coating that meets hygiene standards will subsequently be applied by dipping to ensure safe use.

16:00 - J. Guedje, M. Garcia-Mesa - AMU Students

Aeroponic coupled to hydroponic, to make safe food.

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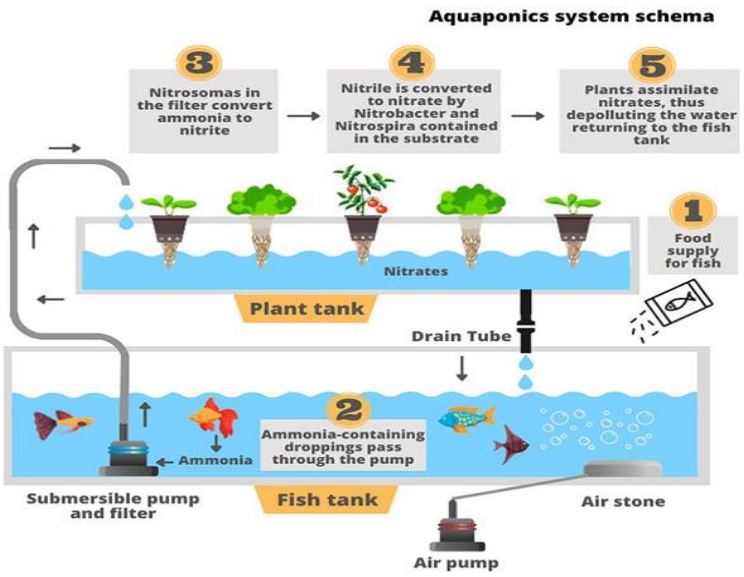

Our initiative (Avenir Vert Solidaire) through aquaponics aims to ensure food self-sufficiency for orphanages by supplying their collective kitchens with fresh and healthy products. The orphans actively participate in managing these sustainable farms, learning about aquaponics principles, the life cycles of fish and plants, and contributing to food production for their own meals. This involvement fosters a deep understanding of agroecology and raises awareness of sustainability within the educational community. Aquaponics is an innovative system that combines hydroponics and fish farming. Fish waste, processed through nitrification, is absorbed by the plant roots, which in turn purify the water before it returns to the fish tanks.

16:30: H. Nouws - IPP Senior

Conclusion of Agrima's first summer camp

Henri Nouws

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Henri Nouws expressed everyone's satisfaction with the scientific and technical qualities of the content (28 oral communications and 8 posters) and with the sociability and connectivity of the event.

POSTERS

P1: Consumer Perception of SCP-Based Edible Films from Cheese Whey Valorisation: Insights for Sustainable Packaging in a Circular Bioeconomy

Sofia Giannikou[1], Danai Ioanna Koukoumaki[1,2], Konstantinos Gkatzionis[1], Dimitris Sarris[2]*

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Edible films are gaining interest as sustainable alternatives to synthetic packaging due to their biodegradability and integration into circular food systems. This study explores consumer perception of edible films made from Single Cell Protein (SCP) produced via cheese whey valorisation – an agri-food by-product. For this study, a mixed-methods approach was conducted. First, focus groups (N=6) assessed sensory traits, labelling concerns, and potential applications. Second, an online survey (N=178) evaluated emotional responses using a CATA list of 33 emotions. Third, eye-tracking analysis (N=100) studied visual attention towards yogurt samples covered with SCP-based films and finally, sensory evaluation (N=80) compared texture, odour, and overall acceptability of edible vs. plastic packaging. Results showed positive overall attitudes toward edible packaging regardless of microbial origin. Eco-friendly claims significantly increased acceptance. However, the brown colour of SCP-based films elicited negative emotional reactions (e.g. disgust, anxiety). Texture was well accepted, but odour scores were low, often linked to spoilage or vinegar-like smells. Participants preferred edible films as internal packaging within conventional containers, suggesting hybrid packaging solutions. From educational perspective, this research supports AGRIMA's mission by highlighting the need to integrate food science, sensory evaluation, and data-driven analysis into higher education curricula focused on sustainability and upskilling. In conclusion, SCP-based edible films present a promising alternative as a sustainable packaging material derived from food industry by-products. Their adoption depends on optimizing sensory and visual attributes and providing clear, eco-friendly labelling strategies.

P2: Valorisation of Wine Industry By-Products in Breadmaking: Functional Properties and Antioxidant Activity

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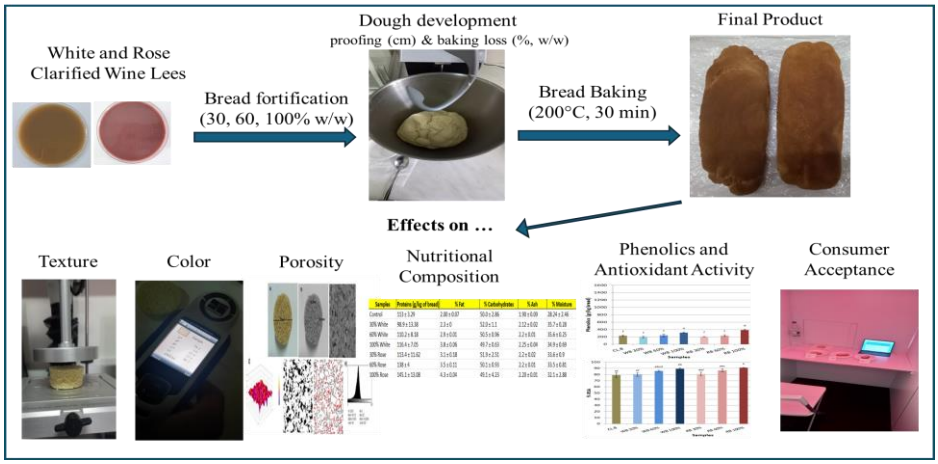
The exploitation of wine industry by-products represents a cost-effective and environmentally friendly approach within the framework of the circular economy. While wine lees are often studied for extracting high-value compounds, their direct incorporation into food remains limited. In this study, clarified white and rosé wine lees were used without pretreatment to substitute water (30%, 60%, 100% w/w) in breadmaking. Bread was chosen as a globally consumed staple with nutritional significance and a projected annual growth rate of 6.37% up to 2028. The impact of wine lees on dough development (proofing expansion,

baking loss), bread characteristics (colour, texture, porosity, composition), and antioxidant activity was assessed. Sensory analysis was also conducted. From the results it was conducted that wine lees addition increased dough expansion and reduced baking loss, likely due to sugar-induced moisture retention. Nutritional analysis revealed enhanced protein, fat, and ash content. Phenolic content increased by 36%–67%, while antioxidant activity enhanced by 15%. Moreover, the incorporation of wine lees led to greater pore size and crumb heterogeneity, desirable in rustic breads. Regarding the Texture Profile Analysis, a reduced cohesiveness and elasticity with increasing lees incorporation was found, while hardness varied by type. Sensory analysis indicated no major differences in texture, aroma, or overall acceptance. Notably, purchase intention improved significantly when participants were informed of the product's sustainable origin. This research highlights wine lees as a promising functional ingredient in breadmaking, enhancing nutritional value and supporting sustainable innovation in line with circular economy principles.



P3: Extraction of bamboo stalk and leaves by subcritical water: chemical and bioactivity comparison

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Subcritical water extraction is a green extraction technique that is gaining increasing interest in research, owing to the fact that water properties can be fine-tuned by heating and pressurization. While maintaining water in its liquid state by pressure, temperature increase causes drop in water polarity, together with change of other physicochemical properties relevant for the extraction (surface tension, viscosity, density etc.). This possibility of modification of water polarity allows the extraction of a wide array of chemical compounds with safe and green solvent. In this research bamboo stalks and leaves were extracted with subcritical water under moderate conditions to avoid possible degradation of bioactive compounds. The extracts of stalks and leaves, obtained under the same operational conditions were compared in respect to their selected composition and activity. Aqueous extracts of both bamboo stalk and leaves, obtained by hot compressed water, exhibited good antioxidant and antiradical properties. Surprisingly, bamboo stalk extracts superseded leaves extract in respect to total antioxidant activity (~ 2 fold) and against DPPH radicals (~9 fold). These findings correlated well with greater concentrations of total phenols and total

flavonoids found in stalk extracts. In respect to phytoscreening, total tannins were detected in stalk extracts, but not in the leaves. C- and O-heterosides were higher in bamboo stalk extracts.

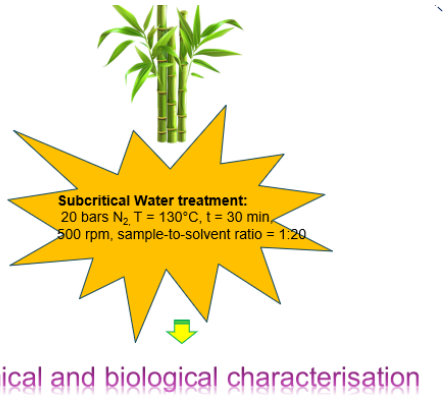

Table 1. Comparison of chemical composition and activity of extracts obtained by subcritical water (mean±2SD)

	Bamboo stalk	*Bamboo leaves*
Extraction yield (%)	34.00 ± 1.41	19.50 ± 0.71
Total phenols (mg GAE/ml)	302.57 ±0.79	117.10 ± 2.37
Total flavonoids (mg RE/l)	149.04 ± 5.44	52.68 ± 0.83
Total antioxidant activity (mg AAE/l)	1554.17 ± 7.22	712.50 ± 24.75
DPPH (mg AAE/l)	130.84 ± 0.47	14.63 ± 0.87
Total sugars (g GE/l)	7.39 ± 0.53	3.03 ± 0.01 l
ABTS IC_{50} (mg d.ex./ml)	11.25±0.7	8.77±0.4

Table 2. Phytoscreening of bamboo stalk and leaves extracts obtained by subcritical water.

Chemical class	*Bamboo stalk*	*Bamboo leaves*
Free flavooids	+	+
Anthocyanines	-	-
Total tannins	+	-
Galic tannins	+	+
Reducing sugars	-	-
Glycosides	-	-
Alkaloids	+	-
Coumarins	+	+
Saponosides	-	-
O-heterosides	++	+
C-heterosides	+++	++

P4: Development of wellness biscuits with prebiotic properties with exhausted bamboo biomass and extracts

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Faculty of Technology, University of Novi Sad, 21 000 Novi Sad, Serbia
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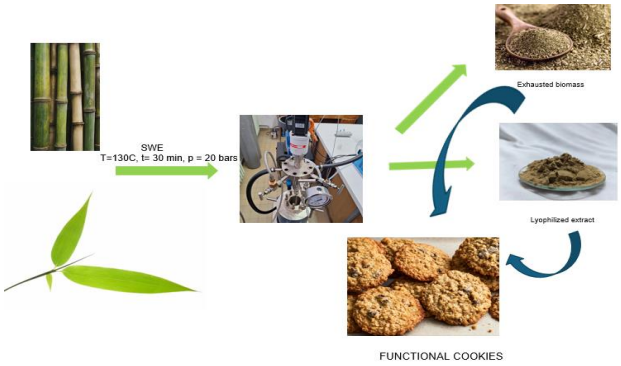
Bamboo is a fast-growing plant, having significant environmental contributions. Different parts of the plant, such as stalks, leaves and shoots, have different chemical compositions. Phytonutrients from leaves and shoots are rich in phenolic acids, flavonoids, vitamin B2, and ascorbic acid, and exhibit anti-inflammatory and anti-microbial properties. Bamboo stalks are primarily composed of cellulose, hemicellulose, and lignin, with minor components being tannins, pigments, fats, and proteins. Different parts of this fast-growing plant can be used for different purposes. In this research bamboo stalk and leaves were treated with subcritical water to extract bioactive compounds and to partially decompose matrix biopolymers. Cellulose and hemicellulose from stalk were partially hydrolysed, owing to high water reactivity, yielding in more digestible dietary fibers with prebiotic properties. Partially hydrolysed biomass, exhausted by extraction, was used as an ingredient to formulate functional cookies that were additionally enriched with bamboo leaves extracts,

contributing to nutritional profile of the cookies. Developed cookies included exhausted bamboo biomass, in which partial cellulose and hemicellulose hydrolysis took place, confirmed by total sugars analysis (14.77±1.06 g/100 g dw). Cellulose hydrolysates, particularly cello-oligosaccharides, have gained attention for their potential as prebiotics. The hydrolysates obtained by subcritical water treatment, derived from bamboo stalk cellulose, can be used as a source of prebiotic fibres, benefiting gut health. Both stalk and leaves extracts exhibited good antioxidant and antiradical properties, with stalk extract (1554.17±7.22 mg AAE/l) being more potent in comparison to leaves extract (712.5±24.8 mg AAE/l). Cookies were formulated without sugar addition for wellness and health concepts. Prepared and baked cookies containing bamboo stalk biomass and bamboo extract were evaluated in respect to their sensory properties and likeliness to consumers.



P5: Modified biochars from basil agro-wastes for environmental photo-remediation

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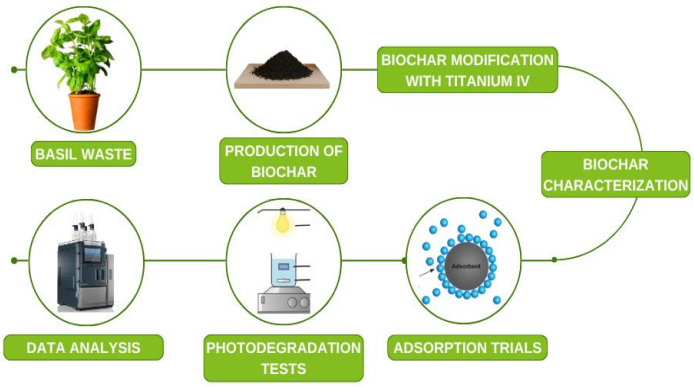
This research study focused on the development and evaluation of modified biochars derived from agro-industrial basil (*Ocimum basilicum*) residues for the removal of emerging contaminants, specifically the antidepressants fluoxetine (FLX) and trazodone (TRZ), from water [1]. The biochars were modified using various titanium (IV)-based formulations to enhance their properties for environmental applications. Aqueous-phase adsorption studies were conducted to assess the removal efficiency of the modified biochars. All materials exhibited removal efficiencies above 65% for both contaminants, highlighting their potential as effective adsorbents [2]. Among the materials produced, the biochar labelled B1 – modified with titanium (IV) oxide sulphate sulfuric acid hydrate – showed the lowest adsorption performance among the tested biochars. However, this material was subsequently evaluated as a photocatalyst in a light-assisted degradation process, achieving removal efficiencies of up to 70% for TRZ. This finding is significant as it demonstrates that even materials with lower adsorption performance can possess high added value as catalysts in advanced oxidation processes [3]. The results of this study emphasize the versatility of titanium-modified biochars, not only as sustainable adsorbents derived from plant waste, but also as efficient photocatalysts. In particular, the dual functionality of B1 biochar reinforces its potential for use in integrated water treatment technologies, contributing to a more sustainable management of waste and water resources.



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P6: Can Sludge Feed the Soil? Eliminating Pharmaceutical Residues with Advanced Oxidation for Safe Composting

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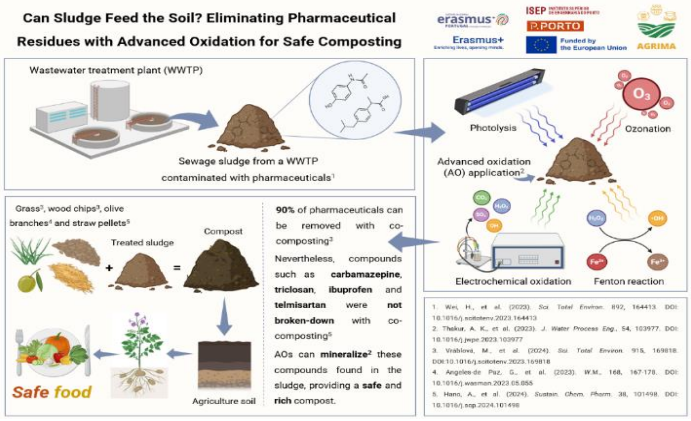
Pharmaceuticals are often found in sewage sludge, a by-product of wastewater treatment, which is rich in organic matter and nutrients [1]. While this sludge is promising as a natural fertilizer, the presence of pharmaceutical contaminants poses risks to soil health, crops, and ultimately food safety [2]. These substances can accumulate in plants [2], making their removal a critical environmental challenge. Sewage sludge can be used alongside grass [3], wood chips [3], olive branch [4] and straw pellets [5] as a co-compost to improve soil and support plant growth. The composting of the mixture itself participates in the decomposition of only a few pharmaceuticals [5], surging the need for a pre-removal treatment for more recalcitrant compounds such as carbamazepine. Advanced Oxidation Processes (AOPs) are emerging as powerful green technologies that can efficiently and safely break down these persistent pollutants [6]. This project examines the application of AOPs to treat sewage sludge before its use in agriculture, thereby transforming a potential hazard into a valuable resource. By removing harmful contaminants, this method facilitates the safe reuse of organic waste, aligns with circular economy principles, and contributes to the development of sustainable food systems.



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P7: Blue Bioeconomy in Action: Macroalgae Extracts as Natural Antioxidants for Food Preservation

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Fish canning is a process used to extend the shelf life of products. However, quality losses and nutrient breakdown can occur due to the multistep nature of this process and pretreatments. Lipid oxidation leads to the formation of rancid flavours that lower the sensory quality of canned fish, significantly contributing to food waste and economic losses [1]. In this context, this study examines macroalgae-based antioxidants as environmentally friendly alternatives to synthetic preservatives, with the aim of reducing lipid peroxidation. Following previous studies [2], two red macroalgae species, *Palmaria palmata* and *Porphyra dioica*, were extracted using ultrasound-assisted methods and tested for their ability to inhibit lipid peroxidation in sunflower oil under accelerated aging conditions [2]. To determine the optimal conditions for inhibiting lipid peroxidation, a design of experiments (DOE) approach was employed, using various oil-to-extract ratios and combinations of seaweed extracts. The effectiveness of this approach was evaluated through peroxide value and p-anisidine index. Preliminary results suggest a significant reduction in oxidation products, especially in samples containing both extracts, suggesting potential synergistic effects. By enhancing oxidative stability naturally, seaweed extracts potentially provide a sustainable solution to extend shelf life and minimize spoilage-related food losses [3]. Further research will examine their application in canned fish, contributing to low-waste agri-food systems.

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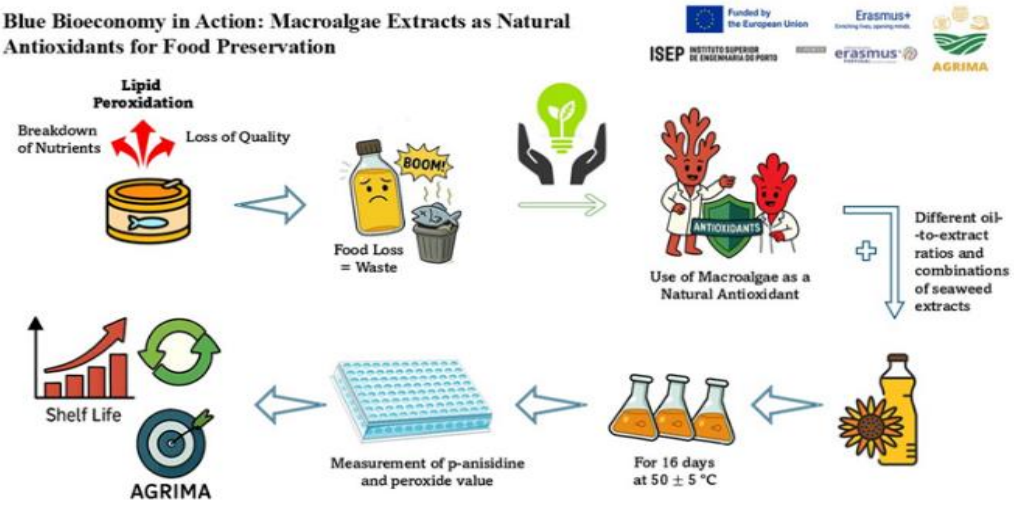

P8: What the Winemakers Left Behind: A New Chapter for Grape By-products

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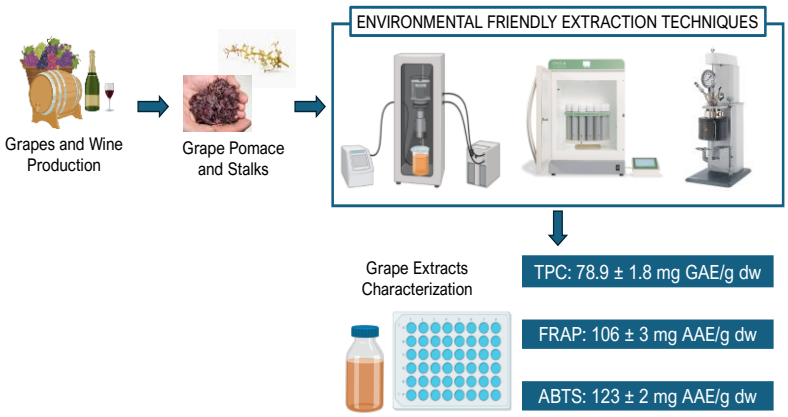

The winemaking sector is one of the most significant worldwide, resulting in the production of vast amounts of by-products, such as grape pomace and stalks, with substantial environmental impacts [1]. These by-products represent potential sources of natural polyphenols, and due to their recognized health-promoting properties, several studies have focused their efforts on their extraction [2]. This study aims to determine the potential of wine by-products as source of antioxidants. For that, three environmental-friendly extraction techniques, namely ultrasound-assisted extraction (UAE), microwave-assisted extraction (MAE), and subcritical water extraction (SWE), were tested and compared with a conventional extraction (CE) using grape by-products from two varieties (*Tinta Miúda* and *Cerceal Branco*). The extracts were assessed for total phenolic content (TPC), and antioxidant/antiradical activities (FRAP and ABTS assays). Among the tested methods, UAE (70% amplitude, 20 minutes) enables us to recover the highest amount of polyphenols. *Tinta Miúda* grape extract exhibited the highest TPC (78.9 ± 1.8 mg GAE/g dry weight (dw)), as well as the strongest antioxidant activity (FRAP = 106 ± 3 mg AAE/g dw; ABTS = 123 ± 2 mg AAE/g dw). These results highlight the potential of grape by-products as sustainable sources of natural antioxidants. The use of green extraction technologies supports circular economy principles, promoting the valorisation of winemaking residues into high-value functional ingredients for the food industry.

References

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