



rethink food resources, losses, and waste **2025**

25-27 September
Athens, Greece

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RETASTE:

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Losses, and Waste**

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Table of Contents

Keynote speakers	9
AFR: Reducing the environmental Footprint of Agriculture	26
<i>Transforming Agricultural Plastic Waste Into Sustainable Concrete Aggregates: a Pathway to Reducing Agriculture's Environmental Footprint</i>	27
<i>Antioxidant Enzyme Reprogramming, Ros Scavenging and Modulations in Secondary Metabolites Attenuate Immunity in Rice Against Helminthosporium Oryzae Attack</i>	28
<i>Valorization of Organic Wastes in Soil Biosolarization: Comparative Assessment of Green Tea Waste, Fish Waste, and Eggshell Waste as Amendments</i>	29
<i>Incentivizing Agroecological Practices in Greece: Insights From Cap 2023-2027 Strategic Plan and Scenario Projections With the Fable Calculator</i>	31
<i>Effect of Chicken Manure Biochar on Lettuce Growth</i>	32
<i>Towards Sustainable Diets and Farming Systems Through Land Use Optimization</i>	33
<i>Rethinking Grain Production and Environmental Nitrogen Losses by Employing Nitrogen Best Management Practices</i>	35
<i>Determinants of Farm-Level Circular Economy Adoption in Italian Agriculture. Empirical Evidence.</i>	37
<i>Empowering Youth-Led Energy Communities - the Poweryouth Project</i>	39
<i>Ultrasound-Treated Brewer's Spent Grain (Bsg) Used to Partially Substitute Wheat Flour in Pasta Formulation</i>	41
<i>Effect of Short-Term Application of Various Bio-Based Materials on Crop Tolerance to Salt Stress</i>	43
<i>Toxicological Evaluation of Saponin-Rich Argan Press Cake Extracts and Their Potential Use in Cosmetic Formulations</i>	45
<i>From Dairy Waste to Protein: Upgrading Cheese Whey Permeate Into Nutritional Microbial Protein to Enhance the Circularity of Food Systems</i>	46
<i>Response of Two Wheat Cultivars to Bio-Stimulants Spraying Levels Under Saline Conditions</i>	48
<i>Reducing the Footprint of Agriculture Through Sustainable Land Management Practices</i>	49
AWR: Alternative Water Resources and Wastewater Reuse	51
<i>Designing Electrospun Fibre Meshes and Yarns For Fog Water and Energy Harvesting</i>	52
<i>Exploring the Role of Microbial Fuel Cells For Transforming Wastewater Into Eco-Friendly Electricity</i>	54
<i>Determinants of Individual Preferences For Unconventional Water For Irrigation Use</i>	56
<i>Evaluation of Metallic Contamination of Sediments in Al Hoceima Bay</i>	57
<i>The Potential of Nature-Based Solutions For Circular Management of Wastewater and Sewage Sludge; Research Experiences in Greece</i>	58
<i>The District Local Government Organization of Larnaka: the Transformation of Wastewater to Value Product For Agricultural Purposes and Reuse</i>	60
<i>Design and Simulation of a Tio₂-Coated Photocatalytic Rectangular Reactor For Enhanced Removal of Metformin: a Cfd Approach</i>	62
<i>Sludge Management and Disposal From Wastewater Treatment Plants in Jordan</i>	64
<i>Biosolids Improve Tomato Resistance to Fusarium Foot and Root Rot and Promote Plant Growth Characteristics</i>	66
<i>Gadolinium-Based Nanoparticles For Efficient Removal of Wood Preservatives From Synthetic Wastewater</i>	67

<i>Use of Silver and Copper Oxide Nanoparticles in Adsorbents to Control Bacteria in Poultry Litter.</i>	69
<i>Hippocrates Project: Design, Construction and Installation of Demonstration Hospital Wastewater Treatment Units</i>	71
<i>Sequential Filtration to Produce Humic Substances Solution and Clean Water From Digestate</i>	72
<i>Hippocrates: a Holistic Approach Towards Onsite Hospital Wastewater Treatment</i>	74
<i>The Hippocrates Life Project: Results From the First Operational Period of the Demonstration Unit at the General Venizeleio Hospital in Heraklion Crete, Greece</i>	76
<i>Presentation of the Automation (Plc) System For Monitoring the Operating Parameters of the Hippocrates Project'S Demonstration Unit."</i>	78
<i>Smart Water Management and Control Systems</i>	80
<i>Urban Water Metabolism & Nbs For Resource Resilience: Insights From the Eupolis Approach</i>	81
<i>Wastewater Treatment and Maximizing Energy Savings Using Machine Learning in a Wastewater Treatment Plant</i>	82
<i>The Hippocrates Life Project: Developing and Installing the Heraklion Demonstration Hospital Wastewater Treatment Unit</i>	83
<i>New European Directive on Urban Wastewater Treatment: the Need For Quaternary Treatment to Remove Micropollutants and Pathogens</i>	84
<i>UFP: Urban Food Production, from green roofs to micro-greens and NBS</i>	85
<i>Enhancing Sustainable Urban Agriculture and Climate Resilience Through Outdoor Agricultural Green Walls in Semi-Arid Environments</i>	86
<i>Investigating the Effects of Elevated Carbon Dioxide Stress in the Production of Mustard and Radish Microgreens Using Kappaphycus Alvarezii-Based Biostimulants</i>	87
<i>Püspökszilágy's Life Projects: From Local Nature-Based Solutions to Catchment-Level and Community-Based Climate Adaptation</i>	88
<i>Designing Sustainable Public Spaces - Biodiversity in Urban Architecture - Life Ip „Silesia. Blue Sky Restored“</i>	89
<i>HAR: Harvest and post-harvest management to reduce losses</i>	91
<i>Apple Pomace From Byproduct to a Resource: Oil Extraction and Effect of Extraction Conditions on Polyphenol Recovery and Antioxidant Capacity.</i>	92
<i>Sustainability Assessment of Hermetic Grain Storage: Environmental and Social Perspectives on Post-Harvest Infrastructure</i>	93
<i>AEP: Alternative Energy Production and energy use optimisation at farm level</i>	94
<i>Phytochemical Composition and Antioxidant Capacity: Comparing Solar Ovens and Traditional Cooking Methods</i>	95
<i>Implementing Resource Efficiency in the Food Industry: Lepto11 Project Case Studies</i>	96
<i>APP: Alternative Protein Production for human consumption</i>	98
<i>Argan Press Cake as a Sustainable Protein Ingredient: Opportunities and Challenges</i>	99
<i>The Shift Towards Alternative Proteins Provides Double Benefit For Biodiversity and People</i>	101
<i>Integrated Recovery of Protein and Phenolics From L. Digitata and A. Taxiformis Using Subcritical Water: Profiling and Anti-Inflammatory Assessment</i>	103
<i>Development of Emulsions Using Ultrasound-Treated Edible Insect Protein Isolates</i>	105
<i>NRF: Nutrients Recovery and alternative Fertilizers</i>	106
<i>Hazelnut Skin Waste as a Functional Ingredient For Food Reformulation</i>	107

Valorization of Plant-Waste Materials to Produce Bioactive Compounds With Potential Biostimulant Function	108
Valorisation of Emmer Bran Through Arabinoxylan Extraction and Prebiotic Functionality Assessment	109
Development of Gas Permeable Membrane Systems For the Ammonia Emission Mitigation in Livestock Production. Life Green Ammonia	110
Innovative Zeo-Biopesticides, Based on Useful Microorganisms, For Eliminating the Use of Copper-Based Pesticides (Life Microfighter)	112
From Waste Stream to Value Chain: Two Decades of Innovation in Olive Mill Wastewater Treatment and Resource Recovery	114
The Preconditions For Re-Using of Municipal Sewage Sludge as Soil Amendment at the Technosols in Ukraine	116
Assessment of the Yield, Nutrients and Trace Metals in Spinacia Oleracea Harvested From Soil Treated With Food Waste Compost	118
Quality Analysis of Households' Compost From Low- and High-Income Communities of Pretoria North, South Africa	119
Valorization of Agro-Industrial By-Products For the Nutritional and Sustainable Reformulation of Breakfast Cereals	120
Development and Characterization of Bio-Based Materials For Improving the Quality of Saline Soils and the Sustainability of Agricultural Production - the Bio4Salt Project	122
NOV: Novel materials from food resources	124
Development of a Low-End Open-Source Bioreactor as a Tool For Democratizing Research and Investigating Novel Materials	125
Development of Alternative Materials From Agro-Industrial Streams in South Tyrol	127
Optimizing Interspecific Crosses in Hibiscus: Toward New Dwarf and Ornamental Varieties	129
Inflammation-Modulating Activity of Aronia (Aronia Melanocarpa) and Blackcurrant (Ribes Nigrum) Pruning Lignocellulosic Biomass' Extracts	130
Valorization of Soybean Residue Through Diverse Food Applications and Fermentation Methods	131
Valorization of Fishery Waste For Sustainable Intelligent Packaging: Chitosan/Jaboticaba Films For Shelf-Life Extension of Fresh Pork	132
Encapsulation of Single-Cell Oil and Oleaginous Yeast Biomass For Functional Applications	133
Upcycling Food Processing Byproducts Into Sustainable Bioplastics	134
Spent Coffee Material - Sustainable Solution Applied in the Culture Medium to Support the Growth of Oleaginous Yeasts Yarrowia Lipolytica	136
Granulation of Fruit and Vegetable Pomace Powder With Hydrolized Bovine Collagen	138
Hydrocolloid-Assisted Granulation of Apple Pomace: Physicochemical Properties and Functional Potential	140
Celery and Apple Pomace Flour as a Carrier of Cheese Starter Cultures	142
Greener Approaches to Extracting Polyphenols From Grape Stalks For Functional Food Development	144
Biogenic Amine Assessment in Fishery Coproducts and Hydrolysates: Ensuring Safety in Novel Protein Ingredients	146
From Food Loss to Health Benefits: Optimised Use of Hypocholesterolaemic Compounds From Oyster Mushroom	148
Evaluating Heat Vs. Ultrasound-Assisted Extractions of Hypocholesterolaemic Compounds From Pleurotus Ostreatus Bioresidues	150
Influence of Camelina Meal Addition on Sensory and Physicochemical Properties of Meatballs	152

<i>Harnessing Food-Derived Orange Peel Waste For the Synthesis of Antimicrobial Silver Nanoparticles: a Novel Resource For Green Nanomaterials</i>	153
<i>Study and Modelling of Novel Processing of Foods to Optimize Nutritional Functionality and Bioaccessibility - the Bac2Food Project</i>	154
<i>From Waste to Taste: Upcycling Blue Crab and Mussel By-Products Into Flavor-Enhanced, Nutrient-Rich Food Products</i>	156
<i>Bioaccessibility of Phenolic Compounds From Olive Pomace Extracts and Their Interaction With Plant Proteins During Digestion</i>	158
<i>Valorisation of Dredged Sediments and Mussel Shell Waste For Sustainable Port Infrastructure: First Results From the Greenlife4Seas Project</i>	160
<i>Valorization of Invasive Blue Crab Through Development of a Nutritious Instant Fish Soup: a Circular Economy Approach</i>	162
<i>Improving Hydrophobicity and Mechanical Performance of Chestnut-Pampa Grass Nanofibrous by Cross-Linking and ZnO Nanoparticles For Food Packaging Applications</i>	164
<i>Eco-Friendly Synthesis of Nanoscale Zero-Valent Iron For Water Contaminant Removal</i>	166
<i>Orange Peel to Upgrade Flexible Expanded-Starch Composites</i>	168
<i>Cosmetic Valorization of Pistachio Shells as a Natural Exfoliating Agent</i>	170
<i>Characterisation of Bioactive Peptides From Family Cucurbitaceae Using an Lc-MS/MS-Based Peptidomic Approach Coupled With In-Silico Data Mining.</i>	172
<i>Valorisation of Damaged Pearl Millet Hydrolysate For Sustainable Phb Production: Process Optimisation Through Strain Selection and Fermentation Parameter Tuning</i>	174
<i>Towards Sustainable Bioplastics: Integrated Valorization and Treatment of Cheese Whey For Phb and Bioenergy Production</i>	176
<i>Bioconversion of Agro-Industrial Waste Into Biogas and Polyhydroxyalkanoates Using a Two-Stage Microbial Strategy</i>	178
<i>Characterization of Novel Formulations of Fish Waste Biopolymers Used as Carriers of Natural Bioactive Compounds From Sea Fennel and Rosemary</i>	180
<i>Comparative Evaluation of Pha Production From the Corresponding Liquid Fraction From Drying/Shredding Food Waste Under Two Different Bioreactor Operational Modes</i>	182
<i>All4Waste - a State-Of -The-Art Circular Economy Technology Park at the Hellenic Mediterranean University, in Crete</i>	184
<i>Closing the Loop: Biowaste-to-Biodegradable Plastics and Green Energy</i>	185
<i>Towards Sustainable Bioplastics: Integrated Valorization and Treatment of Cheese Whey For Phb and Bioenergy Production</i>	186
<i>Bioconversion of Agro-Industrial Waste Into Biogas and Polyhydroxyalkanoates Using a Two-Stage Microbial Strategy</i>	188
<i>Impact of Wastewater Substrates, C:n Ratio, and Extraction Methods on Pha Production by Pseudomonas Putida Dsm 291</i>	190
<i>AAF: Alternative Animal Feed production</i>	192
<i>Transforming Shell Waste Into Sustainable Feed Ingredients</i>	193
<i>Plant Based By-Products as a Valuable Feed Ingredient</i>	195
<i>Turning Food Waste and Agri-Food Byproducts Into Animal Feed Ingredients and Organic Fertilizer Using Insects - a Greek Pilot</i>	197
<i>From Agricultural Waste to Functional Ingredient: Valorization of Grape Leaves For Phytogetic Applications in Food and Feed</i>	198
<i>Upcycling Citrus and Winemaking By-Products For Poultry Nutrition: Replacing Vitamin E With Polyphenol-Rich Extracts in Broiler Diets</i>	200
<i>Valorisation of Field Bean Processing By-Products in Dairy Nutrition: Insights From Flemish Demonstration Trials</i>	201
<i>Legislative Framework For the Use of Insects in Animal Nutrition</i>	203

<i>The Life-Inofeed Project: Innovative Onsite Treatment of Food-Related Wastes For Viable Production of Animal Feed</i>	204
FWU: Food Waste management in the Urban environment, from collection to on-site treatment	206
<i>Urban Farming Practices: a Sustainable Solution For Food Resources, Losses, and Waste</i>	207
<i>Sensor-Based Intelligence to Improve Air Quality in the Treatment of Urban Organic Waste</i>	209
<i>From Waste to Resource: Crayfish Shells as Adsorbents and Biofillers in Natural Rubber</i>	211
<i>Towards an Ideal Urban Food Assistance Network: an Empirical Investigation in the City of Milan</i>	213
<i>Advancing Sustainable and Active Biodegradable Food Packaging to Minimize Packaging and Food Waste - the Reactpack Project</i>	215
<i>Green Active Packaging With Natural Antimicrobials For Perishable Food Preservation</i>	217
<i>Effect of Lipase Pre-Treatment on Biomethane Production From Canteen Food Waste</i>	219
<i>Drying and Shredding of Food Waste For the Sustainable Production of Food Residue Biomass and Waste Management</i>	221
<i>The History and Experiences of the Inter-Municipal Enterprise of Solid (Municipal) Waste Management of Chania Prefecture - Dedisa</i>	223
COM: Compost production, quality and utilization	224
<i>Evaluating Co-Compost Produced From Dewatered Faecal Sludge With Municipal Solid Waste (Kitchen and Garden Waste) in India</i>	225
<i>Pharmaceuticals in Sewage Sludge: Problems and Solutions</i>	227
<i>Biocomforest: Valorization of Pruning and Gardening Waste by Composting For the Development of Local Bioeconomy and Circular Strategies For Ecological Transition</i>	228
<i>Molecular and Physiological Response of Sangiovese Vine to Compost Supply</i>	230
<i>Harnessing Winery Sludge Compost For Sustainable Viticulture: Effects on Soil Fertility and Microbial Activity in Pot and Field Trials</i>	231
ANA: Anaerobic digestion, biogas valorisation and digestate utilization	233
<i>A Novel Composite of Hydroxyapatite/Zinc Oxide/Magnetite @Biochar For Mitigation the Inhibition Effect of Antibiotics on the Hydrogenation of Chicken Manure</i>	234
<i>Experimental Production of Biogas From Organic Waste at the University of Tolima Restaurant</i>	235
<i>Toward Affordable Biogas Toilets: Optimizing the Co-Digestion of Human Excreta and Livestock Waste in Rural Burkina Faso</i>	237
<i>Recovering the Untapped Potential of Biogas and Syngas in Novel Gas Phase Biorefineries</i>	238
<i>Comparative Analysis of Taxonomic and Metabolic Patterns of Microbes From the Digestion of Food Waste Through Metagenomic Sequencing and Analysis</i>	239
<i>Hygienization of Animal By-Products Using Pulsed Electric Field For Biogas Plant: Modelling of Inactivation Performances and Energy Consumption For Two Indicator Bacteria</i>	240
<i>Advancing Humic Substances Recovery From Digestate: Green Pre-Treatments For Urban Bio-Waste Valorisation</i>	242
<i>The Effect of Organic Loading Rate on Cheese Whey Treatment Using a Microbial Electrolysis Cell-Assisted Anaerobic Digestion System</i>	244
<i>Engineered Biochar From Anaerobic Digestate For Advanced Wastewater Treatment Within a Circular Economy</i>	246
<i>Hydrogel-Assisted Chemisorption For Concurrent Acid Recovery and Ph Regulation in</i>	

High-Solid Food Waste Biomethanation	248
Converting Agricultural Waste Into Bioenergy Products Through Hyperthermophilic Hydrolysis	250
Cheese Whey Mixtures as Potential Feedstock For Biohydrogen and Volatile Fatty Acids Production: Comparison of Thermophilic and Mesophilic Dark Fermentations	251
Production of Volatile Fatty Acids by Dark Fermentation in Agroindustrial Wastes: Effects of Hrt	253
Resource and Energy Efficiency in Digestate Valorisation: the Case of the Dimitra Project	255
Microbial Shifts and Potential Contributors to Volatile Fatty Acids and Biogas Production During Anaerobic Digestion	256
Biogas Upgrading Opportunities in Greece	258
W2E: Waste to Energy (other than anaerobic digestion)	259
Alternative Energy Production From Wastes From Vineyard Farms	260
Hydrothermal Processing of Food Waste: Dual Pathways For Enhanced Anaerobic Digestion and Hydrochar Production	261
Digestate-Derived Biochar Enhances Medium-Chain Carboxylic Acid Production From Food Waste Fermentation	263
Turning Waste Into a Fuel Asset: Exploring Sludge-to-Energy Options in Bosnia'S Circular Economy Transition	265
Statistical Approach Using Rsm-D For Optimizing Pectinase Production Through Submerged Fermentation of the Yeast-Like Fungus Coniochaeta Pulveracea Pv702047 in Whey	267
A Pathway to Sustainability Through Sewage Sludge Management in Egypt	268
Integrated Strategies For More Sustainable Sewage Sludge Management Systems	269
Pyrolysis of Sewage Sludge	271
Agroindustrial Effluents as Feedstocks For Biomethanol, Biomethane, and E-Methane: Power-to-X For Sustainable Resource Valorization	272
Harnessing Microbial Fuel Cells For Green Energy Recovery: Insights From Life Cycle Assessment	274
Biowaste as the Goldmine of the Modern Era: Key Findings on the Social Pillar	276
Decentralised Heat and Power Generation From Low-Quality Organic Residues	278
Optimizing Pyrolysis For Sustainable Biosolids Management: Strategies For Micropollutant Removal and End-Product Valorization	279
LCA: Life Cycle Assessment and Social Life Cycle Assessment (S-LCA) of the different components of the farm-to-fork value chain	280
Feeding Sustainability: Rethinking Surplus and By-Products Through Recovery Pathways	281
To Count or Not to Count: Rebound Effects in Food Waste Prevention Life Cycle Assessments	283
Systematic Assessment of Environmental Impacts Embedded in Food Waste - a Framework For Evaluating Environmental Impacts Through Lca Integration	285
Using Llms to Match Disparate Food Classification Systems For Environmental Impact Assessment: Application in the Wastewise Project	286
From Data to Decisions: the Sustainable Food Chain Model For Systemic Environmental Modelling in Food Systems	288
Life Cycle Assessment of Microbial Protein Production Using Hybrid Living Materials	290
Rethinking the Dairy Supply Chain: a Circular and Energy-Efficient Framework From the Betted Project	292
A Tale of Two Modes: How Operation Mode Shapes the Environmental Footprint of Textile Effluent Treatment by Advanced Oxidation Processes.	293

<i>Life Cycle Assessment and Economic Analysis of Halophyte Biorefineries With the Production of Functional Dairy Foods</i>	295
<i>Reducing Waste, Reducing Impact: Lca of the Food Bank of Greece's 2024 Operations</i>	297
<i>A Critical Review of Global Lca Databases Versus Primary Field Data in the Food-System Assessments</i>	298
<i>Impact Assessment of Food Waste Prevention Activities in the Horeca Sector</i>	300
POL: Policy perspective in all aspects of the farm to fork value chain	302
<i>Addressing Systemic Drivers of Food Loss and Waste: the Role of Power Imbalances and Overproduction in Tuscany, Italy</i>	303
<i>Towards a Multi-Dimensional Value Assessment of Agricultural Data</i>	305
<i>Transforming the Food Chain Structure to Reduce Food Loss and Waste (Flw)</i>	307
<i>Building Consumer Capacity For a Just Zero Food Waste Transition</i>	309
<i>Ibo Actions - Strengthening the Innovative Spirit Between Stakeholders in the Region of Crete</i>	311
PLW: Prevention of Food Loss and Waste: policy, methods and best practices	312
<i>Policy Recommendations From Behavior Sciences to Improve Household Food Waste Reduction Interventions in Portugal</i>	313
<i>Food Saving and Food Waste Reduction in the Municipality of Halandri</i>	315
<i>Food Waste in Ghost Kitchens: an Institutional Theory Perspective</i>	317
<i>Postharvest Technology Adoption and Impact Under Access Constraints: the Role of Crate Rental Shops in Nigeria</i>	319
<i>Development of Adsorbents by Green Synthesis For Microbial Reduction in Poultry Bedding</i>	320
<i>Mitigating Urban Food Waste Along With China's Dining Transition</i>	321
<i>The Potential to Reduce Food Waste in Swedish Households</i>	323
<i>Reviving Food Resources: Exploring New Horizons in Upcycled Food Production Through Stakeholder Collaboration in the Swedish Food Sector</i>	324
<i>Study of Bio-Based Fillers and Additives For the Production of Biodegradable Biopolymers</i>	326
<i>Review of Food Waste Quantification and Quantification Methodologies Used by Eu Member States in the National Reporting</i>	327
<i>Ecologically Based Rodent Management in Mediterranean Polycultures: a Collective Strategy For Reducing Food Loss</i>	328
<i>Food Waste Monitoring System Considering Tons and Environmental Impacts For Prioritizing Measures in Companies and in Policy Making</i>	330
<i>Study of Consumers Perceptions and Behavior Towards Food Waste and Date Labelling</i>	332
<i>Store Your Loaves Right! Household Purchase and Storage Practices Associated to Lower Bread Waste: Learnings From a Representative Survey Sample in Norway</i>	334
<i>Instant Controlled Pressure Drop (Dic) as a Method to Reduce Food Waste: Evaluation of Quality Criteria For Dried Kiwi Fruits</i>	336
<i>Valorizing Unripe Grapes: "Verjuice" as an Alternative Acidifier in a Circular Food Economy</i>	337
<i>Understanding and Prioritising Food Loss Drivers in the Primary Sector</i>	338
<i>Reimagining Corporate Museums as Hubs For Food System Transformation and Citizen Co-Creation</i>	340
<i>Exploring Business Approaches to Food Waste Prevention in Retail</i>	342
<i>Life-IP CeI-Greece - Circular Economy Implementation in Greece</i>	343
FWM: Measurement of Food Loss and Waste	344
<i>Data-Driven Approach to Reduce Food Waste Generation in Commercial Kitchens</i>	345
<i>Food Waste in School Catering: Quantification, Contextualization, and Life Cycle Assessment (Lca) For Sustainable Solutions</i>	347

Measuring Unrealized Meat Production: Evaluating Farm-Level Cattle Losses Using Traceability Data	349
Beyond the Bin: Environmental Footprint of Plate Waste in Latvian Schools	351
Blinded by the Bun: Food Waste and Cognitive Biases in the Convenience Sector	353
The Weight of Waste: Rethinking Food Waste Monitoring Through Composition-Based Indicators - a Finnish Case-Study	355
A Food Loss Registry and Sustainability Tool: Monitoring Food Losses and Their Associated Impacts	356
Home-Made or Ready-Made? Food Waste in British Sandwiches	358
Tracking and Evaluating Retail Food Waste in Finland: a Six-Year Perspective	359
Uncovering the Environmental Costs of Trade-Related Food Loss in a Globalized Food System	360
Measurement Biases in Food Waste Tracking Systems and Their Impact on Reduction Strategies	361
Analysing School Children's Eating Behaviour Through Food Waste	363
Circular Economy Practices and Food Loss Management in Italian Agriculture: Survey Data and Descriptive Evidence	365
Tackling Food Waste in Nursing Homes: Identification of Risk Factors and Carbon Footprint	367
Quantifying Food Waste in Greek Primary Production: Evidence From 2022	368
Self-Reporting Bias in Household Food Waste: Evidence From Questionnaire-Diary Comparisons in Greece	370
Uncovering Food Waste in the Greek Food Service Sector: Insights From Restaurants in Athens	372
CFW: Consumer Food Waste Prevention - awareness and behaviour change models and interventions	374
Consumer Behavior Toward Food - We Are Aware of the Problem, but We Still Waste Food	375
Empowering Change: University Students Lead Food Waste Awareness and Reduction in the Local Community	376
Plate Waste in Latvian Schools: Does Age Matter?	377
Eat Better, Waste Less: a Diary Study to Investigate the Link Between Food Choices and Food Waste at Households	379
Consumer Behavior and Food Technology Innovations: Searching Synergies For Reducing Household Food Waste	381
Consumers Need a Plan B: Preparing and Eating Left-Overs Are the Strongest Predictors of (No) Food Waste	383
Causes, Awareness and Behaviour of Food Waste Generation in Latvian Households: a Quantitative Study	385
Metabolic Food Waste, Its Predictors and Associated Global Warming Potential in the Republic of Ireland	387
Exploring the Causes Behind Household Food Waste in Sweden	388
'I Get a Kick Out of It' - Everyday Strategies to Reduce Food Waste Trough Planning and Use of Expiring Foods	390
Food, Preferences, and Patterns: a Machine Learning Exploration of Hostel Mess Meal Skipping in India	392
A Food Environment-Based Approach to Food Waste in Multi-Objective Policy Integration Processes. the Case of the School Catering in Capannori (Italy)	394
Integrated Analysis of Eco Consumer Behavior in Maramureş County	396
Student Food Waste in a Greek Higher Education Institution: Temporal Trends in Attitudes and Behaviors	398
Student Food Waste in a Greek Higher Education Institution: Temporal Trends in Attitudes and Behaviors	400

<i>Small Habits, Significant Impacts: Understanding Household Food Waste</i>	402
FLW: Any other aspects of FLW prevention across the entire food value chain	404
<i>Food Consumption and Online Behaviour: Exploratory Analysis and Baseline Models</i>	
<i>Using Web Search Queries</i>	405
<i>Inkjet-Printed Colourimetric Qr Tags Using Anthocyanins and Zif-8 For Spoilage</i>	
<i>Detection</i>	406
<i>Bioaccessibility of Phenolic Compounds and Antioxidant Activity in Beers With</i>	
<i>Distinct Processing Profiles</i>	407
<i>Development of a Technological Platform Based on the Application of Supercritical</i>	
<i>and Subcritical Solvent States For the Recovery of Bioactive Compounds From</i>	
<i>Biomass Waste: the Case of Tomato Pomace.</i>	409
<i>Valorization of Brewer's Spent Grain Via Its Incorporation Into Bakery Products</i>	
.....	411
<i>External Enablers of Sustainable Practices in the Twin Transition: Insights From</i>	
<i>Dutch F&B Smes</i>	413
<i>Valorization of Brewer's Spent Grain Via Its Incorporation Into Bakery Products</i>	
.....	415
<i>The Re-Wave Project: Bio-Technological Solutions to Reduce, Recover and Reuse Fruit</i>	
<i>and Vegetable Wastes</i>	417
BDZ: Biodiesel	419
<i>Exploring the Potential of Microalgae-Based Biodiesel in India: a Multidimensional</i>	
<i>Analysis</i>	420
RAC: Risk Analysis, Assessment and Management in Circular Economy	422
<i>Real-Time Integrated Safety-Security Risk Assessment in the Framework of Circular</i>	
<i>Economy</i>	423
<i>Treated Wastewater Irrigation: Effects of Nanoplastics and Heavy Metals on Lettuce</i>	
<i>Phenolic Composition</i>	425
<i>Responsible Consumption Habits in Colombian Homes as Strategy Circular Economy</i>	
.....	427
<i>Concentration and Human Health Risk of Heavy Metals on Canned and Bottled</i>	
<i>Beverages Purchased From Various Stores in Pretoria, South Africa.</i>	428
<i>Development of Low Refractive Index Materials For Microfluidic Applications in</i>	
<i>Optofluidic Chips</i>	429
SOC: Social Issues in Food and Food Waste Management	430
ART: Food as Art Material	431
<i>Art: Food as Art Material</i>	432
<i>Heritage Material Futures: Circular Economy and Sustainable Biopolymer Applications</i>	
<i>in Heritage Conservation and Display</i>	433
<i>Food, Community, and Redevelopment in London's Royal Docks</i>	435
<i>Time Preserved</i>	436
.....	437
Index	439

Hydrocolloid-Assisted Granulation of Apple Pomace: Physicochemical Properties and Functional Potential

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Abstract

Dehydrated apple pomace powder (APP) is a promising dietary component due to its high content of soluble and insoluble fiber, bioactive compounds, and favorable physicochemical stability. This study proposes an innovative delivery approach by granulating APP with hydrocolloids (guar, CMC, xanthan) to improve its functional properties. The granulation aimed to enhance rheological behavior and flowability while preserving the nutritional potential. The process of wet granulation in a fluidized bed (pilot-scale device), chosen since it enables drying heat-sensitive material, good temperature control, equal temperature distribution, high drying capacity, short drying time, low maintenance costs, and large-scale production, was performed to obtain granulated powder. The APP, mixed with 3% hydrocolloids, was granulated by top-spray application of distilled water using a two-fluid nozzle at 1.8 bar. The mean liquid flow rate and air flow rate were 5 mL/min and 35 m³/h, respectively. The granulated APP was subsequently dried by fluidization at 40 °C for 15 minutes. The physical and technological properties of APP before and after granulation, including bulk and tap density, particle size distribution, glass transition temperature (determined by DSC), and water activity (aw) were compared. The mean values of bulk and tapped densities were used to calculate the Carr Compressibility Index (CI) and Hausner ratio (H), which define flowability. According to the Carr Index (CI = 27.59) and Hausner Ratio (H = 1.38), the flowability of the initial APF was assessed as poor, whereas the granulated APP exhibited significantly improved flowability and was classified as fair. The particle size of the non-granulated APP ranged from 0 to 250 µm, whereas after granulation it extended from 25 to 600 µm. This corresponds to an approximate increase of 135% in maximum particle size. Granulated APF exhibits two glass transition temperatures (T_g). The lower T_g (~14 °C) corresponds to the transition of a matrix primarily composed of water and sugars. The higher T_g (53–61 °C), which is less visible and less affected by water plasticization, is likely associated with the macromolecular components of APP. The granulation process does not result in significant changes in the thermal properties compared to the starting material. Water activity monitored during storage confirmed the superior storability of granulated APP, which changed only slightly over a one-year storage period. The use of granulated APP provides an easy and precise way to increase dietary fiber intake, which is essential for digestive health, regular bowel movements, and body weight

management. Additionally, when consumed before meals, it may help reduce postprandial glucose spikes, supporting its potential role in dietary strategies for improving metabolic health.

Keywords: apple pomace, granulation, hydrocolloids, dietary supplement

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