Syllabus

Course Description

Course Title	Microbial fermentations in gastronomy and methods of recovery of agro-food by-products
Course Code	40417
Course Title Additional	
Scientific-Disciplinary Sector	AGRI-08/A
Language	English
Degree Course	Bachelor in Enogastronomy in Mountain Areas
Other Degree Courses (Loaned)	
Lecturers	Prof. Raffaella Di Cagno, Raffaella.DiCagno@unibz.it https://www.unibz.it/en/faculties/agricultural-environmental-food-sciences/academic-staff/person/37608 dr. Olga Nikoloudaki, Olga.Nikoloudaki@unibz.it https://www.unibz.it/en/faculties/agricultural-environmental-food-sciences/academic-staff/person/38535 Dott. Ali Zein Alabiden Tlais, AliZeinAlabiden.Tlais@unibz.it https://www.unibz.it/en/faculties/agricultural-environmental-food-sciences/academic-staff/person/38700
Teaching Assistant	
Semester	First semester
Course Year/s	3rd
CP	9
Teaching Hours	54
Lab Hours	36
Individual Study Hours	135
Planned Office Hours	27
Contents Summary	Part 1: Introduction to fermentation and examples of traditional foods in

	gastronomy; Introduction, history and applications of precision fermentation; Ethical constrains and regulation; Challenges and opportunities for future fermented foods; Laboratory activity involves: Application of fermentation to produce fermented beverage. Part 2: Introduction to enzymes in food processing; Mechanisms of enzyme action in nutrient bioavailability; Enzyme-assisted fermentation for enhancing flavors and bioactive compounds with gastronomic benefits; Optimization of microbial enzymes in food biotechnology. Laboratory activity involves: Effect of enzymatic digestion on food sugars (food-grade enzymes and HPLC); Testing enzymatic activities of microbial starters; Plant-based fermentation applications. Part 3: Case studies on methods to recover agro-food by-products and further use for making food and beverages; Case studies on use of fermentation in gastronomy; Industrial application. Laboratory activity involves: external visit, practical exercise dealing with the case studies and use of fermentation to exploit agro-food by products
Course Topics	Part 1 - Introduction to fermentation: definition, principles, and microbial ecology. - Examples of traditional fermented foods in gastronomy (e.g., wine, cheese, bread, yogurt, kimchi). - Historical evolution of fermentation practices from traditional to modern biotechnologies. - Precision fermentation: definition, development, and applications in food, pharma, and cosmetics. - Ethical constraints and societal perception of precision fermentation and novel foods. - Regulatory frameworks at EU and international level for traditional and precision-fermented foods. - Challenges and opportunities for the future of fermented foods: sustainability, scalability, consumer acceptance.

	Part 2 - Introduction to enzymes in food processing. - Mechanisms of enzyme action in nutrient bioavailability. - Enzyme-assisted fermentation for enhancing flavors and bioactive compounds with gastronomic benefits. - Optimization of microbial enzymes in food biotechnology. - Laboratory activity (Effect of enzymatic digestion on food sugars (food-grade enzymes and HPLC); Testing enzymatic activities of microbial starters; Plant-based fermentation applications). Part 3 - Definition of food wastes, food by-products and secondary raw materials. - Solutions for food wastes: use of food-grade enzymes, Upstream and downstream phases of a microorganism-mediated process - Cell recycle biomass recirculation and immobilization - Fermentation as method to recover agro-food by-products - General criteria of starter selection - Side streams/food by-products as ingredient - Case Studies (e.g., Apple by-products, date seeds, milling by-products, bread and pasta wastes) - Gastronomy and fermented foods
Keywords	Food wastes - by-products, food-grade enzymes; flavors; precision fermentation, sustainability.
Recommended Prerequisites	
Propaedeutic Courses	None
Teaching Format	lectures, laboratory activity, external visits, in person teaching
Mandatory Attendance	No
Specific Educational Objectives and Learning Outcomes	The course is designed for acquiring professional skills and knowledge in the field of food fermentations including the precision fermentation and biotechnology. It aims to provide knowledges on the role of microbial fermentation in the production of the main typical fermented foods and how tailored fermentations can give distinctive features and flavors. Moreover, the course provides the basic concepts on the exploitation agro-food by-products through biotechnological processes including the fermentation and use of food-grade enzymes.

	It is divided into three parts, one related to precision fermentation and typical fermented foods, the second related to enzyme biotechnology and the other related to case studies. Educational objectives (a) provide an adequate knowledge and critical approach to develop projects related to the exploitation of agro-food by products taking into account biotechnologies currently applied; (b) provide an adequate knowledge on precision fermentation to develop distinctive flavor traits for fermented foods.
Specific Educational Objectives and Learning Outcomes (additional info.)	
Assessment	Student preparation is evaluated through an oral examination and power point presentation encompassing three components: (i) the presentation of a scientific work by the students, focusing on course topics that could also be extended to other domains of food; (ii) inquiries aimed at assessing their knowledge and understanding of the course material; (iii) questions designed to evaluate their capacity to apply acquired skills to real-world case studies.
Evaluation Criteria	Criteria for evaluation include the clarity of responses, appropriateness of vocabulary, ability to synthesize information, relevance of addressed topics, and capacity for elaboration.
Required Readings	Prasath, C. S., Sivadas, C. A., Chandran, C. H., & Suchithra, T. V. (2024). Precision fermentation of sustainable products in the food industry. In *Entrepreneurship with microorganisms* (pp. 163-177). Academic Press. Terefe, N. S. (2022). Recent developments in fermentation technology: toward the next revolution in food production. Food engineering innovations across the food supply chain, 89-106.
Supplementary Readings	
Further Information	
Sustainable Development Goals (SDGs)	No poverty, Industry, innovation and infrastructure, Affordable and clean energy, Zero hunger