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Emerging Processing Technologies for Sustainable Production of Innovative Foods

BUSRA OKTAR – busra.oktar@unibo.it

Dept. Food Science and Technology, University of Bologna, Cesena, Italy

Tutor: Prof. Pietro Rocculi

STATE OF THE ART

Annual meat production is expected to increase from 218 million tons in 1997-1999 to 376 million tons by 2030. In order to reduce the damage that of animal-based foods cause to environmental sustainability, the consumption of protein-rich foods of plant origin has increased and various plant-based foods have entered the market (FAO, 2018). The market for plant-based meat analogs is booming and has developed from niche to mainstream. Since 2015, over 6485 new products have been launched on the market worldwide. Proteins are modified primarily by altering their structure (secondary and tertiary rearrangement and subunit disaggregation) and then changing their primary molecular characteristics to enhance or alter their techno-functional properties when used as a food ingredient. Many different modification techniques have been investigated, which can be categorized as physical, chemical and biological, depending on the method used. Physical modifications primarily involve the generation of conformational changes in the protein structure without the use of specific chemicals (Dong et al., 2011). Pulse Electric Fields (PEF), High Pressure Processing (HPP), Ultrasound (US), and Cold Plasma (CP) are some of the techniques which makes physical modifications on food. Modification of the structure could have an impact on the techno functional properties as well as allergenicity and nutritional changes (Nowacka et al., 2023). The aim of this PhD project is to improve innovative plant-based foods in terms of their chemical and physical properties through the use of new technologies.

Table 1. Emerging technologies on protein extraction, drying kinetics, and protein modification in the food sector

Aim	Samples	Emerging Technology	Result	Reference
Protein extraction yield increase	Rapeseed cake, sunflower cake	US	6.8% and 53% increase on in rapeseed and sunflower protein extraction yield respectively.	(Dong et al., 2011)
Improvement on drying kinetics	Apple	PEF	Reduced the drying time for air drying apple tissue by 12% and increase the effective moisture coefficient by 20%	(Wiktor *et al.*, 2013)
Modification of the protein	Rapeseed cake	PEF	Improved solubility, oil-binding capacity, emulsion stability, foamability and water-holding capacity.	(Zhang et al., 2017)
	Soy protein isolate	US	Good water holding capacity, oil holding capacity, gel strength.	(Paglarini, Martini and Pollonio, 2018)
	Pea protein	CP	Good foamability, more static stability, and less α-helix and β-sheet.	(Qu et al., 2023)

Table 2 Gantt diagram for this PhD thesis project

Activity / Months		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
A1)	***Bibliographic research***																								
A2)	***Plant-based protein extraction and characterization***																								
	1) Extraction methods																								
	2) Characterization of the proteins																								
A3)	***Treatment with emerging technologies***																								
	1) Pretreatment for increase the extraction yield of the proteins																								
	2) Treatment on protein concentrates and/or isolates for the structure modification																								
A4)	***The treated protein concentrate and/or isolate evaluation***																								
A5)	***Thesis and paper preparation***																								

Selected References

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PROGETTO REALIZZATO GRAZIE AI FONDI EUROPEI DELLA REGIONE EMILIA-ROMAGNA