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VALORIZATION OF FOOD BY-PRODUCTS: TECHNOLOGICAL STRATEGIES FOR TAILORED FOOD INGREDIENTS

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STATE OF ART

In early 2024, grain production has reached 3 billion tons (FAO, 2024). The by-products, offered by the milling industry, possess great nutritional potential. The grain processing industry is trying to find alternative ways to minimize by-product volumes (Skendi *et al.,* 2020). Wheat bran (WB) is the main by-product of wheat obtained from milling and flour production, about 90 million tons are generated each year. WB is mainly used as feed, about 90% of the total (Rossi *et al*., 2024), despite being rich in dietary fibres, sugars, phenolic acids and proteins (Tlais *et al.,* 2020). In recent years the concept of green technology has emerged, involving more environmentally friendly techniques for ingredient processing/extraction (Fărcaș *et al.,* 2022).

Among them, Enzymatic extraction is a sustainable method; the most common strategy for extracting compounds is hydrolase usage. It can be combined with other processing, e.g. fermentation (Verni *et al.,* 2019). By-products of the milling industry could also be natural sources of several structural components, however, the use of polysaccharides and proteins in their native forms is not always convenient. For these reasons, biotechnological processes can be used to modify their structure (Galanakis *et al.,*2022).

AIM

The core aim of the PhD project is to valorize cereal industry by-products using innovative biotechnologies, for the recovery of macro-components with technological properties.

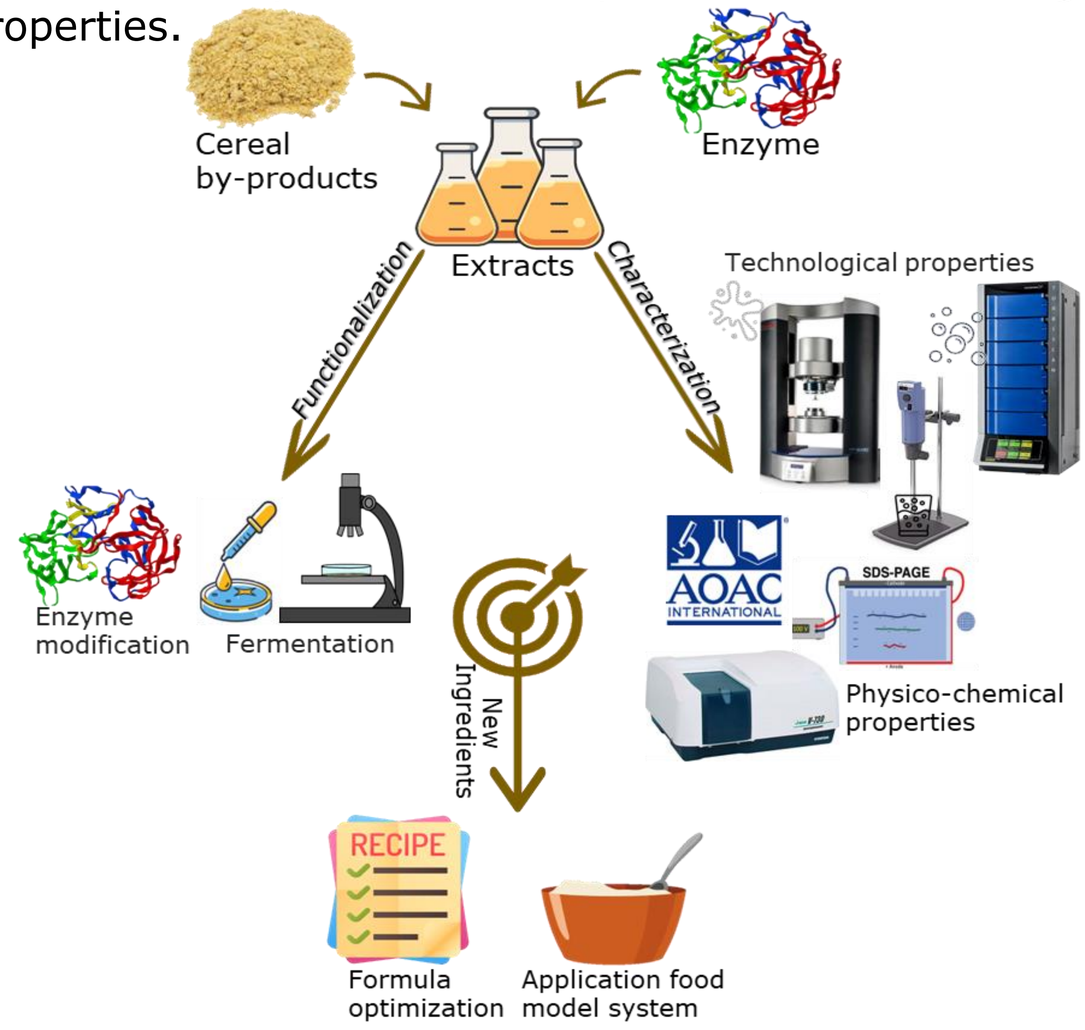

Figure 1: Experimental design

Experimental design and several activities of PhD project are reported in Figure 1 and Table 1, respectively.

Table 1: Gantt diagram of PhD 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) *Individuation of cereal by-products*	■	■	■	■	■																			
Proximate composition and physico-chemical properties	■	■	■	■																				
Choice of by-products			■	■	■																			
A2) *Optimization of enzymatic fractionation of cereal by-products*			■	■	■	■	■	■	■	■														
Enzymatic assay			■	■	■	■	■	■																
Scaling-up						■	■	■	■	■														
A3) *Techno-functional characterization*				■	■	■	■	■	■	■	■													
Physico-chemical properties				■	■	■	■	■	■	■														
Technological properties				■	■	■	■	■	■	■	■													
A4) *Functionalization of selected extracts*							■	■	■	■	■	■	■	■	■									
Enzymatic modification							■	■	■															
Fermentation										■	■	■	■	■	■									
A5) *Development of new ingredients*																■	■	■	■	■	■			
Formula optimization																■	■	■	■	■	■			
Application in model systems																	■	■	■	■	■			
A6) *Thesis, Paper Preparation, and bibliography study*	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■

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