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Functional Ingredients from Potato By-Products: Innovative Biocatalytic Processes

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Abstract : Recent studies indicate that health-promoting functional ingredients and nutraceuticals can help support and improve the overall public health, which is timely given the aging of the population and the increasing cost of health care. The development of novel 'natural' functional ingredients is increasingly challenging. Biocatalysis offers powerful approaches to achieve this goal. Our recent research has been focusing on the development of innovative biocatalytic approaches towards the isolation of protein isolates from potato by-products and the generation of peptides. Potato is a vegetable whose high-quality proteins are underestimated. In addition to their high proportion in the essential amino acids, potato proteins possess angiotensin-converting enzyme-inhibitory potency, an ability to reduce plasma triglycerides associated with a reduced risk of atherosclerosis, and stimulate the release of the appetite regulating hormone CCK. Potato proteins have long been considered not economically feasible due to the low protein content (27% dry matter) found in tuber (Solanum tuberosum). However, potatoes rank the second largest protein supplying crop grown per hectare following wheat. Potato proteins include patatin (40-45 kDa), protease inhibitors (5-25 kDa), and various high MW proteins. Non-destructive techniques for the extraction of proteins from potato pulp and for the generation of peptides are needed in order to minimize functional losses and enhance quality. A promising approach for isolating the potato proteins was developed, which involves the use of multi-enzymatic systems containing selected glycosyl hydrolase enzymes that synergistically work to open the plant cell wall network. This enzymatic approach is advantageous due to: (1) the use of milder reaction conditions, (2) the high selectivity and specificity of enzymes, (3) the low cost and (4) the ability to market natural ingredients. Another major benefit to this enzymatic approach is the elimination of a costly purification step; indeed, these multi-enzymatic systems have the ability to isolate proteins, while fractionating them due to their specificity and selectivity with minimal proteolytic activities. The isolated proteins were used for the enzymatic generation of active peptides. In addition, they were applied into a reduced gluten cookie formulation as consumers are putting a high demand for easy ready to eat snack foods, with high nutritional quality and limited to no gluten incorporation. The addition of potato protein significantly improved the textural hardness of reduced gluten cookies, more comparable to wheat flour alone. The presentation will focus on our recent 'proof-of principle' results illustrating the feasibility and the efficiency of new biocatalytic processes for the production of innovative functional food ingredients, from potato by-products, whose potential health benefits are increasingly being recognized.

Keywords : biocatalytic approaches, functional ingredients, potato proteins, peptides
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