

Bromelain-assisted bioactive peptide extraction from fish by-products

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Abstract

Marine fisheries and aquaculture play a fundamental role in global food security, specifically with the rise in fish production and the United Nations' Sustainable Development Plan for 2030. However, fish processing generates significant by-products, including viscera, carcasses, heads, skin, and bones. Annually, over 20 million tons of fish tissue are discarded worldwide, accounting for about 70% of the total fish weight. Extracting bioactive molecules from these by-products can alleviate environmental issues from improper disposal and create high-value products for industrial applications (Borges et al. 2023). In this sense, the use of bromelain in the release of bioactive peptides has proven to be highly effective, in addition to being indicated to exert bioactivities that promote human health (Coscueta et al. 2021). Bromelain, a sulfhydryl protease, is a well-known enzyme that can be extracted from pineapple by-products (Campos et al. 2019). In this study, a response surface methodology was used to optimize the extraction conditions for bioactive peptides from fish by-products assisted with bromelain. The effects of enzyme/substrate (E/S) ratio and hydrolysis time on protein/peptides extraction, degree of hydrolysis (DH) and antioxidant activity were investigated. The optimum conditions achieved for bioactive peptides extraction were: an E/S ratio of 1.3% and a hydrolysis time of 4 h, at 37 °C. The fish protein hydrolysates produced using the optimized conditions displayed 4123 ± 586 µg/mL of protein, a DH of $14.2 \pm 0.8\%$ and an antioxidant activity via ABTS method of 1639.9 ± 77.7 µmol Trolox equivalent/L. Fish protein hydrolysates revealed the presence of peptides with low molecular weight, mainly below 10 kDa, which has also been directly associated with bioactive properties.

Thus, this study explored a sustainable process using alternative sources of by-products, namely the raw material (fish by-products) and the enzyme (pineapple by-products). The ability of fish protein hydrolysate to provide health benefits, along with the environmental advantages of applying by-products, underscore their promise to advance both nutritional

science and sustainable industrial practices.

Keywords: by-products, protein hydrolysis, sustainable development

References

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