Subcritical water hydrolysis of water-soluble protein from fish meal: effect of pressurization agent and temperature

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Fish meal is a by-product obtained in the marine food industry that is actually used in aquaculture and pet-food industry. It presents a high protein content as well as a valuable lipid fraction composition. The protein fraction from marine origin has a high nutritional value and a great amino acid profile. In order to improve the use of this by-product, more sustainable forms of exploiting it must be considered and the products obtained more useful.

Starting from this fish meal as raw material, new functional and healthy products can be obtained by using more sustainable and environmentally friendly processes [1], being production of small peptides and free amino acids an interesting alternative.

In this study the hydrolysis of the water-soluble protein (WSP) fraction from **tuna fish meal** was evaluated by **subcritical water** (subW) by using two different pressurization agents, N_2 and CO_2, in the temperature range from 140 to 180 ºC.

For both gases, an **increase of the amino group release was observed by increasing working temperature**, producing smaller-size peptides and free amino acids.

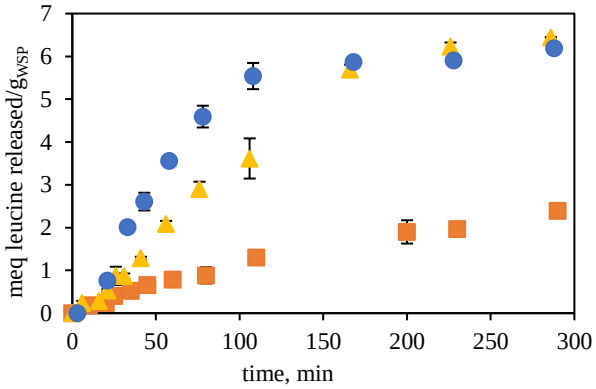

Figure 1. Amino groups release kinetics by subW pressurized with CO2 at ■ 140 °C, ▲ 160 °C, ● 180 °C.

The production of free amino acids (FAA), supported by size exclusion chromatography, showed that **subW at 180ºC using CO_2** as pressurization agent yielded 344 ± 5 mg FAA/g WSP**,** a **higher value than by using N_2** as pressurization agent that yielded a value of 275 ± 3 mg FAA/g WSP; although, the smallest molecular weight amino acids, glycine and alanine, were the majority FAA released in both cases (64% using CO_2 and 59% with N_2).

The difference between the subW and enzymatic hydrolysis treatment by using the commercial proteases (Alcalase and Novozym) was evident. **The free amino acids final content with the enzymatic process was much lower** (75 ± 1 mg FAA/g WSP with Alcalase and 71 ± 0.6 mg FAA/g WSP with Novozym), finding the highest hydrolysis yield for histidine, unlike subcritical water hydrolysis.

Acknowledgements

This work was supported by the AEI [grant numbers PID2019-104950RB-I00, PID2020-116716RJ-I00, TED2021-129311B-I00, PDC2022-133443-I00] and the JCyL and the ERDF [grant number BU050P20]. P. Barea predoctoral contract was funded by JCyL and the European Social Fund (ESF) by ORDEN EDU/1868/2022, de 19 de diciembre. P. Alonso-Riaño predoctoral contract was funded by JCyL and the European Social Fund (ESF) by ORDEN EDU/556/2019, de 5 de junio. R. Melgosa contract was funded by a Beatriz Galindo Research Fellowship [BG20/00182]. A. Bermejo López acknowledges the Margarita Salas grant (MARSA22/03).

References

[1] I. Petrova, I. Tolstorebrov, T.M. Eikevik. *Int. Aquat. Res.* **2018**, 10, 223–241. DOI: https://doi.org/10.1007/s40071-018-0207-4