Bioactive peptides produced from the mussel *Mytilus galloprovincialis* by enzymatic hydrolysis with corolase

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Introduction

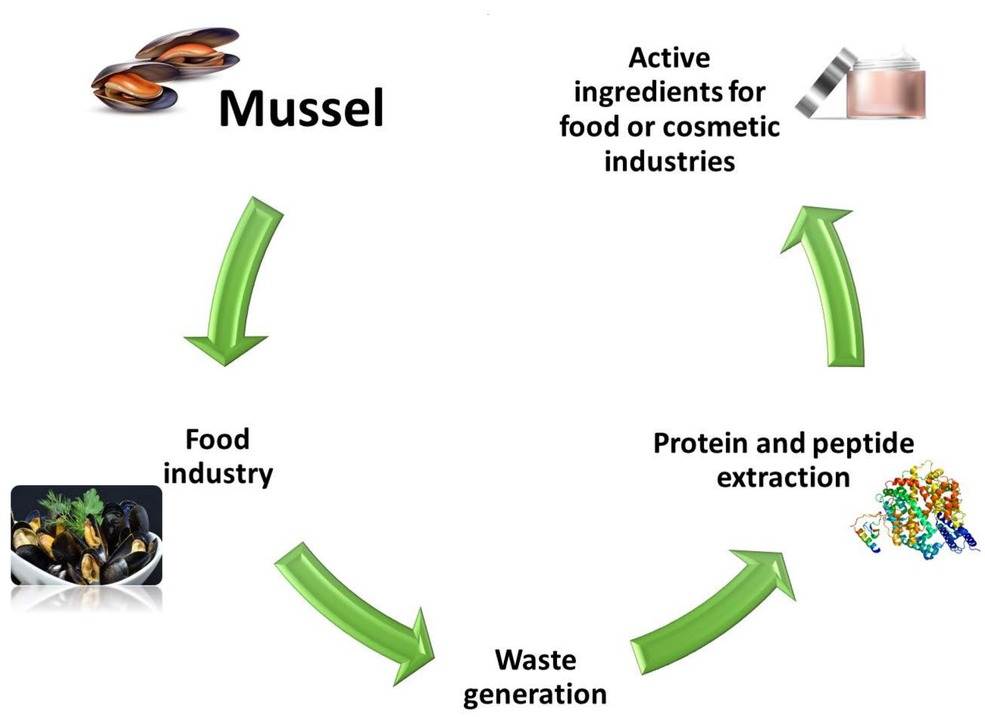


Figure 1: Scheme of the mussel *Mytilus galoprovincialis* normal processing and the sustainable approach studied.

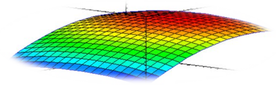
Objectives

Mussel commercialization generates waste, since the small or broken mussels are discarded. Thus, in this work discarded mussels were used with the goal of producing water soluble extracts rich in proteins and bioactive peptides.

Methodology

Enzymatic hydrolysis with corolase

Box-Behnken experimental design



Evaluated characteristics

- Protein release (Kjeldahl)
- Antioxidant activity (ORAC)
- Anti-hypertensive activity (iACE)

Main studied factors

- Hydrolysis temperature
- Protease concentration
- Hydrolysis time

Figure 2: Scheme of the experimental design done to optimize the extraction of bioactive extracts from mussel using the enzyme corolase.

Minced Mytilus galloprovincialis meat → **Enzymatic Hydrolysis** (make up the volume with ultrapure water until the desired final volume). (Adjust the pH to 7.5) → 3h at 40ºC with 3% corolase

Determination of:

- Protein release (Kjeldahl)
- Antioxidant activity (Oxygen-radical absorbance-capacity assay)
- Anti-hypertensive activity (Inhibition method of Angiotensin-I converting enzyme)

Soluble extract (Freeze-drying) | Insoluble extract

Figure 3: Optimized extraction method of bioactive extracts from *Mytilus galloprovincialis* using the enzyme corolase.

Results

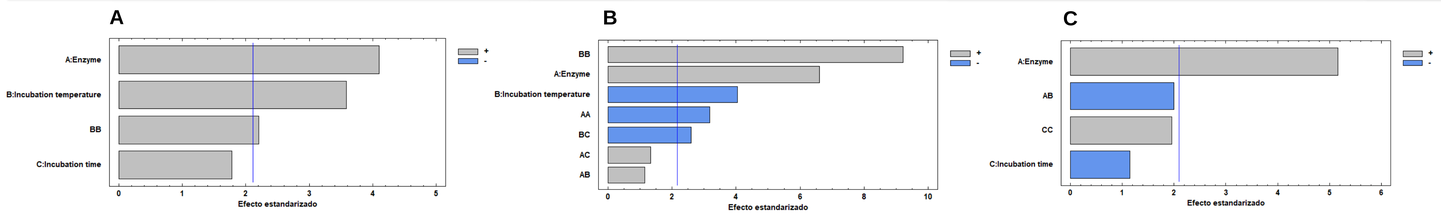


Figure 4: Pareto charts obtained for protein release (A), antioxidant activity (B) and anti-hypertensive (C) in the experimental design, showing the most influent factors.

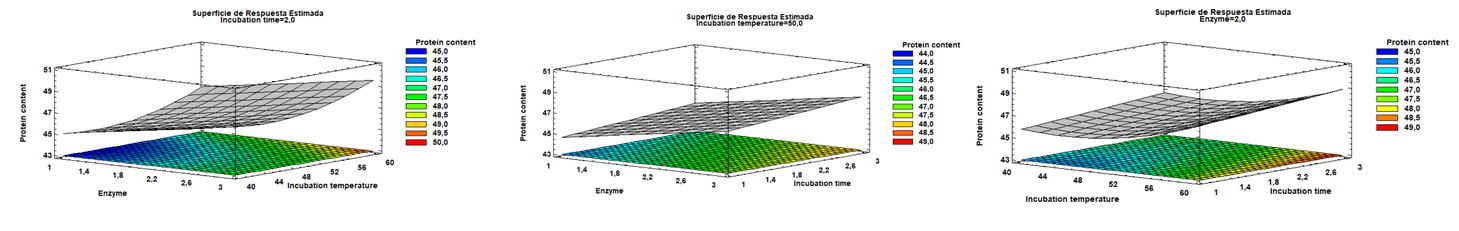


Figure 5: Graphs representing the protein release of the experimental design, showing the best factors combination that allows to achieve a higher protein release.

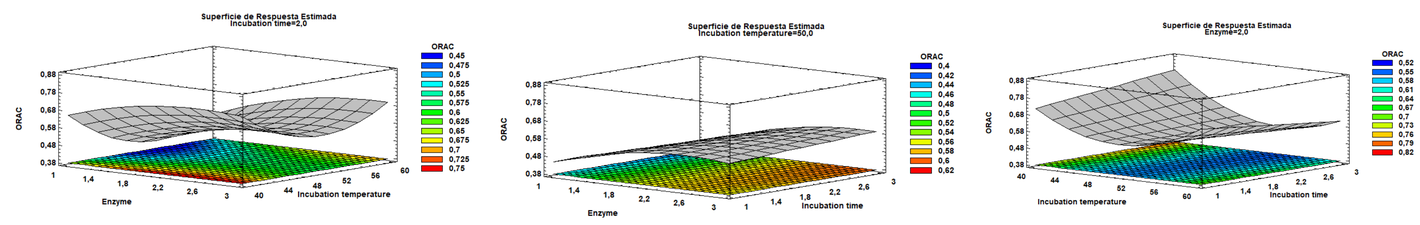


Figure 6: Graphs representing the antioxidant activity of experimental design, showing the best factors combination that allows to achieve a higher bioactivity.

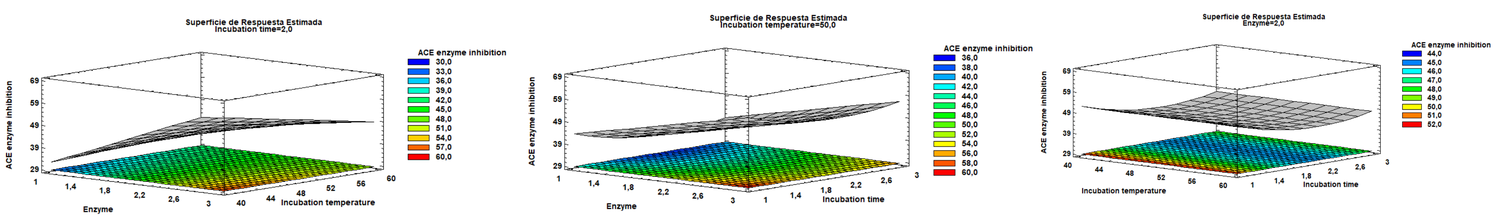


Figure 7: Graphs representing the anti-hypertensive activity of experimental design, showing the best factors combination that allows to achieve a higher bioactivity.

Table 1: Optimal conditions predicted by the experimental design to maximize protein release and antioxidante activity of the extracts.

Factors	Optimal conditions
Temperature	40
% Protease	3
Incubation time (hours)	3

Table 2: Obtained values in an extraction performed with the optimal conditions described in table 2.

Evaluated characteristics	Obtained results
% Protein / dry weight	48,0
Antioxidant activity (µmol TE/g extract)	821
Anti-hypertensive activity (10 mg / mL)	61%

Conclusion

The incubation of the minced mussel meat with 3% of enzyme, at 40 ºC for 3 hours, appears to be the best conditions to obtain the best results of protein extraction, and antioxidant and anti-hypertensive properties. The obtained extracts showed 48% of protein content, an antioxidant activity of 821 µmol TE / g of extract, and an ability to inhibiting the activity of ACE of 61% (using a concentration of 10 mg / mL).

Thus, the factorial design allowed to confirm the combination of experimental factors that leads to the most efficient extraction of antioxidant and anti-hypertensive peptides of the mussel Mytilus galloprovincialis. In conclusion, the use of discarded mussels to produce functional ingredients for food, cosmetic and pharmaceutic industries contribute to valorise world waste in a circular economy context.

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