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Multifactorial study for the production of bioactive collagen hydrolysates from blue shark skin

CATÓLICA FACULTY OF BIOTECHNOLOGY PORTO

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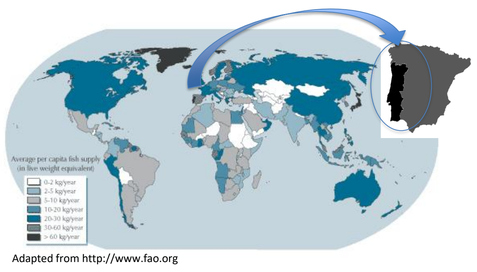
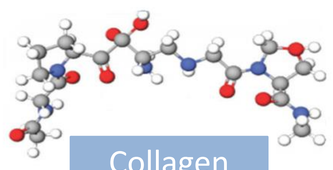
Introduction

Fish consumption in the world[1]



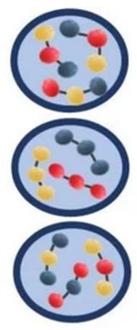
Adapted from http://www.fao.org

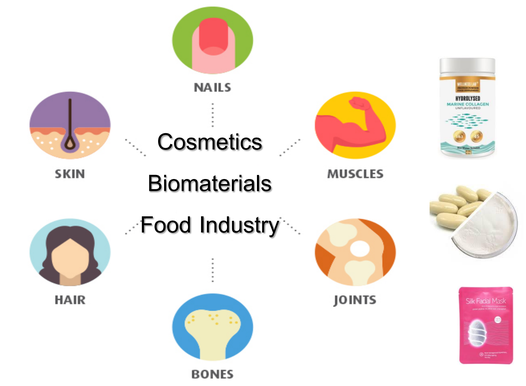
Blue shark skin: an abundant Portuguese by-product from processing industry rich in collagen[2].



Collagen Type I

Hydrolysis[4]





Low molecular weight peptides

Added-value APPLICATION[3]

Objective

To obtain an optimal collagen hydrolysate from Blue Shark skin (BSS) with bromelain (BR), a plant enzyme.

Methods and Results

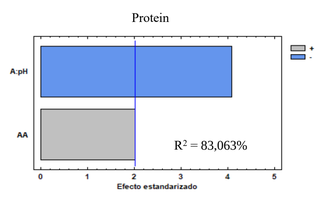
Hydrolysis optimization

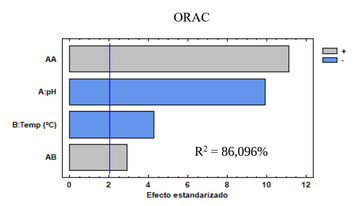
The hydrolysis process was optimized as explained in Figure 1, following for each experiment the same steps described in the subsequent section (Optimized process). A multifactor experimental arrangement was designed following the Box Behnken model. Three experimental factors were considered, and three responses were analysed. The ratio of enzyme to the substrate was kept constant at 0.5% w/w solid.

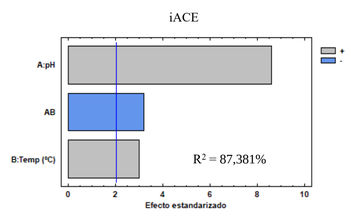
Factors	Low	High
pH	4.0	7.2
Temperature (ºC)	25.0	35.0
Time (min)	30.0	150.0

Responses	
Protein	mg/mL
ORAC	µmol TE/g protein
iACE	% inhibition

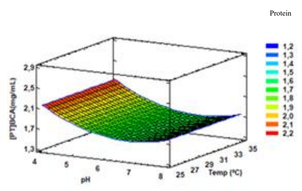
The significance of the effects of each experimental factor in the model was estimated for each analysed response. The models were recalculated considering only the significant effects and thus obtained regression models with a good explanation of the data variability (R^2).

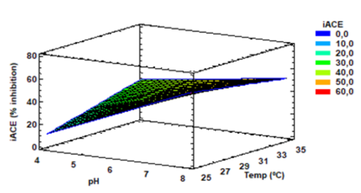


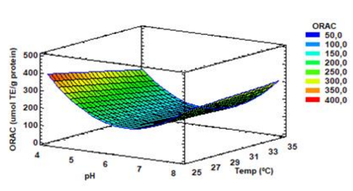




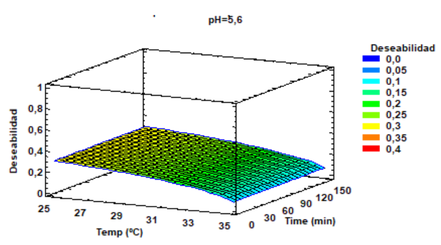
First, each individual response was optimized, obtaining different conditions according to the response to maximize.







To carry out a general optimization, Derringer's total desirability model was applied. Thus, the condition that would allow achieving a good maximization of the responses as a whole was reached.



Factor	Óptimo
pH	4,0
Temp (ºC)	25,0
Time (min)	90,0

The factor Time doesn´t change the hydrolysis capacity, so during the validity or optimization of the process, we hydrolyzed the sample for 60 minutes.

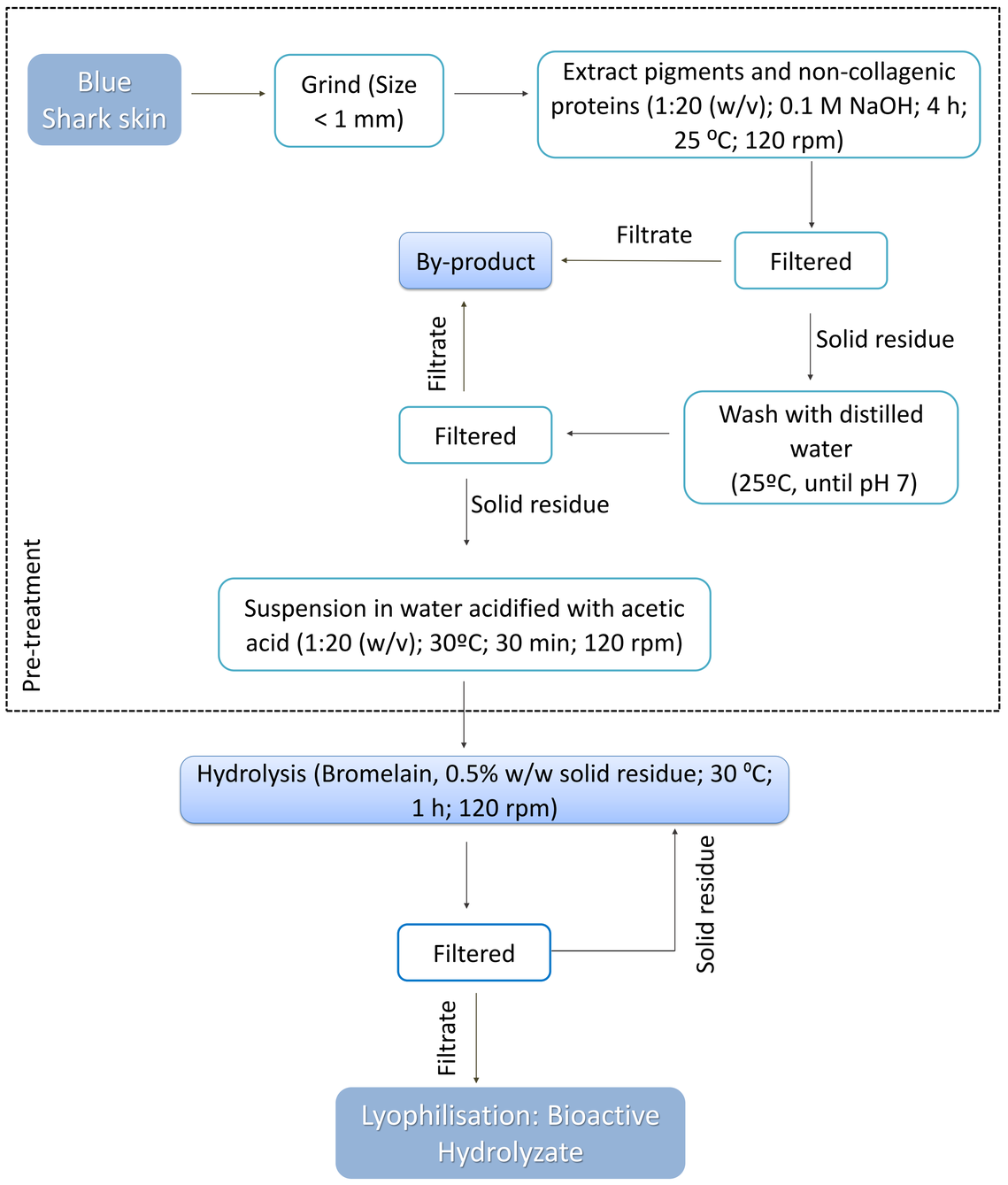


Figure 1. Optimised process. Flow diagram of the optimal process proposed to produce the bioactive hydrolysates from blue shark skin.

Conclusions

A sustainable process was used to obtain low molecular weight hydrolysates with antioxidant activity (ORAC, 665.8 µmol Trolox Equivalent/mg protein) and ACE inhibitory activity (IC50, 314.9 µg protein/mL) at 1 h of hydrolysis. Therefore, it was possible to obtain an ingredient (collagen hydrolyzate) currently required by industries such as Food & Nutraceuticals, with antioxidant and antihypertensive potential. In relation to what already exists in the market, it was possible to apply a sustainable process that is less time-consuming and uses an alternative and abundant raw material.

Acknowledgements

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References

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