

Enzymatic hydrolysis of meat by-products by fish viscera enzyme extracts: antioxidant and antihypertensive activities

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Introduction

- Meat and fish industries generate large volumes of by-products that are costly to be treated and disposed ecologically.
- The use of by-products as a source of bioactive peptides has been widely studied during the last years. In this context, enzymatic hydrolysis has gained attention to obtain protein hydrolysates with defined nutritional, functional and bioactive properties.
- Enzymatic processes have been implemented in a broad range of industries in recent decades because they are specific and fast in action [1]. In food industries, enzymes are used to improve the flavor and to increase protein yield of meat, poultry, fish and vegetables.
- The generation of bioactive peptides depends mainly on the enzymes and substrate used in the hydrolysis. Likewise, peptide size and amino acid sequences are crucial for the bioactive potential [2].
- Proteases account for approximately 50% of the industrial enzymes market. Proteases include different digestive enzyme such as pepsin, trypsin, chymotrypsin, elastase. Fish viscera are a rich source of proteases that are present in gonads and digestive tissues such as stomachs, pyloric caeca, intestines, liver, pancreas, spleen [3].
- Fish internal organs constitute approximately 20% of the marine biomass and these wastes are in many cases discarded directly without attempting to take advantage of them.

Therefore, the present study aims to use an enzymatic extract from fish viscera and a commercial enzyme (as a control) to generate bioactive peptides from meat by-products and evaluate their bioactive potential, such as antioxidant and antihypertensive activities. Thus, meat and fish by-products that represent an environmental and economic problem can be valorize to obtain added value compounds.

Methods



Hydrolysis with viscera enzymatic extract and alcalase (control)
pH 8, 50 °C



Grinding, homogenization and collection of supernatant that comprises the viscera enzymes

Meat/bones Hydrolysates (freeze-dried)



Degree of hydrolysis
Protein content
FPLC
Antioxidant activity (ABTS and ORAC)
Antihypertensive activity (ACE inhibition)

Results

Analysis of enzymatic hydrolysis conditions

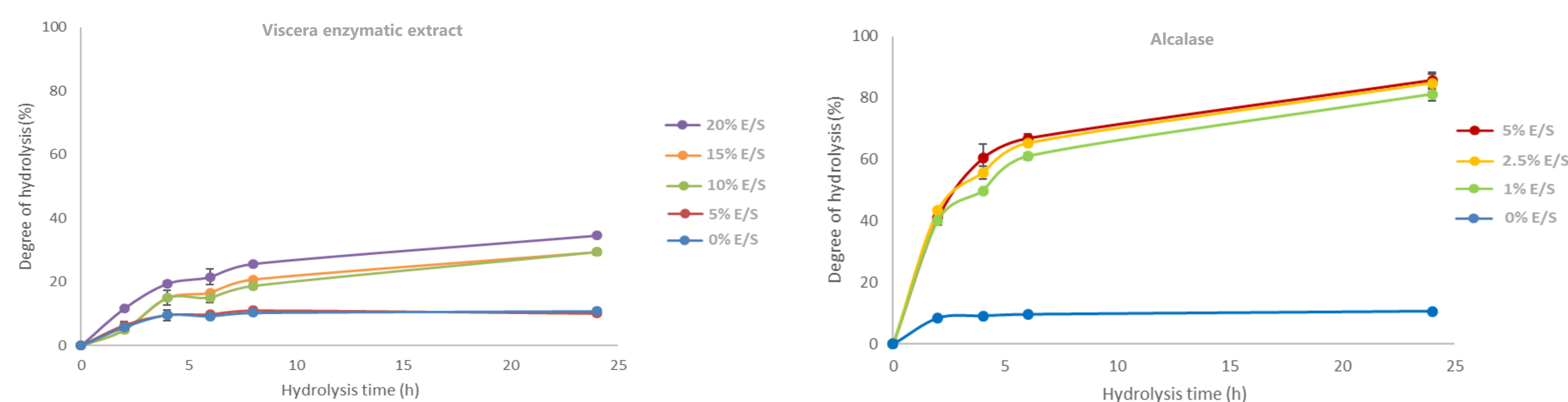


Figure 1 - Degree of hydrolysis obtained for meat/bones during hydrolysis with viscera enzymatic extract and alcalase for 24 h

Characterization of meat/bones hydrolysates

Table 1 - Characterization of meat/bones protein hydrolysates

	Degree of hydrolysis (%)	Protein content (%)
Viscera enzymatic extract	13.5 ± 1.3	61.8 ± 1.2
Alcalase	61.5 ± 8.5	80.3 ± 1.8

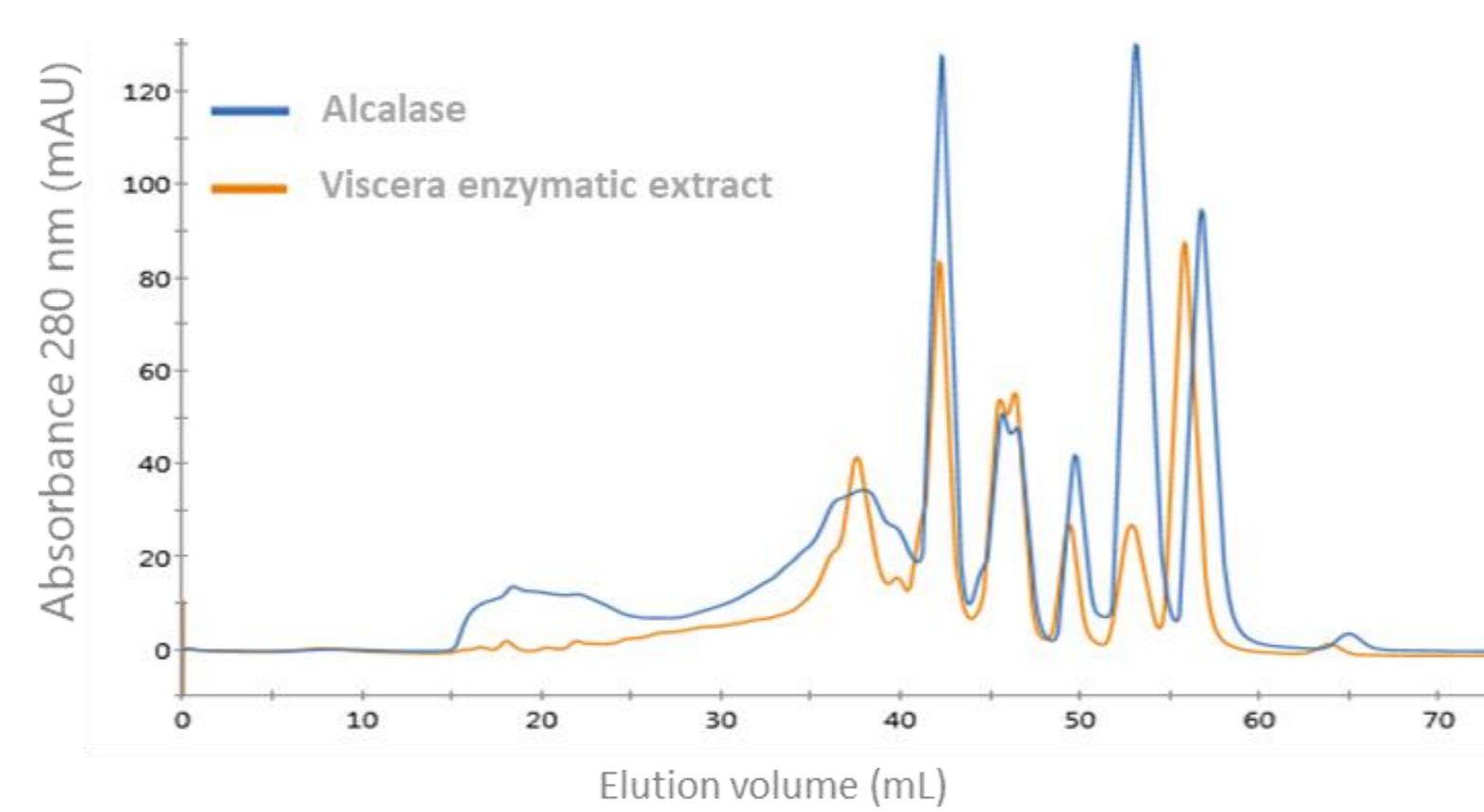


Figure 2 - Peptide profile of meat/bones protein hydrolysates

Table 2 - Bioactivity of meat/bones protein hydrolysates

Bioactivity	Antioxidant activity		Antihypertensive activity
	ABTS (mg ascorbic acid equivalent/ g hydrolysate)	ORAC (mg Trolox equivalent/ g hydrolysate)	IC ₅₀ (µg of protein/mL)
Viscera enzymatic extract	5.1 ± 1.0	77.7 ± 16.6	552.6
Alcalase	9.2 ± 1.4	116.5 ± 41.5	503.1

Viscera enzymatic extract: 20% E/S, 4 h
Alcalase: 1% E/S, 6 h

Conclusions

Fish viscera contain enzymes that can be employed to produce protein hydrolysates, enhancing the value of by-products. This research work defined a process to use fish viscera to hydrolyze meat/bones by-products. The selected conditions for the enzymatic hydrolysis using the viscera enzymatic extract was 20% (E/S) during 4 h and using alcalase was 1% (E/S) during 6 h. Meat/bones protein hydrolysates demonstrated to contain small peptides, in addition to their high protein content. These protein hydrolysates showed relevant antioxidant capacity by ABTS and ORAC methods and slight antihypertensive activity. Therefore, the viscera enzymatic extract showed potential to hydrolyze meat/bones by-products obtaining peptides with bioactive properties. In this way, it will be possible to valorize animal by-products using a sustainable approach and to promote added value compounds for animal and human nutrition.

References

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