Shark cartilage (*Prionace glauca*) by-products as collagen source for biotechnological applications

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INTRODUCTION AND OBJETIVES

Blue shark (*Prionace glauca*) is one of the most widespread species in the epipelagic zone. Its geographical distribution is within the fishing areas of tuna and swordfish, so it has always been an incidental catch in those fisheries. Their fins and meat are consumed as food, skin is used for leather, liver for oil and by-products generated during processing, are normally used in the fish meal industry (FAO) [1].
Trunk cartilage, by-product generated at fish processors, might be a source of collagen and so, its valorisation is worth to be explored. The aim of this study was to investigate the collagen content and characteristics of the cartilage from blue shark as potential alternative of mammals collagen.

EXPERIMENTAL WORK

The isolation of marine collagen is generally carried out in three steps: pre-treatment (**P**), extraction (**E**) and recovery (**R**) (Fig1) with slight modifications depending on the raw material used[2]. Shark trunks structure are depicted in Fig 2. It was washed with distilled water and was subdivided in two parts: proper cartilage (blue part, **C**) and disc or centrum (yellowish part, **D**). Both parts were homogenized by a mixer and stored at -4ºC until used.

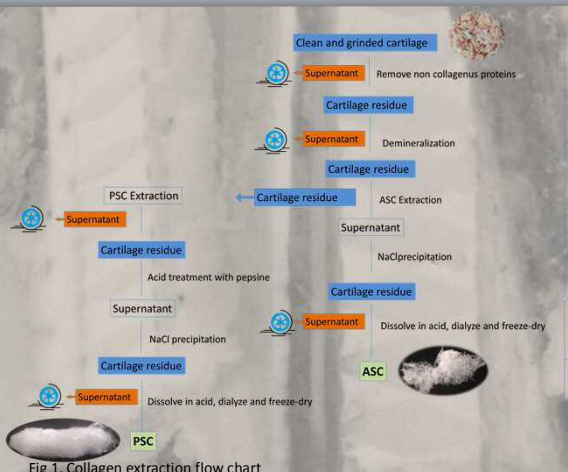

Fig 1. Collagen extraction flow chart

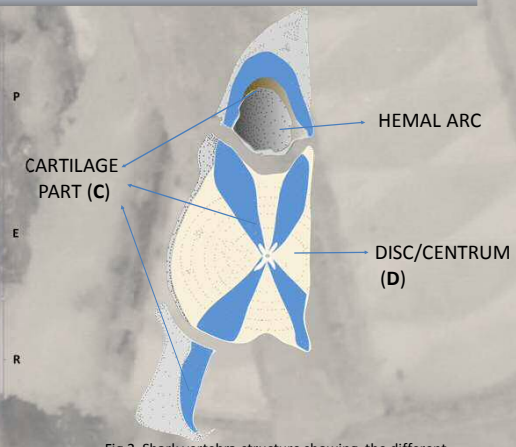

Fig 2. Shark vertebra structure showing the different parts used in this study to extract collagen (C and D)

RESULTS AND DISCUSION

ASC and PSC yields showed that collagen can be isolated from cartilage of blue shark, both from the cartilage part (C) and the disc (D). Higher yield was obtained for PSC from C in comparison with PSC from D (Fig 3). Both parts were characterized by proximate analysis and the collagens obtained were characterized by amino acid contents (Fig 4). ASC and PSC from both parts showed similar amino acid composition, except for Lys and Hlys. SDS-polyacrylamide gel electrophoresis (SDS-PAGE) (Fig 5) and Fourier transform infrared (FTIR) spectroscopy (Fig 6) indicated similar secondary structures and that they could contain type I and type II collagens.

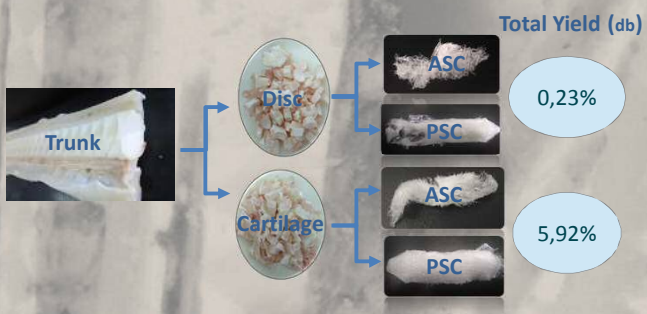

Fig 3. ASC and PSC yields expressed in dry bass. Higher yield was obtained for PSC from cartilage in comparison with PSC for centrum and ASC.

Amino acid	Disc		Cartilage	
	ASC	PSC	ASC	PSC
Asp	4.79±0.004	5.50±0.063	4.12±0.017	4.60±0.055
Thr	2.36±0.003	2.85±0.042	2.19±0.021	2.44±0.030
Hpro	7.89±0.046	7.43±0.069	7.64±0.095	7.28±0.043
Ser	3.72±0.040	4.50±0.005	4.39±0.023	4.51±0.004
Glu	8.73±0.008	8.63±0.005	7.40±0.033	7.57±0.020
Pro	10.13±0.032	9.90±0.038	9.85±0.045	10.04±0.040
Gly	31.73±0.080	30.50±0.070	32.78±0.033	31.90±0.321
Ala	10.66±0.066	10.10±0.014	11.94±0.016	11.56±0.007
Cys	0.27±0.011	0.37±0.007	0.25±0.003	0.32±0.018
Val	2.30±0.037	2.44±0.52	2.39±0.093	2.36±0.059
Met	1.29±0.016	1.31±0.158	1.69±0.229	1.51±0.043
Ile	1.51±0.008	1.87±0.071	1.88±0.101	1.92±0.013
Leu	3.08±0.011	3.45±0.028	2.44±0.063	2.78±0.000
Tyr	0.63±0.033	0.96±0.061	0.29±0.007	0.49±0.010
Phe	1.80±0.057	2.05±0.102	1.48±0.080	1.72±0.103
hlys	1.66±0.007	1.59±0.059	0.93±0.018	0.99±0.004
His	0.62±0.001	0.53±0.004	0.80±0.016	0.75±0.006
Lys	1.95±0.018	1.69±0.012	2.46±0.025	2.34±0.012
Arg	4.83±0.007	4.34±0.025	5.08±0.060	4.93±0.028

Fig 4. Amino-acid content. ASC and PSC extracted from cartilage and disc had similar amino acid profiles, all of them had Glycine as the main amino acid and were rich in alanine, proline and hydroxyproline[3]. Hlys was higher in D, while Lys in C.

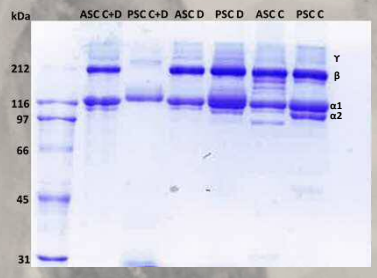

Fig 5. SDS-polyacrylamide gel. SDS-PAGE patterns of ASC and PSC of C presented β- and α- chains as major components with traces of Y-chains. The results revealed that these fractions could contain two types of collagen, including type I and II, as indicated in previous literature [2,4].

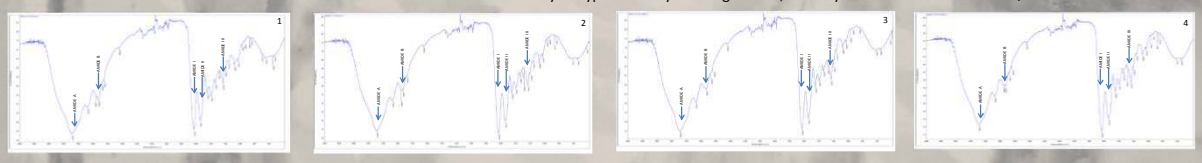

Fig 6. Fourier transform infrared (FTIR) spectroscopy. 1. ASC from D; 2. PSC from D; 3. ASC from C; 4. PSC from C. FTIR spectra showed the major absorption bands in the amide band region, including the peak of amide I, II and II and amide A and B, as a typical pattern of collagens from cartilages.

Due to these characteristics, both collagens could be used as alternative to mammals collagen in different applications.

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