

Comparison of the properties of protein hydrolysates from white and red meat of tuna (*Euthynnus affinis*)

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The processing discards from the seafood industry account for nearly three-quarters of the total quantity of fish catch. These discards contain good quantity of valuable nutritional components and the potential utilization of these nutrients for various applications has been the focus of attention in the recent years. Several techniques have been developed to recover the essential nutrients and bioactive compounds from these protein rich fish processing wastes. Enzymatic proteolysis and solubilization of proteins from various sources has been studied extensively and described by several authors for the past few years. By adopting hydrolysis, these proteinaceous fish waste can be converted to hydrolysates with a range of potential applications.

Tuna and related species are very important economically and are rich sources of high quality protein. Converting these wastes to bioactive hydrolysate finds application in a broad spectrum of food ingredients. Protein hydrolysates are mixture of bioactive peptides obtained by the breakdown of proteins by hydrolysis either chemically or enzymatically. Protein-rich red meat from tuna has limited use compared to white meat and is usually processed into low market-value products and hence conversion of this red meat into protein hydrolysates may generate high value

products. A comparative study of the properties of hydrolysates derived from tuna white meat and red meat were carried out. Protein hydrolysate was prepared using papain (enzyme: protein; 1:100) for 60 min. under optimal hydrolytic conditions and spray dried to obtain a fine powder of tuna white meat (TWPH) and tuna red meat protein hydrolysates (TRPH).

Determination of protein content of tuna waste and tuna protein hydrolysates (TPH) indicated an increase in protein from $26.34 \pm 0.79\%$ to $78.01 \pm 1.37\%$ for tuna white meat to its hydrolysate and 28.34 ± 1.63 to $75.17 \pm 1.69\%$ for tuna red meat to its hydrolysate, respectively. Solubilisation of protein during hydrolysis as well as removal of insoluble undigested non-protein substances after hydrolysis resulted in high protein content in hydrolysates. The protein recoveries from tuna red meat and white meat to their respective hydrolysates were 36.87% and 42.14%.

Colour of fish protein hydrolysate depends on the composition of the raw material, the hydrolysis condition and the drying method adopted. Analysis of colour using the colourimeter (Hunter Lab Colorimeter, Miniscan® XE Plus) gave an L*, a*, b* value (Table 1) revealed darker colour for TRPH than TWPH (Fig. 1).

Table 1. Colour of tuna red and white meat hydrolysates

	TRPH	TWPH
L* (Lightness)	83.14 ± 0.11	92.56 ± 0.10
a* (Redness/Greenness)	2.88 ± 0.10	-1.52 ± 0.14
b* (Yellowness/Blueness)	29.86 ± 0.24	15.34 ± 0.08



Fig. 1. Tuna red meat protein hydrolysate and tuna white meat protein hydrolysate

Evaluation of the protein hydrolysate functional properties viz. foaming properties and emulsifying properties revealed comparatively higher functionality for TWPH. Foaming capacity of TWPH and TRPH were $85 \pm 5\%$ and $75 \pm 5\%$, respectively and foaming stability at 3 min. was

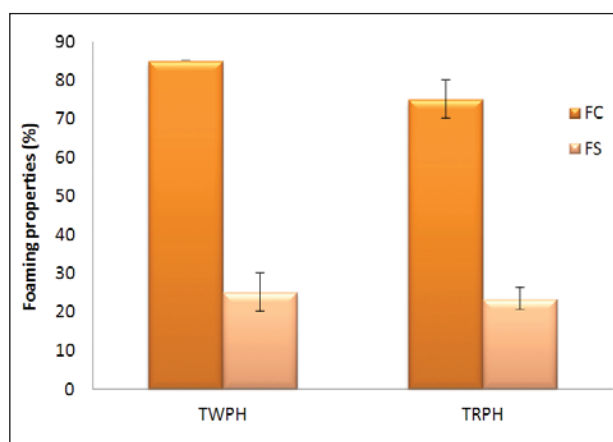


Fig. 2. Foaming capacity (FC) and foaming stability (FS) of tuna protein hydrolysates

observed to be $25 \pm 5\%$ and $23.33 \pm 2.9\%$, respectively (Fig 2). Protein hydrolysates are good emulsifiers due to their improved amphiphilic nature that enable orientation at the oil-water interface for more effective adsorption. Emulsifying properties viz., emulsifying activity index and emulsion stability index were observed to be $5.94 \pm 0.73 \text{ m}^2/\text{g}$ and $24.51 \pm 9.39 \text{ min.}$, respectively for TWPH and $6.52 \pm 1.21 \text{ m}^2/\text{g}$ and $16.57 \pm 4.75 \text{ min.}$, respectively for TRPH.

Antioxidants are substances capable of delaying, retarding or preventing oxidation processes. Synthetic antioxidants have been used in order to prevent lipid peroxidation in food products, but in recent times more interest is generated towards finding antioxidants from natural resources that have little or no side effects. Protein hydrolysates (peptides) are potential antioxidants due to their chemical composition and physical properties. DPPH-free radical scavenging assay evaluates the free radical scavenging capacity of the sample. DPPH-free radical scavenging activity of 0.2% protein hydrolysate solutions was observed to be $81.5 \pm 0.63\%$ and $66.24 \pm 2.42\%$, respectively for TRPH and TWPH. Reducing power is a measure of the iron-reducing capacity and samples with higher reducing power have better abilities to donate electrons and free radicals to form stable substances, thereby interrupting the free radical chain reactions. The reducing power of 1% protein solution was observed as 1.929 ± 0.086 and 1.497 ± 0.086 , respectively for TRPH and TWPH.

Effective utilization of fishery waste generated enormously from fish processing industry by recovering in the form of hydrolysates by enzyme application can satisfy numerous food and pharmaceutical applications. Comparison between the white and red meat protein hydrolysates from tuna meat revealed better functional properties for TWPH, whereas antioxidative activities were higher in TRPH compared to TWPH.