HYDROLYZED FISH PROTEINS

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The Nutritious Value of Fish

- a well balanced protein source
- high levels of minerals and trace elements, such as selenium and iodide
- high levels of B-vitamins
- bioactive compounds for biomedicine.
Bioactive Compounds

- Protein
- Peptides
- Amino acids
- Terpenoids
- Steroids
- Enzymes
- Alkaloids
- Fatty alcohol esters
- Glycolipids etc.
Protein

- polymer of 20 \( \alpha \)- amino acids, with mol.wt from 5000 to 1000,000 daltons.
- N is most distinguished element: among the composing elements of C, H, N, O, S, for some proteins: P, Cu, Fe, I.
- N content in different proteins ranging from 13.4% - 19.1%, and averagely 16%.
- Therefore protein coefficient is 6.25 for most proteins. 5.70 is only for wheat and its products proteins according to AOAC method.
- Most abundant component in cells: 50% of dry cells by weight
Peptid

- Aminoacid + Aminoacid $\rightarrow$ Peptid
Amino Acid

- Aminated carboxylic acid (R-COOH)
Hydrolysis of Protein

1. With Acid and Alkali
   Protein + HCl + 12-48 hours → aminoacid
     \[ \text{H}_2\text{SO}_4 \]
     \[ \text{NaOH} \]
     \[ \text{BaOH} \]

2. With Enzym
   Protein + Pepsin + 30-60 min. → polypeptid
     Tripsin
     Papein
Enzymatic Hydrolysis

- Rapid and reproducible method
- Separate peptide fractions, bones and oils from complex matrices with commercial proteases
- Avoid the extremes of chemical and physical treatments
- Minimize undesirable reactions which could destroy valuable components in proteins.
Enzymatic Hydrolysis

- The fish-raw material: muscle or by-products
- The fish-raw material is divided into a soluble and insoluble peptide fraction following an enzymatic hydrolysis.
- The majority of the hydrolysate liquid is captured within the fish protein hydrolysate fraction, while less is retained in the insoluble peptide fraction.
Enzymatic Hydrolysis

- The B-vitamins, many of the minerals and trace elements, and some of the amino acids are hydrophilic compounds that possibly might be enriched in the fish protein hydrolysate fraction.
- Also, species to species variation with regard to nutrient content might be present.
- So, it might be valuable to evaluate the two fractions obtained from the enzymatic hydrolysis of raw materials from different species.
Enzymatic hydrolysis to reduce antigenicity

- Protein chains are broken down to peptides & amino acids
- Conformational and linear epitopes are neutralised – reduced antigenicity
- Nutritional quality preserved
- In non-sensitized at-risk infants, reduced allergenicity
- Infants with diagnosed CMP allergy – hypoallergenic hydrolysates
## Enzymes

<table>
<thead>
<tr>
<th>Enzymes</th>
<th>Optimum pH</th>
<th>Optimum T (oC)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alcalase</td>
<td>8</td>
<td>50-60</td>
</tr>
<tr>
<td>Protamex</td>
<td>7-8</td>
<td>50</td>
</tr>
<tr>
<td>Neutrase</td>
<td>7</td>
<td>40-50</td>
</tr>
<tr>
<td>Flavourzyme</td>
<td>5.5-7.5</td>
<td>50-55</td>
</tr>
</tbody>
</table>
# Inactivation of Enzymes

<table>
<thead>
<tr>
<th>Enzymes</th>
<th>pH</th>
<th>T (°C)</th>
<th>Time (min.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alacalase</td>
<td>4-8</td>
<td>50, 85</td>
<td>30, 10</td>
</tr>
<tr>
<td>Protamex</td>
<td>4-8</td>
<td>50, 85</td>
<td>30, 10</td>
</tr>
<tr>
<td>Neutrase</td>
<td>4-7</td>
<td>50, 80</td>
<td>50, 80</td>
</tr>
<tr>
<td>Flavourzyme</td>
<td>6-8</td>
<td>90</td>
<td>10</td>
</tr>
</tbody>
</table>
Fish Protein Hydrolysate Production

1. Fish Mince
2. Fish Mince + Water (1:1)
3. Heating (50-60 °C)
4. Adding of Enzym
5. Waiting 30-45 min
6. Upper heating (85-95 °C)
7. Inactivation of Enzym
8. Centrifuge
9. Fish Protein Hydrolysate
10. Freeze-Drying
Fish Protein Hydrolysate

Hydrolysed Protein  Freeze-Dried Hydrolysed Protein
Raw Material

Pelagic Fish

Aquaculture

Fisheries

Fish Oil and Meal

Protein Isolates

Washing water

Fish Processing Operations

Head, viscera, backbone, skin

Tailor made protein and peptid products
Products

High Value Products

Pastes

Powders
Products

Nutraceutics: Antistress Effect

Contain fish protein hydrolysate prepared from sardine
The Potential Applications of Fish Protein Hydrolysates

- improved functional properties
  - Solubility
  - Gelation
  - Water holding ability
  - Emulsifying
  - Foaming
The Potential Applications of Fish Protein Hydrolysates

- improved nutritional value
- enteral diet formulations
- elderly formulations
- sports nutrition
- controlling food allergies, hyper allergic infants
The Potential Applications of Fish Protein Hydrolysates

- bioactive peptides in pharmaceutical application for especially blood pressure reduction
- peptone ingredient in microbial growth media in biotechnological applications
- aquaculture uses, animal feed and fertilizer.
Result

• Global warming and world’s economic crises trigger the concern of food shortage and starving. The most challenging struggle of the modern civilization is supplying food satisfactorily for increasing population.
• The current economics of the fishing industry demand optimization at every step of a given process, including the total utilization of raw materials.
Result

• Hydrolyzed fish proteins are destined to have a widespread application and their production will allow the utilization of vast amounts of fish protein currently being wasted or underutilized.

• Research on fish or fishery by-products demonstrated that they constitute a source of promising health benefits molecules.

• The protein hydrolyzed can be add the other fish product to improve nutritional quality and extend the shelf life of product.
References