

JUNE 1 - 3
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**Fish Collagen – a New Trend in the
Processing of Fish By-Products**





Fish Collagen

A new trend in the processing of fish by- products

Stefan Kirchner
Skagen, June 2022

Introduction



Content

- **What is fish collagen**
- Typical raw materials
- **What is the different between collagen, gelatin and collagen-peptides**
- Typical processes for collagen peptide recovery
- **End Product specification**
- Summary

What is Fish collagen

... a Protein

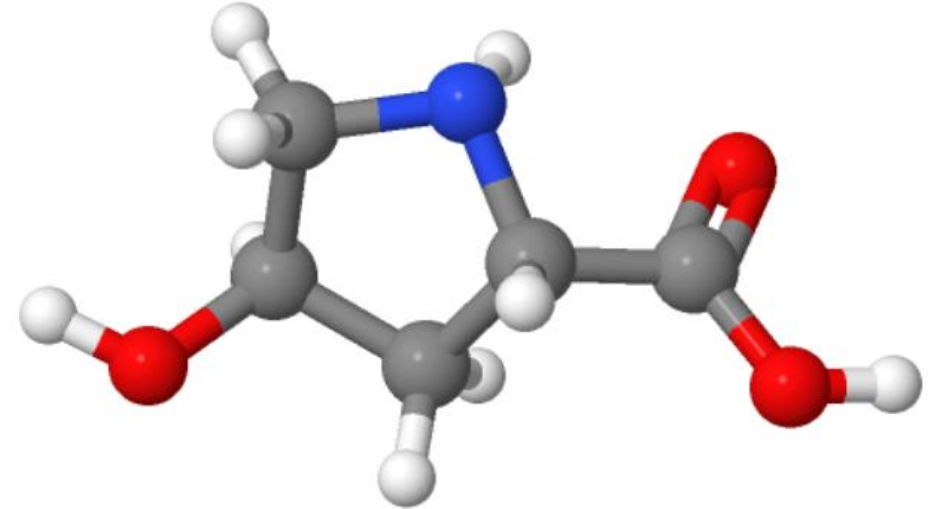
... a special protein with an important role for animals and fish

... a protein which provides structural support

... collagen can be found in skin, tendons and bones

What is Fish collagen

- ... a **Protein with a very special amino acid**
- 12 - 13 % of the amino acid is **Hydroxyproline**



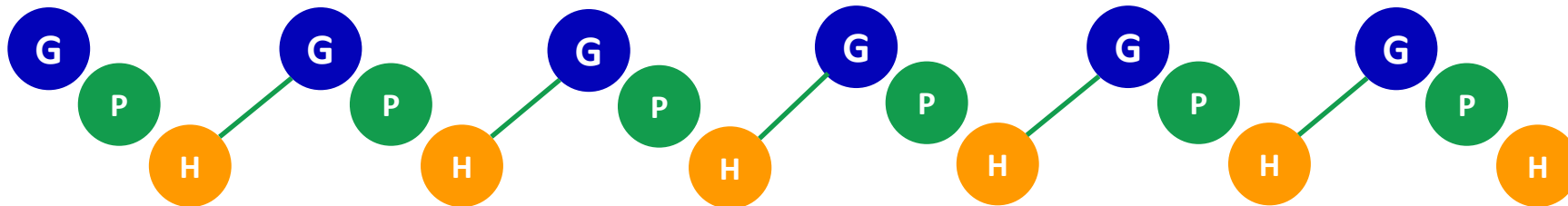
Hydroxyproline molecule, source: Wikipedia

- ... a **Protein with a very special amino acid sequence (primary structure)**
- Glycine/ Proline/ Hydroxyproline

What is Fish collagen

... a Protein which build up in a helix structure (secondary structure)

- Most common is the sequence Gycine – Proline- Hydroxyproline which will build a helix structure of the amino acid chain (**a-chain**)



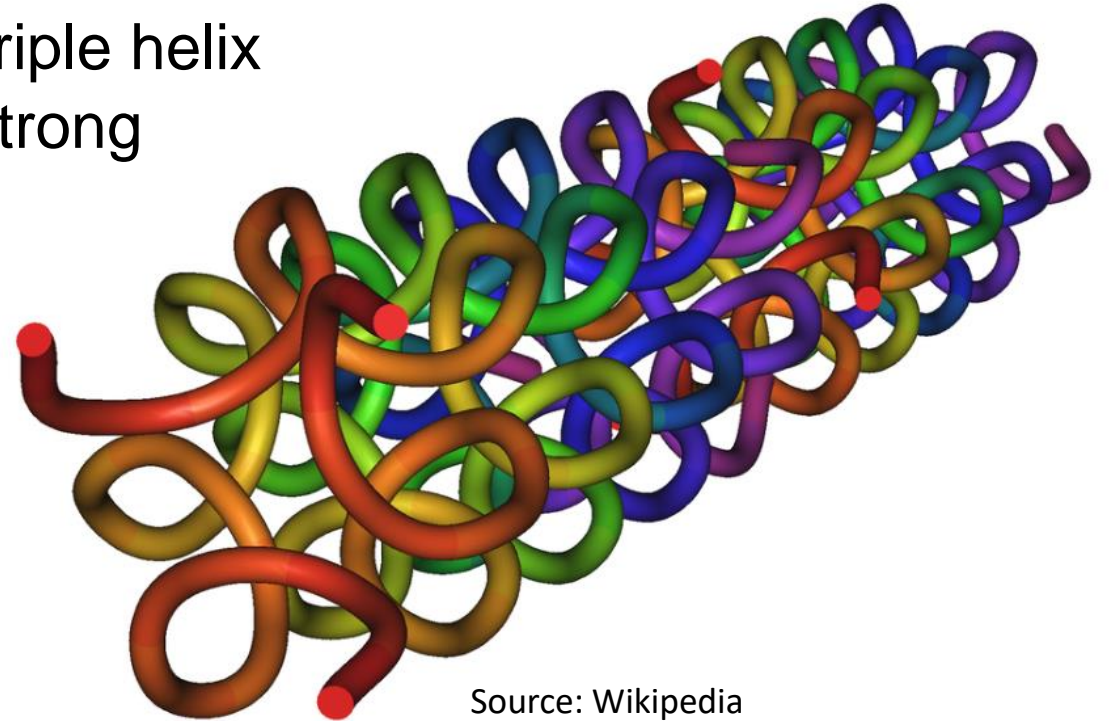
What is Fish collagen

... a Protein which builds a triple helix (tertiary structure)

- 2 x α_1 -chain and 1 x α_2 -chain will build a triple helix
- Intermolecular connections build a very strong structure protein


Impact to processing:

- Collagen is not soluble in water





Source: Wikipedia




Typical raw materials (fish, examples)

Source/ Raw material	Protein/ Collagen Content	Other components
Skin 	Compositon (example tuna): <ul style="list-style-type: none">- 42 % DS- 7,8 % ash- 17,8 % Protein- 23,8 % fat Recovery rate collagen peptide: 4 -6 % Hydroxiprolin content: 8- 10 %	<ul style="list-style-type: none">- Non Collagen Proteins- Fat

Typical raw materials (fish, examples)

Source/ Raw material	Protein/ Collagen Content	Other components
<p>Skin</p> 	<p>Compositon (example tuna):</p> <ul style="list-style-type: none"> - 42 % DS - 7,8 % ash - 17,8 % Protein - 23,8 % fat <p>Recovery rate protein peptide: 4 -6 % Hydroxiproline content: 8- 10 %</p>	<ul style="list-style-type: none"> - Non Collagen Proteins - Fat
<p>Bones</p> 	<p>Compositon (example tuna):</p> <ul style="list-style-type: none"> - 53 % DS - 27,7 % ash - 18,8 % Protein - 1,7 % fat <p>Recovery rate collagen peptide: 5 -8 % Hydroxiproline content: 7- 9 %</p>	<ul style="list-style-type: none"> - Minerals

Typical raw materials (fish, examples)

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Bones 	Compositon (example tuna): - 53 % DS - 27,7 % ash - 18,8 % Protein - 1,7 % fat Recovery rate protein peptide: 5 -8 % Hydroxiproline content: 7- 9 %	- Minerals
Scales 	Compositon (example demin. Tilapia): - 89 % DS - 0,2 % ash - 88 % Protein - 0,3 % fat Recovery rate collagen peptide: > 80 % Hydroxiproline content: 10 -13 %	- Minerals

Summarize Raw material

Main raw material:

- Skin
- Clean bones (from hydrolyzation)
- Scales

Requirements for Raw Material :

- Food grade
- High content of Hydroxyproline
- Low grade of contaminations

General principle of process: **Preparation**

Bones/ Scales

Crude material

Demineralization

Collagen rich material

Acid

Skin

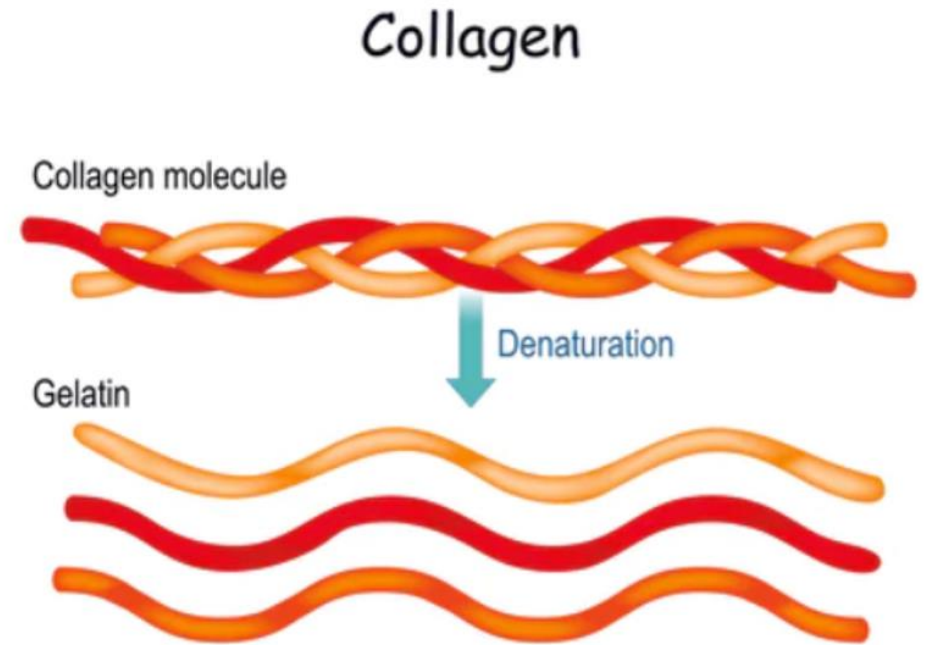
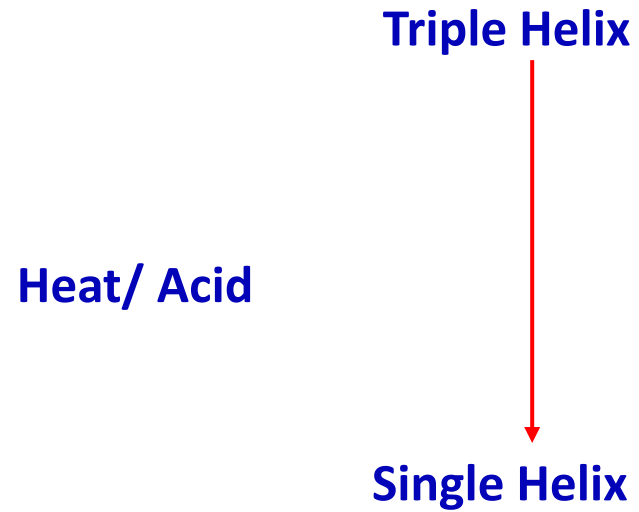
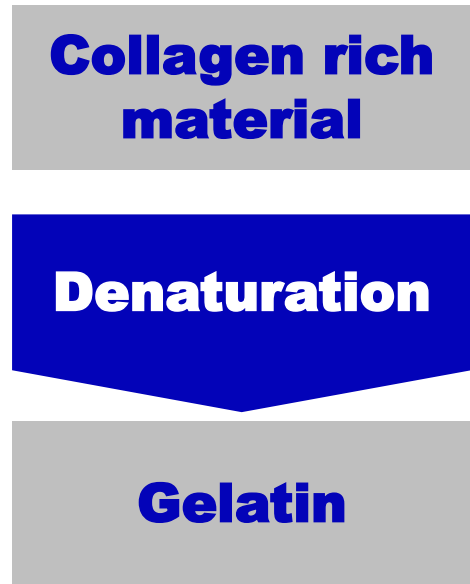
Crude material

Washing

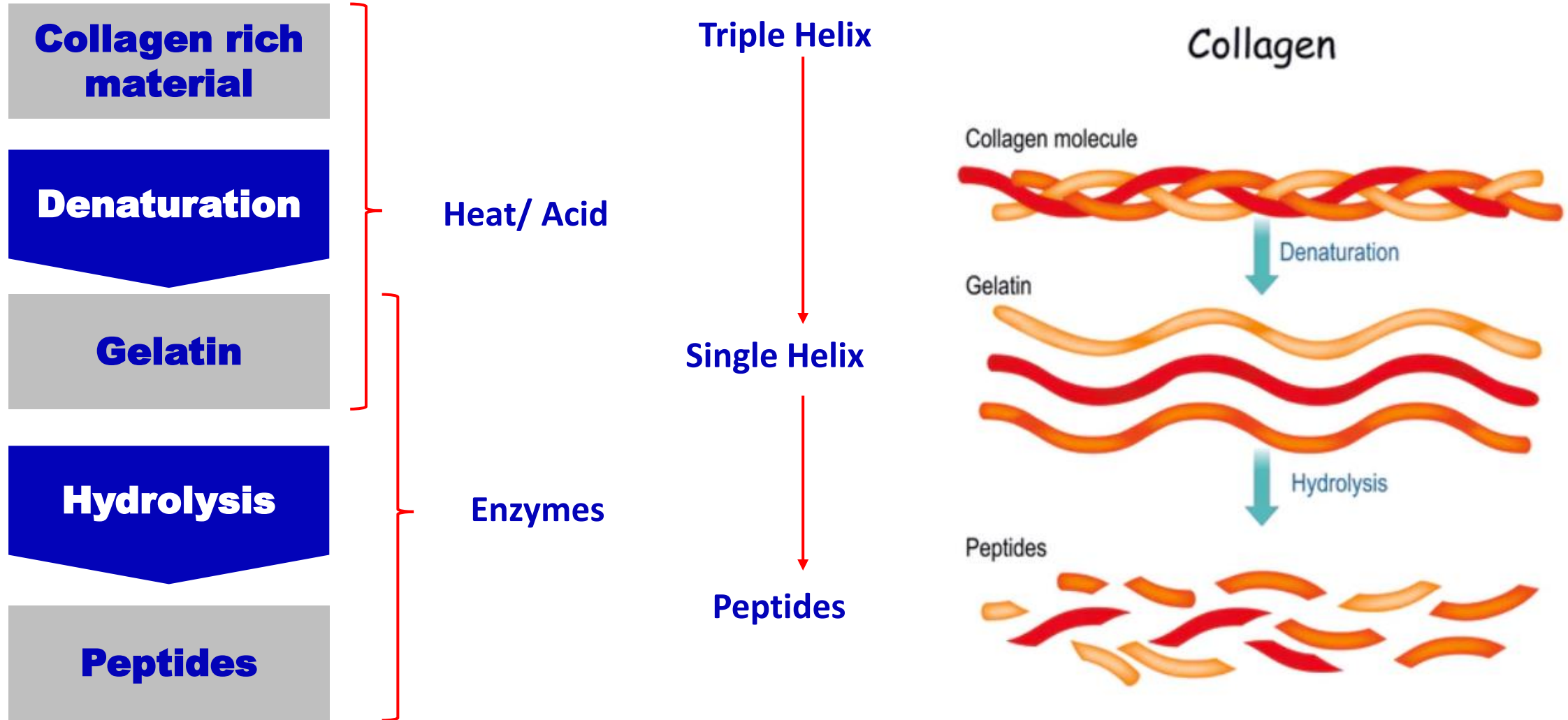
Collagen rich material

Cold water

General principle of process: **Denaturation**

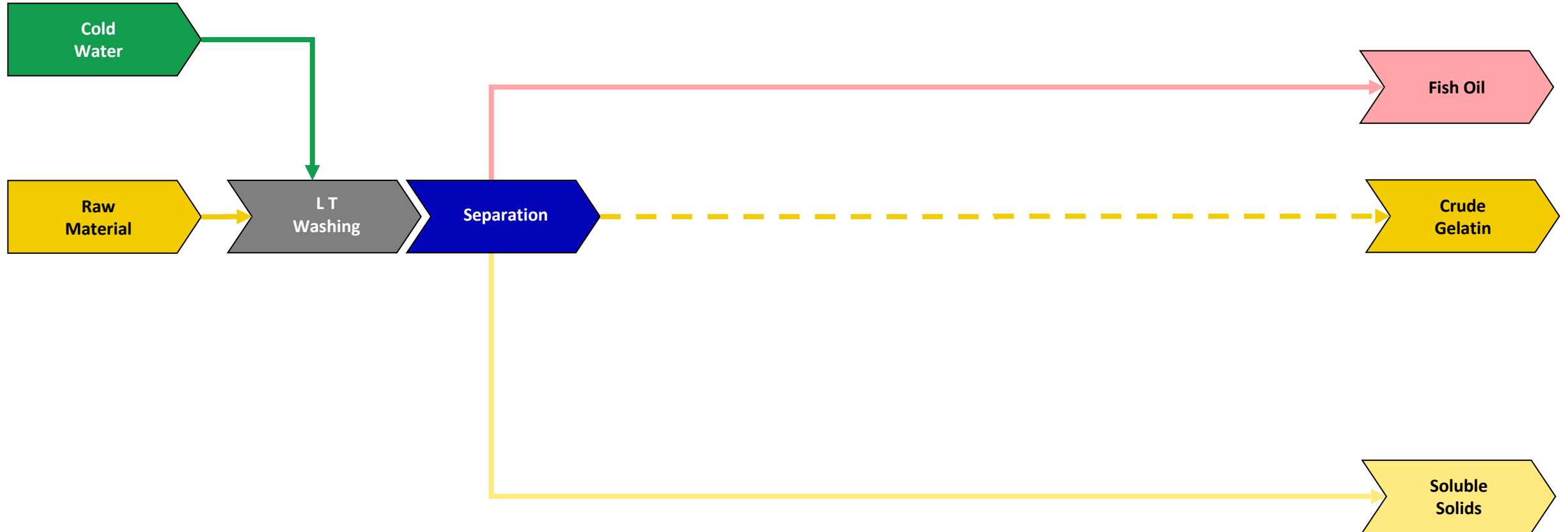


General principle of process: **Hydrolysis**



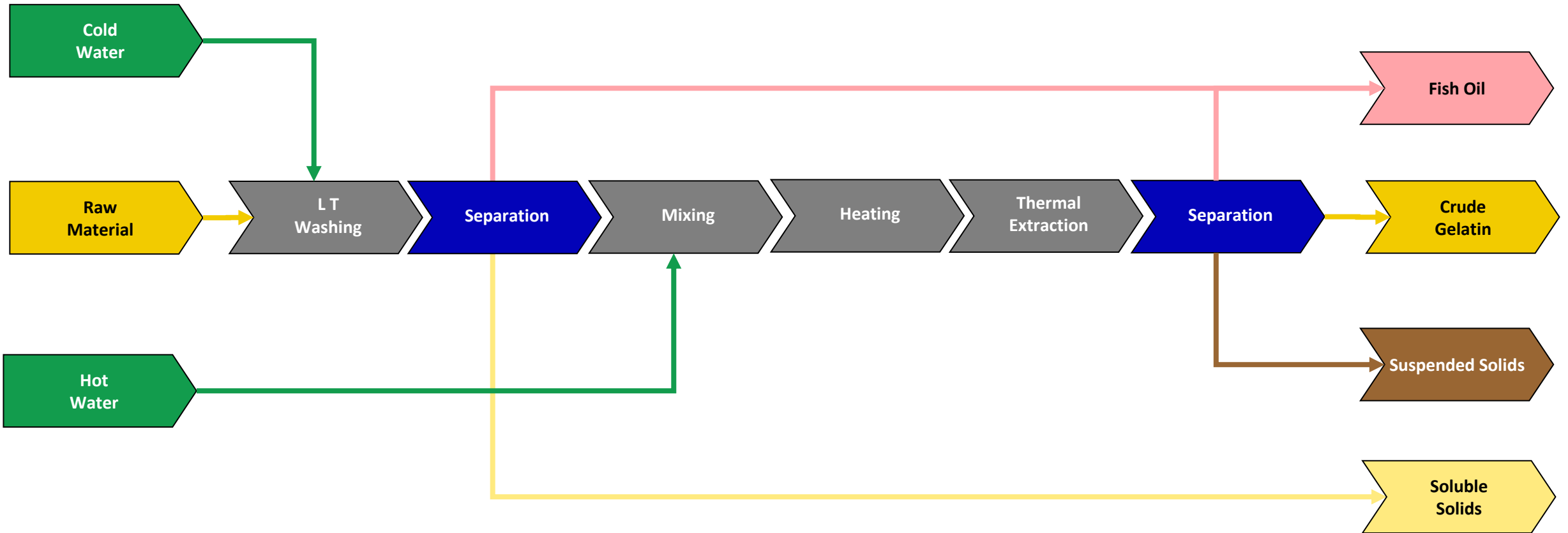
Typical process for: Skin (**Gelatin and Peptides**)

Pre-treatment



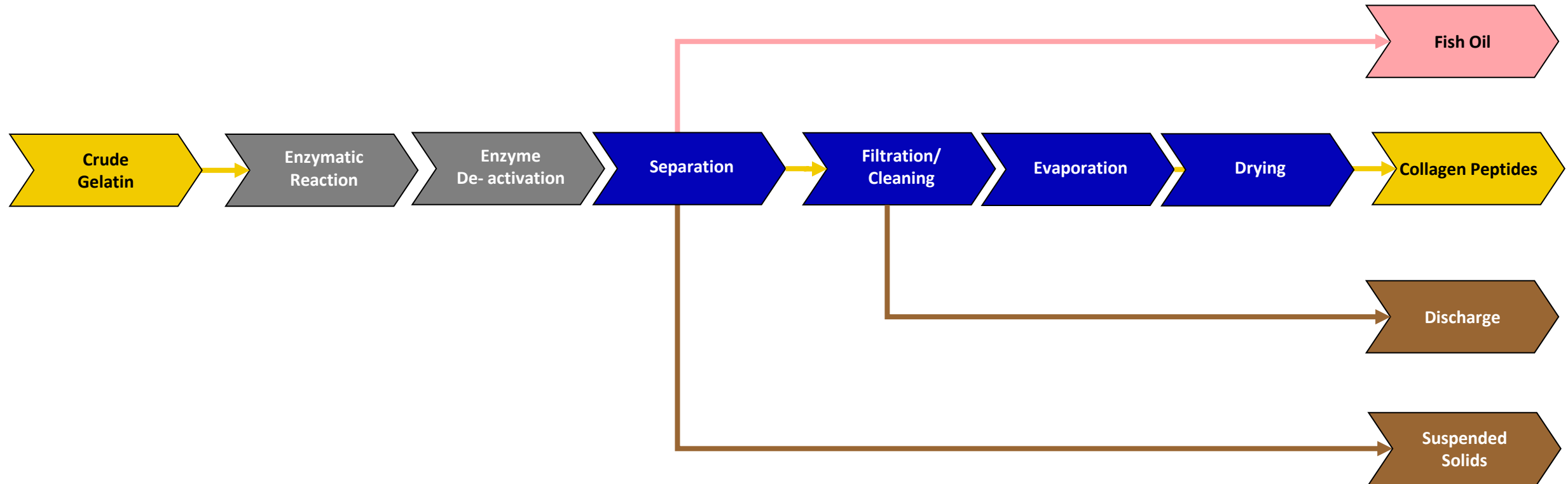
Typical process for: Skin (**Gelatin and Peptides**)

Pre-treatment/ De-naturation (thermal extraction)



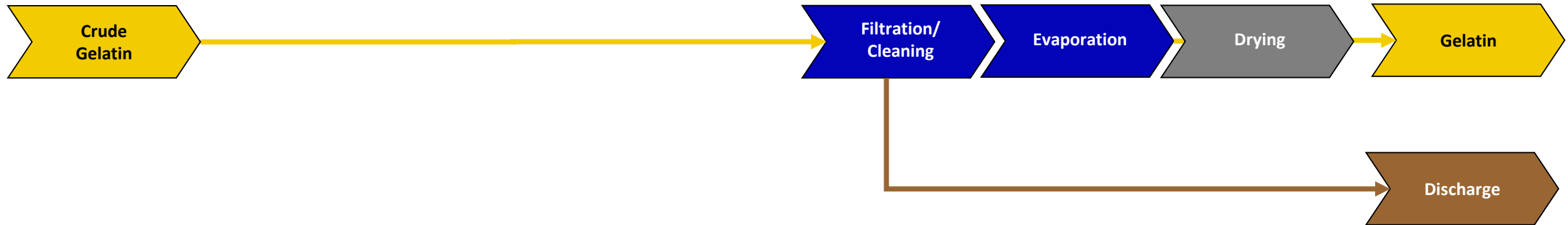
Typical process for: Skin (collagen- peptide)

Enzymatic treatment/ Fractionation/ Concentration



Typical process for: Skin (**Gelatin**)

Fractionation/ Concentration



General Design Features

Process:

- Sanitary design
- Food grade
- CIP cleanable



Summarize Process

Pre- treatment:

- Different process steps for different raw materials



Collagen Peptides:

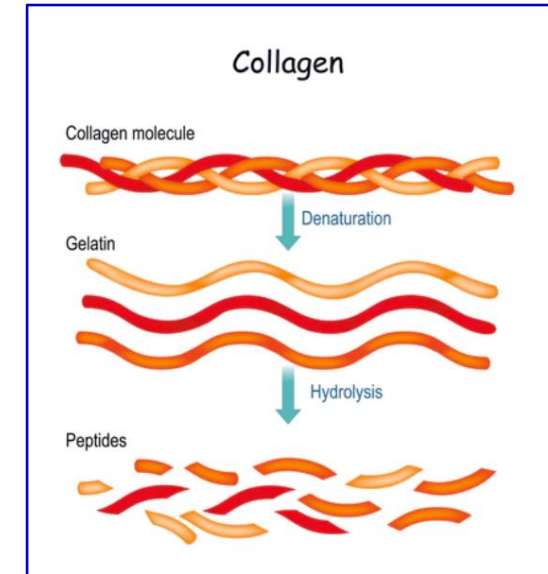
- Thermal extraction and enzymatic extraction
- More equipment but less complicated

Gelatin:

- Thermal extraction
- Less equipment but more difficult to get a product quality

Fish gelatin vers collagen peptides

	Gelatin	Collagen Peptide
Function	<ul style="list-style-type: none"> • Water binding • Viscosity • Gel building • Gel strength • Transparency 	<ul style="list-style-type: none"> • Water solubility • digestibility • “Health improvement”
Use	<ul style="list-style-type: none"> • Food ingrediencies 	<ul style="list-style-type: none"> • Nutraceutical • Food supplement
		



Advantages of Gelatin and Collagen Peptides

General:

- Gelatin and collagen- peptides are water soluble
- Better digestible than collagen
- Both products contain high amounts of amino acids
- Ethic aspects enlarge the group of consumer

Collagen Peptides:

- Collagen- Peptides as Nutraceutical (amino acids)

Gelatin:

- Gelatin in food applications for increasing of viscosity

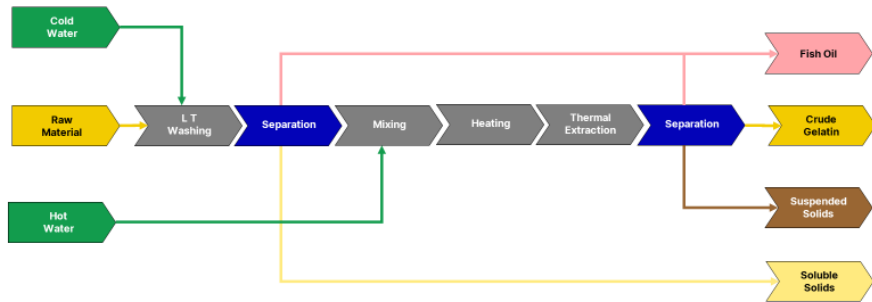
Summary: Fish Collagen Peptides

General:

- Different raw materials available
- Complex process with different by products
- Competition from animal raw materials
- Food grade design

Typical process for: Skin (Gelatin and Peptides)

Pre- treatment/ De- naturation (thermal extraction)

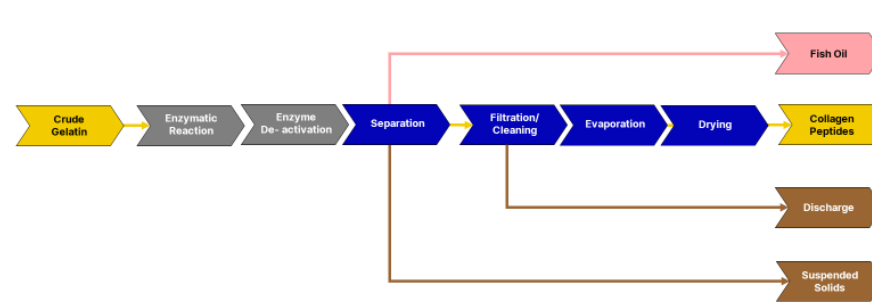


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Typical process for: Skin (collagen- peptide)

Enzymatic treatment/ Fractionation/ Concentration



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