

**BIOCHEMICAL AND
PHARMACUETICAL
PRODUCTS**



• **Biochemical products-** FPC
FPH
Fish oil

• **Pharmaceutical products-** Chitin
Chitosan
Fish gelatin
sea weeds

PHARMACEUTICAL PRODUCTS- FISH GELATIN

- It is a protein.
- Lacks in an EAA – **tryptophan**.
- High source of **lysin** and **methionine** which are deficient in cereal proteins.
- Gelatin can be extracted from the **skin** and **bones** of fish.



EXTRACTION

Raw fish skin



Washed in running water for **3-4 hours**



Draining off the water



Soaked in dil. NaOH, not more than **0.5% conc.** for **6-8 hrs**



Washed in running water for **3-4 hrs**



Maculated three times in fresh solution of **weak sulphurous acid**



Adding 2 parts of water to each part of pre –treated skin and heating to **70-80°C**
for **2 min.**

USES

- Used in food industry as a gelling, stabilizing, emulsifying, dispersing or thickening agent.
 - Used in photo engraving
 - Application in the optical industry in the formation of coating for light sensitive materials like blue print paper.
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CHITIN

- Second most abundant organic compound on earth (after cellulose)
- It is a white, hard, inelastic nitrogenous polysaccharide widely distributed in the exoskeleton of crab, shrimp and lobster and also internal structure of other invertebrates like squid.
- Shrimp shell and head waste constitute the single largest source of chitin, crab shell also.
- About 14-27 % of dry shrimp waste and 13-15% of dry crab shell is chitin.

PROCESS

Involves 2 steps-

1. Demineralisation
2. Deproteinization

- Demineralization is achieved using mineral acid & deproteinization achieved using dil. Solution of caustic soda.

Shell waste is stirred well with dil. HCl acid (1.2N) for 1-2 hr until it becomes soft



Liquid is decanted & washed with water



Demineralised mass is boiled in a 5% caustic soda in water for few min



Liquid portion is filtered off & residue is wash in water until free of alkali



Wet mass is dried under sun or hot air drier



Product is ready (chitin)



It is generally pulverised to the required mesh size before bagging

CHITOSAN

- It is deacetylated chitin.
 - Basic in nature.
 - Soluble in dil. acetic acid.
 - Natural polysaccharide comprising copolymer of glucosamine & N- acetyl glucosamine.
 - It is a copolymer consisting of β 1-4 ,2 - acetamido D- glucose & β 1-4, 2- acetamide D-glucose units
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PROCESS

Chitin is mixed with 40% sol. of caustic soda



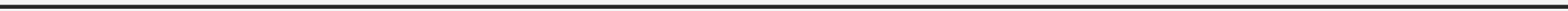
Heated by indirect steam of 90-100°C in a steam jacketed kettle for 90-120 min.



During heating sample – reaction mixture washed free of alkali & tested for solubility in 1% acetic acid sol.



Completion of deacetylation is indicated by complete solubility in acetic acid



End of the reaction– caustic soda sol. Is drained off & residue is washed until free from alkali



Then dried in sun or in hot air drier



Chitosan is pulverised to the required mesh size before bagging

USES OF CHITIN AND CHITOSAN

- Chitin is a growth promoter in animals & plants and used as a ingredients in their feed.
 - Clarifying agent of fruit juice and purification of drinking water.
 - Base of chromatography.
 - Used as a thickening & stabilising agent in food.
 - Used in fibres, films & membranes.
 - Used as sizing agent in textile and paper .
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SEAWEEDS

- Alginates, agar-agar and carrageenan – 3 principle products extracted from seaweed usually under the terms of phycocolloids.
 - Gel forming and water binding properties of phycocolloids make them highly useful in controlling crystal formation (ice crystal), for stabilising suspension, emulsions, solidifying agents and a variety of other uses.
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ALGINIC ACID

- Algin is the main polysaccharide occurring in the cell walls of brown algae.
 - It consists of D- mannuronic acid & L- guluronic acid in various proportions.
 - Sp. of brown sea weeds - **sargassum**, turbinaria, cystophyllum, padina sps.
 - Alginic acid serves as a stabilizer, emulsifier, thickening agent and industry, varnishes, leather polishing materials, etc.
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AGAR-AGAR

- Agar is a colloid extracted from *Gelidium cartilagineum*, *Gracilaria confervoides* and several other related rhodophyceae.
 - Agar are linear polysaccharide complexes.
 - Agar sol. are thermo labile and are rapidly degraded at either high or low pH.
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USES OF AGAR-AGAR

- Used both directly and indirectly human consumption.
 - As a thickener, gelatin agent, absorbent, lubricant, emulsifier.
 - Gelling agent in photo films and plates, in microbiological culture medium as a therapeutic agent.
 - Many pharmaceutical and food uses.
 - It is used as a constituent of medical pills and capsules and jellies.
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CARRAGEENAN

- It serves as an analogue to that of cellulose in land plants
- Philippines is the world's largest producers.
- Irishmass is also known as carrageenan.
- Imp sps- *Chondrus crispis*, *hypnea sp*, *Eucbema cottoni*.

USES

- It is superior to algin and agar in applications requiring high viscosity and thickening, emulsifying.
 - Wide use in dairy products.
 - Direct human consumption.
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BIOCHEMICAL PRODUCTS - FISH PROTEIN CONCENTRATION (FPC)

- it is a stable protein conc. prepared from whole fish .
- Protein conc. Is increased by removal of water, oil, bones \$ other material.
- FPC / Conc. Fish Protein Product (CFPP) are mixture of cross linked \$ or aggregated molecules of various muscle proteins.

STEPS

Whole fish



Wash & weighing



Grinding



1 extraction : room temp. (unheated isopropanol mixed) centrifuge -50 min.



2 extraction : higher temp. (75°C) , 90 min.



3 extraction : temp. (75°C) , 70 min., heat applied , azeotropic mixture of solvent

Drying - vapours



Milling – bone particles



Screening



FPC

PROCESS - 3

1. Viobin process
2. Canadian process
3. Azeotropic extraction method

Viobin process

In this , dehydration and removal of lipid from ground whole fish using ethylene chloride.

1. Ground fish is suspended in ethylene chloride.
1. Mass is heated to boiling using indirect steam with water boiling at 71°C lower than BP of ethylene chloride.

3. On condensation – the azeotropic distillate separates into 2 layers.
4. Solvent layer is pumped back into vessel to carry off more water.
5. Lipid remain in vessel dissolved in residual solvent.
6. Oil solvent sol. Is filtered off.
7. Residue is washed once/ twice with fresh solvent.
8. Heated in a steam jacketed vessel under vacuum to remove as much as solvent
9. The vessel is flushed with dry steam to remove the last traces of the solvent
10. Dry product is then pulverised & bagged.

2. CANADIAN PROCESS

- Fish – grinding
- Acidified with phosphoric acid (pH- 5.5)
- Cooking for 30 min. at 70-80°C with stirring.
- Filtered residue washed with hot water.
- Residue suspended in isopropyl alcohol \$ refluxed for 15 min.
- Solvent removed by filtration / centrifugation.
- Again treated with solvent
- Residue after final treatment is pressed \$ cake dried \$ pulverised.

3. EZIOTROPIC EXTRACTION METHOD

- Indigenous process
 - Involves extraction of fat from fish using eziotropic mixture of hexane & ethyl alcohol.
1. Fish
 2. Cooked in boiling water containing 0.5% acetic acid for 30 min.
 3. After draining off the liquid and solid matter is pressed well.
 4. Pressed cake is refluxed under constant stirring for 30 min. with a eziotropic mixture boiling at 58.68°C.

5. drained of solvent mixture
6. After distilling of the remaining solvent the extracted mass is steam stripped under reduced pressure.
7. Mass is dried & pulverised to a fine mesh size.
8. Final fat content in the product will be below 0.3 % on dry weight basis.

FPC TYPES – A, B & C

Proximate composition

	Component	Type - A (%)	Type - B	Type - C
1.	Moisture	10	10	10
2.	Protein (crude)	67.5	65	60
3.	Pepsin digestibility	92	92	92
4.	Available lysin	6.5	6.5	6.5
5.	Total lipid	0.75	3	10
6.	Chloride	1.5	1.5	2
7.	Silica	0.5	0.5	0.5
8.	fluoride	100 ppm	100 ppm	100 ppm

Residual solvent – isopropanol 250 ppm
ethylene dichloride 5ppm

USES OF FPC

- Intended for human consumption.
- 5-10 % FPC in bread & biscuit is considered limit.
- 38 g / person / day is recommended level of use of FPC.

Textured FPC

- In this process only meat is used.
- which kneaded with salt to make a paste.
- which is then treated with ethyl alcohol at low temp.

PROCESS

1. Meat separate from fish is 1st washed.
meat from low fat fish – light water
fatty fish – 0.4 % aq. Sol. of NaHCO₃.
2. Excess water is removed either by centrifuging or under press.
3. Meat is mixed with 0.5 -1 % NaCl, pH – 7.4-7.8 using NaHCO₃
4. After adding further 1-2 % more NaCl meat is kneaded to a viscous paste.
5. Mixed with 3 times its vol. of ethyl alcohol at 5-10 °C & stirred for 15 min.

6. Coagulate meat is extruded.

7. Alcohol is removed by centrifuging

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8. Mixed with 3 times its vol. of cool ethyl alcohol for 15 min.

9 . After removing the alcohol by centrifuging residue is dried in hot air at 30-40°C to a moisture less than 10%.

10. Products with different texture & rehydration capacity can be produced.

FISH PROTEIN HYDROLYSATE (FPH)

- fishery product from fish muscle wastes.
 - It is a spray dried product - used as a constituent in the preparation of fish protein powder.
 - It is a mixture of amino acid and peptides obtain after hydrolysis of protein.
 - Method of protein hydrolysis- 2
 - Chemical method - 1. acid hydrolysis
2. alkali hydrolysis
 - Biochemical method - 1. enzymatic
2. autolysis assisted hydrolysis.
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PREPARATION OF FPH POWDER

1. Take whole fish
2. Mince
3. Water, equal volume; enzyme, 0.15-0.3 %
4. Incubation – 40-50°C, to 4 hr.
5. Heat to 90°C to inactivate enzyme
6. Separation (oil, residue)
7. Liquified FPC
8. Spray dry
9. FPH powder.



APPLICATION

- Used as a source of essential amino acids.
 - Used as a ingredient in formulation of functional foods.
 - Used as a source of health promoting peptides.
 - Used in fertilizer preparation (organic manure).
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FISH OIL

- It is the fat or oil that's extracted from fish tissue.
- Fish oil – 2 types
 1. liver oil
 2. body oil
- It usually comes from – herrings, tuna, anchovies & mackerel.
- Sometimes produced from the liver of fish- cod
- Fish liver oil are used for therapeutic purposes – treatment of V- A&D.
- Cod liver oil – first used in medicine in **1789** to treat **Rheumatism**, followed by **rickets** in **1824**.
- Cod liver oil contains less omega-3 fatty acid but more V- A&D.
- Body oils have content of PUFA, n-3 PUFA used in control of heart ailments in humans.



USES OF FISH OIL

- 2 most important omega -3 fatty acid contain in fish oils are- Docosahexanoic acid (DHA) & Eicosopentaenoic acid (EPA).
- High unsaturated fish body oils can be used as drying oils in paints & varnishes.
- Used for human consumption.
- Used in margarine.
- Used in manufacture of linoleum, detergents, artificial rubber, lubricants, printing inks, soap, etc.

