

SRI YN COLLEGE AUTONOMOUS NARSAPUR

ZOOLOGY PROJECT:

FISH BY PRODUCTS

SUBMITTED TO;

LAKSHMI MEDAM

DEPARTMENT OF ZOOLOGY

*Value by
[Signature]*

SUBMITTED BY.

Y DIVYA

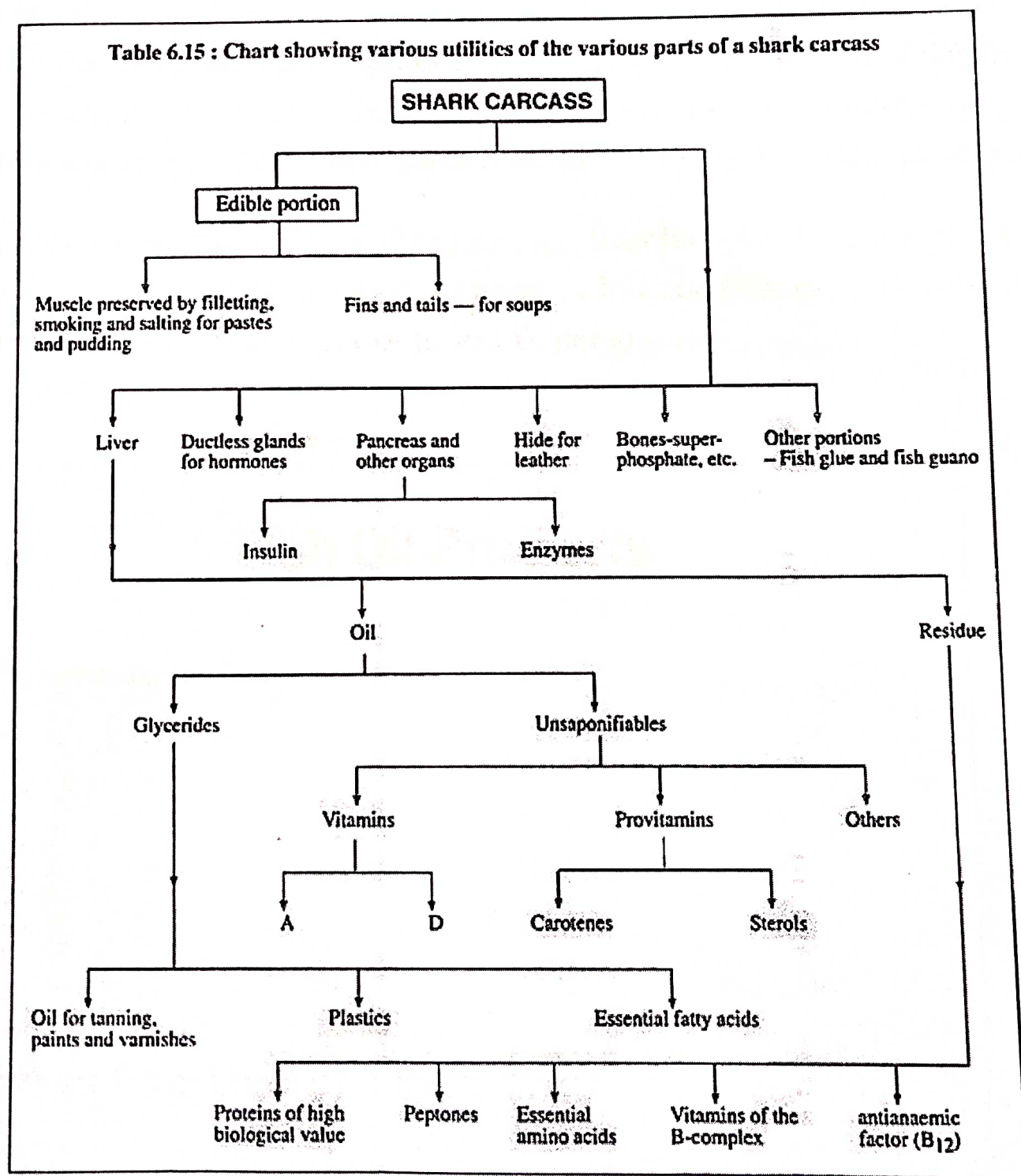
11806011

III Bsc Bzc

Kamal 2 / 15/9/21

By-Product # 1. Fish Liver Oil:

Fish liver oil is one of the most important by-products of fish. Liver, which is a part of the offal discard during dressing of landed fish, is the storehouse of glycogen and fat along with Vitamins A and D. This property of fish livers of certain fishes like Cod, Shark, Ray, Halibut, Tuna, etc. has rendered it of immense commercial value of providing highly medicinal 'liver oil'.



a) Composition of fish liver oil:

ADVERTISEMENTS:

ater — 20% to 36%

Proteins — 5% to 10%

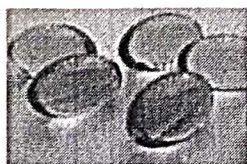
Fats — 55% to 75% (Unsaturated fatty acids higher in concentration than saturated ones).

ADVERTISEMENTS:

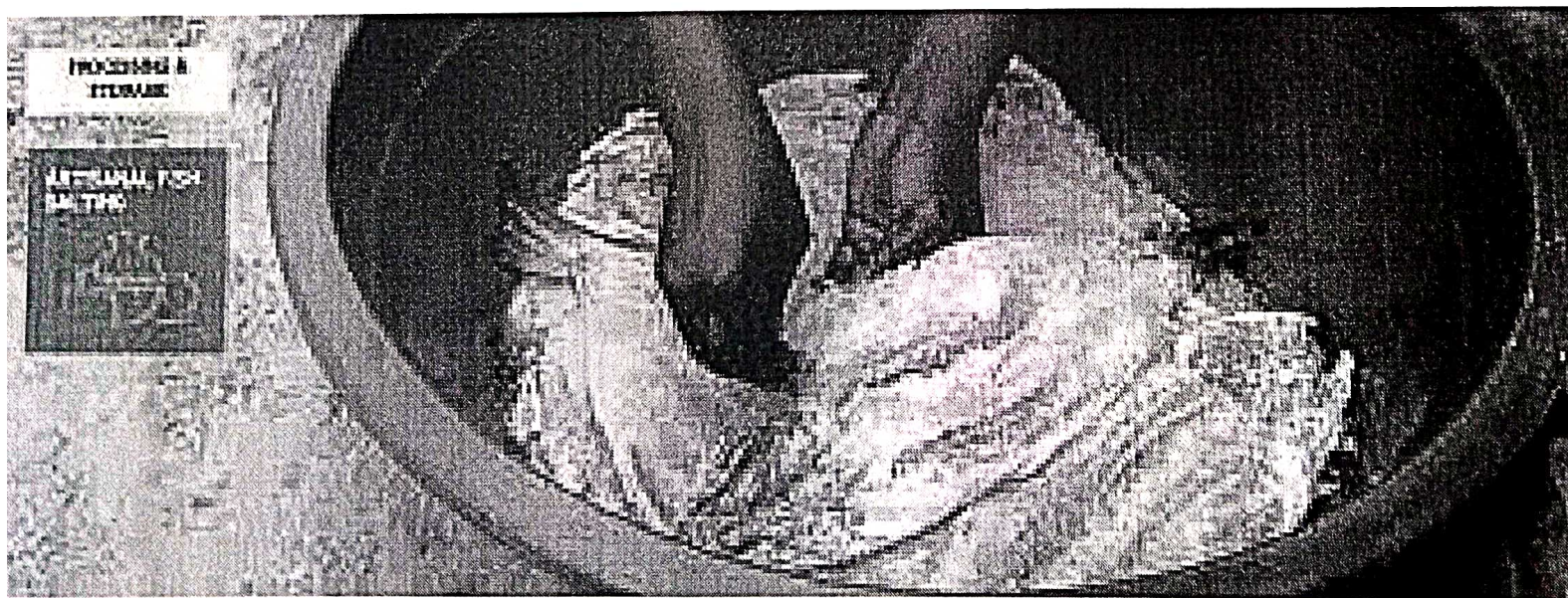
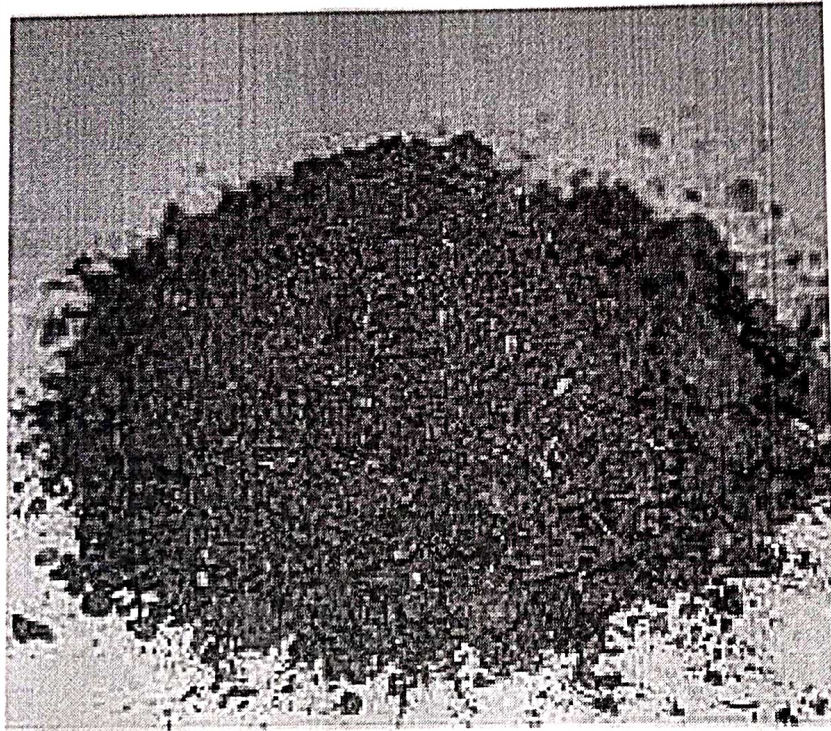
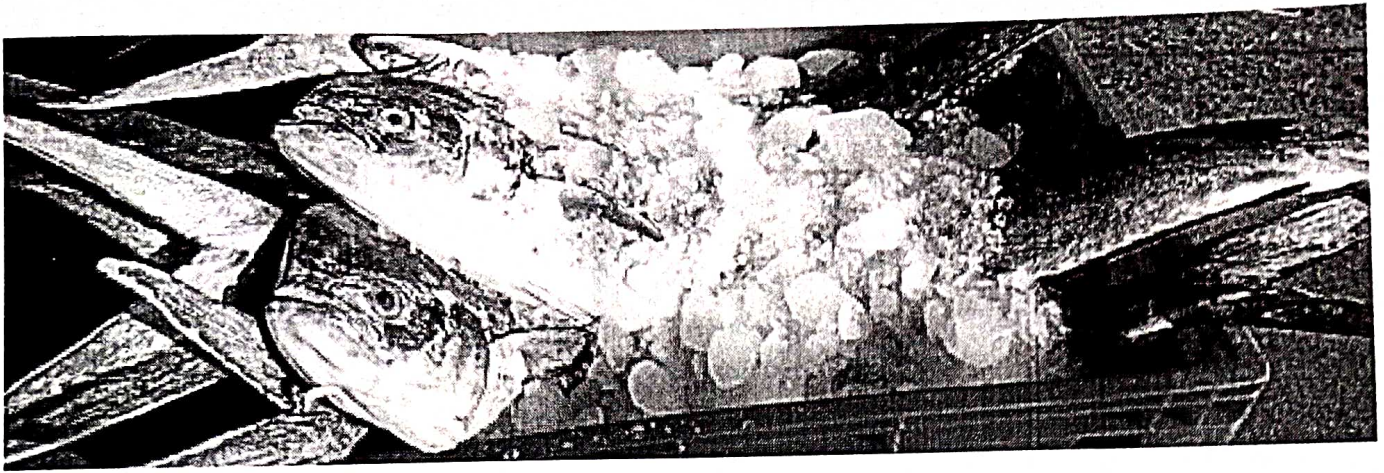
As fat carries with it high concentration of Vitamins A and D, the fat of fish liver is the source of vitamins A and D rich liver oil. However, the concentration of vitamin A and fat in the liver varies from fish to fish and from season to season.

Halibut (*Psettodes* sp.) and tuna (*Thunnus* sp.) liver have low fat but high vitamin A content (50,000 to 3,00,000 I.U. per gram), while cod (*Gadus* sp.) liver is rich in fat but poor in vitamin A (1000-3000 I.U. per gram).

Fish Oil Products

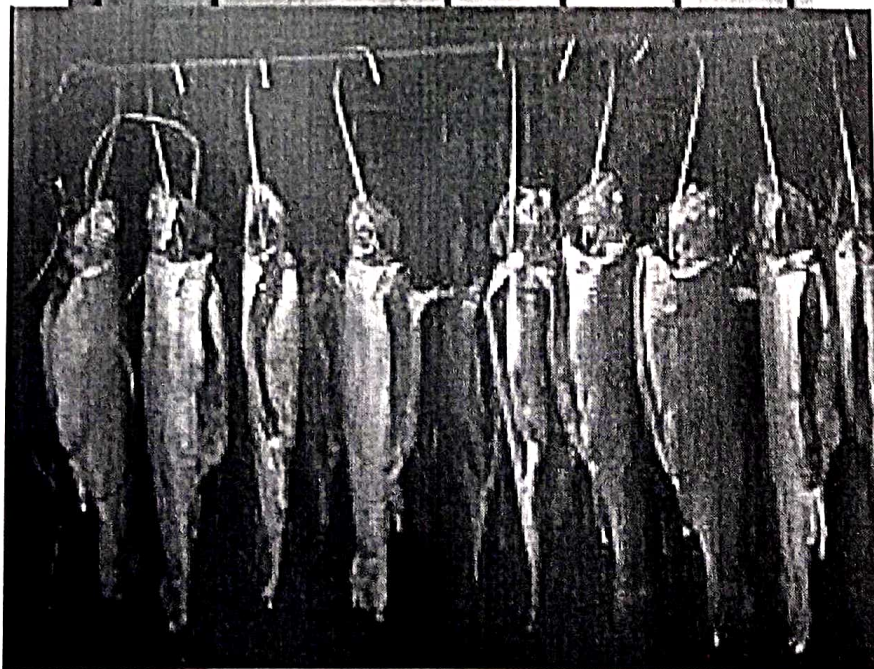


- Used as Food or Feed Ingredient
- Sources of Long Chain Omega-3 Fatty Acids





HAPPY STOPPING



Vitamins A and D present in fish liver oil is in proportion most suitable for human needs, as it has medicinal use in the form of prophylactic and curative.

ADVERTISEMENTS:

(b) Method of extraction of fish liver oil:

For extraction of quality liver oil it is essential that the liver of fishes be in good condition (either fresh or properly preserved). This is to guard the protein and fat rather than vitamin A content which is very stable.

Depending upon the method of extraction used, fish liver oils are of the following grades:

- (1) Crude oil used for burning,
- (2) High quality technical grade oil,
- (3) Intermediate grade oil, and
- (4) Edible oil for medicinal use.

The first three grades of oil are produced from diseased or discoloured livers while the last one is produced from fresh or suitably preserved livers.

(i) Oil extraction:

ADVERTISEMENTS:

Some popularly used methods of oil extraction are given below:

(1) By autofermentation:

Fish livers are first chopped into small pieces and exposed to sun in earthen pots for several days, so that it undergoes decomposition. As it undergoes decomposition, the oil that is released is collected. This oil is crude and used for burning lamps in curing yards.

(2) By boiling:

Chopped livers are boiled with sufficient quantity of water. The released oil is then decanted off easily. Although this method is simple, the yield, however, is moderate as all the oil is not extracted from liver. This method is generally followed in small scale industries.

(3) By steaming:

Minced livers of fishes such as cod (which has high oil content) are steamed at a temperature of 85-90°C under a pressure of 2 kg/sq. cm. The liver cells disintegrate and the oil is collected from the top layer. This method is good for operation while on board of fishing vessels or trawlers, where steam is readily available.

(c) Uses of fish liver oil:

Fish liver oil has the following uses:

- (1) Crude liver oil is used for burning purposes or making lights in curing yards by fishermen.
- (2) Fish liver oil because of its high vitamin A and D contents can cure or prevent occurrence of disease caused by the deficiency in the body of these two vitamins, such as rickets, xerophthalmia, impaired vision and eye defects, abnormalities of skin, mucous membranes and vertebrae.
- (3) When taken orally it will ensure good growth of bone and teeth and will develop more resistance to counter bacterial attack.
- (4) The stearin obtained by chi I ling the oil is used to make soaps of inferior grade and in leather curing.
- (5) Inferior pharmaceutical grades are used in animal and poultry feeds.

(6) The volatile fraction of the liver oil, distilled at 250°C is toxic to bacteria and fungi.

(7) Alkoxyglycerol present in shark liver oil provides a unique immune supporting nutritional effect.

(8) Squalene present in certain shark liver oil as a constituent of the unsaponifiable fraction of fish oil, is used as a mordant in the dyeing of synthetic fibres.

(9) Lecithin, present in high concentration in dogfish liver oil (and in the oil of fish eggs) is used as a wetting and an anti-bloom agent in the chocolate industry.

By-Product # 2. Fish Body Oil:

Fish body oil is the oil obtained from the entire body of fishes like Herring, Sardine, Salmon, Mackerel, Anchovy, etc. It is also extracted from offal and other wastes discarded from canneries or curing yards. Fatty fishes like Sardine yield more oil than non-fatty fishes. However, on an average about half kg of fish body oil can be obtained from five kg of fishes.

Fish body oil varies according to season, sex, size, age, nature of food and the locality from which it is caught. It has been observed that the body oil content in mackerel rises to a maximum in October- November and falls thereafter.

Fish body oil substantially differs from fish liver oil. Fish body oil is poor in vitamins A and D contents and has less unsaponifiable matter as compared to fish liver oil. The presence of various proportions of the glycerides of fatty acids (both saturated and unsaturated groups) has resulted in various uses of fish body oil.

Methods of fish body oil extraction:

There are two methods of extraction of fish body oil:

(i) Dry method and

(ii) Wet method.

(i) Dry method of extraction:

This method of extraction is used in fishes with low body oil content and the oil recovery is less than the wet process. The fishes are grounded in a grinder, cooked (with constant stirring) and pressed to recover the oil.

(ii) Wet method of extraction:

The wet method is employed for obtaining body oil in fishes such as Oil Sardine (*Sardinella longiceps*), which are rich in oil content. In the wet method, the fishes are crushed to a pulp and cooked with steam in a continuous vertical cylindrical cooker. The cooked material is then pressed and a mixture of oil and stick-water (pressed liquid of fish soluble) are collected into setting tanks or are centrifuged to separate the oil.

Refinement of fish body oil:

In both the above methods of oil extraction the residue (after pressing) is processed as a by-product — the fish meal. The oil thus collected after pressing contains protein debris and lots of other impurities such as water soluble and non-fatty acids of the body tissues.

Uses of fish body oil:

(1) After various refinement processes (as above), the better grades of body oils thus formed, are used for edible purposes.

(2) The fish body oil of high iodine value is very suitable for manufacture of paints and varnishes, as it is a drying oil.

- (3) It is used in dressing of leather and tanning of skin.
- (4) Body oil of low iodine value are generally preferred for making solid fats, such as margarine and lard (refined fat from the abdomen of a pig) substitutes.
- (5) It is used in the manufacture of laundry soap and cheaper grades of toilet soap, insecticidal soap, etc.
- (6) It is used in steel and iron industry for tempering of steel, concentration of low grade iron ores, etc.
- (7) Due to the presence of vitamins A and D, the fish body oil is used for medicinal purposes, for animal and poultry feed and in aquaculture practices.
- (8) It is used in the manufacture of chemicals such as alkyl halides, silicones and quaternary ammonium salts.
- (9) It is used in the manufacture of cosmetics, lubricants, candles and cutting oils.
- (10) Fish oil formulations when sprayed on citrus trees have proved effective as fungicide.
- (11) It is used in the manufacture of printing inks, water-proofer preparations, plastics and linoleum (a substitute for rubber).
- (12) Body oil is used for smearing the surface of boats for longer preservation.

By-Product # 3. Fish Meal:

Fish meal is the next most important product after fish liver and body oil. It is a preparation where the body of fresh fish is ground, cooked and dried. It is a highly nutritive product and is an excellent poultry and animal feed, which increases egg and milk production.

The nutritive value of fish meal depends upon:

(1) Type of fish used (low fat and salt content to be used),

(2) The state of freshness of fish,

(3) Season of landing and

(4) Manner of preparation.

Chemical composition:

Moisture — 6-12% (Moisture content is greater in lean fish than in fat fish).

Proteins — 55-70% (The protein of fish meal is of high digestibility coefficient and contains all the essential amino acids).

Oil/fat - 2-15%.

Minerals — 10-20% (calcium 5%, phosphorous 4% and iodine).

Vitamins — Very rich in vitamins A, B, B₁₂, D, K and E.

Raw material:

The raw materials include fishes such as sardines, mackerels, ribbon fish, silver bellies and other fishes. Sharks and rays yield superior quality of fish meal. Fish meal is also obtained as a by-product of the canneries and fish oil industries.

Preparation of fish meal:

For manufacturing of fish meal the following methods are employed.

(a) Preparation for small scale production:

The fish is first minced and then cooked. To remove moisture, the cooked mass is pressed in screw presses. The cake thus produced is dried in the sun, or in flame

driers in which the material is exposed to high temperature or generally in steam-jacketed drums under partial vacuum.

By-Product # 4. Fish Manure and Guano:

Fish manure and guano are inferior quality of fish meal. It is not fit for animal consumption. Fish manure is a by-product of the curing yards, fish glue industries and oil extraction plants, where trash or spoilt fishes have been employed.

Mackerel, horse mackerel, sardine, etc., which are spoilt and unfit for use as food is used for preparation of fish manure.

This manure has a high content of nitrogen (5-7%), phosphates about 4-6% and lime (CaO) 1-5%. For such nutrient content, fish manure is useful in raising coffee, tea and tobacco crops.

Fish guano is the by-product of the body oil extraction plant which is the dried refuse left after the oil is pressed out. Here oil bearing species such as oil sardines are used as raw material. Fish guano contains high concentration of nitrogen (8-10%) and appreciable quantities of phosphoric acid. For this, guano is several times more effective than any animal manure.

By-Product # 5. Fish Flour (Hydrolised Protein):

Fish flour is a superior quality fish meal, produced under strict control and care, and forms an ideal protein supplement for human diet, even for infants of 3-4 months old. On commercial scale, it is produced by a sophisticated solvent extraction process.

The process is complicated and is not expensive. Fish is chopped and washed. It is then boiled with dilute acetic acid at 80°C. The mass is then washed thoroughly and the water is pressed out.

This is then treated with petroleum to remove fat and also to increase its keeping quality. The mass, thus, obtained is then hydrolysed with an alkali, preferably with caustic soda (10% at 80°C). The entire mass is then liquefied when it is neutralised with acetic acid (85%). The liquid is then dried with a spray, which

subsequently forms a dry, cream coloured powder.

By-Product # 6. Fish Silage:

'Silage' generally means fodder converted in a cylindrical tank called 'silo'. Fish silage is a liquid or semisolid fish meal and is a highly nutritive animal feed. It is produced by adding 3-4% of an acid to a minced fresh fish or fish offal. Generally formic acid is used but sulphuric or propionic acid can also be used.

By using these acids the pH of the mixture can be lowered to 4.0 or below. This inhibits bacterial decay. The enzymes present in the chopped fish act upon it and reduce the mixture to slurry. An antioxidant is added to prevent rancidity of fats and the liquid can be stored in a silo up to 6 months.

Fish silage is also obtained by fermentation with lactic acid bacteria in molasses. The advantage fish silage has over fish meal is that the vitamins remain unaffected to a large extent and the product is free from fishy odour. Its production is more preferred in temperate regions (Norway, Denmark, etc.) than in tropical countries.

By-Product # 7. Fish Solubles:

The residual part of the liquid which is obtained during the extraction process of fish oil is known as fish solubles. It is valued as additives to dry feeds for animals.

It is rich in protein and vitamin B-complex and has the following composition:

Water —50.0%

Protein —33.9% (all essential amino acids)

Fat —2-6%

Ash — 9.4%

Vitamin B-complex and choline.

By-Product # 8. Fish Sausage and Ham:

Fish sausages are prepared from minced fish flesh that are stuffed into a prepared intestine or similar other casings. Fish ham, on the other hand, has small pieces of solid fish meat (pieces of one square cm), mixed with pasted fish meat. In both the preparation, spices and additives are added to improve the taste, flavour and keeping quality.

Spices include salt, sugar, chillies, onion, corriander, glutamate, egg- white, hydrogenated vegetable oil, etc. Additives comprise antiseptics and antioxidants (ascorbic acid) to prevent rancidity. Colouring agents also may be added. These products are commercially manufactured in Japan, Russia and USA, and are prepared from less valuable trash fishes.

By-Product # 9. Fish Macaroni:

Macaroni is a pasta (flour and egg food preparation of Italian origin), prepared from wheat flour in the form of dried, hollow tubes. Fish macaroni is a product

which is prepared from *Puntius carnaticus*. The fish is first minced and then mixed with tapioca or sorghum flour in equal parts.

It is then spiced with salt, chillies and tamarind. The product (paste) is extruded and dried. The product has good keeping quality, is cheap and easy to manufacture. It is manufactured on commercial scale by the Mysore Institute of India.

By-Product # 10. Fish Biscuits:

Fish biscuits are manufactured in Chile and Morocco. It is blended with biscuit mixture prior to baking.

By-Product # 11. Fish Glue:

Fish glue is a good adhesive obtained from trimmings, bones and skin of fishes belonging to order — Gadiformes (Cods, Pollack, Hakes, etc.). The raw materials are washed, chopped and steam-heated in steam-jacketed cookers.

The mass is then covered with water and to it is added small quantity of acetic acid. It is then cooked for 6-10 hours. The liquor is extracted and concentrated to form glue. The residue is dried and is used as manure.

Fish glue is used for:

- (1) Smearing the backs of glued stamps and labels.
- (2) Glue obtained from cod is of better quality and is used in photo-engraving.
- (3) Low quality fish glue is used as adhesive for paper boxes, shoes and other things like furniture where joining is required.

By-Product # 12. Isinglass:

Isinglass is a gelatin-like material obtained from the swim bladder or air-bladder of certain fishes. When put in water, it swells up but does not dissolve in it. At high temperature it hydrolyses in water to produce strongly adhesive gelatin.

Swim bladder is a hollow sac, the outer layer is thick and fibrous, while the inner one is thin, often with a silvery lustre. The thin, inner silvery shiny layer of the air-bladder of some fishes, such as sturgeons, carps and catfishes, is used to derive isinglass.

For preparing isinglass the air-bladders are collected, washed thoroughly to remove blood and other extraneous matters. Then the outer thick and fibrous layer of the wall is separated from the inner layer, which is exclusively isinglass raw material. This is then sun-dried and marketed.

Product # 13. Fish Skin:

The skin of larger fishes is collected, soaked in brine and left for a day. On the next day it is salted and again put in brine containing 10% hydrochloric acid. The skin is then taken out, drained and scraped on the surface, particularly to remove fine denticles present in the skin of sharks. They are then limed and tanned by the usual process.

Fish leather has various uses, such as:

- (1) Natives of old age used the dried and spiny skins of Globe fishes or Porcupine fishes for making war helmets.
- (2) In Japan the dried skin of Puffer fishes is inflated and used to make lanterns.
- (3) Now-a-days the skins of larger fishes, such as cod, salmon, halibut, toadfish, sharks and rays are tanned and marketed as ornamental leather and can be dyed in different colours.

By-Product # 14. Artificial Pearls:

The silvery scales of European cyprinid have been used for the manufacture of artificial pearls. By scrapping the scales, a glossy pigment is obtained. It is then coated on the inner surface and formed into hollow glass beads. The beads are then filled with wax.

By-Product # 15. Fish Fins:

The fins (except caudal fin) of shark are cut near the root, washed in sea water, dusted with a mixture of wood ashes and lime and dried in the sun or smoked. The cured product is crisp and brittle. In China and Philippines the shark fins are used in soup.

By-Product # 16. Fish Roe and Fish Caviar:

Roe (mass of eggs or spawn) of a number of fishes is considered as food. The protein of roe is tasteless and its digestibility co-efficient and biological value are

81 % and 88%, respectively. Roe fat is characterised by high lecithin (59%) and cholesterol (14%). Roe is a good source of vitamin B. It also has vitamins C, E and D.

Caviar is the processed and salted form of roe of any large sized fishes. The caviar of sturgeons is held in high esteem as a very delicious food and serves as an appetiser.

By-Product # 17. Medicinal Products:

- (1) The pancreas of shark is very rich in insulin. Whales also provide a considerable quantity of insulin. Fish replaces catties in providing raw material for the manufacture of insulin.
- (2) The large otoliths of Sciaenids are removed from the head and after rubbing and mixing them with water, are given to convalescent children suffering from rickets.
- (3) Amphipnous cuchia has been considered by fisher folks as a highly medicinal fish. As soon as the fish is caught, gram flour (besan) or wheat flour is rubbed on its body, so as to wipe out all the mucous. The flour with mucous is then made into small balls and then dried. Such balls (tablets) are prescribed to the persons suffering from impotency. It has been claimed that such persons soon regain their vigour and strength.
- (4) Live fishes such as *Clarias batrachus*, *Heteropneustes fossilis* and *Channa sp.* are valued for their high nutritive and medicinal properties.
- (5) *Sillago sihama* is considered good and nourishing for nursing mothers.

Handwritten signature