

## **Unit – III: Processing and Preservation of Fish and Fish By-products**

### **3.1 Fish Products**

#### **Fish Minced Meat**

Fish minced meat is obtained by mechanically separating the flesh from bones, skin, and connective tissues using a meat-bone separator. The minced material is white, soft, and uniform in texture. It is rich in protein and low in fat, making it suitable for preparing value-added products such as fish fingers, cutlets, nuggets, sausages, and patties. The quality of the mince depends on the freshness of the fish and the washing process used. Washing helps to remove blood, fat, pigments, and odor-producing substances, thereby improving the color and taste. The mince is usually mixed with cryoprotectants like sorbitol and sucrose before freezing to prevent protein denaturation during storage. Frozen fish mince can be preserved for several months. It offers an economical way to utilize small or low-value fish that are otherwise underutilized. It also helps in minimizing post-harvest losses in the fisheries sector.

#### **Fish Meal**

Fish meal is a dry, protein-rich product prepared from whole fish or fish waste through cooking, pressing, drying, and grinding. It serves as one of the most important products derived from fish processing industries. The production process begins with cooking the fish to coagulate proteins and release oil and water. After pressing, the solid portion known as press cake is dried and ground into a fine powder. Fish meal contains around 60–70% protein and is rich in essential amino acids, vitamins, and minerals. It is widely used in poultry, pig, and aquaculture feed formulations due to its high digestibility and nutrient value. In agriculture, fish meal acts as an organic fertilizer that improves soil fertility. Proper drying and storage are important to prevent spoilage and rancidity. Fish meal production helps in the effective utilization of fish waste, promoting economic and environmental sustainability.

#### **Fish Oil**

Fish oil is a valuable by-product obtained from fatty fish or as a secondary product from fish meal plants. The oil is extracted by heating and pressing the fish mass to separate oil from water and solid residues. The crude oil is then purified by centrifugation and filtration to remove impurities and moisture. It is a rich source of omega-3 fatty acids such as eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA), which have proven health benefits for humans. Fish oil reduces the risk of heart disease, lowers cholesterol, and

improves brain function. It is used in pharmaceutical capsules, dietary supplements, cosmetics, and paint industries. The by-products from oil extraction are further utilized in feed and fertilizer production. Regular consumption of fish oil is known to support joint health and enhance immune function. Proper storage in airtight containers is necessary to prevent oxidation and rancidity.

### **Fish Liquid (Ensilage)**

Fish ensilage is a liquid product produced by fermenting fish or fish waste using acids or microbial enzymes. The process involves grinding the raw material and mixing it with formic acid or lactic acid bacteria to lower the pH, which prevents spoilage and initiates autolysis. During fermentation, fish proteins are broken down into peptides and amino acids, resulting in a semi-liquid nutrient-rich product. It is an economical way to utilize fish waste, especially in areas where drying facilities are unavailable. Fish silage contains high-quality proteins, fats, and minerals that are easily digestible. It is mainly used as a supplement in livestock and poultry feed. The process requires minimal energy and equipment, making it suitable for small-scale coastal operations. Ensilage reduces waste pollution and contributes to sustainable fishery practices. It can also be stored for long durations without losing its nutritive value.

### **Fish Protein Concentrate (FPC)**

Fish protein concentrate is a highly nutritious, dry, and odorless powder obtained by removing water and fat from fish flesh. It contains up to 80–90% protein and is used to supplement human and animal diets. The preparation involves solvent extraction or enzymatic hydrolysis, followed by drying and grinding. FPC is used to enrich bakery products, soups, beverages, and infant foods in developing countries. It serves as an excellent source of essential amino acids and micronutrients. The product is light in color and bland in taste, which makes it suitable for blending with other foods. Fish protein concentrate production adds value to underutilized fish species and by-products. It also helps in addressing protein deficiency in human diets. The storage life is long due to its low moisture and fat content. However, care must be taken during processing to avoid oxidation and rancid flavor.

### **Fish Chowder**

Fish chowder is a thick, creamy soup prepared using minced or chopped fish, vegetables, milk, butter, and seasonings. The preparation involves gentle cooking to preserve texture and

flavor. It is a popular ready-to-eat product in many countries due to its rich taste and nutritional value. Fish chowder provides a balanced meal with proteins, vitamins, and minerals derived from fish and vegetables. It can be packaged in cans or frozen containers for long shelf life. The product is often used as a convenient meal for quick consumption. Proper sterilization and sealing are necessary to ensure microbial safety. The use of different species of fish adds variety in taste and texture. Commercial fish chowder production promotes the use of minced meat from small fish species, adding value to by-catch. It is gaining popularity as a healthy and easy-to-prepare food product.

### **Fish Cake**

Fish cake is a value-added product made from minced fish mixed with flour, starch, salt, spices, and flavoring agents. The mixture is shaped into patties or balls and cooked by frying, steaming, or baking. Fish cakes are highly nutritious and rich in protein and omega-3 fatty acids. They are widely consumed as snacks and convenience foods in many countries. The quality depends on the freshness of the fish and the proportion of ingredients used. Fish cakes can be frozen, vacuum-packed, or canned for long-term storage. They are an effective way to utilize low-cost fish species and increase the economic value of fish. In addition, they serve as an attractive option for export markets due to their popularity in international cuisines. Fish cakes can be made from marine or freshwater species, depending on local availability.

### **Fish Sauce**

Fish sauce is a fermented product made by mixing small fish or fish waste with salt and allowing it to ferment for six to twelve months. During fermentation, enzymes and microorganisms decompose fish proteins into amino acids and peptides, giving the sauce its distinct umami flavor and aroma. The liquid is filtered and bottled as a seasoning for various dishes. It is an important condiment in Southeast Asian cuisines, particularly in Thailand, Vietnam, and the Philippines. Fish sauce is rich in essential amino acids and has a long shelf life due to its high salt content. The fermentation process enhances both flavor and preservation. It represents one of the oldest traditional methods of utilizing fish. Modern production includes controlled fermentation techniques to maintain consistent quality. It also provides a good source of nutrition and contributes to the culinary diversity of fish products.

### **Fish Salads**

Fish salads are prepared from cooked, canned, or smoked fish mixed with vegetables, mayonnaise, or dressings. They are rich in protein, vitamins, and minerals and serve as

healthy ready-to-eat food options. The freshness and flavor of the fish used determine the overall taste and appeal. Fish salads are popular in restaurants, catering services, and health-conscious diets. The product is often chilled or vacuum-packed to preserve freshness. It is convenient for quick meals and provides essential nutrients without heavy processing.

Ingredients such as tuna, mackerel, or sardines are commonly used due to their availability and flavor. Fish salads contribute to increasing the consumption of fish in urban areas where fresh fish may not always be accessible. Proper hygiene and cold storage are important to maintain quality. The variety of ingredients allows endless recipe combinations to suit local tastes.

### **Fish Powder**

Fish powder is made by drying fish meat or fish waste at low temperatures and grinding it into a fine powder. It retains most of the nutrients, including protein, calcium, and phosphorus. Fish powder is used as a flavor enhancer, food supplement, and ingredient in soups, snacks, and baby foods. The drying process ensures long shelf life and prevents microbial spoilage. It serves as an economical way to utilize small and low-value fish species. The powder form makes it easy to transport and store. It is also widely used in animal feed formulations, providing essential nutrients for livestock and poultry. Fish powder helps in minimizing fish waste and supports the development of sustainable fisheries. It is an excellent example of value addition and waste utilization in the seafood industry.

### **Pet Food from Trash Fish**

Pet food prepared from trash fish is a practical use of fish that are unfit for human consumption due to small size or poor market value. These fish are cooked, minced, and blended with grains, vitamins, and minerals to form nutritionally balanced pet feed. The mixture is then extruded into pellets, dried, and packaged. Fish-based pet food is rich in protein, essential fatty acids, and minerals that promote healthy growth in pets. It is used for cats, dogs, and ornamental fish. The process ensures minimal waste of fish resources and provides an additional income source for fishermen. Pet food production also reduces environmental pollution by utilizing fish waste effectively. It is a growing industry supported by the increasing demand for high-quality pet nutrition. The product is safe, digestible, and long-lasting when properly processed and stored.

### **Fish Manure**

Fish manure is an organic fertilizer made from fish waste, spoiled fish, or by-products. The

material is decomposed through microbial action to release nutrients like nitrogen, phosphorus, and potassium. It improves soil fertility, enhances water retention, and promotes plant growth. The manure can be applied directly or after composting with other organic matter. It is especially beneficial for vegetable and fruit crops. Fish manure contributes to sustainable agriculture by recycling fish waste into valuable organic inputs. The preparation is simple and inexpensive, making it suitable for coastal farming communities. It reduces dependency on chemical fertilizers and supports eco-friendly farming practices. The use of fish manure also helps in minimizing waste disposal problems in fish processing industries. It is an ideal example of circular economy in fisheries.

### **3.2 Fish By-products**

#### **Fish Glue**

Fish glue is a natural adhesive obtained by boiling fish skins, bones, and bladders to extract collagen. The extracted solution is concentrated and dried into sheets or a viscous liquid. It has strong adhesive properties and is widely used in woodworking, paper making, and bookbinding. The glue becomes sticky when dissolved in warm water and forms a strong bond upon drying. It is biodegradable, non-toxic, and derived from renewable fish resources, making it environmentally friendly. The quality of fish glue depends on the raw material and method of extraction. It is also used in the manufacture of musical instruments, handicrafts, and decorative items. Fish glue production helps utilize fish waste effectively, reducing environmental pollution. Although synthetic adhesives have replaced it in many industries, fish glue still finds use in traditional and artistic applications.

#### **Isinglass**

Isinglass is a pure form of gelatin derived from the dried swim bladders of certain fish species such as sturgeon, catfish, and carp. It is used primarily in the clarification of beer, wine, and vinegar, where it helps remove suspended impurities by coagulation. Isinglass has a high gel strength and excellent purity, making it suitable for food, pharmaceutical, and cosmetic applications. It is odorless, tasteless, and easily soluble in warm water. In addition to its industrial use, isinglass has applications in the preparation of adhesives, photographic films, and confectionery items. It is also used in surgical dressings due to its natural protein composition. The process of making isinglass includes cleaning, drying, and shredding the

swim bladder into thin strands. The use of isinglass has declined due to the availability of cheaper gelatin alternatives, but it remains valuable for premium products.

### **Chitosan**

Chitosan is a natural biopolymer obtained from chitin, a structural component found in the shells of crustaceans and fish scales. It is produced by deacetylation of chitin using alkaline treatment. Chitosan is biodegradable, biocompatible, and non-toxic, which makes it valuable in various industrial and biomedical applications. It is used for water purification as it can bind heavy metals and impurities. In food industries, chitosan serves as a coating to extend the shelf life of fruits, vegetables, and seafood. It is also used in pharmaceuticals for drug delivery systems, wound healing materials, and dietary supplements. In agriculture, it acts as a natural plant growth enhancer and disease resistance inducer. The demand for chitosan is increasing due to its eco-friendly nature and versatility. It is an excellent example of high-value utilization of fishery waste.

### **Pearl Essence**

Pearl essence, also known as guanine, is extracted from the silvery scales of certain fish species such as herring and sardine. The substance reflects light and gives a shiny, iridescent appearance similar to pearls. It is mainly used in cosmetics, especially in nail polish, lipstick, and creams, to impart a shimmering effect. Pearl essence is also used in paints, decorative items, and artificial pearl manufacturing. The process involves washing, grinding, and extracting guanine crystals from fish scales using alcohol or acetone. The extracted material is purified and suspended in a suitable medium for use in various products. The production of pearl essence adds value to fish scales, which are often discarded as waste. The demand for natural pearl essence is high in the cosmetic industry due to its brilliance and safety. This by-product industry also provides employment in coastal areas.

### **Shark Fins**

Shark fins are the cartilaginous extensions of shark species that are processed and dried for culinary purposes. They are used to prepare shark fin soup, a delicacy in some Asian countries. The fins are removed, cleaned, boiled, and sun-dried to obtain translucent strands known as fin rays. These fins are composed mainly of collagen and are valued for their texture rather than taste. However, the trade of shark fins has led to the overexploitation of shark populations worldwide. Many countries have now imposed bans and strict regulations on shark finning to conserve marine biodiversity. Ethically managed harvesting and the use

of shark by-products are encouraged as sustainable alternatives. In addition to food use, shark fins contain compounds that are being studied for potential medicinal properties. The decline in traditional shark fin markets is also encouraging the use of plant-based or synthetic substitutes.

### **Fish Leather**

Fish leather is produced from the skins of large fish species such as shark, catfish, salmon, and tilapia. The skins are tanned using vegetable tannins, chromium salts, or other tanning agents to produce a strong, flexible, and durable material. Fish leather is unique due to its attractive scale patterns and high tensile strength, which is greater than that of cow leather of the same thickness. It is used in the production of wallets, handbags, belts, shoes, and decorative items. The tanning process removes unpleasant odor and ensures stability of the material. Fish leather is an eco-friendly alternative to conventional animal leather as it utilizes waste from fish processing. It is lightweight, water-resistant, and available in various colors and finishes. The product has gained popularity in fashion and handicraft industries worldwide. It represents a sustainable innovation in the utilization of fish by-products.

### **Fish Maws**

Fish maws are the dried swim bladders of large fish species such as croakers, catfish, and sturgeon. They are considered a delicacy in traditional Chinese cuisine and are also used in medicine due to their high collagen content. The preparation involves cleaning, boiling, and drying the swim bladders under hygienic conditions. Fish maws are valued for their texture and nutritional properties, particularly their ability to improve skin elasticity and joint health. They are also believed to have restorative and healing effects in traditional medicine. The product is lightweight, easy to transport, and has a long shelf life. In international markets, fish maws fetch high prices, contributing significantly to export earnings. The trade of fish maws encourages the full utilization of fish resources and minimizes waste. Sustainable harvesting and proper regulation are essential to maintain the supply and ecological balance.