

## Chapter 16

### Seafood packaging

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#### Food packaging

Food packaging is an external means of preservation of food during storage, transportation and distribution and has to be provided at the production center. It forms an integral part of the production process and has an important function in the distribution of food. In today's consumer oriented market, a package is an extremely vital link between the manufacturer of the product and the ultimate user. There is great awareness among the consumers today regarding their right to obtain proper quality and correct quantity of the product at a fair price in an aesthetic and hygienic package. Hence the basic function of food packaging is to protect the product from physical damage and contaminants, to delay microbial spoilage, to allow greater handling and to improve the presentation.

#### Need for packaging of fish and fishery products

Fish is a highly perishable food item and should be handled at all times with great care, in such a way so as to inhibit the growth of microorganisms. Fish is having a unique biochemical composition and its quality deteriorates rapidly and the potential shelf life is reduced if they are not handled and stored properly. The quality and type of packaging materials and the methods of packaging and storage are, therefore, of great importance for preserving the quality of fish. Fish and fish products can generally be grouped into fresh fish, frozen fish, thermally processed fish, dried fish and other value added fishery products. Each category requires special requirements for packaging and storage and hence different packaging materials.

#### Fresh fish packaging

More than 20% of the fresh fish caught in many tropical areas is wasted due to poor handling and lack of proper packaging and transportation facilities. Fish after catch will remain fresh only for a limited period, 4-6 hours, depending on the environmental conditions and the intrinsic nature of the fish. The fish landing centers are far away from places where fish is processed or marketed and, therefore, they have to be

transported over long distances. Fish must be cooled immediately after landing to prevent microbial deterioration. It is reported that the rate of spoilage doubles with every 5.5°C rise in temperature. Chilling by mixing fish with ice is the cheapest and most efficient method of preservation of fresh fish. The most effective way in which the temperature of wet fish is kept down at the required level is by mixing it with ice. Therefore, the design and material of the container used for transporting fish should have insulating properties to reduce, as much as possible, the rate of melting of ice. In addition, the other requirements of a suitable fresh fish package are to: reduce dehydration, reduce fat oxidation, provide for less bacterial and chemical spoilage and be capable of being washed reasonably, free of bacteria, eliminate drip and prevent odour permeation.

### *Bulk fish packaging*

Fish sold immediately in local markets may not need any special packaging, but a proper packaging to ensure better shelf life becomes essential when it has to be transported to distant localities. For bulk fresh fish packaging, following are the requirements:

- The container should be sturdy
- Shall be of light weight, hygienic and easy to clean
- Shall possess good insulation properties
- Should have good barrier properties

Double walled insulated moulded plastic containers, made of High density polyethylene (HDPE) or polypropylene (PP) with polyurethane insulation sandwiched between the inner and outer walls are suitable. They are durable, lighter in weight, and in normal use have a life span of over 5 years. These containers are hygienic and easily washable and provide good insulation. The other types of packages used for fresh fish transportation is the moulded container made from expanded polystyrene. Such boxes are very light in weight, provide very good insulating properties and can be cleaned easily by washing.

### *Retail packaging of fresh fish*

The retail packaging of fresh fish in convenient forms is gaining popularity and the retail pack must be clean, crisp and clear and make the contents appear attractive to the consumer. The most popular form of package for fresh fish is a shallow tray of moulded pulp, foam polystyrene or clear polystyrene, which is over-wrapped with a plastic film which may

be printed or over which a pressure sensitive label is applied. Generally food-grade Poly Vinyl Chloride (PVC) films are used as overwraps.

### **Packaging of frozen products**

#### *Raw frozen fishery products*

Frozen raw fish and cooked shrimps constitute the major chunk of seafood products for export market. Frozen products are of two types in general – Block frozen and Individually Quick Frozen (IQF).

In case of Block frozen products, the fishery products are frozen with adequate glaze water and the frozen block is once again glazed in ice-cold water before final packing. The principal considerations in packaging requirement are adequate strength to withstand handling stress and strain and resistance to moisture. Fishes are frozen as blocks, packed in duplex board carton lined with low density polythene (LDPE) and such cartons are packed in a master carton made of 5 or 7 ply corrugated fiber board boxes.

Shrimps in various styles are generally processed in Individually Quick Frozen (IQF) form. The other major IQF products are cooked whole lobster, lobster tail, lobster meat, cuttle fish fillets, boiled clam meat and fish fillets from white lean fishes. The packaging requirements of IQF products vary considerably from those of block frozen products as they are in consumer packs. The risk of moisture loss or oxidative reaction leading to flavour changes etc. are more since each product in an IQF pack is remaining as a discrete piece. Some of the essential characteristics desired out of a packaging material for IQF shrimp are:

- Low water vapour transmission rate (WVTR) to reduce the risk of dehydration.
- Low oxygen/gas permeability (OTR/GTR), thereby reducing the risk of oxidation and thus changes in odour and flavour, and retention of volatile flavours.
- Flexibility to fix the contours of the product.
- Resistance to puncture, brittleness and deterioration at low temperature.
- Ease of filling, packing and sealing.

Monofilm, co-extruded film or laminated pouches of different capacities varying from 500 g to 4 kg per pack are generally used. The unit pouches

may be provided with unit/intermediate cartons or directly packed in master cartons. The unit / intermediate cartons are made of duplex or 3 ply corrugated fiberboard. The most functionally effective film has been identified as 10 microns Biaxially oriented Polypropylene (BOPP). Cartons made of 5 or 7 ply corrugated fiberboard having minimum compression strength of 500 kg can be safely used as master carton for IQF products.

#### *Battered and breaded fishery products*

Battered and breaded products are an important class of value added products having great demand in the export and internal markets. The battering and breading process increase the bulk of the product and a number of products can be prepared from fish minced meat, shrimp, squids, cuttle fish etc. Battered and Breaded products in convenience form include battered and breaded peeled shrimp, fantail (butterfly), shrimp round tail-on, squid rings, stuffed squid rings, stuffed squid, fish fillets, fish fingers, fish cutlets and fish patties. The changes taking place during frozen storage of the value added products are desiccation, discoloration, development of rancidity etc. Application of proper packaging prevents or retards these changes and enhances shelf life. Thermoformed containers are commonly used for the packaging since conventional packaging materials alone are not suitable for these products. Thermoformed containers provide mechanical protection to the products and as a result the products do not get damaged or broken during handling and transportation. Thermoformed trays produced from food grade materials are suitable for the packaging. Generally trays made of materials like PVC, HIPS(High Impact Polystyrene) and HDPE are unaffected by low temperature of frozen storage and provide protection to the contents.

#### **Packaging of dried fishery products**

A large chunk of fish catch is salted and dried for internal consumption. Dried fish is highly hygroscopic in nature and absorbs moisture when the climate is humid. When it comes in contact with air or oxygen, the deterioration due to oxidation is rapid. Dried fish is also prone to attack by insects. The most important requirements for a dried fish/product package are inertness, leak-proofness, impermeability to oxygen and moisture and less transparency. Resistance to mechanical abrasion and puncture is also required.

#### *For bulk packaging*

The packaging employed for internal distribution is baskets improvised with braided coconut leaves or palmsheaths. An overwrap

with gunny fabric is given as reinforcement in the case of products meant for export and those which have to be transported over long distances. These packages are however prone to easy entry of insects, rodents and other pests. The product being highly sensitive to changes in relative humidity, the packaging has to be sufficiently water vapour proof. Among different packaging materials studied for bulk packaging of dried fish, high density polyethylene (HDPE) woven gusseted bags laminated with 100 gauge low density polythene (LDPE) are found quite suitable.

#### *For consumer packs*

The commonly used packaging materials for consumer packs of dry fish are low-density polythene or polypropylene. These materials are cheap, readily available and have good tearing and bursting strength. Disadvantages are high water vapour and gas transmission rate, proneness to puncture or damage from sharp spines and smell coming out. Shelf life is limited. The use of Polyester-Polyethylene laminated pouches for consumer packs is considered as a suitable alternative.

### **Packaging of thermally processed fishery products**

Thermal processing is one of the most widely used methods for fish preservation which facilitates long-term stability for a wide range of seafood products. In thermal processing, food is preserved in hermetically sealed containers, subjected to very high temperatures and pressure and the processed product is stored at ambient temperatures.

#### *Cans*

Cans are generally used for the packaging and processing of heat sterilized products. Today there are several choices available like standard tin plates, light weight tin plate, double reduced tin plate, tin free steel (TFS cans) and vacuum deposited aluminium on steel and polymer coated tin free steel cans. For fishery products they are coated inside to get desirable properties like acid resistance and sulphur resistance. But care has to be taken to avoid tainting of the lacquer. Metal cans are advantageous as packages because of superior strength, high speed manufacturing and easy filling and dosing. Disadvantages of metal cans are weight, difficulty in reclosing and disposal.

#### *Retort pouches*

Retort pouches are the flexible laminated packaging materials required for thermal processing of fishery products. The three or four layer retort pouches consist of an outer polyester layer, a middle aluminum

layer and an inner cast polypropylene layer. Nylon is also added as an additional layer or is substituted for the aluminum layer to give additional strength in a four layer pouch. Aluminium foil is the barrier layer which gives the product a longer shelf life. Polypropylene has a high melting point of about 138°C and is used as the inner layer to provide critical seal integrity, flexibility, and strength. It also provides flavor locking properties, making it compatible for a wide range of products. The different layers are held together with adhesives which are usually modified polyolefins such as Ethylene Vinyl Acetate (EVA).

### **Packaging for other seafood products**

#### ***Surimi***

Surimi is mechanically deboned fish mince that has been washed, refined and mixed with cryoprotectants for frozen storage. It is generally frozen as rectangular blocks and is an intermediate product or raw material for processing several value added products like shrimp and crab analogues and a variety of other products. In order to prevent deterioration during storage like oxidative rancidity and desiccation, the packaging materials used have low water vapour permeability and low permeability to gases and odours. The packaging materials employed should be sufficiently strong and durable to withstand stress during handling, storage and distribution. Packaging employed for block frozen fish and shrimp are considered safe for surimi.

#### ***Fish sausage***

Fish sausage is a product for which surimi is the base material, which is homogenised after mixing with several other ingredients. The homogenised mass is stuffed in synthetic casings like Ryphan (Rubber hydrochloride) or Kurehalon (Vinylidene chloride). The casing is closed using metal rings after which it is heated in water at 85-90°C and then slowly cooled. After drying the surface the sausage is wrapped in cellophane laminated with polythene. Fish sausage is kept at refrigerator temperatures for retail marketing but kept frozen for prolonged storage. Duplex cartons lined with a plastic film are ideal for short-term storage, for prolonged storage, packaging suggested for block frozen fish and shrimp is suitable.

#### ***Fish curry***

Fish curry is a processed product presented in a 'ready to serve' style. It can be preserved both by freezing and by heat processing. For frozen stored curry, the common problems met with are discoloration,

desiccation and rancidity. Thermoformed trays made of food grade polystyrene or polyvinyl chloride is an ideal packaging for frozen fish curry. For thermally processed fish curry, retortable flexible pouches are identified as the ideal choice of package as they offer advantage of low cost, boil-in-bag facility, ease of opening and reduced weight. The suitable flexible laminate is Polyester/Aluminium foil/Cast Polypropylene.

### ***Fish pickles***

Conventionally glass bottles are used as containers, which offer properties like inertness, non-toxicity, durability, non-permeability to gases, moisture etc. But they are heavy, prone to break, voluminous and expensive. New flexible packaging materials developed for fish pickle is based on polyester laminated with LDPE-HDPE co-extruded film or Nylon/Surlyn or LD/BA/Nylon/BA/Primacore. These are inert to the product, can be attractively fabricated as stand up packs and can be printed on the reverse side of the polyester film. For dry fish pickles the packaging material which offers safe storage of the product up to 14 months at ambient temperature has been identified as nylon/surlyn or LD/BA/nylon/BA/primacore.

### ***Fish soup powder, Fish Protein/Hydrolysate powders***

Such powdered products are hygroscopic and hence the selection of the package assumes great significance. Appropriate package developed for such products are 12 micron plain polyester laminated with LDPE-HDPE co-extruded film or 90-100 micron LD/BA/Nylon/BA/Primacore multilayer film which ensures a safe storage.

### ***Accelerated freeze dried (AFD) products***

These are practically devoid of moisture, its percentage generally being below 2. The products are very fragile and can easily undergo chemical reactions with air leading to oxidation, deterioration of colour, absorption of water etc. They are generally packed under an inert gas to exclude air and oxygen. Hence the main requirements in the packaging employed are low oxygen and water vapour transmission to protect the product from rancidity and absorption of moisture and sufficient mechanical strength to protect from shock. Paper/Aluminium foil/Polythene laminates or metallised Polyester-Polythene laminated pouches are recommended for accelerated freeze dried products.

### ***Extruded products***

The moisture content of extruded snack is very low, and any increase due to the hygroscopic nature of the product may lead to loss of crispness of the product. Moisture also accelerates other biochemical changes such as oxidative rancidity. Oxygen inside the package is replaced by an inert gas like nitrogen. Low water vapour and gas permeability of the package is, therefore, a very critical requirement. Also the packaging material must be physically strong enough to withstand the processes of vacuuming/gas flushing. Considering these facts, Metalized Polyester-Polyethylene laminated pouches are used for the packaging of extruded snacks.

### **Further reading**

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