Ministry of Food Processing Industries
Government of India

NIFTEM
KNOWLEDGE • INNOVATION • OUTREACH

PACKAGING OF MARINE PRODUCTS

AATMANIRBHAR BHARAT
PM Formalisation of Micro Food Processing Enterprises (PM FME Scheme)

INTRODUCTION

- Seafood are highly nutritious at the same time sensitive, perishable.
- Packaging maintains quality, offers protection, and facilitates movement of goods and handling.
- Packaging provides information on
- Product identity & origin
- How to use & store
- Nutritional information.

- Good packaging should keep your specific food product safe and catch the customer’s eye.

ROLE OF PACKAGING

- Protect the products - physical, chemical & biological agents, adulteration, tempering, contamination, damage.
- Help for easy distribution and handling during display.
- Serve as a communicator & provide information about product.
- Add value to the product with high quality and attractive packaging.
- Help to minimize the cost of product.
- Help to extend shelf-life of product.

FISH

- Fresh fish - Fish or fishery products that have received no preserving treatment other than chilling (FAO, 2009).
- Types fish packaging – 4 common types

  1. Bulk packaging
  2. Wholesale packaging
  3. Retail packaging
  4. Air freight packaging

BULK PACKAGING MATERIAL SHOULD BE

- Suitable size to handle any type of fish comfortably
- Easy to manage, carry and clean
- Designed with proper insulation to maintain temperature
- Designed to allow draining out of melted water
- Protect the fish from crushing, spoilage, environmental pollution and pilferage
- Easy to store and effective for transporting chilled fish
- Available at a reasonable cost.

BULK PACKAGING

- Recent years, wooden and woven bamboo baskets are replaced by plastic boxes.
- Plastic boxes - more hygienic, lighter and stronger.
- Material used for plastic

  Low density polyethylene (LDPE)

  High density polyethylene (HDPE)

  Polypropylene (PP)

- Life span of material – 5 years
- Aluminum steel and fibreglass also used for insulated containers.

BULK PACKAGING – FRESH FISH

- Local transport - Insulated corrugated plastic container – last for 5 trips, light weight & easy to handle.
- Cycle hawkers – U shaped box (100kg capacity) made of HDPE.
- Boats & processing Centre's - Insulated galvanized iron box (40kg) – not become popular due to high tare weight.
- For rail and road – Wooden box (20-120kg) – generally used in western India – looses its insulation property once its get wet.
- For long distance – Fiberboard container – keep the fish fresh for 60h covering 1700 km – used for freshwater fishes

WHOLESALE PACKAGING & RETAIL PACKAGING – FROZEN FISH/SHRIMP

- Frozen product - Fish that have been subjected to freezing in a manner to preserve the inherent quality of the fish by reducing the average temperature to -18°C or lower and which are then kept at a temperature of -18°C or lower.
- Frozen shrimp which includes shrimps, means the product frozen raw or partially or fully cooked, peeled or unpeeled.
- Domestic / Export - transported in refrigerated fright container/ Reefer container (-18 °C).
- Retail pack required for house hold purpose whereas wholesale packaging used for restaurants, repacking and catering services.

WHOLESALE PACKAGING & RETAIL PACKAGING – FROZEN FISH AND FISHERY PRODUCTS

FROZEN FISH/SHRIMP packaging material should be

- Protect the products from moisture and aroma loss
- Oxidation and rancidity
- Should not become brittle and torn
- Low water vapor permeability
- Low oxygen permeability rates
- Able to withstand sub-zero temperatures
- Retain the odour inside the package

FROZEN FISH/SHRIMP PACKAGING MATERIAL

Packaging of frozen products

- Primary packaging
- Secondary packaging
- Tertiary packaging

- **Most common packaging material –**

i. Polystyrene trays over-wrapped with polyethylene/ polypropylene film

ii. Polyethylene bag

iii. Plastic bag inside carton box

iv. Waxed paper box

v. interlocking, printed, polycoated and corrugated fibreboard carton

FROZEN FISH/SHRIMP/SURIMI - BLOCK – PRIMARY PACKAGING

- low-density polyethylene (LDPE) is generally used to line the primary carton.
- Some exporters use a LDPE pouch/ bag instead of a wrapper.
- 100 gauge LDPE used for wrap; 200 gauge used for bag.
- Instead of LDPE film, High Molecular High Density Polyethylene (HM-HDPE) film (60 & 120 gauge) is also used – cost effective but not transparent.

FROZEN FISH/SHRIMP/LOBSTER/SQUID/CUTTLE FISH/OCTOPUS – INDIVIDUAL QUICK FROZEN (IQF) – PRIMARY PACKAGING

- A plastic unit pouch or wrapper is used as a primary pack
- Pouches vary in capacities ranging from 200 grams to 10 kgs.
- Materials used for the construction of the unit pouches
  - Monolayered LDPE or LLDPE (Linear low density polyethylene) film
  - Co-extruded LLDPE - LDPE, two-layered film
  - Co-extruded LLDPE - B - polyamide - B - LLDPE
  - Five layered film
  - Polyester / LDPE laminate

FROZEN FISH/SHRIMP – INDIVIDUAL QUICK FROZEN (IQF) – PRIMARY PACKAGING

- Plastic Trays: Some of the processors use plastic trays of Expanded Polystyrene (EPS) or Polyethylene Terephthalate (PET).
- Specially for head-on shrimps, lobsters, butterfly shrimps.
- The trays are either placed in a plastic pouch, which is heat-sealed, or in printed paperboard cartons with see-through windows.
- For butterfly shrimps, after the product is placed on the EPS tray and frozen, they are skin packed with a high barrier plastic film.

PRIMARY PACKAGING – MODIFIED ATMOSPHERE PACKAGING (MAP)- FRESH FISH

- Product shelf-life can be extended by modified atmosphere packaging (MAP)
- It depend on the species, fat content, initial bacterial load, gas mixture, type of packaging material and, especially important, the temperature of storage.
- MAP should be strictly controlled by:

Monitoring the gas–product ratio

Types and ratio of gas mixtures used

Type of film used

Type and integrity of the seal

Temperature control of product during storage

IS : 10146 - 9845 SPECIFICATION FOR POLYETHYLENE – PRIMARY PACKAGING (FSSAI REQUIREMENT)

Specification for primary conduct with food material

Water vapour transmission rate	18 gm/sqm / 90 ± 2% RH /24 h / 37 °C
Tensile strength	Not less than 120kg/cm^2 in the machine direction
Elongation at break	100% in machine direction
	350% in cross direction
Overall migration residue	60 mg/l or 10 mg/dm^2

SECONDARY PACKAGING – FROZEN PRODUCTS

- Cartons can be a primary packages or secondary packages.
- Kraft boards - Frequently used for packaging frozen foods - usually made from fully bleached materials - strong good appearance & suitable for direct contact with food.
- Folding box boards - One fully bleached side which is suitable for direct contact with food.
- Recycled fibre boards - These are usually used for secondary and tertiary packaging.

SECONDARY / TERTIARY PACKAGING - CARTONS

- 4 types of cartons used for seafood products
- Top opening type – filling is done from the top – mainly for filling larger pieces of fish and cephalopods.
- End opening type – product is smaller and free flowing (e.g. fish curry or fish soup.
- End loading – product are loaded from one end into a horizontal glued carton. End flaps are heat sealed or closed by tucks in flap.
- Tray type – Polypropylene trays - heat sealed –used for frozen precooked products.

AIR FREIGHT PACKAGING

- Packing and packaging for the export market is similar to the process for domestic sales.
- Export market shipment packing and packaging requirements will vary according to the type of product, type of market and method of shipment.
- Packing materials used on airlines must withstand leakage, vibration, shock, stacking and changes in temperature and atmospheric pressure.
- Insulating materials can help to maintain temperature.
- If the product tends to leak liquids, it should be packed with an absorbent pad in polybags.
- Absorbent pads help to remove liquid drip which can be a medium for bacterial growth.

AIR FREIGHT PACKAGING

- Outer packaging materials should be multi-walled, wax impregnated fiber board/cardboard boxes with fan folded corners.
- Boxed product should be banded at least twice for added strength. The best quality boxes have reinforced corners.
- Heavy corrugated or solid fiberboard cartons or sturdy expanded polystyrene boxes lined with polybags
- Boxes that are wax saturated, wax coated or treated with some other water resistant process are desirable.
- The combination of a corrugated box and a molded foam box is a commonly used seafood packing system.
- Both expanded polystyrene and fiberboard have a high rate of breathability and allow for a certain amount of air exchange

SPECIFICATION DUPLEX CARTONS – SECONDARY PACKAGING

Material	**Duplex board**
Style of carton	One piece staple
Grammage	300 g/m^2 (minimum)
Bursting strength	4 kg/cm^2
Wax coating	Inner & outer side 10g/m^2 on each side (minimum)
Polyethylene coating	20gsm on each side
Ring stiffness	270 N
Printing details	Brand name, product type, net content, size grade,

MASTER CARTON (CORRUGATED FIBREBOARD) - TERTIARY PACKAGING

Style of box	Constructed from one piece of board
No of plies	3 or 5 ply corrugated paper board
Type of flute	Vertical
Bursting strength	14 kg/cm^2 min
Puncture resistance	160 oz in/ tear in
Cobb value (30 min)	120g/m^2 max
Compression strength (kg)	350 (minimum)
Manufactures joint	Staples on the outside. Overlap not less than 3 that 6 cm apart and not further than 2.5 cm from beginning and end of joint
Type of glue	Water resistant, preferable starch based or any other neutral adhesive
Wax coating	Inside and outside of 20 g/m^2 (min) on each side
Printing details	Product details, country & packer/exporter details

- **FROZEN SHRIMP – 6 units of 2 kg each or 10 units of 2kg each packed.**
- **3 or 5 ply corrugated fibreboard generally used for frozen products.**

PACKAGING OF BATTERED AND BREADED PRODUCTS

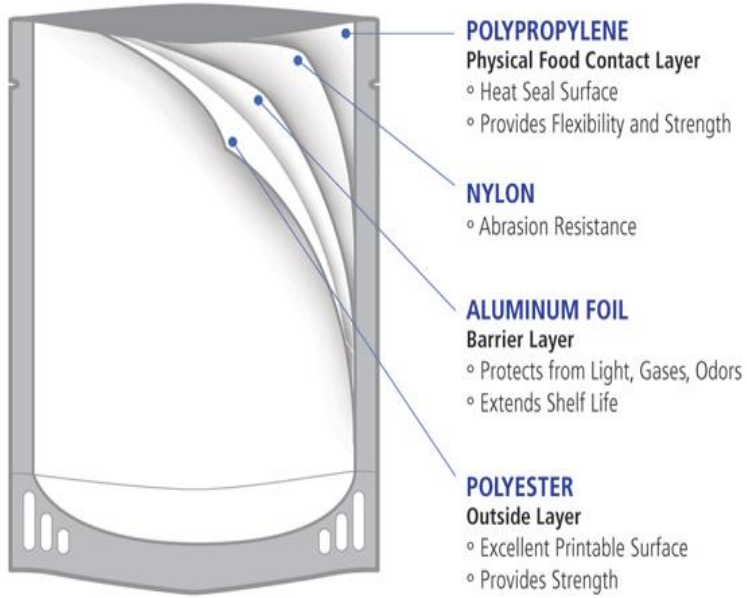
- These form an important class of value added products in convenient form.
- Major issues are desiccation, dis-colouration and development of rancidity.
- Plastic films alone are not suitable - they provide little mechanical protection to the products and as a result, the products get damaged or broken during handling and transportation.
- Thermoformed containers are commonly used for this purpose.
- Materials used for thermoformed trays are
- Poly Vinyl Chloride (PVC)
- High Impact Polystyrene (HIPS)
- High Density Polyethylene (HDPE)

FISH SAUSAGE

- Fish sausage is a product identical to the popular pork sausage. Surimi is the base material, which is homogenized after mixing with several other ingredients.
- Homogenized mass is stuffed in synthetic casings like Ryphan (Rubber hydrochloride) or Kurehalon (Vinylidene chloride).
- Surface of the sausage is wrapped in cellophane laminated with polythene.
- Conventionally fish sausages are packed in sheep or goat intestine, which is edible.
- Duplex cartons lined with a plastic film are ideal for short-term storage
- Frozen storage, packaging suggested for block frozen shrimp are suitable.

PACKAGING OF THERMAL PROCESSED FISH PRODUCTS

- It should be hermetically sealable, thermally conductive and inexpensive.
- Sulphur resistant lacquered cans are generally used for fish products.
- Common materials used for manufacturing containers for fish products the world over are tinplate, aluminum and tin free steel (TFS).
- Retortable/flexible laminated pouches are also used
- The material should be superior barrier properties for a long shelf life, seal integrity, toughness and puncture resistance and must also withstand the rigors of thermal processing.



PACKAGING OF DRIED/SMOKED FISHERY PRODUCTS

- Packaging material – inert and should not allow any moisture and gas to enter the product.
- Dried fish normally are having sharp edges and spines.
- They will puncture the packaging material and the moisture will enter the package.
- So, the packaging material should be strong enough to withstand normal puncture.
- High density polythene woven gusseted bags laminated with 100 gauge low density polythene are found quite suitable for bulk packaging of dried fish.
- Consumer packs of dry fish are low density polythene or polypropylene.
- Polyester polythene laminated pouches.

ACCELERATED FREEZE DRIED (AFD) PRODUCTS

- AFD or lyophilized product - removes moisture from raw, frozen product through a vacuum system.
- Products are very fragile
- It can easily undergo chemical reactions with air leading to oxidation, deterioration of colour, absorption of water etc.
- Generally packed under an inert gas to exclude air and oxygen.
- Main requirements in the packaging employed are low oxygen and water vapour transmission to protect the product from rancidity and absorption of moisture
- Sufficient mechanical strength to protect from shock.
- Paper/aluminium foil/polythene laminates or metalised polyester/polythene laminated pouches and in some cases metal cans are recommended for these freeze dried products.

FISH PICKLE

- Fish Pickle - Fish Pickle means an oily, semi-solid product with spices and acidic taste obtained from maturation of partially fried fish with vinegar.
- Low cost fish, clam meat, oyster meats etc. are used
- Conventionally, glass bottles are used as containers, which offer properties like inertness, non-toxicity, durability, non-permeability to gases, moisture etc.
- Disadvantage - They are heavy, prone to break, voluminous and expensive.
- New flexible packaging materials

Plain polyester laminated with LDPE-HDPE co-extruded film or Nylon/Surlyn.

These are inert to the product, can be attractively fabricated as stand up packs and printed on reverse side of the polyester film.

FISH SOUP POWDER, FISH PROTEIN / HYDROLYSATE POWDERS

- FISH POWDER – contains partially hydrolysed protein, carbohydrates, fat and several seasoning compounds including salt - highly hygroscopic in nature.
- Packaging material - 12 micron plain polyester laminated with LDPEHDPE co-extruded film or 90-100 micron LD/BA/Nylon/BA/Primacore.

EXTRUDED PRODUCTS

- Extruded product - Ready to eat snacks prepared by the extrusion process.
- Product - hygroscopic nature - 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.
- Packaging requirement -

Low water vapor and gas permeability

Physically strong enough to withstand the processes of vacuuming/gas flushing.

- Metalized Polyester-Polyethylene laminated pouches are used for the packaging of extruded snacks.

GLUCOSAMINE HYDROCHLORIDE

- D-Glucosamine hydrochloride is used to cure rheumatic arthritis, and is also used as an additive in the food & cosmetic industry.
- It is stored in a cool and dry well-closed container, the temperature should be lower than 25°C & relative humidity should not exceed 50%.
- Packaging - polybottle, namely PP or HDPE of 1kg, 500g and 20 g, 1kg metallised bag, 25kg in drums for commercial use and smaller quantities are packed in auto sample vials.

CHITIN AND CHITOSAN

- Chitin and chitosan are derived from prawn shell waste.
- It should be protected against moisture gain as well as microbial and insect attacks.
- Bulk packaging of chitosan is done in HDPE woven gusseted bag laminated with 100 gauge LDPE liner.
- Chitosan is also marketed in capsule forms for consumption.
- Capsules made of gelatin are used for filling chitosan.
- Since chitosan is in the powdered form or flakes they are filled into the capsules.
- A particular numbers of capsules are then placed in HDPE containers.

FISH MEAL

- Fish meal is a source of high quality protein (60%) and is also a rich in omega-3 essential fatty acids EPA and DHA due to the high fat content.
- Packaging should be impermeable to moisture, oxygen and other insets and pests.
- Generally packed in HDPE sacks for bulk transportation.
- It also packed in jute bags, multiwall paper bag which are lined with polythene and in HDPE woven bags with liner.

FISH SILAGE

- Fish silage – liquid product – prepared by acid hydrolysis.
- Fish silage is generally stored in huge drums or polycontainers.

FISH OIL

- Fish oils - highly unsaturated fatty acids.
- Easily susceptible to oxidation when exposed to air.
- Packaging material - high barrier properties which are moisture proof, oil resistant and impermeable to oxygen.
- Larger quantities of fish oil are mainly packed in LLDE/Nylon films or in glass bottles.
- Bulk transportation food grade flexi tanks made of 4 layered polyethylene and tubular Polypropylene (PP).
- Advantages of using flexitanks are that they can carry 50% more than bottles and therefore will save on storage space, packaging and transportation cost.

Item	Packaging Materials / Packages
Live Fish	
Shrimp/Lobsters	Polystyrene foam container, inner and outer bag of polyethylene film (100µ) and outer CFB (in water 1:3 ratio in sealed bag flushed with oxygen).
Live Crustaceans	Pre-chilled sawdust, water-absorbing material, ice cubes in polyethylene bag, CFB boxes. Transportation by air.
Chilled Fresh Fish	Polystyrene foam slabs / boxes (thickness 10-25mm), Polyethylene bag (150g), Ice (2 to 4 kg for 15 kg fish, depending on distance) with or without outer CFB box. Transportation by air.
Dry Fish	
Bombay duck laminated/head and tail cut	100/200 g. LDPE bags (200 grams net) and further packed (100-150 units) in 7 ply CFB boxes / gunny bags.
Other dry fish	Palmyrah leaf mats, Jute liner, Polyethylene film-packed as bundles or in sacks and reinforced with jute twine. Transportation by sea.
Frozen Fish / Shrimp	
Block frozen shrimp whole/ headless/ peeled and deveined/ peeled and undeveined butter fly etc (1.8-2.0 kg/net)	Waxed/poly coated printed duplex board cartons tuck-in-type, LDPE/HDPE liner/pouch to hold individual blocks. 5 Ply / 7 Ply CFB box (waxed / unwaxed) for bulk packaging (Regular slotted container type) closure – BOPP tape and PP or HDPE strapping.
Individually quick frozen shrimp/fish (200 gm-10kgs) 10 kg) Raw headless/Cooked peeled Cooked salad/ Headless shell on/ Butterfly shrimp, marinara mix (squid/cuttle fish/mussels/ clams etc.)	LDPE. LLDPE, LDPE co-extruded film, multi-layer LLDPE– B –Nylon–B-LLDPE, co-extruded film, Polyester/LDPE laminate as wrapper / pouch, unprinted printed waxed / unwaxed / poly coated duplex board / 3 ply CFB tuck in or lid and tray type carton. Thermoformed PVC (food grade), expanded polystyrene trays. Master carton – 5 ply / 7 ply CFB box RSC / or two piece lid tray type. Closure by BOPP tape. Transportation by sea in refrigerated containers (gross weight 30 kg maximum).
Accelerated Freeze Dried Shrimp	Bulk packaging (5 kgs) in metallised polyester / LLDPE or LLDPE – PA – LD co-extruded film bags with nitrogen flushing, 2 packs in a 5 ply CFB shipping.

Common packaging practices adopted in India for exports of selected fish and marine products

FOOD SAFETY AND STANDARDS (PACKAGING AND LABELLING) REGULATIONS, 2011

(i) IS : 10146 (Specification for Polyethylene in contact with foodstuffs)

(ii) IS : 10142 (Specification for Styrene Polymers in contact with foodstuffs)

(iii) IS : 10151 (Specification for Polyvinyl Chloride (PVC), in contact with foodstuffs)

(iv) IS : 10910 (Specification for Polypropylene in contact with foodstuffs)

(v) IS : 11434 (Specification for Ionomer Resins in contact with foodstuffs)

(vi) IS: 11704 Specification for Ethylene Acrylic Acid (EAA) copolymer

(vii) IS: 12252 - Specification for Poly alkylene terephathalates (PET)

(viii) IS: 12247 - Specification for Nylon 6 Polymer

(ix) IS: 13601 - Ethylene Vinyl Acetate (EVA)

(x) IS: 13576 - Ethylene Metha Acrylic Acid (EMAA)

LABELLING - FOOD SAFETY AND STANDARDS (PACKAGING AND LABELLING) REGULATIONS, 2011

Labelling should provide the information of

- Name of food
- List of Ingredients
- Nutritional information
- Declaration regarding Non veg
- Declaration regarding Food Additives

Size of logo

Area of principal display panel	Minimum size of diameters in mm
Upto 100 cm^2	3
Above 100 cm^2 upto 500 cm^2	4
Above 500 cm^2 upto 2500 cm^2	6
Above 2500 cm^2	8

LABELLING - FOOD SAFETY AND STANDARDS (PACKAGING AND LABELLING) REGULATIONS, 2011

Labelling should provide the information of

- Name and complete address of the manufacturer
- Net quantity
- Lot/Code/Batch identification
- Best Before and Use By Date
- Country of origin for imported food
- Instructions for use

For More details Contact:
National Institute of Food Technology and Entrepreneurship and Management
Ministry of Food Processing Industries
Plot No. 97, Sector-56, HSIIDC, Industrial Estate, Kundli,
Sonipat, Haryana-131028

Website: http:www.niftem.ac.in

Email: pmfmecell@niftem.ac.in
Call: 0130-2281089