

Coated Products from Fish Meat

Sreelakshmi. K.R. and George Ninan

Fish Processing Division

ICAR- Central Institute of Fisheries Technology, Cochin

E-mail: sreecift@gmail.com

The present day consumers' particularly urban consumers are showing more and more interest in food products which are available as ready to eat or ready to cook. These food items are called convenient products and the global demand for such products is increasing rapidly. This has led to the development of several fishery products varied in taste, texture and appearance. One group among them getting high consumer appeal is battered and breaded products popularly known as coated products. Battering and breading techniques have contributed significantly to value addition of fish and fishery products.

In essence, a coated food product is one that is coated with another foodstuff. Coating by battering and breading enhances a food product's characteristics such as appearance, flavour and texture. Coating acts as a moisture barrier, minimizing moisture losses during frozen storage and microwave re-heating and retains the natural juices of foods, thereby ensuring a final product that is tender and juicy on the inside and at the same time crisp on the outside. The first commercially successful coated product was fish finger.

There are several ingredients used in the formulation of coatings. Each ingredient performs its functions to contribute to the unique characteristics and functionality of coatings. The commonly used ingredients fall under five categories. They are polysaccharides, proteins, fats, seasonings and water. Besides small quantities of leavening agents, gums, spices, colour etc. may be added to provide specific functional effects. The major ingredients used for the production of batter mix and breadcrumbs are more or less same but the manufacturing techniques employed are different. The preparation of coated products includes seven major steps.

- 1. Portioning / forming :** A perfectly portioned product is the right starting point. Mechanically deboned fish meat is formed to different shapes and sizes after mixing with ingredients, if needed. The product should keep its consistency with proper weight and shape. The key factor in this production step is speed and accuracy of processing the frozen fish block at minimum costs without any compromise to the product quality.
- 2. Predusting:** Predusting is usually done with very fine raw flour type material or dry batter itself, sprinkled on the surface of food substrate before coating. This helps to reduce the moisture on the surface of the product so that the batter can adhere uniformly. Flavourings such as salt and spices can be added in minimum amounts.
- 3. Battering:** Batter is defined as the liquid mixture composed of water, flour, starch, and seasonings into which the fish products are dipped prior to breading. Two types of batter are there- adhesive batter and tempura batter. The adhesive batter is a fluid, consisting of flour and water. Tempura batter is the puff-type batter containing raising/leavening agents. This forms a crisp, continuous,

uniform layer over the food. The predusted portions are applied with wet batter and excess batter can be blown off by a current of air. The batter mix helps in governing the amount of bread to be picked up and it contributes to flavour of the final product. Specific ingredients are used to aid viscosity, texture and adhesion. Typical formulation of a batter system is given in Table. 1. The ingredients are classified as critical and optional based on the functions.

Table.1 Formulation of batter

Ingredients	Addition range%
Critical	
Wheat flour	30-50
Corn flour	30-50
Sodium bicarbonate	Upto 3
Acid phosphate	Adjust based on neutralizing value
Optional	
Flours from rice, soy, barley	0-5
Shortening oil	0-10
Dairy powders	0-3
Starches	0-5
Gums, emulsifiers, colours	Less than 1
Salt	Upto 5
Sugars, dextrans	0-3
Flavourings, seasonings etc.	As required

Ingredients of batter mix formulated at CIFT

An adhesive type quick setting batter is usually used. A typical adhesive batter formulated at CIFT, Kochi is given in Table 2.

Table 2. Batter Ingredients

Maida	2000 g
Corn flour	200 g
Bengal gram	200 g
Salt	30 g

Guar gum	5 g
Turmeric powder	5 g
Sodium tripolyphosphate	10g

- a. Flour- Wheat flour provides structure to the product through gelatinisation of starch as well as through formation of gluten protein matrix. Higher protein levels in flour increases viscosity of batter and produce darker crispy coatings. Corn flour can be added to produce yellow colour and to enhance browning during frying.
- b. Water- The ratio of water to dry batter mix is 1.8:1. Formation of gelatinised starch phase, hydration of flow proteins, batter viscosity etc. depends on the purity of water used.
- c. Starch- Corn starch is added mainly to control batter viscosity and thus increasing the batter pickup and breading retention.
- d. Flavour and flavour enhancers- salt, sugar, spices etc. can be added to improve the organoleptic characteristics of the products.
- e. Sodium tripolyphosphate- This lowers the water activity of the product and has bactericidal property. It increases the hydration of proteins and reduces protein denaturation.

The ingredients are mixed evenly and one part of batter powder is mixed with two parts of water to get the required consistency.

4. **Breading:** Breading is defined as the application of a dry mixture of flour starch, seasonings having a coarse composition to battered food products prior to cooking. Bread crumbs, puffed grains or small potato chips can be used for coating. Normally the battered fish portions are dropped in to dried bread crumbs and are turned over to ensure complete coating with bread crumbs. A fine layer or coarse layer of bread crumbs will contribute to structure and tastiness of the product. For soft products the crumb depth should be fine so as to avoid the product damage on further processing.

Preparation of Bread Crumbs

- Remove the outer brown layer of bread
- Grind in mixer grinder
- Spread over aluminium tray
- Keep for drying for 2 ½ hrs at 70°C in dryer (smoker)
- Store in appropriate packages

Commercial bread crumbs like planko bread crumbs (flake like), extruded bread crumbs (float in oil) etc. can also be used.

5. **Pre-frying/ flash frying:** Pre-frying is the process of giving a shallow fry so as to coagulate batter over the product and lock the flavour and juices to the product. The time of frying and temperature of oil are crucial factors. This could be done at 180-200°C for 40-60 sec, thus restricting the actual heat transfer to the surface of the product. The term pre-frying is used as frying will be completed only when the consumers fry the product for 4-6 minutes depending on the product size.

6. **Freezing:** The first step in preparing the fried fish portion for freezing is air-cooling. This is usually accomplished with the use of a fan or a series of fans. This allows the coating temperature to drop, while at the same time allowing the batter coating to recover from the frying shock and also to stabilize itself. The coated fish portions are then fed to the freezer through conveyor belts. Since the fried portions are fragile, care should be taken to avoid contact between the portions while loading in the freezer. Freezing is usually carried out in spiral freezers. Other types of IQF freezers can also be used depending on the product and convenience. Freezing is completed when the internal and external temperature of the fish portion drop to about -40°C .
7. **Packaging and storage:** The common deteriorative changes taking place during frozen storage of battered and breaded fish products are desiccation, discolouration, development of rancidity etc. Application of proper packaging prevents/retards these changes to a great extent. Conventional packaging materials like flexible plastic films are not suitable for these products as they provide little mechanical protection to the products and as a result the product gets damaged or broken during handling and transportation. Hence thermoformed containers are commonly used for this purpose. The packed coated products are usually stored at -20°C .

Coated fish fillets

Fried coated fish fillet is a prominent food item in the European markets. Along with fried potato chips it forms a substitute for lunch for majority of the floating population in Europe. Fresh water fish fillet of table size and having minimum fin bones can be used for this purpose. Various stages in the production of coated fish fillet are:

- Filleting
- Cold blanching
- Pre-dusting
- Coating with batter
- Coating with bread crumbs
- Pre-frying
- Freezing
- Packaging
- Storage

Filleting: A fish fillet is a skinless, boneless fish loin cut along the central bone frame and trimmed free of loose or hanging meat. Skinless and boneless fish fillets can be prepared manually as well as using filleting machines. While fillet yield is 30 to 40% with machine filleting, manual filleting gives better yield.

To fillet, keep the fish on the chopping board and cut from behind the pectoral fin down to the main bone and move the knife along the bone frame with minimum loss of meat. Remove the skin along with scales by passing the knife along the skin layer. Also remove the belly flaps. Trim off any hanging meat from the fillet and make it regular and uniform. Wash the fillets in chilled water and drain.

Cold Blanching: Dip the fillets in 5% brine solution containing 0.1% citric acid for 3-5

minutes depending upon the size grade and then drain off.

Pre-dusting: The fillets are then pre-dusted with a suitable pre-dust or dry batter mix itself. The excess pre-dust adhered to the substrate is then removed either by shaking or using an air blower.

Battering: The pre-dusted fillets are then coated with batter uniformly.

Breading: The batter coated fillets are further coated with bread crumbs. Generally medium size porous crumbs having a relatively large granulation are used even though the selection of the crumbs depends upon the requirement of the finished coated product. The bread crumbs are uniformly applied on the product and the excess crumbs are then removed using an air blower. The coating picks up depends on the viscosity of the batter and the type of crumbs and 30-35% is generally obtained.

Pre-frying: After the application of bread crumbs the fillets are flash fried in hot vegetable oil for 20-30 seconds depending on the size grade of the fillets. The temperature of frying is maintained at 180-200°C.

Freezing: The flash fried fillets are cooled immediately using a fan and then frozen in an IQF freezer preferably a spiral freezer for the required time depending on the size of the fillets. The time is adjusted by regulating the conveyer speed of the freezer belt.

Packaging: The frozen coated fillets are immediately packed in thermoformed containers or pouches made of 12µm plain polyester laminated with 118µm LDPE. A specified number of such consumer packs are then packed in master cartons.

Storage: The packed cartons of frozen coated fillets are stored in a cold storage maintained at -20°C.

Fish fingers/Fish portions/fish sticks

Fish fingers are regular sized portions cut from rectangular frozen blocks of fish fillet or fish mince. A common size fish block in commercial practice in Europe is 47.9cm long, 25.4 cm wide x 6 cm thick weighing 7.5 kg. On the production line the blocks are subdivided by a series of band saws and subsequently cut into the desired width and shape. Fish fingers are made in to different shapes such as rectangular, square, wedge and french cuts. For small-scale units, frozen slabs of 1.5 cm thick may be convenient for cutting out fish fingers of uniform size. A typical British fish finger normally weighs about 28 g (1 oz) of which up to 50% of the total weight is contributed by the batter and crumbs. Accordingly, a rectangular piece of 7.5 x 2.0 x 1.5 cm weighing about 15 g may give a final weight of 28 g.

The frozen fish block is prepared by mixing fish fillet/mince with 0.6% sodium tripolyphosphate and 1% sodium chloride, placing in a frame of convenient size, pressing slightly and frozen to form a solid block of fixed dimension. (The removal of pin bones from the fillets of fresh water fish of many species is a difficult task. In such cases it will be better to prepare the fish block from the fish mince after removing the pin bones using a fish meat strainer). The frozen block is cut into suitable uniform sizes. These pieces are given a coating of pre-dust, batter and breading as in the case of coated fish fillets. The battered and breaded fish fingers are flash fried in oil at 180-200°C for 30 seconds. After cooling, the fingers are frozen preferably in an IQF machine and packed in thermoformed trays or pouches and stored at -20°C. The flow chart for production of fish finger is given in Fig. 2.

The fish fingers when fried in vegetable oil develop a golden brown color with attractive appearance and odour. It has been observed that the sensory quality of fish finger developed from the frozen block of fish fillets is superior to that developed from the block of mince.

Preparation of Fish Fingers

I. Fish Fingers from Fillet

Ingredients

Fish fillet	1 kg
Salt	3%

Procedure: Fillet the fish and cut into small pieces (about 10 cm in size) and blanch in 3% salt solution for 10-15 minutes. Drain off and pre-dust with batter powder and coat with batter and breadcrumbs and fry.

II. Fish Fingers from Mince

Ingredients

Fish fillet	1 kg
Tri-sodium polyphosphate	0.1 %
Salt	0.6 %

Procedure: Dress and fillet the fish and mince in a meat mincer. Add 0.1 % tri-sodium polyphosphate, 0.6% salt, mix, spread the mince in a tray uniformly and freeze. Cut into small pieces (about 10 cm in size) in the frozen condition itself. Pre-dust the finger with batter powder and coat with batter and breadcrumbs using a bamboo stick. The battered and breaded fish fingers are flash fried in oil at 180-200°C for 30 seconds. After cooling, the fingers are frozen preferably in an IQF machine and packed in thermoformed trays or pouches and stored at -20°C.

The fish fingers when fried in vegetable oil develop a golden brown color with attractive appearance and odour. It has been observed that the sensory quality of fish finger developed from the frozen block of fish fillets is superior to that developed from the block of mince. The removal of fin bones from the fillets of fresh water fish of many species is a difficult task. In such cases it will be better to prepare the fish block from the fish mince after removing the fin bones using a fish meat strainer

Fish Cutlet

Fish cutlet has become a popular snack at celebrations, household functions, tea times etc. The basic raw material required for preparation of this product is cooked fish meat generally from less costly fishes with white meat or cooked meat from skeletal frame obtained after filleting of fish.

Ingredients

Cooked fish meat	:	1000 g
Salt	:	25 g (approx.)
Oil	:	125 ml
Green chilli	:	20 g

Ginger	:	25 g
Onion	:	250g
Potato (cooked)	:	500g
Curry leaves	:	20 g
Mint leaves	:	20 g
Pepper (powder)	:	3 g
Clove (powdered)	:	2 g
Cinnamon (powdered)	:	2 g
Turmeric	:	2 g
Batter mix	:	250 g
Bread crumb	:	300 g

Method of preparation

- Cook the dressed fish /skeletal frame/mince in 2% brine for 30 minutes and drain off the water
- Remove the skin, scales and bones and separate the meat
- Mix the meat well with a little salt and turmeric powder in a homogenizer
- Fry chopped onions in oil till brown. Add curry leaves, chilly and ginger in chopped form and mint in blended form and fry. Mix these with the cooked meat
- Add mashed potato and spices and mix well with the cooked meat
- Adjust the salt content to taste and shape 30 g each in round or oval form manually or using a forming machine
- Batter with batter mix dispersed in water in the ratio 1: 2 and roll in breadcrumbs
- Freeze the cutlets preferably in an IQF machine.
- Pack in thermoformed trays/pouches and store at -20 °C.

Fish Balls

There are several varieties of fish, which do not command a ready market as fresh fish, but are comparable to many table fish in nutritive value and other attributes. One of the ways of ensuring effective utilization of such fish is to process ready-to-serve or ready-to-cook value added 'convenience' products, for which there already exists great demand. Fish ball is one such product prepared using fish mince and starch that can be processed as a coated product or as a heat-processed product in a suitable fluid medium. Coated fish ball is a palatable and nutritious product prepared from mince of low cost fishes. The preparation of fish ball is simple and requires only few locally available ingredients. Hence it is an ideal product for small scale units.

Ingredients

Fish mince	:	1000g Corn
starch	:	50g

Ginger	: 20g
Garlic	: 20g
Pepper	: 2g
Salt	: 10g (1%)
Batter	: 250 g
Bread crumbs	: 350 g

Process

- Allow the frozen fish mince to thaw. Wash the mince and drain.
- Add corn starch and salt to fish mince and mix thoroughly.
- Add ginger and garlic made into a paste along with pepper powder and mix thoroughly.
- Prepare balls of size 2-3 cm diameter.
- Cook in 1% boiling brine for 10 minutes.
- Take out, drain and cool.
- Pre-dust the balls with the dry batter mix
- Using a bamboo skewer dip in batter prepared in the ratio 1:2 with water
- Apply bread crumbs
- Flash fry in vegetable oil
- Pack the balls in thermoformed trays
- Freeze at -40°C (Blast Freezer or IQF machine) and store at -20°C

Preparation of Specialty Products from Shrimp

1. Centre-peel shrimp

Raw Material: Prawn 26/30 to 31/40 counts/kg

Process: Wash the whole shrimp in potable water. Peel at the centre retaining the head, the last segment and the tail fans. De-vein by inserting a pointed needle or pointed bamboo stick between the segments dorsally and lifting off the vein. Remove the telson by gently raising upwards. Trim off the head and tail fans to reduce the sharpness to avoid damage of the package. Arrange in PVC/polystyrene trays and vacuum pack in laminated pouches. Blast freezing at -40°C & storage below -18°C in master carton.

2. Cooked centre peel shrimp

Raw Material: Prawn 26/30 to 31/40 counts/kg

Process: Wash the whole shrimp in potable water. De-vein by inserting a pointed needle or pointed bamboo stick between the segments dorsally and lifting off the vein. Remove the telson by gently raising up wards. Cook the shrimp in 1% boiling brine for 2-3 minutes depending on the size grades. Cool in chilled water. Peel at the centre retaining the head, the last segment and the tail fans. Trim off the head and tail fans to reduce the sharpness to avoid the damage of the package. Arrange in PVC/polystyrene trays and

vacuum pack in laminated pouches. Blast freezing at -40°C & storage below -18°C in master carton.

3. Easy-peel shrimp

Raw Material: Prawn 26/30 to 31/40 counts/kg

Process: Wash the whole shrimp in potable water and remove the head. De-vein by inserting a pointed needle or pointed bamboo stick between the segments dorsally and lifting off the vein. Remove the telson by gently raising up wards. Cut the cuticle, up to end of the last segment dorsally or laterally leaving it intact, just to make the cooked shrimp easy to peel. Arrange in PVC/polystyrene trays and vacuum pack in laminated pouches. Blast freezing at -40°C and storage below -18°C in master carton.

4. Cooked easy-peel shrimp

Raw Material: Prawn 26/30 to 31/40 counts/kg

Process: Wash the whole shrimp in potable water and remove the head. De-vein by inserting a pointed needle or pointed bamboo stick between the segments dorsally and lifting off the vein. Remove the telson by gently raising up wards. Cook the shrimp in 1% boiling brine for 2-3 minutes depending on the size grades. Cool in chilled water. Cut the cuticle, up to the end of the last segment dorsally or laterally leaving it intact. Arrange in PVC/polystyrene trays and vacuum pack in laminated pouches. Blast freezing at -40°C and storage below -18°C in master carton.

5. Shrimp skewer

Raw Material: Prawn 26/30 to 31/40 counts/kg

Process: Wash the whole shrimp in potable water and remove the head. Remove the telson by gently raising upwards. Peel the shrimp completely, including the tail fans and de-vein. Arrange 4-5 pieces in a skewer in an inverted "U" shape. Arrange the skewered shrimp in PVC/polystyrene trays and vacuum pack in laminated pouches. Blast freezing at -40°C and storage below -18°C in master carton.

Major Markets: Japan, US and Europe

6. Fantail round

Raw Material: Prawn 26/30 to 31/40 counts/kg

Process: Wash the whole shrimp in potable water and remove the head. Remove the telson by gently raising up wards. Peel the shrimp leaving the shell intact on the last segment and the tail fans. De-vein the shrimp and trim the tail fans using a pair of scissors. Arrange in PVC/polystyrene trays and vacuum pack in laminated pouches. Blast freezing at -40°C and storage below -18°C in master carton.

7. Coated fantail round

Raw Material: Fantail round shrimp pre-dust, batter and bread crumbs.

Process: Coat the Fantail round shrimp with a thin layer of pre-dust either manually or using a pre-dusting machine. Coat the pre-dusted shrimp either with a conventional (adhesive) batter or a tempura type batter, depending upon the market. Coat the battered shrimp with breading (Japanese style light coloured coarse crumbs for Japan Markets and darker coloured crumbs (yellow-orange) for European and US Markets.

Arrange in PVC/polystyrene trays, preferably in “well” trays and vacuum pack in laminated pouches. Blast freezing at -40°C and storage below -18°C in master carton.

8. Butterfly shrimp

Raw Material: Prawn 26/30 to 31/40 counts/kg

Process: Wash the whole shrimp in potable water and remove the head. Remove the telson by gently raising up wards. Peel the shrimp leaving the shell intact on the last segment and the tail fans. De-vein the shrimp and trim the tail fans using a pair of scissors. Cut through the dorsal side length-wise using a sharp scalpel or knife (Butterfly cut) to partially separate the lateral muscle block. Gently open up the cut surface to reveal the butterfly shape. Arrange in PVC/polystyrene trays and vacuum pack in laminated pouches. Blast freezing at -40°C and storage below -18°C in master carton.

9. Coated butterfly shrimp

Raw Material: Butterfly shrimp pre-dust, batter and bread crumbs.

Process: Coat the butterfly shrimp with a thin layer of pre-dust either manually or using a pre-dusting machine. Coat the pre-dusted shrimp either with a conventional (adhesive) batter or a tempura type batter, depending upon the market. Coat the battered shrimp with breading (Japanese style light coloured coarse crumbs for Japan Markets and darker coloured crumbs (yellow-orange) for European and US Markets. Arrange in PVC/polystyrene trays, preferably in “well” trays and vacuum pack in laminated pouches. Blast freezing at -40°C and storage below -18°C in master carton.

10. Butterfly “sushi” shrimp

Raw Material: Prawn 26/30 to 31/40 counts/kg

Process: Wash the whole shrimp in potable water and remove the head. Remove the telson by gently raising upwards and de-vein. Insert bamboo skewer along the dorsal side length-wise up to the last segment so as to stretch the shrimp completely. Blanch/lightly cook in 1% boiling brine for 1-2 minutes depending on the size grades. Cool in chilled water. Peel the cooked shrimp completely, including the tail fans. Cut the shrimp gently down the ventral side length-wise up to the last segment using a sharp scalpel or knife without damaging the lateral muscle blocks on either side. Gently open up the cut surface to form the butterfly shape. Arrange in PVC/polystyrene trays and vacuum pack in laminated pouches. Blast freezing at -40°C and storage below -18°C in master carton.

11. Stretched shrimp (Nobashi)

Raw Material: Prawn 26/30 to 31/40 counts/kg

Process: Wash the whole shrimp in potable water and remove the head. Remove the telson and trim the tail fans. Peel the shrimp, leaving the shell intact on the last segment and the tail fans. Make three or four parallel cuts, across or diagonally on the ventral side using a sharp razor. Stretch the shrimp to the desired length by gently pressing it using a stainless steel mould. Arrange in PVC/polystyrene trays, preferably in “well” trays and vacuum pack in laminated pouches. Blast freezing at -40°C and storage below -18°C in master carton

12. Breaded “Nobashi”

Raw Material: Stretched shrimp (Nobashi), pre-dust, batter and bread crumbs.

Process: Coat the stretched shrimp with a thin layer of pre-dust either manually or using a pre-dusting machine. Coat the pre-dusted shrimp either with a conventional (adhesive) batter or a tempura type batter, depending upon the market. Coat the battered shrimp with breading (Japanese style light coloured coarse crumbs for Japan Markets and darker coloured crumbs (yellow-orange) for European and US Markets. Arrange in PVC/polystyrene trays, preferably in “well” trays and vacuum pack in laminated pouches. Blast freezing at -40°C and storage below -18°C in master carton.

13. Shrimp single kebab (barbecue)

Raw Material: Prawn 26/30 to 31/40 counts/kg

Process: Wash the whole shrimp in potable water and remove the head. Peel the shrimp completely and devein. Insert a bamboo skewer along the dorsal side length-wise up to the last segment so as to stretch the shrimp completely. Arrange the skewered shrimp in PVC/polystyrene trays and vacuum pack in laminated pouches. Blast freezing at -40°C below -18°C in master carton

14. Shrimp vegetable kebab

Raw Material: Shrimp (any species), carrots, onion and capsicum.

Process: Wash the whole shrimp in potable water, remove the head, Peel and de-vein. Blanch in 1% boiling brine for 15-30 seconds and cool in chilled water. Wash the vegetables in potable water and dice to approximately 2 cm cubes or cut into square pieces and blanch in 1% boiling brine for 30-60 seconds and cool in chilled water. Arrange in skewer, shrimp alternating with diced vegetables. Arrange the skewered shrimp vegetables in PVC/polystyrene trays and vacuum pack in laminated pouches. Blast freezing at -40°C and storage below -18°C in master carton
