

Chapter 11

Battered and Breaded Fish Products

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Battered and breaded products are convenient products having high demand among consumers as it is available for consumption in ‘ready to eat’ and ‘ready to fry’ forms. They are also known as coated products or enrobed products. As the name implies, in the coated products the meat protein component represents the core which is usually surrounded by a cereal base that forms the outer coating. In simple terms, coated products are those products in which one food material is coated with another stuff. The coating is referred to as the batter and/or bread crumbs adhering to the product after cooking. The coating increases the bulkiness of the product thus profit also increases. Consumers relish such products because of their taste and crispy texture. Ready-to-eat and ready-to-cook/fry products can be taken up well in the domestic market and frozen ready-to-cook coated products can target distant markets. The process of manufacturing of battered and breaded products can be simple home-style as well as fully automated production lines depending on the investment.

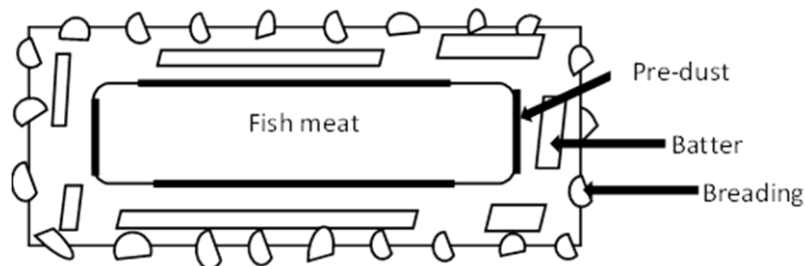


Fig. 1. A cross sectional view of battered and breaded fish products

Functions of coating

- Coating enhances the appearance of the product
- Enhance taste characteristics by providing food products with more crispy texture
- Improves the nutritional value
- Provide more desirable colour

- Act as moisture barrier & minimise moisture loss during frozen storage and microwave reheating
- Act as sealant by preventing natural juices from flowing out and seal the flavour inside

Coating process

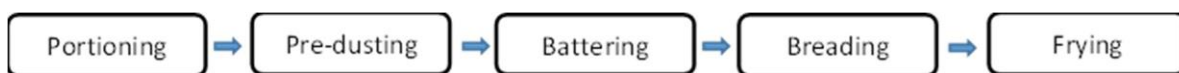


Fig. 2. Process involved in the production of coated products

The fig. 2 represents the steps involved in the development of battered and breaded products.

1. Portioning

The process of **portioning** is also known as forming where the substrate is cut or shaped most economically way with minimum cutting loss to lessen processing loss in the succeeding stages. The surface area of the cut portions is an important factor to focus upon. The shapes of the portions can be oval, round, fillet shape, finger shape, triangle, ball shape, bell shape, boot shape etc. Frozen fish fillets moulded in the form of blocks is one of the common substrates for coated products.

2. Pre-dusting

Pre-dusting refers to the process of dusting the fish portions with raw flour before they are dipped into the batter. Pre-dust is the first layer applied before battering and breading. It forms an intermediate layer between the fish portion and the subsequent batter. The pre-dusting flour adheres to the surface of the portions by absorbing free water at the surface. Generally, the same flour used to make the batter is applied as pre-dust. Very fine bread crumbs alone or in combination with flour can also be used. Pre-dusting is carried out for the proper and uniform adhesion of the batter to the portion. Along with the flour, salt, spices, seasonings and flavourings can also be added to make the pre-dust. It is better to add the flavour components to the pre-dust as it can protect the volatile flavour components by embedding them under the coating layers and the amount of flavouring agents required will be less compared to seasoning the outer layers. The pre-dusting material should have good flow characteristics to minimize clump formation.

This process is not required in every product, the choice can be made depending upon the wetness of the surface, extracted proteins on the product surface and availability of the equipment in case of the automated line. If pre-dusting is required, preconditioning of the product surface is essential as a frozen surface or the presence of ice crystals will interfere with the binding of the fine flour particles to the product.

3. Battering

A **batter** can be defined as a suspension of dry ingredients used for coating the products. In short, it is the wet coating used before the process of breading. It is usually a liquid mixture composed of water, flour, starch and seasonings in which fish portions are dipped before the frying process. The function of the batter is glue or bind the product with the entire outer layer of crumbs. The main ingredients used in different types of batter include wheat flour, corn flour, proteins, gums and leavening agents. All these ingredients are not present in all batters. The starch component of the flour helps in better adhesion and the addition of modified starch can enhance the adhesion to the product. Starch also improves texture of the fried products. **Proteins** such as wheat proteins, egg proteins, dairy proteins and soy proteins etc. can be added for better adhesion and proper texture of the product. **Gums** are added to the batter for maintaining batter viscosity and water holding. Hydrocolloids like xanthan, guar and modified cellulose gums are used for this purpose. **Leavening agents** are used in the tempura batter to produce air spaces within the coating layer which subsequently gives proper crispiness to the fried products. Sodium bicarbonate is the most commonly used leavening agent in the batter for this purpose. When it gets hydrated, carbon dioxide is released and get entrapped in the batter in turn assisting to increase the volume of the final product. Furthermore, the created air spaces can influence the light reflection from the surface of the product which improves the colour and appearance.

Additionally, **flavouring agents** such as spices, salt and sugar can be added to the batter. Pepper is one of the common ingredients usually added to the batter. Natural colouring agents such as paprika can be used to enhance the red colour of the outer layer. Batter viscosity is an important parameter to give much importance as it influences the amount of batter remaining on the product and gets a consistent amount of pickup. There are three categories of batter such as adhesion batter, cohesion batter and tempura batter.

Adhesion batter: These batters are developed to adhere to the product. They are usually starch based having high solid content and low viscosity. The adhesion batter is generally made up of corn starch or modified corn starch. Adhesion batters are generally applied as a thin coat which can adhere well to the surface of the product. As it forms a thin coat, the applied batter gets dried up quickly and a significant amount stays on the product which acts as a good base for glueing the bread crumbs.

Cohesion batter: This batter is used for forming a shell or envelope around the product and acts as the base for cementing the breading. Cohesion batters are thicker flour-based batters compared to adhesion batters. They contain a medium amount of solid content compared to other batters. As it is more viscous and forms a thicker layer, the drying time required is more.

Tempura batter: This kind of batter is for making a puffed layer with a lot of air spaces around the product. Tempura batters are a type of cohesion batter with a leavening agent. In this case, the process of battering is not usually followed by breading. The products will be crispier. These kind of batters are having high solid content that usually made from a mixture of flour and starch. The viscosity is high for tempura batters.

Whenever required the dry ingredients of the batter can be mixed, further, it can be diluted with water in the ratio of 1:2 (Batter mix to water) before breading. Care should be taken to prepare a homogeneous batter without clump formation. The batter should be prepared with chilled water and while processing it should be kept in ice (5–10°C) to maintain its viscosity.

4. Breading

Generally, bread-based crumbs are used for coating followed by the process of battering. Instead of bread crumbs small potato chips or puffed grains like rice can also be used. Typically, the layer of breading is cereal-based crumbs that are baked or dried and crushed to fine, medium or large crumbs. The sticky batter helps the dry crumbs to adhere properly to the product. The process of breading is followed to enhance the appearance, and texture along with the increase in volume and weight of the product. There are different kinds of bread crumbs simple to very structured baked ones. The particle size, area-to-volume relationship, browning rate, moisture absorption, colour and texture and oil absorption are some of the important characteristics of bread crumbs that influence the functional characteristics.

Different types of breading are as follows.

1. **Flour type:** This type of crumb is available in powder forms that are more economical compared to other types. These are used when the products are intended for deep frying. In this case, the coating matrix will be very dense and a low browning rate on the surface is expected. The pick-up and weight gain in the final product will be relatively less.
2. **Traditional/ cracker type:** This type of bread crumbs are usually white or coloured crumbs having a flat-like flake structure with minimal or no crust on the surface. This type of crumbs can be made easier with the least expenses. It forms an even surface on the product as it has a fine granulation and the rate of browning achieved during frying is low. This type of crumbs is used for making fully-fried or oven-heated types of products. Moreover, they can be used in pre-dust in combination with different flours. The much denser flakes give a crunchy texture to the final product after frying.
3. **Home-style or American type:** This type of crumb has a distinct crust that gives a nice highlighting during the frying that resembles the crumbs usually consumers prepare at home. A medium to high browning rate can be achieved using these crumbs. Compared to the other types, American-style bread crumbs gives a crispier texture to the product as they have an open structure. To get more pickup, medium to large quantities may require while coating. The price of American-style crumbs is much higher than flour and cracker type but they are cheaper compared to Japanese crumbs.
4. **Japanese-style:** These types of crumbs are having an elongated spindle shape. It is the most expensive type of crumb usually used in full-fat fried or oven-heated high-value products. They are produced by electrical induction heating rather than the conventional baking process to have a fairly open/porous texture. The process helps to form a very light-density crumb without having a crust and also it is possible to produce large- sized crumbs without having a hard texture. Japanese-style crumbs are produced as white or coloured crumbs. Pickup of the product can be controlled from medium to high and the degree of browning to medium light to dark during frying.

5. **Frying**

The battered and breaded products are deep-fried or flash fried after breading. The purpose of frying is to develop a golden brown colour on the surface of the product and to solidify the coating system for better adherence to the product for preventing breakage further. In the

process of flash frying, or par frying the product is fried for a very short time of 20-30 seconds (for less than 1 minute) at 190°C to cement the breading to the surface to prevent breakage and also to develop a nice brown colour. Whereas in deep frying the product is fried for a longer time at 180–200°C to get a fully cooked product. If the product is only par-fried, it must be fully cooked and if the product is deep-fried it should be reheated/ warmed before consumption.

For every coated product the pickup should be calculated as (final weight of the product-initial weight of the portion)/final weight of the product X100. Generally, the product is considered fritter in case it is having a pickup of more than 30%.

Battered and breaded fish products

Few examples for fish based battered and breaded products are as follows:

Fish cutlets

Fish cutlets are prepared by mixing cooked meat with vegetables, salt and spices followed by shaping the mix, battering and breading. The cutlets are available in different shapes like round, oval, heart shape, triangle etc. It can be stored in the freezer after coating or after flash frying.



Fish Finger



Fish fingers or portions or sticks are regular-sized portions cut from rectangular frozen blocks of fish flesh. Unlike other coated products, the fish finger is a product having 100% fish meat. Generally, after coating, it is flash-fried and stored under frozen conditions. The fish finger can be made from fillet and fish mince.

Fish Balls

Fish balls are also ready-to-eat coated products prepared from the mince of a low-cost fish. It is generally prepared by mixing the fish mince with starch, salt and spices. Small balls of around 2cm thickness are prepared from the mix and cooked in 1% boiling brine. The cooked balls are then battered and breaded after cooling.



Coated Shrimp



Coated shrimp can be prepared in different product styles like peeled and deveined, butterfly, round tail- on, cooked and peeled, nobashi etc. Both farmed and wild-caught shrimps can be used for the preparation of coated shrimps. After coating it with batter and bread crumbs it can be flash fried or deep fried.

Coated squid rings

To prepare the squid rings, cleaned squid tubes are cut into the form of rings followed by cooking in brine to make it tender before battering and breading. The flash-fried coated rings can be packed properly and stored in the freezer.



Storage

Battered and breaded products can be stored after coating or after flash frying preferably in thermoformed trays in frozen condition. These products can be stored for six months in the freezer and two weeks in the refrigerator.

Defects in battered and breaded products

- 1) **Excess/insufficient pickup:** This can be observed as a thick or thin coating over the products. The defect occurs when the batter viscosity is too high or too low.
- 2) **Uneven coating:** The use of low viscous batter is the major reason for uneven coating in the products. This will lead to insufficient breading adhering to the product. The presence of ice crystals or partial freezing can also cause uneven coating.
- 3) **Marriages or doubles:** It is the defect where fried products are found sticking to each other. The use of sticky batters is one of the reasons for this kind of defect.
- 4) **Flares and Tails:** This happens when an excess amount of batter sticks to the fried product. The use of highly viscous batter can result in this kind of defect. Excess quantities of breading attached to the products can also result in flares and tails.
- 5) **Dark colour:** This defect can be seen in products if proper frying temperature and frying time are not followed. Frying at a high temperature can darken the oil and also the product. Frying for too long can burn the surface of the coated products.
- 6) **Ballooning:** In this defect, the coating layer of the product gets cracks followed by falling off the breading after frying. This occurs when the outside coating gets hardened faster during flash frying without allowing the water vapour to escape from the product. Proper batter viscosity should be maintained to avoid this defect.
- 7) **Shelling:** In this defect, a hard shell is formed around the products as the hot water vapour is trapped inside the product while frying. This usually happens when thick tempura batter is used in the product. The viscosity of the batter can be maintained properly to avoid this defect. The high amount of pre-dust deposition and too much water on the substrate can be the other reasons for shelling.