

## Surimi products

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### Surimi and Surimi Products

Surimi is stabilized mince made from deboned and washed fish meat. Surimi processing involves processing whole or gutted fish into mince, repeated washing of the mince (at mince and water ratio of 1:3 for 2-3 cycles), dewatering (done by manual press, nylon mesh bag method, Centrifugation and screw press till the moisture content of the meat, ranges between 80% and 84%) and refining. Refining is a screening mechanism, where the remaining scale, connective tissues and bones are separated from the mince. Surimi originated in Japan in 1115 and is used basically in Kamboko type products. Kamaboko is the term which often refers to all surimi seafood. Thus, surimi is minced and deboned fish meat that has been washed of lipids, water-soluble or sarcoplasmic proteins, and other impurities for use in the manufacture of intermediate products. These products are manufactured by manipulating the gel forming capacity of fish myofibrillar protein-myosin. Hence, the suitability to be raw material for surimi production is determined by the functionality of fish myofibrillar protein called 'gelation' which are generally greater in white-fleshed fish than in dark fleshed fish. Globally, Alaska Pollock is the main species used for the surimi production.

As mentioned earlier, surimi is an intermediate product and a large number of products can be developed from surimi depending on the creativity, innovation and knowledge of the one involved in this line. However, kamaboko, chikuwa, hanpan and satsum-age are the traditional surimi based Japanese products. Of late, products like fish ball, fish sausage and fish ham has been introduced. Today, surimi is used mainly in analog or imitation products like crab stick, shrimp analog, lobster analog and scallop analogs.

Surimi seafood products are defined as products prepared by heating (roasting, steaming, deep frying or smoking) of ground fish meats mixed with seasonings, stiffeners or other ingredients.

### Fish sausage

Fish sausage is an emulsion based fish product. It is prepared by mixing the fish mince with salt to solubilize the protein and mixing with other additives. Thus, fish sausage is considered as one of the surimi seafood products originally produced in Japan, but different from other surimi seafood based on the added ingredients (i.e. edible fat and spices). The ingredients used in sausage preparation may include sugar, sodium tri-polyphosphate, spice mix (chilli powder, pepper, ginger & garlic paste), monosodium glutamate, starch and oil). For the preparation of fish sausage, the surimi or fish mince is first mixed with salt followed

by mixing with other ingredients in a bowl chopper to get a homogeneous paste. The mixing process should be ideally completed within 12-15 min. The paste is then stuffed into synthetic casings (natural/synthetic) and heat processed for 45-60 min at 90 °C followed by cooling for 15 min in chilled water (5-8°C) and re-boiling (1 min) to remove wrinkle on the casing surface. The sausage is consumed primarily as a snack and as an appetizer or used as an ingredient for salad and stir-fried food. Unlike other surimi products which restrict only from white muscled fish, sausage can be made from wide range of fish species.

### ***Unit operations in fish sausage processing***

- Raw material
- Dressing of fish
- Meat picking
- Mincing
- Mixing with additives/ingredients (should be completed within 12-15 min)
- Stuffing
- Clipping
- Heat processing
- Chilling
- Re-boiling
- Cooling
- Packing
- Storage/Distribution

**Note:** Temperature should be maintained below 5° C to obtain good textural properties of product throughout the process (during mixing it may exceed to certain extent)

### **Sequence of meat mixing**

- Fish mince
- Addition of salt
- Addition of sugar
- Addition of STPP
- Addition spice mix (add little water to disperse)
- Addition of starch (simultaneously add water/crushed ice)
- Addition of oil/fat/vanaspathi

**Table 1: Role of ingredients and quantity used in the fish sausage preparation**

| Ingredients  | Function  | Percentage used |
|--|---|-----------------|
| Mince  | Gel formation/Texture development   | 70 %            |
| Salt   | Solubilizing the myofibrillar proteins of fish  | 2.5 %           |
| Sugar  | Imparting taste and act as preservative   | 1.5 %           |
| STPP   | Enhance the water holding capacity and act as cryo-protectant                                   | 0.2 %           |
| Spice mix<br>(chilli powder<br>Pepper<br>Ginger<br>Garlic<br>Garam masala) | Impart taste and flavour and act as source of natural antioxidants and antimicrobial agents     | 3.0 %           |
| MSG  | Taste enhancer  | 0.2%            |
| Starch   | Aid in gelation and act as a bulking agent  | 8.7 %           |
| Gur-gum  | Gelation enhancer   | 0.3 %           |
| Oil  | Avoid the stickiness of paste with casing<br>Impart flavour, enhance the palatability and taste | 5.0 %           |
| Water  | Media for gelation  | 10 %            |



Fig 1: Fish sausage

### Crab analog

The frozen surimi is converted to imitation crab meat through various steps. First, it is tempered at  $-4^{\circ}\text{C}$ , then shredded into coarse flakes and subjected to comminution during

which, the surimi flakes are mixed with other ingredients include starch, salt, natural crab meat, egg white, and flavors in a bowl chopper. Comminution results in the formation of thick surimi paste, which is then transferred to a hopper (holding tank). The paste is conveyed from the hopper to the sheet-forming machine. Continuous sheets of surimi, about 10 inches (25 cm) wide and 0.05 inch (1.2 mm) thick are extruded. Due to the functional nature of surimi protein, the extruded sheets are very smooth in texture. After the sheets are formed, they are passed to machines and subjected to initial cooking. This cooking mediates the setting of the sheets and prepares them to be suitable for the further slitting process. Slitting gives the appearance and texture of crab meat. The slitting is done by a machine which is composed of two steel rollers that cut the thin sheets into strands having 1.5 mm wide. These thin strands are pulled, bundled and rolled into a rope. This rope is colored, wrapped, and cut to the appropriate size. It is then steam cooked, forming a product that imitates in texture and tastes very much like the crab meat.

### **Shrimp and lobster analog**

For the preparation of shrimp and lobster style products, the surimi paste is commonly mixed with pre-prepared surimi meat fibers and transferred to a molding machine or cold-extruded in a three-dimensional shape. For imparting the color, a color solution is sprayed inside the mold before stuffing. Another way to impart the color is directly using the colored paste (brushed) on the surface of cooked molded products. In the later method an additional, additional heating is needed to set the color.

### **Scallop analogs**

The plant set up for the production of scallop analog is similar to crab analog. For the preparation of scallop analog, a wider and thicker surimi sheet is extruded compared to the surimi sheet extruded in crab analog preparation. After sheet formation, surimi sheet subjected to partial cooking for facilitating the gelation and subsequently subjected to slitting. After slitting, an uncooked layer of surimi paste is added on top of the gelled surimi sheet immediately. This additional layer of surimi paste is to enhance the binding of fibers. The gelled fibers are wrapped and cut into 2-foot lengths and heat processed. The cooked fiber bundles are cut into the desired dimension of scallops shapes using flaking machine.

