

**Training Manual**  
**On**  
**Modern Food Processing Technology**

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## CONTENTS

S.No	Title	Page No
1	Fish as health food- Suseela Mathew	1
2.	Handling, chilled storage and transportation of fish and shellfish- George Ninan	11
3	Freezing and frozen storage of fish and shellfish products– George Ninan	40
4	Post-mortem changes in fish- Ravishankar C N and Venkateswarlu R	54
5	Traditional cured and dried fishes-Bindu J	65
6	Thermal processing of fishery products- Ravishankar CN	84
7	Freeze drying of fish-Bindu J	95
8	Active and intelligent packaging for fish preservation-Mohan C O	102
9	Pulsed light technology- Srinivasa Gopal T K	121
10	Applications of high pressure in fish products- Bindu J	129
11	Coated Products- George Ninan	140
<b>12</b>	<b>Surimi and surimi based products- Jeyakumari A</b>	<b>169</b>
13	Bacteria of public health significance- K V Lalitha	176
14	By-products from fish and waste utilisation-Zynudheen A A	186
15	Quality assurance in seafood processing- T V Sankar	193
<b>16</b>	<b>Quality defects in fish and fishery products- Jeyakumari A</b>	<b>197</b>
17	Application of statistical techniques in food processing- Joshy C G	205

## 12. SURIMI AND SURIMI BASED PRODUCTS

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Surimi and surimi based seafoods are traditional products of Japan and occupy an important position in the dietary culture of the country. Today, the largest producers of surimi are the United States, Japan and Thailand. Surimi is also manufactured in China, Vietnam and Malaysia. The process of making surimi originated in Southeast Asia and was further developed in Japan in the 16th century. The Japanese word “surimi” means “ground meat.” In Chinese, it is called “yú jiāng,” which means “fish puree.”

### **Surimi**

Technically, surimi is the stabilized myofibrillar protein which is obtained by mechanically deboned fish flesh, which is washed, mixed with cryoprotectants, and stored frozen. Washing not only removes fat and undesirable matters such as blood, pigments and odoriferous substances but also increases the concentration of myofibrillar protein. A fish-based product serving the raw material for preparation of analog of seafoods like crab, lobster, scallop & other shellfish.

Two major distinguishing features of Surimi from minced meat

- i) Gel-forming capacity, allowing it to assume almost any texture desired
- ii) Long-term stability in frozen storage, imparted by the addition of sugars as cryoprotectants.

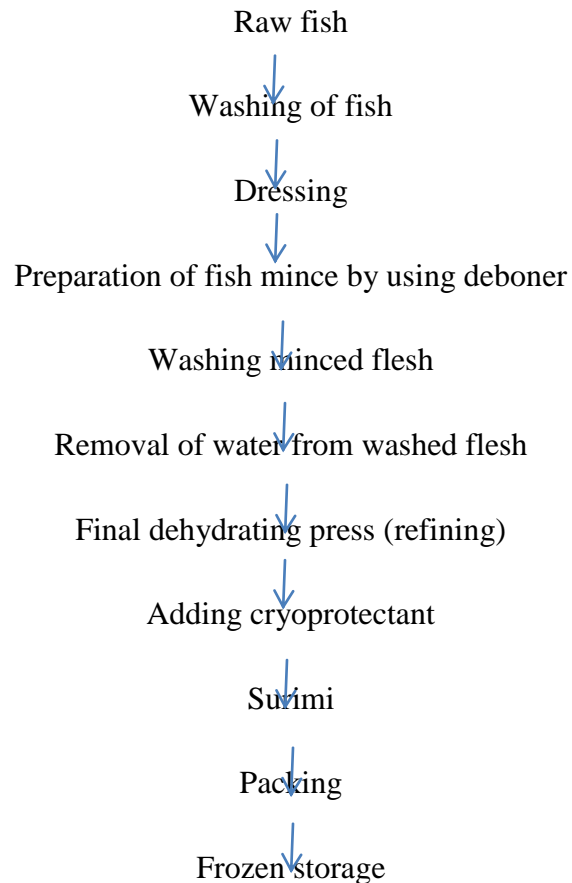
### **Important & desirable properties of the fish for surimi production**

- Strong gel-forming capability when processed into surimi-based products.
- Good organoleptic quality; White flesh; Year round availability Abundance and, Reasonable price

### **Raw material for surimi production**

According to gel-strength Alaska Pollock has been the predominant fish species used for surimi production. In India, for the preparation of surimi, Gopakumar and co-workers utilized the mince of barracuda (*Sphyraena spp.*), threadfin bream (*Nemipterus japonicus*), croaker, Lizard fish, prawn (*Metapenaeus dobsonii*) and tilapia (*Oreochromis mossabicus*).

## Surimi Production



### Cryoprotectant used in surimi

- **Sucrose – 4% ; Sorbitol – 4%**

It protects the protein from freeze denaturation by increasing the surface tension of water as well as the amount of bound water.

- **Phosphate**

Phosphate is added to surimi as a cryoprotectant at 0.25-0.3%. The most likely explanation is its function as a metal chelator and/or antioxidant. In addition, because of the strength of the phosphate in raising pH, the holding/binding of the gel improves and better salt solubilization of myofibrillar protein results. It enhances the

cryoprotective effect of sugar. Disodium phosphate, sodium tripolyphosphate or tetrasodium pyrophosphate etc. are used in @ 0.1 to 0.3% by weight.

### **Surimi-Based Products**

Surimi-based products are prepared by extruding the surimi paste into various shapes that resemble shellfish meat such as crab, lobster, scallop, or shrimp. The products may be divided into four major categories according to their fabrication and structural features:

#### **Molded Products**

These products are produced by molding the chopped surimi paste into the desired shape and allowing it to set and form an elastic gel. eg. Different varieties of kamaboko. Kamaboko mainly made by shaping or by moulding.

#### **Fiberized Products**

These products are produced by extruding the paste into a thin sheet through a rectangular nozzle having a narrow opening (1-2 mm). The extruded sheet is then partially heat set and cut into strips of desired width by a cutter, similar to a noodle cutter, so that a sheet of strips results. The resulting sheet of strips is folded into a rope (a bundle of fibers) by a simple narrowing device called a rope former. The rope is then colored, wrapped, and cut into a desired length by a wrapping machine. Eg.- Shell fish analogs - shrimp and lobster analogs.

#### **Composite-Molds Products**

Strings or shreds are produced either by the method just described or by shredding a block of surimi gel into thin rectangular pieces (<1 mm thick). Texture can be manipulated by adjusting the mixing ratio of strings and shreds and surimi paste (binder). Most typical products under this category that can be found in the market are shrimp and lobster analogs. Another type of composite-molded product called fish ham.

#### **Emulsified Products**

To make this type of product, surimi is treated in a manner similar that used when meat is processed for emulsion products. The level of fat added is usually less than 10%, and the type of fat used is not limited to animal fat. In fact, vegetable oil is often added because unlike mammal and bird meat, fish meat readily produces stable emulsion with oil. Sausage-type analogs are example of this kind of products.

#### **Ingredients for surimi products**

##### ➤ **Salt (NaCl)**

Added (during final washing) to increase the ionic strength of meat, thereby, solubilizing actomyosin (the active component which forms gel). Optimum level is approx. 2% at pH 7.0.

##### ➤ **Sugar**

Acts, more importantly, as cryoprotectant and sweetener. Protects protein from freeze denaturation by increasing the surface tension of water as well as the amount of bound water.

Examples: sucrose, lactose, glucose, fructose, glycerol and sorbitol.

➤ **Egg White**

It modifies the rubbery texture caused by the addition of starch and to give the product a whiter and glossier appearance. A 10 % addition imparts highest yield stress to the gel product and 20% addition gives a softer product with higher gel quality

➤ **Starch**

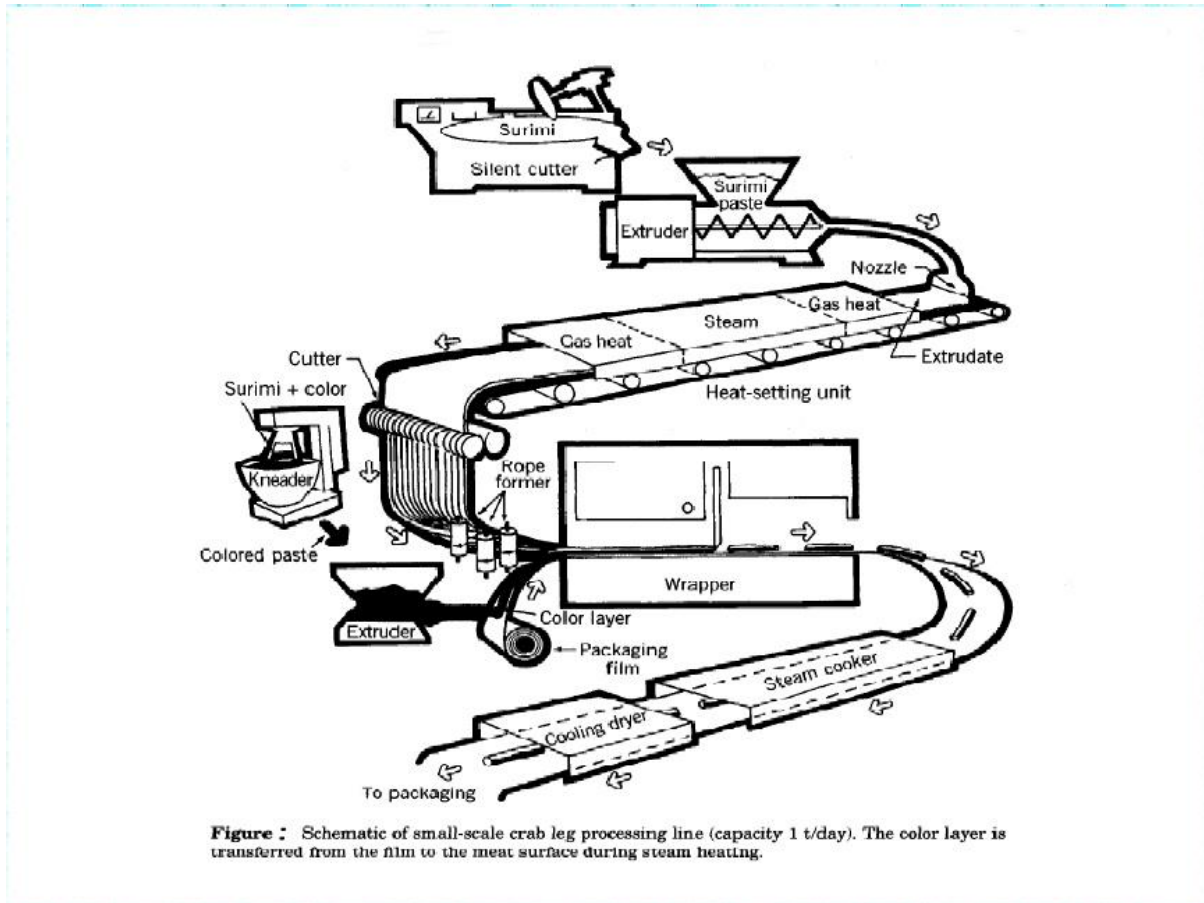
It can modify the texture of final product, improve gel strength of a low quality surimi and reduce the cost of the formulation due to imbibed water. (due to the gelatinization of the starch granules) Up to 10% starch can be added. In excess , it causes surimi products brittleness.

➤ **Colour and Flavor Additives**

Analog crab is added a orange-red surface colour that is associated with the real product. Similarly yellow color is added to white flesh to get creamy white for scallops. Hydrolyzed proteins, either as peptides or amino acids, are used as flavoring agents. MSG is basically a amino acid, but used as a flavor modifier and enhancer. Several artificial flavors are available for seafood analogs , compounds with the flavor of tuna, caviar, scallop, oyster, shrimp, crab , lobster, and anchovy are used

**Important processing considerations**

- Use of high-quality surimi is essential in making fiberized products that require a highly elastic and resilient texture.
- Selection of ingredients is determined by the formulation needs, primarily gel strength and freeze thaw stability requirements.
- Water may be added so that the moisture level remains at 78 to 80%, as a maximum, in the paste.
- Chopping must be sufficient for maximum solubilization of actomyosin.
- Setting of the paste extrudate should occur slowly and to a moderate degree without surface drying.



## SURIMI BASED PRODUCTS

### Kamaboko

The most typical surimi-based product in Japan is Kamaboko. Surimi paste is formed in to Quonset-hut shape on a wood board panel before any thermal treatment. Sometimes its surface is coated with colored paste for appearance. After its unique shape is formed, the surimi paste is subjected to a low temperature setting process (20-40°C for 30-60min), depending on species. or During this process, the gel –forming ability of solubilized myofibrillar proteins is highly enhanced, which yields a strong gel. Cooking by either steaming or baking is carried out to complete the gelation of fish proteins. The finished steamed product is called “mushi” (steaming) kamaboko.

### Chikuwa

It is an original model of surimi-based products. Its shape is typically like a pipe or tube. Surimi paste is placed on to a grooved hole in a rectangle shape on the surface of a drum. The paste is rolled onto a metal stick on the conveyor. The rolled paste on the stick is baked rotationally in the oven on the screw conveyor for gelation. The finished products are packed , pasteurized and chilled before entering their marketing channel.

### **Satsuma-Age**

It is fried kamaboko with various shapes and characteristics. Additional ingredients such as vegetables, shrimp, squid, and minced fish are sometimes mixed into the surimi paste for satsuma-age. The paste is then molded into various shapes (stick, patty, ball, nugget) before frying. In recent years, most satsuma-age is manufactured using a two step-frying process because it yields high gel strength and productivity. The first frying is done at 130°C and the second frying is subsequently done at 170°C

### **Hampen**

The surimi paste is aerated compulsorily by the continuous mixer. Recently, gums, polysaccharides are used as a whipping and stabilizing agent. Vegetable oil is commonly mixed for the development of texture as well. The whipped paste is then boiled in hot water (80-85°C) to fix the soft gel texture.

### **Types of kamaboko**

#### **Based on heating method**

- Steamed kamaboko (Itasuki)
- Steamed and broiled kamaboko
- Broiled kamaboko (chikuwa)
- Boiled kamaboko (Hampen)
- Fried kamaboko (Tempura, Satsuma age)

#### **Based on shape**

- Tubular shaped (Chikuwa)
- Ball, bar, square shaped (age kamaboko)
- Lead shaped (sasa kamaboko)
- Noodle shaped (soba kamaboko)
- Rolled (date maki)
- Chipped (kezuri kamaboko)

### **Fish Sausage**

It is the ground fish meat with ingredients and packed in a synthetic casing, properly sealed, boiled and cooled products. It is a ready to eat proteinacious food which is heat processed.

#### **Ingredients used:**

Fish mince/ surimi (70%), salt (2%), sugar (1.5), polyphosphate (2%), spices (1%), MSG (0.2%), preservative (0.2% potassium sorbate), 2-3% colour solution (0.15%), starch (9%), cold water (10%), fat/vegetable oil (5%)

### **Fish Sausage preparation**

The minced meat/surimi is mixed with several ingredients in a silent cutter. First the meat is ground to about 2-3 minutes by adding little by little in the silent cutter. Various ingredients are added one by one as prescribed. Mixing process should be finished within 15 minutes. Over mixing leads to more friction, hence the temperature of the mince increases. After mixing the meat with all ingredients, transfer the fish paste to clean and dry container. Then the fish paste is filling into synthetic casings by stuffer. Synthetic casings made from Krehalon-a copolymer of polyvinylidene chloride and vinyl chloride are best. Stuffing should be done as quickly as possible. Otherwise setting of the paste takes place (i.e) product becomes hard and stuffing will be difficult; even taste gets affected. During stuffing care should be taken to prevent the entry of air inside the casings. The air pockets if present inside the casings may burst during heating.

After filling the paste in to the casings, open end is twisted and ringed and excess length of casing is trimmed. The residual paste sticking after ringed portion is washed with potable water and wiped with a cloth. Then the casings are boiled at temp of 80-90°C for about 50-60 minutes. (Keep temp constant). After boiling the casings are cooled by dipping in ice cold water for 20 min (thermophiles inactive). Reboiling is done at 100°C for about 30 seconds to prevent wrinkles on the surface of sausage. After heat process, casings are air dried and stored in cool, dry place at temperature of 2°C.