THE FISHWORLD A MONTHLY MAGAZINE
ISSN: 3049-138X
Vol.2(3) March 2025, 175-181
Popular Article

Sustainable Development in Surimi Technology

[1]Hema, K., [2]Yuhana Telisha, Brimapureeswaran, R and [3]Usha Antony

[1]Assistant Professor, Department of Food Safety and Quality Assurance, Tamil Nadu Dr. J. Jayalalithaa Fisheries University, College of Fish Nutrition and Food Technology, Madhavaram Milk Colony, Chennai.

[2]B.Tech. III Year (Food Technology), Tamil Nadu Dr. J. Jayalalithaa Fisheries University, College of Fish Nutrition and Food Technology, Madhavaram Milk Colony, Chennai.

[1]Assistant Professor, Department of Food Process Engineering, Tamil Nadu Dr. J. Jayalalithaa Fisheries University, College of Fish Nutrition and Food Technology, Madhavaram Milk Colony, Chennai.

[3]Dean, Tamil Nadu Dr. J. Jayalaithaa Fisheries University, College of Fish Nutrition and Food Technology, Madhavaram Milk Colony, Chennai.

DOI:10.5281/ScienceWorld.15199382

Abstract

In recent decades, there has been a growing need for protein-based products among individuals due to the increasing health awareness among the population. Surimi is a highly proteinaceous product and an excellent source of myofibrillar proteins, which are preserved by different cryoprotectants such as sucrose, sorbitol, sodium chloride and sodium tri polyphosphate. This paper explores different types of surimi-based products, export market trends of surimi-based products.

Keywords: Fish Paste, Chikuwa, Hanpen, Tempura, Kamaboko, ultrasonication, ultraviolet and Microwave

Introduction

Surimi is the Japanese word that refers to the wet concentrate of fish myofibrillar proteins. The word “surimi” means fish myofibrillar protein obtained from washed fish mince. It is an intermediate product that is generally produced in 10 kg blocks and it is conveniently transported and stored between -18 and -20 °C. In India, lean and fatty fish species such as threadfin bream, croaker, ribbon fish, big eye snapper, bull eye fish and sardines are used as raw material for surimi production. Surimi is a colourless and semi-finished raw material that does not contain a natural fish smell. The surimi and surimi-based products are mainly exported to Asian countries such as Japan, Taiwan, Vietnam, USA, Southeast Asia, Europe, China, Korea, Russia, South America and Thailand. In India, the major export of surimi and surimi-based products, at the 5th largest position by value US$ (3.99 %share) and 4th largest position by quantity (7.60%share), has shown a positive export trend of 4.12% in terms of quantity, though value has declined by 6.13% and 9.19% (from US$ 324.24 million to US$ 294.43 million) during the year 2023 – 2024.

Japanese Fish Paste Products

Traditional surimi-based japanese fish products are Kamaboko (steamed), Chikuwa (baked), Hanpan (boiled), Tempura and Satsum-age (fried), fish balls, fish sausage and fish ham. Recently, surimi has been prepared mainly as analogue products like crab sticks, shrimp analogue, lobster analogue and scallop analogues.

Kamaboko (Steamed Fish Paste)

Kamaboko is otherwise known as "Fish Cake" and it is the traditional surimi-based product in Japan. In Western Japan, the steamed kamaboko is named as sumaki or mushiita, but in Eastern Japan, it is called Satsumage. The product is resilient, white in appearance with a chewy texture. The processing of kamaboko from surimi paste into a Quonset hut shape on a wood board is an essential step before subjecting to any thermal treatment. Sometimes, the surface of shaped meat is coated with colored paste for appearance. After shaping, the surimi paste is subjected to a low-temperature setting process (20 to 40°C) for 30 to 60 min to enhance the gelation. This process yields a very strong and elastic gel. Cooking is done by either steaming or baking. The finished steamed product is called mushi (steaming) kamaboko. On the other hand, the baked kamaboko is called yaki-ida (baked on the board). Another type of kamaboko is called molded kamaboko, which is also processed in a Quonset hut-shaped mold. The molding technique is mainly applied for the utilization of low- grade surimi which has low gelling capacity. In this process, surimi paste is poured into a plastic mold and cooked at 90°C (baking or steaming) after setting at 10 to 15°C for 10 h. The finished products are packed, pasteurized and chilled before being supplied to the market. Pink and white slices of kamaboko are served chilled with soy sauce and soup.

Figure 1 Kamaboko

Chikuwa (Grilled fish paste)

Chikuwa is a pipe-shaped product and it is a popular snack in Japan because it is relatively low in fat but high in protein. Chikuwa, which means "bamboo ring" is so called because it resembles the cut end of a bamboo stalk. Seasoned white fish paste is skewered on bamboo or metal spits, then grilled or steamed. Chikuwa is made by broiling a mixture of surimi, seasoning, and other ingredients. Surimi paste is placed onto a grooved hole in a rectangular shape on the surface of a drum. The paste is then rolled onto a metal stick on the conveyor. To facilitate gelation, the rolled paste on the stick is baked rotationally in the oven on a screw conveyor. The interior of good chikuwa is white, and it has a brown channelling to the

market. It is usually eaten chilled as a side dish, often dipped in soy sauce or used outside. The finished products are packed, pasteurized, and chilled like kamaboko before to accompany beer or sake and also can be grilled and eaten hot.

Based on heating method, the kamaboko can be further divided into five types such as steamed kamaboko (Itasuki), broiled kamaboko (Chikuwa), boiled kamaboko (Hampen) and fried kamaboko (Tempura, Satsumage). Based on shape, the kamaboko can be divided into six categories like tubular shaped (Chikuwa), ball, bar, square-shaped (age kamaboko), lead-shaped (sasa kamaboko), noodle-shaped (soba kamaboko), rolled (date maki) and chipped (kezuri kamabo). According to BSN, the Kamaboko product has a moisture content of maximum 60%, ash content of 2%, protein content of minimum 5% and fat content of maximum 16.0%.

Figure 2 Chikuwa

Hanpen / Naruto (Boiled)

Hanpen is a traditional type of fish paste product made from washed fish mince. In addition to minced fish, Japanese yam, egg white, starch and salt are also key ingredients of hanpen, and it contains a lot of air by trapping large amounts of foam inside. The major characteristic of hanpen is its marshmallow-like and soft texture or tofu. For the development of soft texture, whipping and stabilizing agent are required. At the last step of mixing, gums or polysaccharides are added as whipping agents or stabilizers. Vegetable oil is commonly mixed as well for the development of soft texture. The surimi paste is traditionally whipped using pestles of stone mixer at high speed. In recent years, however, the surimi paste has been aerated compulsorily by a continuous mixer. The whipped paste is then boiled in hot water (80 to 85°C) to fix the soft gel texture.

Figure 3 Hanpen

Satsuma-age

It is a fried kamaboko originating from Kagoshima, Japan is called tsuke–age, in Tokyo it is Satsumage and in Osaka it is tempura. Surimi and flour are mixed to make a compact paste solidified by frying it. The paste is made from fish seasoned with salt, and spices and molded into several shapes (stick, patty, ball, nugget) before frying. These fried products are very common in Korea and it is commonly called as twighin ahmook. People mostly eat satsumage plain or lightly roasted and dipped in ginger and soy sauce or mustard and soy sauce and also it is used in stewed dishes.

The primary cooking method for satsumage is frying. The method of frying is classified into three methods such as boiled – fried, mushi (steamed–fried and ki (fried–fried). Satsumage is produced 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 done at 170°C.

Fish Ham

Fish ham is prepared by mixing fish paste with cured meat made from a red fish such as tuna or marlin followed by the addition of pork fat, stuffing into a PVC synthetic casing. The curing is usually carried out using salt (2%) and nitrite (200 ppm) and sodium tri poly phosphate (0.2%) for 48 h at 2°C. The fish paste and cured meat ratio is 2:1. The heat processing is similar to sausage processing. The paste is stuffed in casings, sealed and heat processed at 85-90°C for 40-60 min and cooled in chilled water for 30 min and then stored in the cold at - 18°C. For fresh market distribution, the product undergoes a four-minute steaming process at 120°C. The shelf life of fish ham is up to 20-22 days.

Figure. 4 Fish Ham

Fish sausage

Fish sausage is a value-added fish product in which fish meat is mixed with additives such as starch, sugar, salt, spices and fat; then stuffed into suitable casings and heat processed. Fish sausages add cooking convenience and value in addition to nutritional benefits. Both fresh water and marine, white-fleshed, lean fishes are used for fish sausage. The main tropical fish species used are threadfin breed (*Nemiptereus spp*.), big eye snapper (*Priacanthus spp*.), croakers (*Pennahia* and *Johnius spp*.), lizard fish (*Saurida spp*.) and goatfish (*Upenius spp*.). Fish sausage is an emulsion- based fish product, prepared by mixing the fish mince with salt to solubilize the protein and mixing it with other additives. Thus, fish sausage is considered 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 and 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 are restricted to white muscled fish, sausage can be made from wide range of fish species.

Molded surimi-based products

Surimi-based seafood analogue products are developed in various styles, but especially from crab meat. There are two categories produced namely crab meat and filament meat.

Crab analogue

The frozen surimi is converted to imitation crab meat using crab meat and filament meat through various steps. First, frozen surimi is tempered at -4°C, then shredded into coarse flakes and mixed with other ingredients including starch, salt, natural crab meat, egg white, and flavours in a bowl chopper. Approximately a chopping time for 25 min is normally required with open bowl cutters compared with less than 15 min using a vacuum silent cutter. The major two functions of chopping are to solubilize the myofibrillar proteins and give a smooth–textured uniform surimi paste. The main role of chopping is to reduce the particle size of the fish meat. There are two stages of chopping, in the first stage salt is added and in the second stage dry ingredients are added and sprinkled onto the surimi paste. Starch should be premixed with water before addition. Uniform mixing results in the formation of thick surimi paste, which is then transferred to a hopper. For industrial practice, the final paste temperature is generally near 10°C. 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 meditates 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 1.5 mm wide. These thin strands are pulled, bundled and rolled into a rope. This rope is colour, wrapped, and cut to the appropriate size. The wrapping film is made of HDPE (95%) and LDPE (5%) and then steam cooked for 90 - 95°C for 15 – 30min and followed by quick chilling. For industrial applications, drum or belt type is used. The total cooking time varies from 50 – 100 seconds and mainly depends on the production speed and mechanical adjustment.

Packaging

Japanese surimi-based products are mainly packed in plastic film such as polyester (nylon), polypropylene, polyvinylidene chloride (PVDC), ethylene vinyl alcohol (EVOH) and polyethylene (PE). The shelf life of vacuum packaged surimi-based products is 60 – 90 days.

Surimi Market Report

The global surimi market is projected to grow significantly from 2024 to 2031. Fish surimi, particularly from tropical sources, holds the largest market share, with fresh surimi dominating by form. The B2B segment leads distribution channels, accounting for over 50% of the market in 2020, while the HoReCa sector represents the largest application. The Asia-Pacific region continues to dominate the global surimi market, reflecting its strong demand in food processing and hospitality industries.

CURRENT SCENARIO OF THE SURIMI MARKET

Key factors driving the Growth of Surimi Market

The aquaculture industry is rapidly growing, driven by increasing global seafood demand. According to the FAO, aquaculture and fisheries produced approximately 214 million tons in 2020, projected to rise by 15% by 2030. This growth fuels the surimi market, as it provides a lean, versatile, and convenient protein alternative, catering to diverse dietary needs. Surimi's popularity is particularly notable in Asian cuisines, with its sustainability and availability boosting demand in emerging markets. Globally, fish and marine products are vital for nutrition and food security, with countries like Portugal, South Korea, and Japan being major consumers, while landlocked nations have minimal intake. This rising seafood consumption is a key driver of the surimi market's expansion.

Changing dietary trends to drive the growth of the surimi market

The surimi market is thriving as dietary preferences shift toward healthier, low-fat, and high-protein options. Surimi’s adaptability makes it suitable for various dietary plans, including gluten- free and low-carb diets, offering a versatile and guilt-free seafood choice. Its high nutritional value, rich in protein and omega-3 fatty acids, supports heart health, reduces obesity and inflammation, strengthens bones and muscles, and enhances metabolism. Consumers seeking convenient and delicious seafood options appreciate its health benefits, including minimizing cardiovascular risks and maintaining a healthy weight. This growing awareness is driving surimi’s market expansion.

Key factors hampering the Market growth

- Lack of raw resources and high initial cost for setting up plants required to produce surimi will hamper the growth of the market

The global surimi market is projected to grow significantly from 2024 to 2031, driven by rising seafood demand and health-conscious dietary trends. Fish surimi dominates the market, with fresh surimi leading in form and the Asia-Pacific region holding the largest share. Surimi’s high protein, low fat, and omega-3 content make it ideal for various diets, reducing obesity and cardiovascular risks. Major applications include HoReCa and food processing, with B2B channels leading distribution. However, challenges like raw material shortages, high production costs, and sustainability issues hinder growth. Manufacturers are focusing on innovation and sustainable practices to meet evolving consumer needs.

References

Majumder, R.K., Balange, A.K., (2023) Advances in Fish Processing Technologies Preservation, Waste Utilization and Safety Assurance. In: B.A. Shamasundar, Surimi and Surimi Based

Products, published by Apple Academic Press Inc., pp. 31 – 52.
Yadav, N.K., Lal, J., Vaishnav, A., Patel, B., A. and Biswas, P., Innovations in Fisheries Science and Aquaculture Ishwar, C., (2024). In: Chandra, I., Advancing surimi-based product development. Chapter 18,
Atul, K., Jana, A., Jayaswal, R., Lai, J. and Chandra, I., Exploring New Horizons: Advancing Surimi Based Product Development, Sathish serial Publishing House, Azhagar, Delhi, pp – 347 – 365.
Elavarasan, K., Sathish Kumar, K. and Mandakini Devi, H. (2024). Surimi and Surimi Products ICAR-Central Institute of Fisheries Technology, Kochi, Kerala, India.
Surimi and Surimi Seafood, (2013). edited by Jae. W. Park Oregon State University, Astoria, Oregon,3rd Edition ,pp-666
Nisha Deore,(2024), Gnitive Market Research,8th edition ,pp-250.