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The Equipment Utilized in Fish Mince and Surimi Processing

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Abstract

Fish mince and surimi are valuable seafood products that enhance global food production, sustainability and economic growth. Fish mince is mechanically separated flesh, while surimi is a refined, protein-rich concentrate. Both the seafood products are processed from underutilized species, that reduces waste and maximize the efficiency of resources. The processing of such products relies on the specialized equipment like mechanical deboner, fish meat separator, fish washer, rotary screen dehydrator, washing system and decanter centrifuge along with freezing and blending technologies that ensure product quality and stability. This review highlights the role of key equipment involved in the production of fish mince and surimi production in order to improve yield, food safety and sustainability while fulfilling the growing demand of high-quality seafood globally.

Keywords: Deboner, Fish meat separator, Rotary screen dehydrators, Surimi

Introduction

Mince is the comminuted form of flesh which is extracted from fish skin, scales, bones and fins. The nutritive properties of fish mince (unwashed) have similar properties like raw material, but having superior properties than surimi. While, Surimi is a wet concentrate form of myofibrillar protein extracted fish muscle and is originally discovered in Japan (Walayat *et al*., 2025). Surimi is a stabilized fish mince which is mechanically deboned, washed and filtered. In global food production, the seafood industries play a crucial role, because it involves the significant increment in the production of two highly valuable products like fish mince and surimi. These processed products have several benefits such as nutritional, functional and economical, which makes them highly essential for consumers as well as manufactures. As, the fish mince and surimi were processed from fish trimmings and low value species, it supports sustainability efforts and also minimize the accumulation of seafood waste generated during production. Their production involves the efficient utilization of raw materials such as underutilized fish species, fish trimmings and bycatch which might be discarded and also maximizes the utilization of resources and supports sustainable fishing practices. Such processing techniques increases the market value, earns a good exchange money and create good opportunities for revenue generation. Under the category of processed products from surimi, such as imitation crab, fish balls and fish sausages earned incredible demand in global markets, mainly in Asian countries, Europe and North America. Fish mince and surimi, both are the excellent reservoir of essential amino acids, high-quality protein and omega-3 fatty acids. They are widely used for the production of healthy and nutritious seafood-based products. If the surimi is processed properly under hygienic and frozen condition, it can have an extended shelf life as compared to fresh fish. Thus, it has ensures the availability of surimi throughout the year and reduction in post-harvest losses. In the present era, there is demand for processed and ready-to-eat seafood products, so the production of fish mince and surimi provides a scalable solution, which can fulfil the consumer demand without sacrificing the nutritional benefits. Followed by the refining process, the process of preparation of fish mince involves the mechanical extraction of meat from bones. To enhance the yield and consistency, various automated equipment, such as

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heading, deboning, filleting, washing and freezing, have been used in the modern processing industries. This article briefly describes about the key equipment and technologies which are involved in the preparation of fish mince and surimi. It also highlights the role to improve quality of product, in order to ensure food safety and to increase sustainability in the processing industries. The flowchart of fish mince and surimi was presented in figure 1.

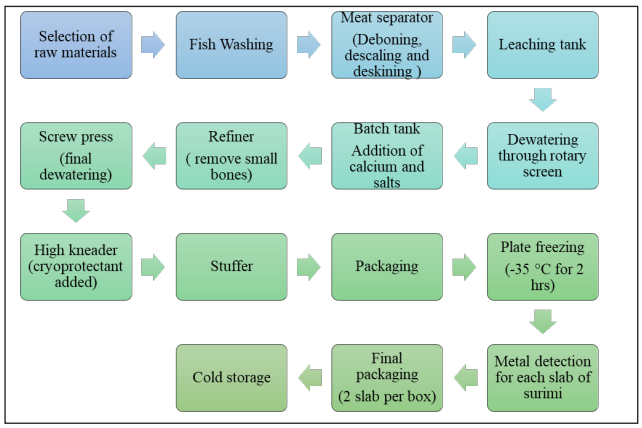

Figure 1: Processing of fish mince and surimi production

Different Machineries Used for the Preparation of Fish Mince/ Surimi

1. Fish Header/Gutter

Raw fish before filleting was processed in header/gutter which is a machine fabricated for the removal of head, viscera and a significant portion of the backbone. This step is crucial for minimizing the microbial load, contamination and enzymatic activity, because most of the microorganisms and enzymes are majorly found in the viscera and gills. The quality and yield of the mince was directly affected by the accuracy of head-cutting position. If the cut is too far forward, remnants of the gills and heart may remain, leading to a decline in product quality. Conversely, if the cut is too far back, valuable flesh is lost, reducing overall yield. Proper calibration of the header/gutter machine ensures optimal processing efficiency and maintains the balance between quality and yield.

2. Raw Material Washer

A raw material washer [Figure 2(i)] is an essential piece of equipment used in fish mince and surimi processing to remove impurities such as blood, slime, scales and residual viscera from the fish before further processing. Proper washing helps improve the quality, colour and texture of the final product by reducing microbial load and unwanted components. Fresh fish (headed and gutted), transported in a vehicle which is fully insulated, into raw-material storage chamber *via* chute doors. Once the raw materials are received, their organoleptic characters and temperature checking is carried out. Then the fishes are drained and weighed. Further, the raw material is iced carefully and stored in chill room having constant temperature between 2 to -5 °C.

3. Fish Washer

Fish washer and meat separator are connected. After carrying out the process of deheading, degutting and washing of fishes, it is washed properly to completely remove the adherent particles and blood, to make it suitable for further processing like deboning. When processing is done by using machine, its speed can be increased to get high yield of fillets. Sorting can be done automatically by using apparatus like roller or caterpillar. The fish washer used in processing industry was shown in figure 2(ii).

4. Mechanical Fish Meat Separator

A separator (belt-drum type) is the most commonly used equipment for meat separation in fish mincing and deboning operations. During the production of surimi and fish mince, the hopper is fed with fishes and transported by a conveyor belt made of rubber material into a perforated drum. The drum, typically featuring openings of 3 mm or 5 mm, allows the separation of soft flesh from bones, skin and connective tissues. The choice of perforation size significantly influences the texture and quality of the final product. A 5 mm perforation is commonly used as it produces a coarser mince with better texture, whereas smaller perforations yield a finer mince but may reduce overall efficiency. Conversely, using a larger perforation may result in an excessive amount of bone fragments in the mince, compromising product quality. The selection of the appropriate meat separator depends on fish size and its texture. Smaller or firmer fish benefit from smaller perforation openings, as larger holes may lead to an increased presence of fragments of bones and broken skin in the mince (Park, 2005). Another critical factor is belt pressure, which affects both yield and product stability. Higher belt pressure increases the force amount of minced fish through the perforations, improving yield. Thus, excessive force can negatively impact protein functionality, lipid stability and colour, leading to reduced frozen storage stability. Therefore, optimizing the pressure, perforation size and drum perforation area is essential to balance yield, texture and quality in fish mince and surimi production. Image represented in figure 2(iii).

5. Leaching Tanks

Leaching tanks [Figure 2(iv)] in surimi production are used to wash minced fish paste to remove impurities like blood, fat and unwanted pigments. The process involves agitating the paste in chilled water, sometimes with mild alkaline or salt solutions, to enhance purification. Multiple water changes are done to achieve the desired purity, improving the texture, flavor and gelling properties of the surimi. This step is essential for producing high-quality surimi products. Leaching process helps to remove sarcoplasmic protein and other fatty substance. Water percentage decreases with consequent process of leaching. Two times leaching is done in industrial level. In first leaching tank water percentage is 60-70% while in second leaching tank water percentage is 50%. The count of washing cycles and water volume varies with several factors like fish species and its freshness, the quality of surimi and type of washing unit required. During processing a batch, the desired ratio of water to mince ratio is 5:1 to 10:1.

6. Rotary Screens

Large rotary screens are used to strain the fish mince which

(i) Raw material washer

(ii) Fish washer

(iii) Meat separator

(iv) Leaching tank

(v) Rotary screen

(vi) Batch tank

(vii) Refiner

(viii) Screw press

(ix) High kneader

(x) Stuffer

(xi) Surimi block

Figure 2: Machineries used for the preparation of fish mince/surimi

is mixed with wash water for intermediate dewatering. These rotary screen dehydrators are typically fabricated with stainless steel material having punched or mesh plates, designed for retaining the fine particles of meat (Kim and Park, 2007). The screen openings, usually around 0.5 mm in diameter, gradually decrease from front to the rear end to enhance the process of dewatering. Therefore, the quantity of the initial mince that gets lost as fine particles when passed through the screen was 8%. To mitigate or reduce such loss, modern surimi processing plants are increasingly utilizing the decanter centrifuges that can recover the particles of protein from the wash water. The material having moisture content is typically reduced from 99.0% to 93.3% in exiting the rotary screen. The image of the equipment was depicted in figure 2(v).

7. Batch Tank

A batch tank [figure 2 (vi)] used in surimi production is a vessel like equipment that hold and mix fish paste during different processing stages, such as washing, seasoning, or adding additives like cryoprotectants. It is basically designed for holding fish paste after it has been leached. The paste can be mixed with other ingredients or chilled to maintain its quality. The batch tank can hold a specific quantity of fish paste at a time (hence "batch"), where the fish paste can be stirred or agitated. The tank can also utilize for the addition of additives, salt, preservatives, or various other ingredients. The batch tank ensures the uniform mixing because of its controlled environment, which is necessary for producing surimi with consistent texture, flavour and other qualities. Temperature and mixing can be controlled to maintain the quality of the surimi.

8. Refiner

Refiners [Figure 2(vii)] are used to separate the skin, scales and tissue, by selective screen sizes. This equipment typically contain screen which is in cylindrical shape and fitted with screw shaped rotor. The mince which is washed, faded in the machine, where the meat is forced selectively *via* perforations under the compressive force generated by the rotor. Further, the soft and white meat comes out from the frontal part of the refiner. Hard materials such as skin, bones, scales and connective tissues, those which can't passes through the perforations, were discarded through the end part of the refiner as rejected material.

9. Screw Press

Prior to adding cryoprotectants and freezing in blocks, a considerable amount of water is removed at the last dewatering step using a screw press. The efficiency of water removal is determined by the screw press's length and speed, volume reduction ratio and screen perforation. In the industry, screens with holes ranging from 0.5 to 1.5 mm are frequently utilized. In order to maintain recovery, screens with smaller perforations are typically positioned in the end portion. Usually, the material that goes through a screw press has a moisture content of 80-84% (Park, 2005). Equipment showed in figure 2(viii).

10. High Kneader

From screw press, concentrated meat transferred in high kneader [figure 2(ix)]. The cryoprotectant is added to frozen surimi to ensure maximum functionality. Most commonly used cryoprotectants in surimi are sucrose, sorbitol and polyphosphates in a concentration of 4%, 4% and 0.3% to enhance protein solubilization and gel elasticity (Walayat *et al*., 2025). A mixture of components like sodium tripolyphosphate and tetrasodium pyrophosphate in (1:1) is commonly used as a synergist at 0.2-0.3%. Polyphosphate use for binding agent and its percentage is 0.2%.

11. Stuffer

Blended material is shaped into blocks of appropriate size and weight (10 kg). Stuffer used in processing industry was represented in figure 2(x).

12. Freezer

Surimi is frozen in shape of rectangular blocks which weigh about 10 kg in a plate freezer. Before loading the material for freezing, the plates of freezer are cleaned properly. The surimi blocks [Figure 2(xi)] should be loaded evenly in freezer plates to maintain better contact between plates and blocks. Blocks are held in freezer for approximately 2.5 h or until the inner core temperature of blocks reaches -25 °C. To have better shelf-life, frozen surimi blocks are kept in cold storage at -18 °C maintaining a minimum temperature fluctuation.

Conclusion

Efficient fish mince and surimi production relies on specialized equipment to ensure quality, consistency and sustainability. Key technologies, including mechanical deboners, rotary screen dehydrators, washing systems, decanter centrifuges and advanced freezing methods, optimize yield and maintain product functionality. Automation enhances the efficiency, reduces the generating waste and ensures food safety. As the demand increases, advancements in the sector of processing technology will further maximize the resource utilization, sustainability and production efficiency.

References

Kim, J.S., Park, J.W., 2007. Mince from seafood processing by-product and surimi as food ingredients. In: *Maximising the Value of Marine By-Products:* (Ed.) Shahidi, F. Woodhead Publishing Series in Food Science, Technology and Nutrition, Woodhead Publishing. pp. 196-228. DOI: https://doi.org/10.1533/9781845692087.2.196.

Park, J.W., 2005. Mince from seafood processing by-product and surimi as food ingredients. In: *Surimi and Surimi Seafood*, 2nd Edition. (Ed.). Park, J.W. CRC Press, USA. pp. 167-200. DOI: https://doi.org/10.1201/9781420028041.

Walayat, N., Blanch, M., Moreno, H.M., 2025. Surimi and low-salt surimi gelation: Key components to enhance the physicochemical properties of gels. *Gels* 11(2), 142. DOI: https://doi.org/10.3390/gels11020142.