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Innovations in Seafood Processing

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Fish are considered highly nutritious products of the aquaculture system due to the presence of well-balanced macronutrients such as proteins, lipids and micronutrients such as vitamins and minerals. These fish are a good source of human food that promotes growth and protection of the body from a variety of health diseases such as cardiovascular and coronary heart diseases and prevents rickets and mental diseases in children (Ali et al., 2022) Humans eat fish due to it's an excellent food. They prefer superior processed foods with a small degree of nutritional value changes. Advanced methods of handling, packing, preserving, and storing food limit unwanted changes in food because food manufacturers develop various kinds of processing technologies. (Belcher, 2006) Aquatic foods are highly perishable and usually spoil faster than the other food. Fresh fish undergoes many changes as a result of autolysis and bacterial activity. Proper storage conditions are required to present the spoilage of fishes and their products. Many new technologies have developed for this purpose. Among these, high pressure processing irradiation, microwave processing etc. are very much important (Sitaram, 2021) With the ever-growing world population and the need to store and transport the food from one place to another where it is needed, food preservation becomes necessary in order to increase its shelf life and maintain its nutritional value, texture and flavour. Therefore, good food preservation techniques must prevent microbial spoilage of food without affecting its quality and nutritional aspects.

Spoilage in fish can be occur due to two major reasons such as Enzymatic and bacterial, the enzymatic spoilage is due the of enzyme. The main function of enzyme is to catalyst any chemical reaction. After the death of fish, the enzyme performs just opposite of it and performs the fast spoilage in fish, whereas the bacterial spoilage is mainly depending on the water from fish which has been harvested and local bacterial load present in fish and such as mostly present in gut, gill and followed by skin. When fish dies the entire immunity of the fish collapses and bacteria use the nutrition present in fish to proliferate. Seafood processing has traditionally been challenging due to the rapid spoilage rates and quality degradation of these products. With the rise of food science and technology, novel methods are being developed to overcome these challenges and improve seafood quality, shelf life, and safety are as follows.

1. High-pressure processing (HPP)

This is a non-thermal processing method in which already packed fish products are placed in a high-pressure processing container and subjected to uniform pressure circulates to the product by hydraulic fluid. This process eliminates the existence of food spoilage bacteria, mostly fungi that have been discovered found to be especially sensitive to high-pressure

processing. This method is beneficial as it offers high-quality food, particularly for very heat sensitive foods. It doubles the product's shelf life and doesn't release an off-odour while maintaining texture, taste, and flavour. this method cannot guarantee that the enzymes are resistant to pressure or spores. it is too expensive to install.

2. Irradiation

Irradiation is the process of utilising atomic energy to process food by ionising radiation. Food irradiation is a process of processing and preservation that works similarly to pasteurisation or freezing. The food is subjected to radiation or ionising energy doses throughout this process. In seafood industry, ionizing radiation mainly used is Cobalt-60 and Cesium- 137. Radiation increases a product's shelf life at low dosages. This technique kills bacteria, moulds, insects, and other potentially dangerous microorganisms at larger dosages. Since no heat is applied, there is no detectable change in taste when compared to heat treatment technology. This technique destroys harmful microorganisms, kills insects, and prevents crops from sprouting or losing weight.

3. Retort Pouch Processing

Flexible retort pouch is a great substitute for metal canisters. It provided products of superior quality. Retort pouches, having a three-layer structure of thickness 12.5 µm polyester/12.5 µm aluminum foil/80 µm cast polypropylene were sterilized in a steam/air mixture over a pressure retort. These three layers form an impermeable package by keeping moisture and air from escaping. The preservation is achieved by heating items that are in hermetically sealed pouches or containers to high temperatures (121^0C), which achieves commercial sterility and kills most germs save for those that are extremely heat stable. This procedure involves heating the items to a high temperature (121^0C) for a predetermined amount of time in order to achieve commercial sterility and reduce the possibility of pathogens and toxins producing bacteria occurs in canned foods. This temperature is mainly used to eliminate spore forming anaerobic bacteria named C*lostridium botulinum* as *Cl. Botulinum* produces a toxin in food that causes botulism which attacks on nervous system.

4. Modified Atmospheric Packaging (MAP)

The term "Modified atmospheric packaging" (MAP) refers to a method of extending the shelf life of perishable goods by changing the gas composition around the food. It helps to slow down of aerobic bacteria and mould, minimise oxidation, maintain freshness, colour and nutritional content. With replacing air, the package contains with a specific combination of gases, typically carbon, oxygen, and nitrogen. Nitrogen is a non-reactive gas that displaces oxygen, Prevents oxidation. A tiny amount of oxygen may occasionally be added to items to preserve their colour and texture in addition to carbon dioxide's ability to prevent microbial growth. For a wide range of food goods, including meat, fruit, and shellfish, MAP is commonly utilised. Over the past 20 years, altered atmospheric One of the most advanced fish packaging technologies now is in use. The combination of gases used depends on the kind of fish; for lean fish, the ratio is 40% carbon dioxide, 30% nitrogen, and 30% oxygen; for fatty fish, the ratio is 60% carbon dioxide, 40% nitrogen; the shelf life of fish is impacted by temperature and storage; at 0^0 C, it can last up to 9 days for lean fish.

Conclusion

In order to solve the issues of food and nutritional security, variety in products, value addition, increasing exports, and reducing post-harvest losses, aquatic foods are crucial. They can also help to reduce global hunger and promote economic growth. Customers want processed foods of the highest standard with the fewest possible nutritional alterations. Modern heat-and non-heat-processing technologies will assist preserve fish's nutritional

qualities, lengthen its shelf life, assure safety, improve convenience, eliminate waste, ease imports and exports, and most importantly raise its economic value.

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