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QUALITY CONTROL OF MOLLUSCAN PRODUCTS

77. QUALITY CONTROL OF MOLLUSCAN PRODUCTS

—Theme Paper

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INTRODUCTION

The molluscan shell fishes, like clams, mussels, oysters and scallops are important animals in the ecology of coastal waters particularly with respect to the productivity of coastal waters and their role in aquaculture. They also represent an important food source in many parts of the world, particularly in Far East, South America and Europe. The scientific exploitation of this food resource and its proper processing is very important in the national economy of these countries. Besides effecting substantial improvement in the economy of the fisherman it can also meet the acute protein deficiency of a country like India.

Mussels are widely used by scientists as a monitor in pollution studies. Most studies on molluscan fish carried out in India have a physiological orientation, in the sense being carried out by biologists who are basically concerned with metabolic regulation of the whole animal. Hence, many data, particularly on biochemical composition, accumulated over the years have of little applied value to the processing technologists whose principal aim is to process and sell. In this article the author summarises the various reports which are of applied value and aids in drafting possible quality standards for the molluscan products.

Nutritive value of molluscan fishes

Several workers (Lakshmanan and Nambisan 1980, Chinnamma George, 1984) have reported varying values. It is likely that seasonal variations, feeding habits, availability

of food, temperature of the habitat and stages of sexual growth would have largely contributed to the vast differences in the biochemical composition reported by the several investigators. However, the data shows, from the nutritional points of view, that these molluscan forms one of the best source of protein, fat and minerals. It is said that mussels are best to be consumed in late autumn and winter, probably due to high nutritive value in these months. No such views are seen for clams or oysters.

Problems of processing molluscan resources

Heavy metal contents

Being filter feeders and also bottom feeders they eat all the dirt and detritus. Hence, their meat is likely to contain large quantity of mud, chlorophyll, sand and microorganisms. Apart from this, these fishes have no system in their body by which they can metabolise/destroy the absorbed heavy metals and pesticide residues. When living on polluted coastal water they accumulate large quantity of heavy metals. The relative amount of these heavy metal that can be contained as an integral part of the muscle constituent has no fixed limits. It only reflects the amount that is contained in the ecosystem. Clams and mussels caught from water bodies where there is a discharge of industrial effluents will invariably contain a heavy load of such metallic residues. Hence, they can be used as animals to monitor the rate of environmental pollution. This is also applicable to the bacterial flora of the molluscan fisheries.

Nambisan and Lakshmanan (1977, 1979, 1980 and 1983) have done extensive investigations in the heavy metal content of molluscan fish and toxicity. Processing of contaminated

molluscan fish and eating them poses enormous problems of health hazards to man. This necessitates proposing of limits for all contaminants in molluscan products. Our experiences in CIFT have revealed that often the processed products fail to meet the prescribed standards. This is one major reason why our fish processing establishments did not show much interests in processing and exporting substantial quantity of our molluscan resources.

Microflora of clam, mussel and oysters

Since molluscan bivalves like clams, mussels and oysters are filter feeders, they accumulate in their body a large number of bacteria from their environmental water. The major group of bacteria found usually are coliforms, *E. coli*, Faecal *streptococci* and occasionally pathogens like *Salmonella*, *Shigella*, *Vibrio parahaemolyticus* and *Vibrio cholerae*. Generally the profile of the bio-accumulated bacteria will be a true reflection of the bacterial profile of their environmental water. Since clams are harvested from the brackish water, which are usually more polluted than sea water they are to harbour more bacteria of public health significance. As sea water has some bactericidal properties, mussel and oysters harvested from sea have less number of faecal bacteria. Surendran *et al* (1985 a, b) and Balachandran *et. al.* (1984, 1985) have done an extensive study of this aspect of the nature of molluscan microflora. Their study unmistakably proved one fact that molluscan fish, particularly clam, mussel and oyster, can create health hazards if not properly processed. The study also showed that both *Faecal streptococci* and *Coliforms* are invariably present in clams while they are insignificant/seen in lesser limits in mussels and oysters. This shows that for molluscan products we have to recommend higher limits for the total number of organisms per g. of sample compared to fish and prawn.

Pesticide residues

Indiscriminate use of large quantities of pesticide residues result in pollution of water bodies associated with farm lands. Both clams and mussels are found to accumulate substantial amounts of pesticide residues. In recent times

international standards have been suggested for maximum limits for pesticide residues in processed foods. However, this has not become a major problem to the seafood quality and hence not discussed in detail here.

Opening of bivalves

This is a moajor problem while consuming the bivalves. The following methods are widely used:

1. Opening by hand
2. Opening by steam. Cooking at 240°F plus and at and at pressures 12 psig plus.
3. Opening by heat and water jet.
4. Opening by infrared light.

Processed products

Generally clams, mussels and oysters are processed to get the following products:

Drying

Dried clams and mussels are usually prepared with a view to keeping for long periods of time. Meat is shucked, blanched in boiling brine (5%), drained and dried to a moisture level 10% Shelf-life 6-8 months.

Smoking

Shucked meat is blanched in 5% boiling brine, drained, semidried and then smoked in conventional smoke kiln for 30-45 min. It is further dried to 10% moisture content. Shelf-life 6-8 months.

Quality problems

The product is usually attacked by moulds, fungus and halophilic bacteria.

Standards

There are no standards postulated in India or elsewhere so far for either smoked or dried clams and mussels. There is also practically little or no export of these commodities.

Canning

After heat treating both clams and mussels, the shucked meat is blanched in 5% brine. The materials are canned in the usual way. A relatively higher heat processing time

is usually recommended for both clams and mussels owing to the occurrence of high amounts of Coliforms and *F. streptococci* in the native meat. Clams and mussels are processed mainly as 'oil pack'. Brine is also used as a filling material.

Standards

There are no Indian Standards for canned mussels and clams.

Freezing

Clams and mussels:

Prior to freezing the materials are often kept under ice in insulated containers. Meat is separated by one of the earlier referred processes and then frozen either individually or as blocks at -40°F and kept stored at -40°F and kept stored at -10°F. Usually water is used as a glaze to the frozen material.

Shelf - life

Mussel : Fresh frozen : upto 40 weeks iced (upto 8 days) and frozen, 15 weeks

Clams : Fresh frozen : 35 weeks iced (8 days) and frozen : 4 weeks.

Processing of oysters

Processing of oysters encounters another technical problem which is not seen for both clams and mussels. When oyster is removed from its shell it immediately begins to bleed losing much of its juices and liquid with consequent loss of weight and flavour. Therefore, it is recommended that oysters should be immediately eaten once its shell is opened. The oysters must be transported (preferably alive) under refrigeration, the shell must be forcibly opened and immediately consumed. This poses the economical marketing of oysters at a distance from sea difficult.

Oysters can be best processed in the following ways:

1. As frozen material (IQF)
2. Transported fresh as live and served (cooked) immediately.
3. As canned in oil medium.
4. As a processed oyster powder.

Quality criteria for processed molluscan products

As there are no international standards recommended for molluscan products it is difficult to stipulate standards. However, based on the work carried out at CIFT and elsewhere the following approximate standards can be adopted for various products. Only boiled clam meats are sold locally. Over the years about 200 samples were analysed by CIFT for their microbial quality.

Code of practice for handling and processing

Depuration

Since all molluscans invariably contain mud and high levels of bacteria and studies conducted conclusively proved, depuration must be recommended as an accepted code of practice for handling and further processing of these material. By depuration in clean natural habitat water, preferably over night for 18-24 hrs., in live condition usually 90% reduction in bacterial Population can be achieved. Also substantial improvement in the flavour of the meat is also obtained. A subsequent washing of the meat in 5 ppm chlorinated water is also recommended.

Metallic impurities

All molluscan processed products must contain a certificate enclosing the levels of metallic residues as per the proposed standards.

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