Trans. Nat. Acad. Science
& Technol. 1984.6:77-84

QUALITY ASSURANCE IN THE FISH PROCESSING INDUSTRY

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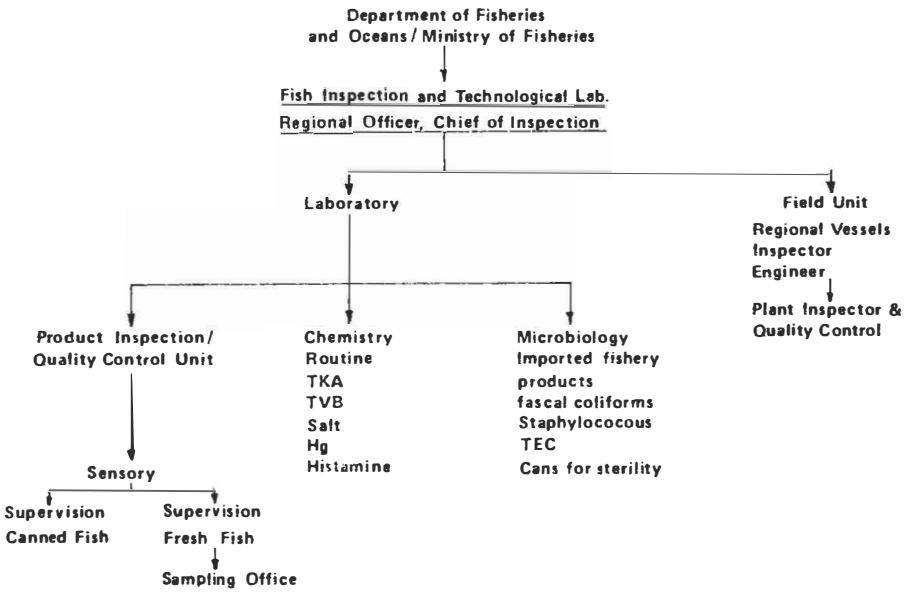
1.0 Quality Assurance vs. Quality Control

The development and expansion of the local export trade of fish and fishery products can be facilitated by instituting a system of quality control measures.

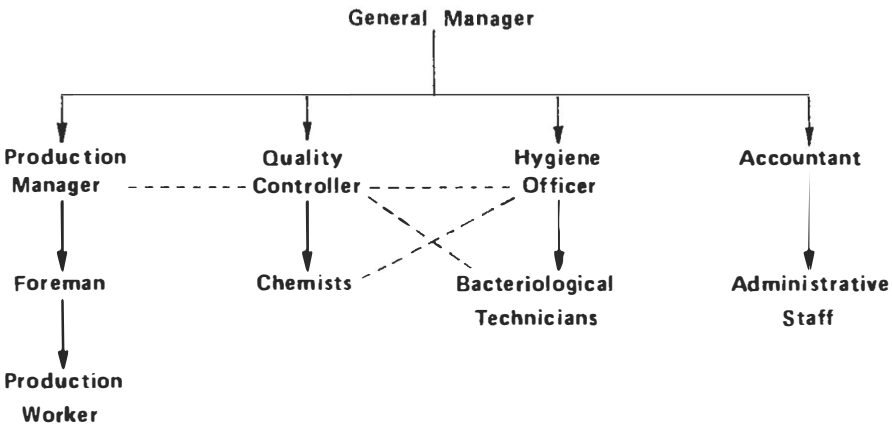
Quality Control is defined as the application of measures that slow the deterioration of quality to its lowest practical rate while *Quality Assurance* is the application of measures that ensure the availability of only high quality seafoods for consumption.

2.0 Schematic Diagram of an Ideal Quality Control Organization

2.1 Government



2.2 Industry/Processing Plant



3.0 **Problems in the Local Industry Due to Lack of Quality Assurance Measures**

3.1 *Vibrio, Staphylococcus, Salmonella* in exported shrimps and prawns

Tons of frozen shrimps imported from the Philippines were destroyed because of *V. cholerae* contamination by Tokyo quarantine officials of the Health and Welfare Ministry (April 21, Bulletin Today, 1984). It was the first case of cholera genms found in frozen shrimps imported from the Philippines.

Failure to comply with food import regulations has resulted to tremendous losses incurred by exporters of fishery products, these losses can be avoided. Importing countries like West Germany, Denmark and France have strict specifications for food poisoning organisms such as *Staphylococcus* and *Salmonella* in frozen shrimps and prawns. These countries require the absence of *Salmonella* in 25 g sample; *S. aureus* counts must not exceed 10^2/g sample. Mendoza (1981) reported that the counts of *S. aureus* in market samples of frozen shrimps and prawns ranged from $10^1 - 10^3$. Three processing plants were found to be positive for *Salmonella*. Analysis of the possible source of contamination in four shrimp processing plants investigated showed a prevalence of *S. aureus* in the hands of workers ranging from 40 to 77.88%. Moreover, the raw materials were found to be contaminated with *Salmonella*. Observance of proper hygiene by the workers and in all stages of processing of the product must be strictly followed to eliminate the risks of contamination of the shrimps and prawns with pathogenic organisms.

3.2 Histamine in Canned Tuna

Histamine is implicated in scombroid poisoning. Scombroid poisoning

is due to microbial enzyme decarboxylation of histidine to histamine. Scombroid toxin is common in frigate mackerel (tulingan) and other species of the family Scombridae such as tuna, tuna-like species and mackerel. Studies on the effects of delay in icing and processing of scombroid fish on the histamine levels have been conducted locally (Orejana *et al.*, 1983).

Canned tuna for export usually contains between 10 mg% and 30 mg% histamine which is above the limit of 10 mg% set by importing countries like West Germany. The BFAD (Bureau of Food and Drug) therefore requires a certificate of histamine analysis before canned tuna can be exported as an assurance of quality.

3.3 Lack of Hygiene in Fish Sauce/Fish Paste Establishments (Processing Plants)

Recently (April 19, 1984; Bulletin Today) shipments of fish sauce and paste for the U.S.A. were rejected and detained by the US Food and Drug Administration due to the presence of insect and rodent filth. The rejection of the contaminated food products was mainly due to lack of hygiene in the processing establishments. The practice of using dirty containers, contaminated salt, contaminated raw materials should be strongly discouraged in the fish sauce/fish paste industry.

3.4 Under-Processing/Over-Processing of Canned Fish Products

Microbial spoilage of canned products may be a consequence of underprocessing which may result to health risks with *Clostridium botulinum* contamination and commercial risks with non-pathogenic spoilage. The process must be sufficient to eliminate heat resistant spores of *C. botulinum* or other even more heat resistant spores. The specified process time and temperature for a specific product must be achieved and strictly followed.

The lack of heat penetration data monitoring can result in underprocessing or overprocessing. Overprocessing may lead to overcooking and loss of color, flavor, texture, and nutrients. All these are to be avoided with implementation of quality assurance measures.

3.5 *Salmonella* in Fish Meal

The Salmonella outbreaks in U.S.A., U.K., Europe and Israel in the early 1970's resulted to strict regulations for incoming fish meal. Contamination of fish meal with *Salmonella* will likely occur if the meals are not properly handled. Sumner, Quiazon and Nieto (1981) found that fish meal imported from the U.S.A was contaminated with *Salmonella*. The contamination of the meal may have possibly occurred in the Philippines due to improper handling and storage.

3.6 Aflatoxin in Fish Meal and Some Smoked Products

Fish meal and smoked products may harbor aflatoxin producing molds if not properly handled. Prevalence of aflatoxin producing molds in some smoked fish products has been reported by Bulaong (1983). Possible source

of these aflatoxin producing molds is the brine used for salting the smoked fish. Trinidad, Espejo-Hermes and Reilly (1983) isolated several species of *Aspergillus* which are potential aflatoxin producers in the brine used in the commercial production of smoked fish. The practice of some local processors of using the brine continuously must be discouraged due to the danger of growth of aflatoxin-producing molds in the product.

3.7 Freezer Burn in Frozen Fish

The rate of deterioration of frozen fish is mainly dependent on its temperature. Variation in temperature may result to freezer-burn (whitened, toughened, and wrinkled appearance of parts of the surface that have been excessively dehydrated). Freezer burn can be reduced by using tight-fitting wrapping impermeable to water vapour, and by glazing the product (dipping the frozen product in water).

3.8 Poor Market Quality of Wet Fish

Wet fish usually command lower prices than processed products due to improper practices of fishermen, wholesalers and retailers. Fish must be maintained at a temperature of as near as 0°C as possible after catch to assure its good quality. For this purpose adequate amounts of ice must be used. Re-icing, particularly during the hot months, must be done as often as possible.

3.9 Inferior Quality of Local Extracts of Carrageenan

The inferior quality of carrageenan produced locally could be due to lack of quality control of materials. Mixtures of seaweeds for carrageenan extraction are being used in the industry. Proper selection of raw materials must be done to produce good quality carrageenan extracts.

3.10 Inferior Quality of Dried and Smoked Fish

This problem emerged due to the absence of standards for these products. Variability in the processing practices results to inferior quality. The important aspects of quality in dried and smoked fish are concerned with the freshness and manner of preparation of the raw material, the salting process, the smoking process and the post-processing history of the products i.e. its storage, transportation and retailing.

3.11 Melanosis in Shrimp

The development of the black spots or melanosis may begin within a few hours after catch of the shrimps. However, even with continuous icing, blackening may be far advanced before the shrimps can be marketed. Icing of the shrimps immediately after catch should be encouraged to prevent melanosis. Removal of the head of the shrimps and/or the proper use of soluble antioxidants such as ascorbic and citric acid will help prevent blackening. *Calamansi* juice has been reported to be efficient in preventing blackening in shrimps (Bersamin, Legaspi and Macalincag, 1971).

4.0 Quality Standards and Codes of Practice Recommended for Fish and Fishery Products

The regulations on fish and fishery products are intended to ensure that these products conform to the standards of wholesomeness, sanitation and labelling required of domestic and import trade.

All fish and fishery products must comply with the FDA requirement covering the following areas: adulteration, misbranding, labelling, definition and standards for identification, tolerance of poisonous and deterioration substances, pesticide residues, food additives and good manufacturing practices defect action level.

Failure to declare the presence of added salt or the kind of oil used as the packing medium in canned fish has resulted in the detention of fish products. Artificial coloring is not permitted if it conceals damage or inferiority. Use of permitted artificial flavouring, artificial colors or chemical preservation must be conspicuously declared in the labelling. Imitations must be labelled as such.

Particulate and bacterial contamination in the processing, storage, handling, incubation, and operating practices within the plant must be avoided.

4.1 Quality Indices

4.1.1 Physical/Sensory

The sensory evaluation of fish quality has usually been made by methods based on either hedonic scale or on descriptions of the various sensory attributes of the fish: appearance of the eyes, gills and skin; texture of the flesh; odour of the raw and cooked fish and flavour of the product.

Physical evaluation includes TD (thaw drip measurement in frozen fish), Torrymeter (freshness test), texture measurement (by Instron or modified texture meters), odor/pollution levels measurement for fishmeal and others.

4.1.2 Microbiological Tests

Most commonly employed for microbiological analysis are the following:

Standard plate count at 35-37°C
Escherichia coli (Faecal coliform)
Staphylococcus aureus
Salmonella and *Vibrio*

4.1.3 Chemical/Nutritional Methods

Analyses for histamine (TLC, GLC, Fluorimeter) amino acid rancidity (TBA peroxide value), mercury, TMA (trimethylamine) and DMA (dimethylamine), TVB (total volatile base), protein, fat and others are required by some importing countries.

4.2 Specifications and Recommended Codes of Practice of Handling and Transport, Processing, Storage, and Distribution of Fish and Shellfish

4.2.1 ICMSF (International Commission on Microbiological Specifications of Foods). This body reviews and publishes values for SPC (Standard Plate Count) and pathogens, commonly used in different countries for different fishery products.

4.2.2 Codex Alimentarius — Joint FAO/WHO Food Standards Programme

Currently up to 121 (as of Nov. 1, 1981) countries are collaborating in the drafting of comprehensive, minimum standards for a wider range of products moving in international trade. Almost all are for products meant for direct sale to the consumer.

4.2.3 PSA (Philippine Standards Association)

The PSA (NSTA funded) is putting up standards on processed fish and shellfish with the cooperation of various research/government agencies (BFAR, UP, FDA, NIST) and the industry. FTI has also formulated standards for frozen and fresh fish.

5.0 Role of R & D (Research and Development) in Quality Assurance

Research and Development is important in the development of a new product, process or equipment which may elicit a change in quality control procedures. It could also be helpful in the task of translating values obtained from test procedures into meaningful grades and in integrating the various grades into a complete standard of quality. In short, R & D can lead to quality control measures which will upgrade the quality of products thereby improving their competitiveness in the market.

6.0 Conclusions and Recommendations

The emphasis given by developed countries on the quality control and fish inspection of fish and fishery products is quite remarkable. The high quality of fish and fishery products may be attributed to the voluntary and/or mandatory regulations and guidelines issued by government and private agencies. Quality consciousness is inherent in the manufacturer's concept while with the local manufacturers in the Philippines profit seems to be the primary consideration. In the developed countries, improved quality is synonymous with a better price for the product.

In the Philippines, the law of supply and demand and other economic factors as well as psychosocial problems make it quite difficult to enforce standards, if they exist at all for a limited number of products.

The lack of well-equipped centralized and regional quality control laboratories and the lack of qualified manpower mainly account for the poor credibility of government research agencies from the point of view of the industry. As a consequence, the improvement of quality of fishery products through technology transfer or research results is quite difficult to achieve. The traditional products (smoked, dried, and fermented) in the market are of heterogeneous quality. Since no grading of products is made locally, better quality products are not assured of

a higher price, as is the case in the U.K. and other countries due to the use of the EEC rating.

As to research priorities, local government agencies emphasize production and give lower priority to processing and quality standardization of products.

It is highly recommended that the organizational scheme of quality control and inspection in the Philippines should be reviewed and bureaucracy reduced accordingly. The overlapping of functions of various agencies which lessens efficiency must be eliminated or well-coordinated. Voluntary rather than mandatory compliance to guidelines (e.g. Codes of Practice by the Codex Alimentarius) should be encouraged. The private sector should be willing to share the task of improving product quality by financing semi-private or cooperative ventures similar to those found in Germany and Norway.

The importers of tuna in Germany and Denmark require histamine data from the exporters. The need for setting up a histamine laboratory for the industry either by the government and/or private sector is a priority that should not be overlooked.

There is a need to establish uniform procedures (microbiological, chemical, and sensory) for all the local agencies and the industry to adopt in the quality assessment of fish and fishery products, particularly for exported products.

The development of standards that are applicable to local products is recommended. For exported products the standards set by the importing country must be fully satisfied in order to create a good image of Philippine fishery products in the international market.

The grading of products as to quality and the corresponding increase in price for products of better grade will help encourage the industry to voluntarily conform to the codes of practice and standards put up by the quality control and fish inspection agencies.

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