

# ESSENTIALS OF FISH PLANT SANITATION

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Protection of the consumer against food borne diseases and maintenance of manufacturer's reputation are mainly based on the levels of sanitation in the processing establishments. The size of the individual production units in this country varies from small processing units running on marginal profits to well established factories adopting even mechanisation in washing and grading. This unevenness within the industry is often reflected in varied approaches towards the problems of sanitation. The Central Institute of Fisheries Technology has got a separate team to investigate on the problems of sanitation in fish processing, the results of which have indicated notable improvements in the sanitary conditions of the processing factories in recent years. Investigations pertaining to the location of sources of microbial contamination during processing,<sup>1, 2</sup> development of cleaning schedule,<sup>3</sup> relationship between product quality and bacterial load in processed product,<sup>4</sup> influence of season on bacterial quality of fresh and processed prawn and the like have considerably added to our knowledge on the technology of seafood production. Methods developed for the preparation of bacte-

riologically sound frozen froglegs<sup>5, 6</sup> and cooked frozen shrimp<sup>7</sup> have amazingly improved the microbial quality of such products. Based on these studies standards pertaining to sanitary handling of fish have also been formulated.<sup>8, 9</sup> Fishery Scientists and Technologists have to undertake lot of investigations in the coming years also when we make more concentrated efforts in augmentation of catch and product diversification. A well organized programme of sanitation in each factory will definitely result in better returns. It will be better that all fish processing establishments including fishing boats are brought under a system of licencing. The minimum hygienic requirements that each of these units may have to follow is outlined below. Some suggestions regarding organization of sanitation programme have also been given.

## **I. Minimum hygienic requirements**

### **A) Fishing boats**

1). Fish holds including linings, penboards, shelving etc. shall be designed and constructed in such a way that

they can be easily cleaned and disinfected between trips. Surfaces may be of non-corrosive materials and shall be smooth, hard, water-impervious and free from undue cracks and crevices.

2). All utensils and surfaces in the fishing boats that come in contact with fish shall be kept clean. Surfaces may be scrubbed with a suitable detergent like 'teepol' followed by disinfection using Chlorine of 100 ppm strength (for wooden surfaces concentration of chlorine may be raised to 1000 ppm) giving a minimum contact time of 15 minutes or by any other suitable method to get the desired effect.

3) Fishing boats shall carry ice prepared from potable water. Alternatively, ice shall also be prepared from sanitary sea water. Ice may be stored and handled in such a way that contamination can be avoided.

4) After each haul, the catch may be washed in potable water or sanitary sea water.

5) Immediately after washing, the material shall be mixed with ice in the ratio 1:1 and boxed or shelved.

6) Boxes and shelves shall be kept in fish holds having proper drainage facilities.

7) Boxes used for packing fish shall preferably be of polythene and shall be so designed and arranged that ice melt water carrying blood, dirt or slime does not trickle over the other.

8) Immediately after each haul is stored, the deck may again be cleaned and disinfected.

9) Wooden holds, bins, pens and shelves shall be dried and painted at least once a year. Paints used may be of such a nature that they do not contain any toxic ingredient. Worn and unsani-

tary shelves and penboards shall be discarded.

10) Provision shall be made on the vessel for the proper storage of oils or any other substance or material of such a nature that could contaminate or taint the fish and all fish shall be protected from such contamination.

11) Ice used or loaded during one fishing trip shall not be reused in subsequent trips.

#### **B) Unloading**

1) Unloading shall be done in accordance with procedures inherent of good commercial practice. The fish shall not be exposed to adverse elements of nature.

2) Fish de-iced for weighing shall be reiced or chilled below 2°C within 1 hour of unloading.

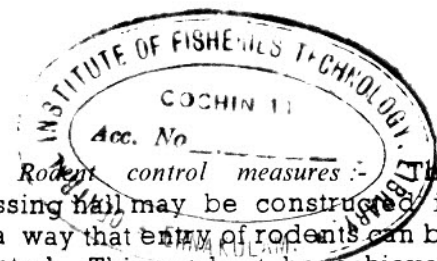
3) After unloading fish, all surfaces with which fish comes in direct or indirect contact shall be cleaned and disinfected.

#### **C) Transportation to the preprocess handling centres**

1) Fish may be transported at all times in accordance with the best commercial practice.

2) Containers used for transport shall not be filled to such an extent that may cause damage to fish when one container is placed on another.

3) All vehicles and containers used in the transport of fish shall be so constructed as to be easily cleaned. Material used for lining shall be of non-corrodible metal or other material impervious to water. The floor of the vehicle shall be constructed of durable material impervious to water. All corners shall be rounded to facilitate quick and thorough cleaning.



4) Both before and after transport of fish, the containers and fish carrying compartments of vehicles shall be washed and disinfected as per method outlined in A. 2 above.

5) All interior surfaces of vehicles and containers shall be clean and free from abnormal odours before being loaded with fish or fish products.

6) Insulated containers and vehicles equipped with refrigeration equipment shall be precooled to an air temperature of 5°C or below before loading starts.

#### D) Handling at preprocess centres

During this stage, fish meat is likely to come in contact with alimentary canal and its contents and therefore maximum vigilance is required at this stage.

1) *Location and design* :- The preprocess handling centres may be situated by the side of the water front along East-West direction facing North. Floor of the unit shall be smooth and cemented and the slopping shall be such that the water always runs into the drain. The roof may be of such a construction that accumulation of dirt and dust can be minimised. Floor-wall joint may be rounded so as to facilitate better cleaning. Wall may be cemented and well polished to a height of at least four feet from the floor.

2) *Separation of process* :- The area in which the raw material is received and stored shall be so separated from the area in which the material is graded or packed to the freezing/canning factories as to avoid cross contamination. Areas and compartments used for storage of edible products shall be separate and distinct from those used for inedible materials. Fish handling area shall be completely separate from the area used for residential purpose.

3) *Rodent control measures* :- The processing hall may be constructed in such a way that entry of rodents can be prevented. This can best be achieved by making the roof-wall joint tight and by closing the drainage channels using grills.

4) *Fly control measures* :- All doors and windows may be fitted with fly control nets. The doors may preferably be of self closing types.

5) *Lighting* :- Lighting shall be adequate for reasons of both safety and efficient working. If natural light is not adequate, it can be supplemented with artificial lights which are similar to natural light. Light bulbs and fixtures suspended over the product or any stage of its preparation shall be of safety type or otherwise be protected to prevent contamination in case of breakage.

6) *Ventilation* :- There may be sufficient ventilation in the processing hall. Exhaust fans shall be installed wherever found necessary.

7) *Water Supply* :- There shall be plentiful supply of potable water. The water supply may further be chlorinated to a residual level of 10 ppm and this water alone may be used at the different stages of processing. The consumption of water for every kilogram of raw material shall not be less than 10 litres which is considered to be the absolute minimum. Non-potable water supply circulated in the factory for such purposes as fire control, shall be in separate lines identified preferably by colour and shall be with no cross-connection or back-siphonage with the lines carrying potable water.

8) *Ice* :- Ice may be prepared from chlorinated water (10 ppm) and shall be handled, stored or used in such a way

that bacterial contamination can be avoided.

9). *Utensils and equipments:-*

a). The peeling, deveining or other processing operations shall be carried out on tables. The table top shall be of stainless steel, aluminium, or any other non-corroding, non-reacting material.

b). All food contact surfaces shall be smooth, free from pits and crevices and of non-absorbent types. These shall be capable of withstanding repeated exposure to normal cleaning. Enamelled and wire-mesh utensils shall not be used.

c). Equipments may be installed in such a manner as would permit easy cleaning.

d). Utensils used for inedible and contaminated materials shall be separately identifiable by some mark or colour so that these are not used for handling edible products.

e). Before starting and after finishing each day's work, all the utensils and equipments used for processing may be made slime free using a suitable neutral detergent followed by disinfection using sodium hypochlorite of 100 ppm strength giving a minimum contact time of 15 minutes or by any other suitable method to get the desired effect.

10). *Personnel hygiene:-* Factory personnel shall be properly clothed while on duty. They may wear clean overalls and head coverings and shall be trained to be appreciative of the need for high standards in both personal and plant cleanliness. Before starting the work, all those who have to handle the food

material, food ingredients or surfaces coming in contact therewith shall wash their hands from elbow down using soap followed by disinfection using Chlorine of 200 ppm strength. The process may be repeated each time they leave the processing hall and return for work again or at any other time their hands become otherwise contaminated. Spitting, excessive talk and use of tobacco shall be prohibited in premises where food material is being handled. Separate eating places may be provided and eating at any other place other than one allotted for the purpose may be discouraged.

11). *Personnel health:-* Plant management shall take care to ensure that no person while known to be affected with a communicable disease is permitted to work in any area of the unit. Workers having some injury in their hands may also be equally kept aloof from handling the material. Management shall also arrange quarterly medical examination of personnel.

12). *Waste disposal and drainage:-* Waste material shall be frequently removed from the working areas during plant operation and adequate waste receptacles shall be provided for this purpose. There shall also be adequate drainage facilities for carrying away water used in the factory premises and to discharge it into the water front at least 10 feet from the unit.

13). *Lavatory facilities:-* Lavatories may be situated away from the processing hall and arrangements may be made for daily disinfection of such rooms. The main door of the row of lavatories shall have fly proof netted self closing doors.

14). *Instructory/Advisory posters:-* There shall be adequate instructory / advisory posters in the processing hall, well de-

pecting the importance of hygiene in fish handling and processing.

15). *Toxic substances*:- All rodenticides, fumigants, insecticides or other toxic substances shall be stored in separate locked rooms or cabinets and handled only by properly trained personnel with a thorough understanding of the hazards involved including the possibility of contamination of the processed product.

E). **Transportation of the material from pre-process handling centres to final processing factories**

All the precautions mentioned under 'C' are applicable.

F). **Handling at processing factories**

1) **Freezing factories**

In addition to the requirements given in 'D', the following are also important.

1). There may be separate processing halls and preferably even separate utensils for handling raw and pre-cooked fishery products.

2). Glaze water used may be pre-cooled to about 1°C and chlorinated to a residual level of 5 ppm.

3). Technique of packing the finished product shall be of such a type that preclude the introduction of contamination into the product.

4) Packaging materials shall not transmit objectionable substances or micro-organisms to the product.

5). Method of storage shall be of such a type that protection against contamination, deterioration, or development of public health hazard is perfectly guaranteed.

6) Finished product shall be transported to the market under such conditions as will preclude micro-organisms and protect against deterioration of the product or of the container.

ii). **Canning factories**:-

In addition to the requirements given in D, it is also mentioned that the cooling water used for dipping the retorted cans may be chlorinated to a residual level of 5 ppm.

G). **Hygienic requirements for fish curing yards**

1). Curing sheds may be fitted up with self closing doors with fly proof nets. Fly proof nets may be attached to window also.

2). The processing halls may be well lighted and ventilated.

3). Sorting, dressing, washing and draining shall be in an area separated from the salting section.

4). Covered drain lines may be provided for facilitating easy flow of wash water. The wash water as well as self brine formed in the curing tanks may be led far away from the premises after treatment, (such as lime etc. to bring down the B. O. D. level) wherever necessary.

5). Plentiful supply of potable water shall be made available to the curing shed.

6). Table tops, utensils, cemented tanks, floor etc. shall have a smooth surface, free from crevices and resistant to salt and chlorine.

7). Polished cement tanks shall be used for curing purpose. Before starting and after finishing each day's work, all the utensils and accessories shall be

initially washed with a suitable neutral detergent followed by disinfection using chlorine of 100 ppm strength.

8). After each use, the curing tanks may be washed free of dirt and oil using a suitable neutral detergent followed by the application of disinfectant as described above.

9). No person with communicable disease shall be allowed to work in the yard.

10). Drying shall be done on raised platforms. The platform shall be washed and disinfected after each day's work. The entire yard shall be covered with fly proof nets.

11. Dried material may be packed in such a manner as to avoid spoilage and contamination.

## II. Organization of Sanitation Programme

The main objective of sanitation programme is to establish and maintain sanitation for buildings, equipments, raw materials and products manufactured. The responsibility of the programme must lie with the management, the technologist and the supervisory personnel.

### A) Part to be played by Management

Plant Manager is directly responsible for sanitation of the plant as the director of all activities. As it is not possible for management to take personal cognizance of all the details necessary to maintain a sanitary plant, this responsibility and authority must be delegated. The management may also see that the codes of sanitation are strictly adhered to in

the construction and layout of factories and the facilities required to maintain sanitation are offered in liberal terms with particular emphasis on the following:-

1) Rodent and fly control measures. Permanent control measures may be used in conjunction with supplementary measures.

2) Supply of adequate quantities of detergents and disinfectants to the factories, trawlers and preprocess handling centres under their management.

3) Adequate hand and leg washing and disinfecting facilities may be provided at the entry to the processing hall.

(Leg washing can be effectively achieved by constructing disinfectant baths at the main door of the processing hall. Wash basins constructed of an impervious non-corrosive material like porcelain or stainless steel may be situated near the same door. Wood or galvanized metal is not satisfactory. It may be necessary to clean the washing facilities several times a day. There may be at least one wash basin for each 10 employees or portion thereof upto 100 persons and one wash basin for each additional 15 persons or portions thereof. Detergents and disinfectants may be supplied for washing hand )

4) Supply of clean overalls and headcovers to the workers.

5) Arrangement for quarterly medical examination for the workers.

6) Spacious rest rooms to the workers.

7) Sufficient toilet facilities.

The minimum number of such facilities may be as follows:-

<i>No. of persons / shift</i>	<i>Minimum No. of facilities</i>
1 — 9	1
10 — 24	2
25 — 49	3
50 — 100	5
Over 100	1 for each additional 30.

One toilet may be eliminated for each urinal provided, except that the number of toilets should not be reduced to less than two-thirds that specified in the table given above. There may also be arrangements for cleaning and disinfecting of these toilets.

8) Employee education.

The following measures can be adopted.

a) Lectures preferably in Vernacular on the importance of sanitation in fish processing.

b) Visual aids such as movies and slides.

c) Posters and signs. Humorous posters and signs often make ever lasting impression. It is important that these posters may be changed frequently and never ones installed in its place.

d) Pamphlets and news letters preferably in Vernacular.

**B) Part to be played by Technologist**

Technologist should work both in advisory and regulatory capacities and should see that the material is handled in the most hygienic way possible. He may have sufficient knowledge on the basic principles of such branches of science as chemistry, Bacteriology, Fish Technology and Sanitary engineering. Production, quality control and sanitation are interrelated and shall be properly co-ordinated. Duties of the technologist include overall supervision on cleanliness of processing hall, factory building

and premises, elimination of rodents, flies and other pests. quality of water supplies, storage of raw and finished products, sanitary handling of ice, and quick and efficient disposal of waste and sewage. He should supervise sanitation of factory owned eating and housing units, toilet rooms, rest rooms, dressing rooms and the like. Maintenance of general house keeping of plant and premises, lighting and ventilations, is also his responsibility. He should also see that the instructions given to the supervisors and workers with regard to washing of raw materials, processing halls, utensils and equipments, personnel hygiene and the like are strictly followed. He should trace out the factors that may contribute to contamination of the product and take appropriate measures to rectify them. Responsibility of storage and proper utilisation of toxic substances like rodenticides, fumigants and insecticides if any used in the factory may also be vested on the technologist. He should also act in a liaison capacity with the Government Regulatory Agencies.

**III. Inspection techniques in sanitation assessment**

The desired effect from any sanitation programme can be fully achieved only through frequent inspection. Inspection may mainly be of two types.

1) The daily general inspection by the technologist of the factory.

2) A detailed inspection by a regulatory agency.

**A) Recording of observations**

Wherever possible, the conditions observed during the survey may be classified in order of importance as follows :-

a) Those requiring immediate attention which might result in direct contamination of food or might cause injury or illness to employees.

b) Those which may indirectly cause contamination.

c) Those less urgent, but needing attention.

## B) Factors to be considered

### a) *Fishing boats*

1) Whether the fish hold, deck or storage boxes are of easily cleanable types?

2) Are they impervious to water and free from cracks and crevices?

3) What is the material of construction of fish hold and boxes? Are they free from corrosion?

4) Are they apparently clean and free from slime?

5) How and in what frequency these are washed and disinfected?

6) Whether sufficient ice is taken? Whether the ice is stored and handled hygienically?

7) After each haul, is the catch thoroughly washed? How quick the material is iced and stored?

8) What is the type of storage-stacking, shelving or boxing? Is there possibility for bruising of fish on the bottom portion because of the excessive pressure of the fish on the top.

9) In case of boxing whether adequate precaution has been taken so that ice melt water containing blood and slime from one box does not trickle over the fish on the other kept underneath?

10) Is near shore water used at any time for washing material, deck or other surfaces?

11). Is the ice used during one trip, reused in subsequent trips?

### b). **Preprocess handling centres and processing factories**

During inspection, the following points may be carefully scrutinized:-

#### a). **Construction of buildings**

1). Are the buildings painted and kept neat?

2). To what extent they are proofed against birds, flies, insects and animals?

Is there evidence of such a problem?

3). Are the roof and wall kept free from dust and debris that may contaminate the food?

4). Is it easy to clean the building?

5). Is the processing hall well ventilated?

6). Is lighting in the different sections satisfactory?

7). Can the gutters be easily cleaned? Do they have rounded bottoms? Whether drainage channels have been covered using grills?

8). Is the receiving area separate from the preparation / packing section? Is there any possibility of flies, dust or debris from the receiving area contaminating the product as it is being prepared?

9). Is there enough space in the processing hall or are they overcrowded? disorderly?

#### b). **Plant surroundings**

1). Is any equipment stored in the yard?

2). Are there areas which might serve as rodent harborages?

3). Is there any condition that result in undesirable odours?

4). Is there any condition that attract or breed flies or other insects ?

5). Are the grounds well drained ? Does the surface water drain away from the buildings and receiving areas ?

**c). Utensils and equipments**

1). What types of utensils are used? Are there any non-metallic utensils? How clean the utensils are ? Are they free from slime, debris or meat / shell particles ? Are they free from any objectionable odour? What is the cleaning system followed ? Whether the utensils are cleaned, disinfected before starting and after finishing each day's work ?

2). If equipments or machines are used in the factory, can they be quickly dismantled or opened up for cleaning ? Is there any slime or debris present in these ?

3). Is there any possibility of utensils or machinery contaminating the food material ?

4). Can the waste which accumulate near the machinery be easily removed ?

5). Is the floor around machinery kept clean ?

6). Is the equipment corroded? Are the surfaces clean and smooth ?

7). Are there any metals or materials used in the construction of utensils or equipments that might result in contamination or loss in quality of the product ?

8). Is the equipment painted ? Any flaking of paint ? Does the paint used contain any toxic ingredient ?

9). Are the motors, bearing etc. located at places where they might drip oil or grease into the product ?

10). Are there any dead ends or valves in the machinery where bacteria can grow ?

**d). Rodent control**

1). Are there any rodent droppings body smears, nests, burrows, grawings, dead rodents, urine stains, odours etc.? Check the following areas: Storage, cafeteria, receiving area and general plant areas.

2). What methods are used to eliminate rodents ? How effective is the programme ?

3). Are poisons used and if so whether they are handled carefully to avoid contamination of the product ?

**e). Fly and insect control**

1). Are there any flies, roaches, ants or other insects in the plant ?

2). What are the measures taken to avoid them and how effective are they ?

3). Are there any potential breeding places inside the hall ?

4). Whether any insecticides are used ? Is there any danger of contamination of fish with the insecticide ?

**f). Lighting, ventilation and temperature control**

1). Is the lighting adequate ? Are there any dark areas or corners ? What type of lighting is used ?

2). How often the fixtures are cleaned ?

3). Is there any possibility of the food material being contaminated with broken bulbs ?

4). What type of ventilation is used? Are there exhaust fans ? Are the existing ventilation facilities adequate to remove all moisture and fumes ?

5). Are the temperature and humidity congenial for working? Is there any danger of perspiration contaminating the food?

**g). Water supply**

What is the type of water used? If wells are used, are they protected from contamination?

2). Is the water potable? Whether any analysis of water has been done previously to ascertain potability?

3). Is the water supply adequate for peak loads?

4). How many types of lines of water are there in the plant and are any of these monopotable? If so are they marked separately?

5). Are there any cross connections or dead ends so that potable water may become contaminated?

6). Is the water chlorinated and if so to what extent?

7). Is there any overhead tank for storage of water? Of what material is it constructed? Is it covered and protected from rain, birds, insects, dust and other forms of contamination? How often is it cleaned? Is it clean at the time of inspection?

**h). Ice storage**

1). By which type of water, ice is prepared?

2). How hygienically it is stored and handled?

3). Are there possibilities of ice contaminating the material processed?

**i) Cleaning programme**

1). How is the cleaning programme organized?

2). Is there any separate team for cleaning utensils, equipments and processing halls? Do they work satisfactorily?

3). Are there any special tools or equipments used?

4). Whether detergents and germicides are used and whether they are used in desired concentrations?

**j). Storage rooms**

**i). Empty containers**

1). How are the empty containers stored?

2). Are they protected from dust and such other sources of contamination?

3). Are the metallic containers washed before filling the material?

**ii). Raw products**

1). Is the product stored in clean containers?

2). Of what material the containers are made and is there any possibility of contamination of the product through the container?

3). Is the material stored in a rodent and insect-proof room?

4). Is the storage temperature satisfactory?

5). How long is the product held in the storage?

6). Is there any sign of spoilage?

**iii). Finished products**

1). Is the storage temperature satisfactory? What is the storage temperature and humidity?

2). How the containers are stored? On the floor or on wooden platforms?

3). Do storage conditions guarantee protection against contamination, spoilage or development of public health hazard ?

The following points may be noted in store rooms attached with canning plants and fish curing yards:-

1). Are the temperature and humidity of storage satisfactory ?

2). Is the warehouse rodent, bird and insect proof ?

3). Do the storage conditions ensure protection from deterioration and spoilage of the product ?

#### k) Waste disposal

1). What method is used for waste disposal and how frequently is it removed ?

2). How far the disposal areas are situated ?

3) Are there waste receptacles in the processing hall and how frequently they are cleaned? Are the waste receptacles separately marked ?

4) Whether solid waste create any insect or rodent problems ?

5) What happens to liquid wastes? How far they are let out? Any treatment required before disposal ?

6) Are the gutters properly constructed and covered ?

#### l) Personnel hygiene

1) Do employees wear clean and appropriate clothing while on duty ?

2) Are hair coverings worn properly ?

3) Are gloves sterilized before use?

4) Do the employees give a general impression of cleanliness ?

5) Is there any evidence of skin eruptions ?

6) Are they free from any obvious disease ?

7) Do they wash and disinfect their hands before starting the work and after leaving the toilets ?

8) Do they wear finger nail polish ?

9) Do they wear any jewellery on the hand or on the fingers while on duty?

10) Do they use tobacco during work or sneeze or cough over the product ?

#### m) Sanitary facilities

1) Are there sufficient numbers ?

2) Are they situated away from the processing halls ?

3) Are there hand washing facilities attached to the toilet rooms? Indicate the extent to which these are used.

### IV. Microbiological methods in Sanitation Assessments

In addition to the visual observation of the factors given above, random sampling of some of the utensils and equipments, water supplies, ice used for preservation and palm of the workers may be helpful in judging the level of sanitation of the processing unit. As a policy, only samples from washed utensils may be collected, but in cases where sources of contamination has to be located, samples may be drawn during processing also. Bacterial counts of samples of utensils, water and ice shall not exceed the following limits.

	Total bacterial count/*
Utensils & equipments/cm <sup>2</sup> (washed & disinfected)	160
Water/ml.	100
Ice/ml.	100

\* Faecal indicator and pathogenic organisms shall be absent in all cases.

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