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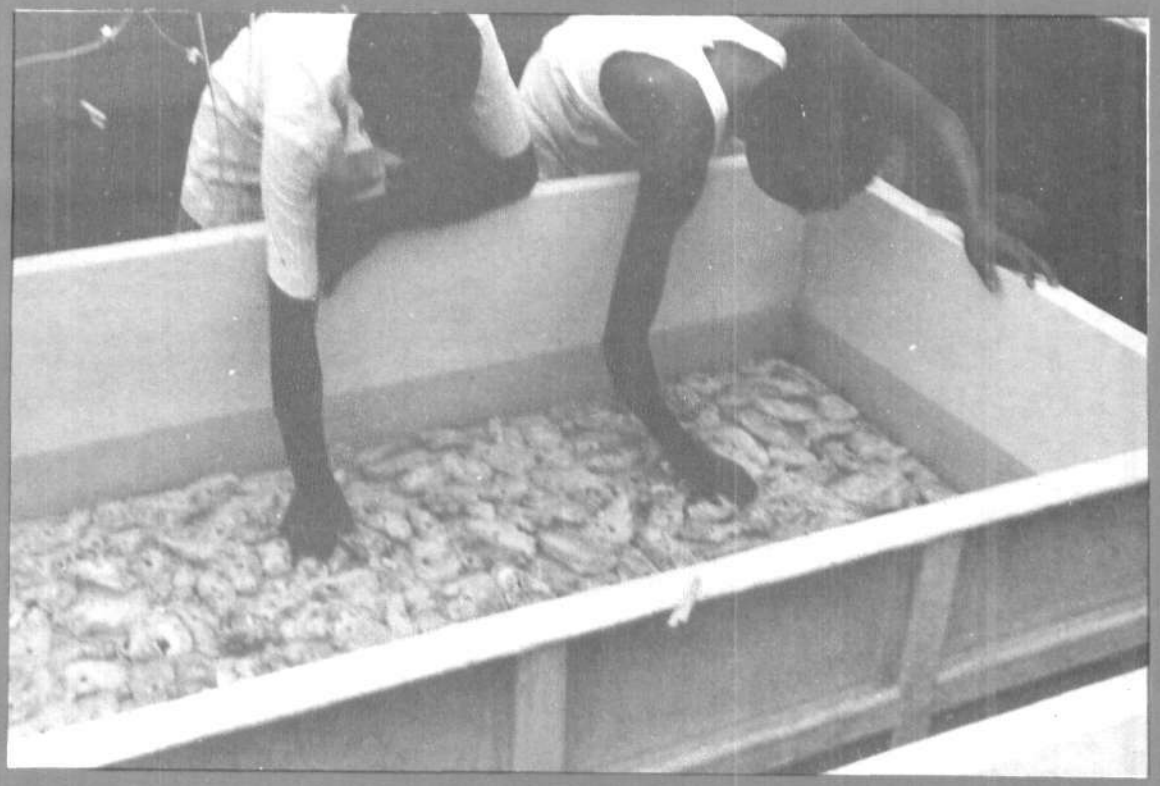

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QUALITY CONTROL OF MOLLUSCAN SHELLFISH PRODUCTS

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The export of molluscan shellfish products from India is picking up momentum since the last few years. At present among the molluscan shellfish products exported from our country frozen boiled clam meat forms the major item. In 1991 India has exported 1,232 tonnes of frozen boiled clam meat valued at Rupees 3.7392 crores. The other products being exported are frozen mussel meat, dried clam, dried mussels, canned mussel meat and oyster shell powder (Annexure-I MPEDA, Cochin). Clams, mussels and oysters are also processed in other forms like pickles, marinades, etc. but are mainly utilized for local consumption.

General quality problems

a) *Bacteriological*

Molluscan shellfish filter large volumes of water during their feeding activities and as a result they concentrate microorganisms including pathogens within their bodies. Most of these pathogenic microorganisms are of faecal origin and cause great health hazards. Surendran *et al.* (1986) have reported that mussels collected from shallow waters off Calicut have a total bacterial population of 103 to 106 per gram, faecal coliforms 36 to 2150/g, *E. coli* 0 to 115/g and faecal streptococci 30 to 1800/g. They

have also reported that the mussels always harboured greater bacterial populations than the aquatic environments. Varma *et al.* (1988) have studied the quality of frozen boiled clam meat meant for export. In general the commercial frozen boiled clam belonging to *Villorita cyprinoides* from Cochin are contaminated with faecal indicator and pathogenic organisms than in that belonging to *Katelysia opima* from Quilon. 5.4% of the samples belonging to the *Villorita* sp. also contained *Salmonella*. Iyer & Varma (1987) have also isolated *Salmonella* from mussel. Indicator bacteria has also been isolated from mussel (Gore *et al.*, 1992).

b) *Metals*

Since the molluscan shellfish filter large quantities of water during their feeding process, there are chances of accumulation of toxic heavy metals in their body, if the environment is polluted with toxic metals. Lakshmanan and Nambisan (1986) have reported trace metals in mussel collected from Narakkal and Mahe. According to them the mussel contained mercury 0.06-0.09 µg/g, copper 1.367 to 5.652 µg/g, zinc 9.36-18.75 µ/g and lead 0.64-1.83 µg/gm. Nair and Nair (1986) have also reported the presence of Cd, Cu, Fe, Mn, Zn and Hg in oysters collected from Cochin backwaters.

c) *Other contaminants*

Radhakrishnan *et al.* (1986) have reported the presence of chlorinated pesticides in mussel collected from Calicut. They have reported that the level of these pesticides in mussel is two times more than that in fish.

d) *Paralytic shellfish poisoning*

Paralytic shellfish poisoning (PSP) is caused by a neurotoxin produced by certain marine dinoflagellate algae. Various mussels, clams, scallops etc. become toxic if they feed on toxic dinoflagellates. Incidences of PSP has long been known along the Pacific and Atlantic coasts of North America and Canada where many fetal cases have been recorded (Prakash *et al.*, 1971). Out breaks have also been reported from Western Europe (Luthy, 1979) and Japan (Hashimoto, 1979). From India Indrani Karunasagar *et al.* (1984) have reported incidence of PSP after consumption of clam from Kumble near Mangalore.

Quality standards

a) *Indian*

No Indian standards are available for molluscan shellfish products. However, the Export Inspection Agency has prescribed some limits for frozen clam meat which come under the compulsory preshipment inspection of EIA. The limits are *E. coli* 10/gm. Coagulase positive staphylococci 100/g and total bacterial count 2 lakhs/g for raw consumption and 5 lakhs/g if the product is for further cooking.

b) *Overseas*

The quality standards for oyster is given in Table 1 and the quality standards for molluscan shellfish in general are given in Table 2. In general total bacterial count ranges from 1-5 lakhs/g, *E. coli* MPN index 230/100 g and *Salmonella* absent. USA has also prescribed a limit for paralytic shellfish poison at 80 mcg/ 100 g.

Code of practice

Code of practices have been prescribed by Codex Alimentarius Commission of FAO (Codex CAC/RCP 18-1978. Recommended International Code of hygienic practices for molluscan shellfish) and National Health and Medical Research Council of Australia.

Code of practices recommended

1. *Use of near-shore water for washing purposes*

Near-shore water shall not be used for washing the catch or the fish-contact surfaces. The harbour water is often polluted with land sewage and harmful enteric organisms.

2. *Sorting of catch on sea beach*

In certain areas of the country the landed fish get sorted on the sea beach where even presence of faecal matter has been noted. This is a very important source for contamination of the catch with pathogenic microorganisms.

3. *Washing of utensils and fish-contact surfaces*

On constant use, the utensils get a coating of fish slime which can harbour harmful bacteria. The utensils and fish-contact surfaces shall be washed at frequent intervals using suitable detergents like teepol, spectrol etc. followed by disinfection using sodium hypochlorite solution having a residual chlorine strength of 100 ppm giving a minimum contact time of 15 minutes.

TABLE 1. *Quality standards for oysters*

		Japan		Australia (1)		USA (2)	I C M S F	
1.	Total viable count Max/g	5.0×10^4	Raw oyster for uncooked consumption	1,00,000	Fresh & frozen		5,00,000	Fresh & frozen
2.	*E. coli* (MPN) Max.	230/100 g		2.5/g	AS 2788		230/100 g	
3.	Arsenic ppm			1.0	For all			
4.	Cadmium ,,			2.0	molluscs			
5.	Copper ,,			70.0	includ-			
6.	Lead ,,			2.5	ing			
7.	Mercury ,,			0.5	oyster			
8.	Zinc ppm			1000 for oyster				
9.	Paralytic shell-fish poison					80 mcg/100 g		

Ref : 1) Infofish International 4/90, p 59-60.

2) Codex Alimentarious Commission CAC/RCP 9-1976.

3) Microorganism in Foods. II International Commission on Microbilogical Safety of Foods.

Canada

Fresh or frozen oysters are not permitted entry from any country except those which have sanitary control programmes which have been approved by Canadian Ministry for Fisheries and Oceans. (Ref : Infofish International No. 5/90 p 56).

TABLE 2. *Quality standards for molluscs*

Country	TPC	*E. coli*	*Salmonella*
Denmark	at 20°C 5 days Max. 1,00,000/g	Not present in any of 10 samples	Not present in any of 10 samples
France	—	Less than 1/ml (for raw eating) Less than 2/ml (for eating after cooking)	Absent
Italy	—	MPN 160/100 ml in 90% samples collection centre; " 500/100 ml in 10%	—
U. K.	—	MPN 600/100 g — in Market 0-2/ml Sale permitted 3-4/ml 5/ml Temporary prohibition 6-15/ml 16/ml — Sale prohibited	
U. S. A.	5,00,000/g at 35°C	MPN 230/100 gm	Paralytic shellfish poison 80 mcg/100 g in the edible portion of raw shellfish meat

Ref : Codex Alimentarious Commission CAC/RCP 9-1976.

Bamboo baskets, cane baskets and such other containers that are difficult to be cleaned shall not be used to store/transport fish.

4. *Chlorination of water supply*

It may be made a practice to use only chlorinated water (10 ppm) in the fish processing factories. Many of the enteric organisms are water-borne and, as considerable amount of water is used in the seafood industry, chlorination of water is to be given top-priority. In a set up like ours, where the material is handled in primary process centres situated in villages that are not provided with municipal water, chlorination of the water supply is one of the major recommendations.

5. *Handling of ice*

Considerable quantity of ice is being used in the seafood industry and any bacterial defect in the ice will reflect on the microbial quality of the processed product. Ice is to be prepared from chlorinated (10 ppm) water and to be stored and handled in such a way that bacterial contamination can be avoided. In some of the primary processing centres, ice blocks are stored on the

floor of the processing hall itself. This practice has to be discontinued in the interest of the quality of fishery products being processed and exported from this country.

6. *Worker's hygiene*

Before starting work, all fish handlers shall wash their hands from elbow down using soap followed by disinfection using water chlorinated to a level of 100 ppm. The process may be repeated at any time they leave the processing hall and return for work again or at any other time their hands become otherwise contaminated.

7. *Workers' health*

Workers can be healthy carriers of may dangerous bacteria like *Salmonella* or *V. cholerae.* These workers will contaminate the material they handle thereby creating public health problems. Many typical examples of such contamination from workers have been reported in the literature. In our country, so far, there is no system of medical examination of fish-handlers to trace out the carriers and to treat them in the proper way. This is another area which requires immediate attention.

8. *Rodent control measures*

Rodents may carry many diseases such as plague, endemic typhus fever, infectious jaundice, *Salmonella* food poisoning etc. Most of these are transmitted from the infected rodents to man by lice, mites or by contamination with rodent urine and excreta. There are many reports in India indicating isolation of *Salmonella* and Vibrios from rodents and well lizards. All possible precautions have to be taken to prevent the entry of rodents to the processing hall.

Multiplication of rats and mice depends upon the food and harborage available. Therefore, the only permanent and lasting means of control is the elimination of food source and harborage. The processing hall should be made rodent proof. As a guide for rodent proofing it may be noted that :

i) Rodents can gain entry through a $^1/_2$ inch hole.

ii) They can climb vertical wires.

iii) They can climb outside vertical pipes not more than 4 inches in diameter.

iv) They can jump 26 to 36 inches both horizontally and vertically from a flat surface.

v) They can drop 50 feet without being killed.

9. *Fly control measures*

Flies will transmit a number of bacteria to the food from the surroundings. Proper fly-proof nets have to be used in the processing units to prevent the entry of flies.

10. *Separation of process*

On no occasion a finished product should come in contact with the raw material. It is dangerous to handle cooked and uncooked fishery products in the same processing hall. Separate team of workers should handle such products in separate rooms using separate utensils.

11. *Waste disposal*

The disposal of wastes from food processing plants often presents special problems on account of their relatively high content of organic matter and their high biochemical oxygen demand. There should be an efficient system for disposal of waste material from the factory premises. Accumulation of waste will attract flies and rodents also apart from making the premises dirty.

12. *Toilet facilities*

Plant hygiene also includes proper construction and supervision of toilet facilities. Such facilities should be adequate in number and should be cleaned and disinfected at frequent intervals. Toilet should be atleast 100 feet away from the processing hall. The roof-wall joint of the lavatories should be tight so as to avoid entry of flies and rodents. The door of the lavatories should be fitted with self closing doors. The recommended number of toilet facilities may be as follows :

Number of persons/shift	Number of facilities required
1 to 9	1
10 to 24	2
25 to 49	3
50 to 100	5
Over 100	1 each for additional 30 persons

The toilet seats and the floor of the toilet rooms should daily be scrubbed with a detergent followed by disinfection using chlorine solution of 200 ppm strength.

13. *Depuration*

Depuration is a process by which most of the pathoorganisms/ metals accumulated in the molluscan body can be removed. The following processes are recommended.

a) Shell stock intended for should remain out of water for not more than 48 hrs.

b) Sea water used for depuration should be clean and should be of a salinity necessary for normal physiological functioning of the shellfish. There should not be any toxic substances in the water.

c) The water used for depuration should be disinfected with UV light, or other suitable techniques.

d) In turbid condition the water should be pre-filtered.

e) The flow of water used in depuration tank should be such that a complete change of water occurs every 30 mts.

f) The shell stock should be laid out at a density which will permit them to open and undergo depuration.

g) The oxygen content of water should be maintained.

h) The water temperature during depuration should be maintained. Tanks should be protected from direct rays of sun.

i) The equipments in contact with water should be constructed of non-porous, non-toxic materials.

j) To avoid recontamination of shell stock undergoing depuration, unpurified shell stock should not be placed in the same tank.

k) Shell stock undergoing depuration should remain immersed for a minimum period of 36 hrs.

l) After depuration the shell stock should be washed in potable water.

m) Depuration tanks should be drained cleaned and disinfected.

n) Proper registers should be maintained regarding depuration.

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ANNEXURE - 1. *Export of molluscan shellfish*

Qty : in tonnes
Value : Rs. Thousand

Item		1987	1988	1989	1990	1991
Fr. Boiled clams	Q	730	311	329	414	1232
	V	12,975	4,385	5,369	7,558	37,392
Fr. Mussel meat	Q	6	7	—	6	13
	V	119	160	—	131	328
Dehydrated clam meat	Q	—	—	42	107	164
	V	—	—	933	2,546	4,789
Dried mussels	Q	4	3	—	—	—
	V	109	89	—	—	—
Canned mussel meat	Q	—	—	—	4	—
	V	—	—	—	76	—
Oyster shell powder	Q	1,448	—	160	—	16
	V	973	—	111	—	35

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