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78. POST HARVEST TECHNIQUES AND SANITATION FOR OYSTERS

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ABSTRACT

Oysters are often transported alive and consumed raw. They are likely to harbour pathogenic microorganisms due to their filter feeding habit. Therefore depuration of the shellfish using appropriate method is essential. The need for monitoring the bacterial quality and levels of the oyster growing areas and the bacterial load of oyster meat is emphasized. Results of bacteriological studies on the water quality in the oyster farm at Tuticorin and meat of cultured oysters are discussed.

INTRODUCTION

Oysters, mussels and clams are filter feeders and are likely to accumulate pathogenic bacteria such as *Samonella* spp, *Straphylococus* spp and *Clostridium spp* (FAO and WHO 1974). The viral disease transmitted appears to be infectious 'viral hepatitis' (Mason and Mclean 1962). Hence shellfish have to be rendered free of bacteria before marketing.

The awareness that the shellfish could be purified and thus rendered harmless goes back in history much farther than the medieval times. The Romans during the first century B. C. consumed cockles and oysters after keeping them in unpolluted seawater in tanks which are the earliest known examples of 'cockle washery' (Yonge 1962).

Purification of bacteria contaminated oysters have been effected by utilising their own physiological filtration mechanism at the Fisheries Experimenfal Station, Conway, U. K. (Dodgson) 1928). Wells (1923) described the purification of oysters using chlorinated seawater. The method of chlorine sterilisation is still in vogue in many developed countries. Recently the

process of purification has been to a large extent superseded by ultraviolet sterilisation and ozonisation. Using sophisticated ultraviolet sterilisers, reduction of coliform as high as 99% could be attained (Wood 1961; Kelly 1961). In this paper the purification and processing methods of oysters suited to Indian conditions have been presented.

The salient features of the pilot purification plant designed by the Tuticorin Research Centre of CMFRI have been explained in this paper. Further the continuous monitoring of the bacterial levels of the oyster growing areas and the tolerable bacterial level of the oyster meat is also discussed. The accumulation of toxic materials in the oyster meat (Organic and inorganic) have to be monitored.

Purification of oysters

Most of the oysters produced in developed countries such as U. S. A., U. K and European countries are distributed alive and frequently eaten raw. Therefore in many countries, strict sanitary control in farming the oysters, as well as elaborate purification methods have been followed. Oysters are held for 36 h in filtered and UV sterilised seawater or by relaying them in filtered running seawater for 48 h and later treating them for 1 h in chlorinated seawater.

Nayar et al (1983) have designed and operated a simple method to purify the oysters cultured in the farm at Tuticorin. In this method the oysters are purified to a satisfactory level at the rate of 14,400 oysters (1,300 kg) per day. The harvested oysters are cleaned externally to remove silt and other debris by a strong jet of seawater and culled for removing the damaged or moribund oysters. Then the oysters are placed in trays one or two layers deep and placed in concrete tanks on wooden grids. The floor of the tank slopes with a gradiant of 2 cm per metre towards the drain valve to facilitate the flushing of silt, faeces, pseudofaeces and debris out of the tanks. The drain valve in the tanks is provided with a PVC 'T'. The vertical limb of 'T' is raised at a height of 50 cm, so that the same height of water column is maintained in the tank. The horizontal limb is plugged when the tank is engaged in cleaning operations. The plug is removed while draining the tank. A slow and steady flow of filtered seawater is maintained in the tank for 12 h. At the end of this the drain valve is released and the oysters are flushed with strong jet of seawater and once again this operation is repeated for another 12h At the end of this, the flushing is again repeated and the oysters are relayed in chlorinated (3 ppm) seawater for 1 h and again flushed with a strong jet of filtered seawater.

QUALITY OF THE SEAWATER

The oysters' metabolic activity especially the pumping rate will vary in response to changes in water quality. In order to achieve purification to an optimum level it is necessary to know the effect of environmental factors during the depuration process. In general, the variables which control the depuration process are temperature, dissolved oxygen content, salinity and turbidity.

Temperature

The average temperature of the seawater is 30° C. However a slight increase in the temperature do not affect the rate of pumping of the oysters and thereby will not affect the affect the purification proces. The depuration process is not recommended when the temperature is below 20° C the area..

Dissolved oxygen

The oxygen requirement of the oysters during the depuration process is to be maintained at a satisfactory level. The normal oxygen level of the seawater is 4 to 7 ml/l. During the hosing and jetting of seawater the level is slightly increased by 0 2 to 0.5 ml/l. But under static condition, the oxygen level is much reduced and tha pumping rate eventually ceases. Hence the depuration process is always accomplished by slow flow of running seawater. While oxygen concentrations below certain limits are detrimental, there is also an upper limit determined by the solubility of oxygen in water which also could be harmful. The solubility of oxygen decreases with rise in temperature and with increase in salinity. When supersaturated water warms, it releases the excess oxygen (and other gases) in the form of bubbles and this in turn can cause

death of oyster by embolism. Therefore supersaturation of the water is avoided.

Salinity

Oysters in nature grow and reproduce in regions where mean salinity range form about 5 ppt. Although oysters may be depurated over a wide salinity range (15 ppt to 35 ppt) depuration could be properly effected in salinity ranges in which the oysters have been originally thriving. If oysters are moved form a high to low salinity or from a low to high, a period of acclimation may be needed for resumption of normal pumping activity of the oyster. This will prolong the purification time.

Turbidity

Depuration process will not be effective with turbid waters. The filtration process becomes expensive when turbidity is high. Filters get clogged very often. Further sterilization can not be properly effected with turbid waters, Hence while selection of site for depuration plant, areas with excessive growth of seaweed, high waves, and currents should be avoided.

BACTERIOLOGICAL INVESTIGATIONS

Since the early 1900's bacterial indices (as exemplified by the coliform counts) have been used to demonstrate the degree of faecal pollution of water including marine waters. As pollution levels have increased the number of approved shellfish reefs in U.S.A. have declined. The shellfish industry has lost ground steadily and today is becoming more dependent on relaying and depuration practices for survival.

MATERIAL AND METHODS

For each sample a minimum of 10 oysters were taken. The shucked oyster meat and shell liquor were blended in sterile containers. 10 g of the sample was taken for dilutions on sterile phosphate buffer solution. Bacterial counts were determined with four plate method by placing 1 ml of of appropriate dilutions on ZoBell Marine Agar medium 2216. Plates were incubated at 28°C ±2°C. Colonies were counted after 48 h and on the 5th day of incubation. To determine microbial types, colonies were picked at random from countable plates. The colonies were identified by the scheme followed by Usiosimudo and Kayayoshi Aiso. Total plate counts at 28°C ± 2°C of freshly harvested oysters ranged from 10^3 to 10^4 colonies per g of oyster meat. After 24 h purification in filtered seawater the total plate counts ranged from 10^2 to 10^3 colonies per g of oyster meat. Samples were assayed in MacConkey Broth medium for faecal coliform counts. Faecal coliform counts in oyster meat by MPN method was 7.8 to 37 per 100 g of meat. *Achromobacter, Pseudomonas, Vibrio* Sp. predominated in the fresh oysters. Pathogenic bacteria such as *Salmonella* and *Staphylococcus* were absent both in the oyster meat and the water samples collected from the oyster growing area.

The total bacterial count of water samples taken from the Karapad farm area ranged from 10^1 to 10^2 colonies per ml and the faecal coliforms count (MPN) was 0 to 47 per 100 ml of water.

TOXICOLOGICAL INVESTIGATIONS

Bacteriological and toxicological analysis carried out at the inspection laboratory of the Marine Products Export Development Authority, Cochin indicated that the meat of oysters from the oyster farm of CMFR Institute at Tuticorin, heavy metals such as Copper, Mercury and Cadmium were found to be below permissible limit (Silas et al 1982).

However monitoring studies of this aspect of work has to be continued to watch the changes in the level of heavy metals.

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