

# SOME COMMON DEFECTS IN PRAWN PROCESSING - THEIR SOURCES AND REMEDIES

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## INTRODUCTION :

The processing of prawns has assumed very great importance in India in these days because processed prawn products have become one of the most important foreign exchange earners in our country. In the year 1964, we exported fishery products worth Rs. 6.85 crores of which Rs. 4.75 crores were contributed by processed prawn products, viz; frozen, canned and dried. The demand for processed prawn products in foreign markets is increasing day by day. In order to meet the requirements of the quality conscious importers and to compete successfully with other exporters of these products and above all to get competitive returns for our processed prawn products, it is absolutely essential that we should maintain high standards of quality of our products. The purpose of this article is to enumerate some of the important points to be observed to achieve this end. It is earnestly hoped that strict observance of the remedial measures suggested hereunder will help a good deal in further improving the quality of our processed prawn products.

## FREEZING INDUSTRY :

1) *Care of the raw material*: a) The raw material must be properly handled right from the time of catch, since the quality of the landed material depends to a great extent on the care with which they are handled and stored in the fishing vessel. The boat decks, fish holds and wooden boxes used to store fish on board harbour heavy bacterial loads unless they are properly cleaned and disinfected after each operation. Instances of these surfaces developing total bacterial loads of the order of  $10^8$  organisms per square inch, *E. coli* ranging from 0 to 259 and faecal streptococci of the order of  $10^5$  per square inch have been often encountered on fishing vessels (Anon, 1966.)

b) *Icing*: The prawns must be iced as immediately as possible after they are taken out of water and under any circumstance not later than four hours after they are caught, since this is the maximum time limit for which the prawns can remain really fresh at our temperatures. All the chemical indices of spoilage generally employed for objecti-

vely assessing the quality of prawns, viz; trimethylamine, total volatile nitrogen, volatile acid number and total bacterial plate count show rapid rise after this period (Velankar et al., 1961). However, the initial stages in the chain of biochemical reactions leading to spoilage obviously occur before this period and can proceed, though at a slow rate, even after the prawns are iced, until they attain ice temperature. That is the reason why immediate icing after catch is recommended. Icing must be done in thin alternate layers (bottom and top layers in the container being ice) in such a way that there is intimate contact between ice and prawns, using at least 1:1 proportion of ice and more in cases where the material has to be transported over long distances. Not more than three feet depth of material (ice and prawns together) should be put in one container as otherwise, the bottom layers are liable to get squeezed or bruised. There must be sufficient water in the container so that its level is at least one inch above that of the prawns, because contact of the prawns with atmospheric air will cause black discoloration (melanosis). The development of the black colour has three requirements, viz; certain free amino acids, some enzymes and oxygen. If one of them, say oxygen, is excluded by keeping the prawns under water, the reaction can be retarded to a great extent (Anon, 1961). Often, cases of improper or insufficient icing are met with in our processing plants.

c) *Quality of Ice:* The ice used at this stage as well as all other stages of processing must be free from microorganisms and must have been frozen from potable water and stored without subsequent contamination. Instances of bacterial loads of the order of  $10^6$  per gram with considerable numbers of pathogenic organisms in the ice have been observed.

This could be avoided by chlorinating the water prior to freezing and careful handling after freezing.

d) *Beheading:* It is very important that the prawns must be beheaded as quickly as possible. The advantages of this step are: (1) it gives the same effect as evisceration does in the case of teleost fishes, (2) as beheading removes nearly 50% of volume of the prawns, space requirements in chill storage and quantity of ice required for preservation will be reduced to half or even less and (3) headless prawns keep better than whole prawns with respect to general deterioration and especially as regards black spot formation. Experiments have shown that in the case of prawns stored in ice in the round and headless condition, nearly 70% blackened in the case of the former in 9 days, while only less than 10% were blackened in the case of the latter in the same period (Velankar and Govindan, 1959).

e) *Cleaning of raw material:* In a large number of instances, the preliminary stages of peeling and deveining have been found to be carried out in the fishing villages themselves. In such villages where sanitary water supply is not available, steps should invariably be taken to disinfect the water used for washing the prawns etc. as unprotected sources of water has been often observed to be contaminated with heavy bacterial loads including harmful types, which otherwise pollute the material. In the case of 11 samples of raw materials (prawns) drawn at random from various peeling centres, the total bacterial load varied from  $3.1 \times 10^5$  to  $1.0 \times 10^7$  per gram, enterococci from 57 to  $1.6 \times 10^4$  per gram, staphylococci from 340 to  $5.7 \times 10^4$  per gram and coliforms from 41 to  $2.2 \times 10^3$  per gram (Anon, 1963). Such heavy bacterial contaminations are generally

attributable to the use of unprotected water and unhygienic handling, because the material looked sound organoleptically.

2) *Preparation of raw material:* During the various stages of preparation also, the prawns should be maintained at as low a temperature as possible by the use of crushed ice. The water used at all stages must be of potable quality, i. e., containing 1.0 ppm of available chlorine, less than 100 microorganisms per ml and no coliforms in 100 ml of the sample. Extreme care must be taken at this stage to sort out and remove discoloured, spoiled and bruised pieces and to clean the material free of foreign particles, loose shells, vein bits etc. The presence of foreign material in the finished product reduces its score in quality assessment (I. S. Specifications for frozen prawns, 1962). Size grading which is to be done at this stage has been very often found to be defective. Sufficient care must be exercised in weighing, as it has been observed that in quite a large number of cases the frozen block is sometimes overweight and more often underweight. The latter defect occurs more in the case of peeled and deveined pack as this type of material holds a larger quantity of water in the fresh condition and the water holding capacity becomes less on freezing and thawing. Invariably some extra weight than the declared drained weight of the slab will have to be used to compensate for this. Fixing this extra weight to be used depends upon many factors such as degree of draining the material, size grade of the material (smaller ones usually hold more water than larger ones) and type of material i. e; headless or peeled and deveined. This can be done only by experience. Frequent changes of personnel attending to this work and also insufficient care taken by them are the main causes for fluctuations in

drained weight often met with. Final washing of the material must be done after weighing so as to reduce human handling to the minimum after the final washing. Failure to follow this procedure has resulted in high bacterial loads in the frozen products (Anon, 1962). The glazing water used must be pre-cooled and kept in a closed container provided with a tap, as in many an instance it has been found that glazing water kept in open containers and delivered with dippers is an important source of bacterial contamination of the product. Bacterial loads ranging from 10 to  $4.3 \times 10^4$  per ml in such glazing water have been observed (Pillai et al; 1965). The whole process of preparation should be done as quickly as possible and the time interval between taking the raw material from the chill storage and loading the same (after preparation) into the freezer should be reduced to the minimum.

3) *Freezing and frozen storage:* The material should be frozen as quickly as possible. The quicker it is frozen the more it will retain the characteristic properties of the fresh material. The time taken for freezing is usually 2 to 3 hours in the contact freezer and 4 to 5 hours in the tunnel freezer. Slow freezing lowers the quality of the material. Similarly, frozen storage temperatures must be 0 to  $-10^\circ$  F. Fluctuations in this temperature by frequent opening of the store room or due to mechanical trouble must be avoided as far as possible, as it will have adverse effect on the quality of the product. Sufficient care has to be taken in reglazing also, because a large number of cases of dehydration due to insufficient reglazing has been met with. The water used for reglazing also must be free from bacterial contamination.

4) *Cooked frozen prawns:* One problem facing the prawn freezing industry is the occurrence of high bacterial load in cooked

frozen prawns. The bacterial contamination occurs during the time interval between cooking and freezing and the sources are the water used for chilling after cooking, the surface of tables where the cooked material is spread for cooling, subsequent handling for cleaning, sorting, weighing etc, trays used for freezing and glazing water. Detailed studies have shown that the total bacterial counts immediately after cooking ranged from 270 to  $1.0 \times 10^3$  per gram which increased to  $3.0 \times 10^4$  to  $4.5 \times 10^5$  per gram just before going into the freezer and  $1.8 \times 10^5$  to  $3.8 \times 10^5$  immediately after freezing. (Pillai and Lekshmi, 1961). This can be overcome by using specially chlorinated water for chilling, glazing and reglazing, thoroughly cleaning and disinfecting beforehand all surfaces like tables, troughs, trays etc with which the cooked material comes into contact, reducing handling of the cooked material to the minimum by doing the size grading, cleaning etc before cooking and by reducing the time interval between cooking and freezing to the minimum.

#### THE CANNING INDUSTRY

Some of the common defects observed in canned prawns are:

1) *Poor appearance* (faded colour) and flavour. This is largely due to using stale raw material which had been in ice-storage for unduly long time. In order to get a product with attractive colour and flavour the freshest possible raw material must be used. Prolonged storage of prawns in ice not only reduces the colour and characteristic flavour but also considerably decreases the yield on blanching (Anon, 1963) and also toughens the texture. (Govindan, 1964)

2) *Insufficient cleaning*: Loose flesh, shell particles, vein bits, appendages and occasionally even the rostrum, human

hair, coconut fibre, pieces of cotton thread and jute fibre have been encountered in canned prawns. Sufficient care must be bestowed to free the prawns of these materials before they are filled into the cans.

3) *Low vacuum and overfilling*: Even though low vacuum may to some extent be attributed to overfilling, it can be caused by several other reasons such as insufficient exhausting, delay in seaming, defective seams, microbial activity due to insufficient sterilisation etc. At least in some cases it has been observed that even though the cans were overfilled, they had good vacuum, but invariably in all these cases the volume of filling brine was very low. Overfilling the cans and reducing the volume of filling brine to get good vacuum will create other difficulties: like non-uniform cooking of the material during retorting due to non-uniform heat penetration, black discolouration in pieces remaining outside the brine etc.

4) *Salt and acid contents in filling brine*. The salt content and acidity of the filling brine show very wide variations. 3% NaCl in brine on opening the can is recommended by the Indian Standards. (I. S. Specifications for canned prawns, 1962). This can be obtained by using 10% (or 40° sal) brine for blanching and 2% (8° sal) brine for filling (blanching time 5 to 8 minutes depending upon the size of the material). A pH of 6.6 in the filling brine is known to retard black discolouration of the prawns to a great extent and for obtaining this the brine should contain 0.15 to 0.20% citric acid.

5) *Blanching conditions*: The concentrations of the blanching brine and the time of blanching should be strictly standardised in such a way that the blanched material filled in the cans neither takes up nor loses moisture during the sterili-

sation. An over-blanching material takes up moisture and results in overweight and under-blanching material loses moisture and consequently becomes underweight during the processing operation (Choudhuri and Balachandran, 1965). In the latter case the filling brine also becomes turbid and facilitates gel formation when exported to colder countries.

6) *Grading*: Size grading has been found to be defective in many cases, individuals of different size grades being encountered in the same can. This has to be strictly avoided.

7) *Undercooking and Overcooking*: This defect which is often met with in canned prawns is caused by non-uniform conditions during retorting. Strict watch and control should be exercised in complete removal of air from the retort before building up pressure, coming up time, time of processing, time of releasing the pressure and immediate cooling.

8) *Cooling*: Care must be taken to see that the water used for cooling the cans is of potable quality. Instances of the cooling water contaminating the product inside the cans, as also using heavily chlorinated water (upto even 70ppm of available chlorine) and the can surfaces getting corroded have been met with.

*Factory Hygiene*: Cracks on floors of processing halls, anterooms etc. (which retain dirty water, pieces of flesh etc.) and unrounded corners of walls which are difficult to clean are often met with in processing factories. Such defects must be promptly rectified. Table surfaces, floors, utensils, trays etc. should first be cleaned with some detergent like soap powder, washing soda, trisodium phosphate or teepol (0.5%) and then disinfected with a solution of bleaching powder or sodium hypochlorite containing 50 to 100ppm of available chlorine which must be allowed to act on the surfaces for at least 4 minutes,

followed by flushing with potable water to remove the excess of chlorine (Gopalakrishnan and Choudhuri, 1965). This must be done at every break of work. Small articles like freezing trays, basins, scissors, knives etc. can preferably be kept immersed in the disinfectant solution for the time specified above and washed afterwards. Walls and ceilings of processing halls must be sprayed with 50 ppm chlorine solution at least every week to prevent accumulation of flies and other insects. Unwanted materials like dealwood cases, gunny bags etc. must never be allowed to remain in processing halls. Tables with wooden surfaces must not be used in any section of the processing factory as these are difficult to be cleaned free of micro-organisms. Overhead water storage tanks must be cleaned frequently. The factory must be well lit and ventilated.

*Personal Hygiene*: No person suffering from any sort of disease or having infected cuts or wounds nor coming from homes where somebody else is suffering from infectious diseases should be allowed to work in the factory. The workers must be insisted to wear clean and tidy dress and provided with head dresses. No labourer must be allowed to smoke, chew or spit in the factory premises nor they be allowed to grow finger nails and use nail polishes. The workers should be insisted to wash their hands well with a disinfectant soap before entering the processing halls. Urinals, lavatories etc. should be as far away from processing halls as possible. (Anon, 1961.)

#### DRY PRAWN INDUSTRY

Compared to the freezing and canning Industries, the dry prawn industry is less organised and is still carried on as a cottage industry. There is plenty of scope for organising this into a modern industry like freezing or canning. Some of the important

defects observed in our commercial samples of dry prawn pulp are high moisture contents (ranging from 14 to 35%), high shell contents (2 to 40%), high percentage of broken pieces (0 to 47%) and low shelf life contributed by one or more of these defects (Lekshmy et al; 1962). These can be overcome by adopting the following methods: Fresh raw material alone must be used. In case the raw material has to be stored for more than 4 hours, it should be stored in ice. Clean vessels alone must be used for cooking. Heavily tinned copper vessels can be used. Rusted galvanised iron vessels and untinned copper vessels will contaminate the product with metal traces which will cause quick discolouration of the finished product. Sufficient water must be used while cooking. It is preferable to boil the brine first and then put the prawns and stir vigorously to ensure uniform cooking. Drying must be done hygienically on mats without contact with sand etc. to a moisture content of 15 to 20%. Deshelling must be done more carefully. If the traditional method of beating in gunny bags is followed, it must be supplemented by hand-cleaning. If the best quality product is desired, the prawns must be peeled, deveined cooked and then dried, or cooked whole, hand-peeled and dried.

The godowns where the product is stored must be clean and well ventilated with good cemented floors (without cracks) and plastered walls preferably with a ceiling and rodent proof. The corners of walls etc. should be rounded so that they can be cleaned easily. The bags containing the pulp should be placed on some platform at least a few inches from the floor and a clearance of a few inches to one foot must be left between the walls and the gunny bags. The godowns must be disinfected periodically (Anon, 1962).

Better methods of production of dry prawns have recently been worked out making use of a tunnel dryer (Balachandran and Bose, 1965) and drum dryer (Balachandran and Bose, 1964) developed by the Central Institute of Fisheries Technology, Ernakulam. These could be advantageously exploited for commercial production on modern, scientific and hygienic lines.

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