Observations on the Process Control Factors in the Seafood Plants in Kerala

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Process control factors like freezing time, freezer and cold storage temperatures, drained weight, packing count and bacterial counts were studied. The products were kept in the plate freezer for significantly varying times. The plate freezer temperature did not show much variation in different factories. Fluctuations in storage temperature were noticed in some factories. Fluctuations in the count were found to be more pronounced in small size grades. Total bacterial counts of frozen shrimps were within specified standards. *Vibrio cholerae* and *Salmonella* were absent in the samples.

Seafood products exported from India suffer from a lot of quality problems due to lack of proper process and quality control measures. The frozen blocks of marine products exported from India often lack proper glazing and also the square shape of the block. The inner cartons are reported to be not in good shape. Sometimes a few pieces of smaller or bigger shrimp other than the specified count are seen in a particular block (Anon, 1982). The quality of frozen fish products is found to be affected by fluctuations in cold storage temperature. A study on the quality changes of frozen fish in retail cold stores due to temperature fluctuations has been reported by Lakshmanan *et al.* (1991). Occurrence of *Salmonella* in frozen products and factory premises has been reported by Iyer & Shrivastava (1989).

Process control is the most vital step to be taken in seafood plants to improve quality and productivity. Information is scanty on the process control factors of seafood freezing plants. A study was carried out in randomly selected processing plants in Kochi Region to estimate the status of various process control factors.

Materials and Methods

A detailed study on the various process control factors like freezing time, freezing and cold storage temperature, drained weight, count per pound and bacterial counts was carried out in six seafood processing plants selected at random from Kochi Region. Random samples of the products and random observations on the processes were carried out in these plants. Time between loading of material into the freezer and its unloading from it was noted. The temperature of the freezer at the time of freezing was periodically noted. The fluctuation in the cold store temperature was also noted at random. Drained weight of frozen products were noted at random as per IS : 2237 (1971) and the study was carried out as per Anon (1977). Observation on the count (number of pieces per pound) of thawed and drained material was also carried out. Total bacterial count was estimated using Tryptone Glucose Agar (TGA). The incubation was done at 37°C for 48 h. Samples were analysed from 2 plants to find out the occurrence of *Vibrio cholerae* and *Salmonella*. The study was carried out for a period of two years.

Results and Discussion

The freezing times observed in six processing plants are given in Table 1. Fluctuations in the duration of time the products were kept in the plate freezer for freezing were noticed in plants 1, 2 and 5. This was

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Table 1. *Observations on the duration of the product in the plate freezer, temperature of plate freezer and cold storage of six fish processing plants in Kochi Region*

Factory No.	Duration of the product in the plate freezer, for freezing, min	Average freezer temperature, °C	Average cold storage temperature, °C
1	183.95 ± 18.84	-38.61 ± 2.12	-18.68 ± 2.77
2	184.29 ± 14.43	-37.89 ± 1.71	-17.37 ± 1.95
3	180.71 ± 6.90	-39.16 ± 1.21	-18.00 ± 1.49
4	181.46 ± 5.99	-39.11 ± 0.99	-18.89 ± 2.31
5	171.19 ± 16.75	-37.21 ± 2.37	-18.58 ± 1.80
6	181.25 ± 6.66	-38.58 ± 1.30	-18.42 ± 1.46

Note : 18-28 observations were made on each parameter

mainly to adjust the fluctuating arrivals of raw materials. The inefficiency of the freezers was another reason. Keeping the product in the plate freezer for a shorter period results in unfrozen state and deformation of the slabs, and reduction in quality. This affects the consumer acceptance. (Anon, 1982). Freezing for a long period than the required time affects the economic utilization of the freezer. The freezer temperature did not show considerable variation among different plate freezers. Moderate variations in the frozen storage temperature were noticed in few factories. This can be attributed to poor maintenance, frequent opening of the cold store, unnecessary delay in loading and unloading and the electricity failures.

Fluctuation of cold store temperature of even 10°C was noticed in some plants. This had adverse effects on product quality (Jul, 1985). The findings of Pottinger (1952) and Shenoy (1976) also showed similar results.

The observations on the drained weight of peeled and deveined shrimp (PD shrimp) and peeled and undeveined shrimp (PUD shrimp) are presented in Table 2. The average weight of the thawed and drained material was between 2.3 kg (110/120 grade) and 2.37 kg (91/100 grade) in the case of PD shrimp. The required drained

Table 2. *Observations on the drained weight of peeled and deveined shrimp (PD) and peeled and undeveined shrimp (PUD) after thawing the frozen blocks within two weeks of storage at -18°C*

Grade*	Average weight, kg
PD	
61/70	2.330 ± 0.029
71/90	2.320 ± 0.037
91/110	2.370 ± 0.063
110/130	2.300 ± 0.040
130/200	2.330 ± 0.029
200/300	2.330 ± 0.050
300/500	2.341 ± 0.050
Broken	2.360 ± 0.055
PUD	
100/200	2.103 ± 0.071
200/300	2.070 ± 0.066
300/500	2.070 ± 0.062
Broken	2.138 ± 0.101

No of pieces / lb

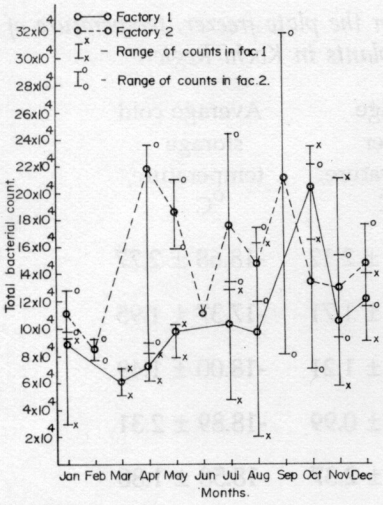

Fig. 1. Total bacterial count of frozen peeled and undeveined shrimp from two fish processing plants in Kochi region

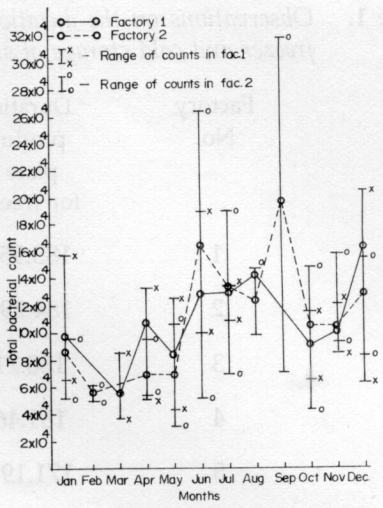

Fig. 2. Total bacterial count of frozen peeled and deveined shrimp from two fish processing plants in Kochi region

weight was 2.27 kg (5 lbs) per slab. In PUD shrimp, the range was between 2.07 kg (200/300 and 300/500 grades) and 2.138 kg (broken grade). The drained weight required for PUD shrimp was 2.0 kg per slab. Short weights were also noticed in some samples especially of smaller size grades. On an average, the processors were packing 2.335 kg of PD shrimp instead of 2.27 kg required for a slab. In the case of PUD shrimp also, instead of 2 kg per slab, 2.095 kg was being packed. In a few factories more than 5% excess weight in thawed material was noticed. This causes significant loss of material. These can be controlled by adopting quality control measures like controlling the quality of raw material, freezing time and frozen storage conditions.

Observation on the count/pound of various samples of PD and PUD shrimp blocks analysed from various plants are presented in Table 3. In both PD and PUD shrimps some samples were found to have counts beyond the tolerance limit and the deviation was found to be more pronounced in smaller size grades. This was mainly due to the improper grading and

Table 3. *Observations on the count (number of pieces/lb) of various samples of PD and PUD shrimp analysed after thawing within two weeks of storage at -18°C*

Product grade	Count
PD	
61/70	66.40 ± 1.14
71/90	84.80 ± 5.89
91/110	98.30 ± 2.54
110/130	119.86 ± 4.91
130/200	183.57 ± 14.78
200/300	275.50 ± 12.39
300/500	444.66 ± 44.75
PUD	
100/200	183.80 ± 12.65
200/300	265.50 ± 10.25
300/500	437.55 ± 49.01

sorting of the material. This results in lack of uniformity among the pieces in a particular pack. This type of nonuniformity in grades has also been pointed out by many buyers (Anon, 1982).

Results of the study on the (monthwise) Total Bacterial Count of frozen PD and PUD shrimp from two factories in Kochi Region are presented in Figs. 1 and 2 respectively. Total Bacterial counts of the samples were within the specified standards. But wide fluctuation were noticed in the bacterial counts of the samples drawn during the same month. This might be due to the procurement of raw materials from different landing / pre-processing centres. There was no incidence of *Vibrio cholerae* and *Salmonella*. Earlier work done by Iyer & Shrivastava (1989) reported the incidence of Salmonella in frozen PD and headless shrimp. But now the handling, preservation and overall hygienic conditions in the plants have improved substantially.

Statistical control charts help to control the process and quality at different stages of processing. Rao (1977) recommended the use of control charts for controlling the drained weights in frozen prawns. Control charts should be introduced especially to control variations in material count, weight, temperature in freezers and cold stores.

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