

A Method for the Preparation of Cooked-Peeled-Frozen Prawns

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Several consignments of cooked-peeled-frozen prawns exported from India were rejected last year due to high total plate count (TPC) at 30°C. The specified temperature of incubation for TPC in our country is 37°C. Hence the effect of incubation at 30 and 37°C on TPC was studied. It is seen that the count is higher on incubation at 30°C. A method for production of cooked-peeled-frozen prawns conforming to the specification for TPC at 30°C is standardised and is reported. It consists of recooking the cooked-peeled prawns followed by packing and freezing without further contamination. The method minimises batch to batch or sample to sample variation in TPC.

The technology for the production of bacteriologically sound cooked-peeled (CP) frozen prawns was reported by Iyer *et al.* (1969). Since then production and export of this item remained without any problem till last year when several consignments were rejected owing to higher total plate count (TPC). The Export Inspection Agency stipulates a maximum TPC of 1,00,000/g at 37°C. Hence investigations were carried out with a view to establishing the differences in TPC at 30 and 37°C and working out a procedure for the preparation of this item with as low a TPC at 30°C as possible.

Materials and Methods

Commercial samples of cooked peeled frozen prawns which remained in stock at the time of this crisis were examined for TPC at 30 and 37°C by standard procedures (IS: 2237-1971). Commercially produced cooked and peeled prawns were subjected to heat treatment by dipping in 3% boiling sodium chloride solution for one minute before freezing and bacteriological analysis on the production line starting from the raw prawns was carried out. End product obtained as per the proposed flow chart was also examined for bacterial quality. In all cases 5 samples each were examined from the same code/batch. In addition to TPC, samples were simultaneously tested for *E. coli*, faecal streptococci and coagulase

positive *staphylococci* by methods outlined in Indian Standard Specification for Frozen Prawns (shrimp) (IS: 2237-1971).

Results and Discussion

Total plate count at 30 and 37°C of commercial frozen cooked and peeled prawns held in stock at the time of the crisis is shown in Table 1. Table 2 presents changes in TPC at 30°C during different stages in the production of CP frozen prawns. Data on TPC at 30 and 37°C of CP frozen prawns prepared as per the proposed flow sheet is shown in Table 3.

Table 1 clearly indicates that TPC at 30°C is definitely higher than that at 37°C. This is explained as follows: Cooking of raw prawns destroys the natural flora. Whatever bacteria added on further are terrestrial. The prevalent atmospheric temperature is 27-32°C. Hence the bacteria added on after cooking grow better at 30°C and hence higher TPC at 30°C. The data also shows lack of uniformity in TPC from code to code and even from sample to sample for the same code. This is attributable to the variations in sanitary conditions of the processing environment.

Table 2 shows that cooking of raw prawns results in very low TPC which increases during peeling. Recooking reduces

Table 1. *Total plate count of commercial frozen, cooked and peeled prawns*

Batch/Code	Total plate count/g ($\times 10^3$)	
	30°C	37°C
A	31.0	1.5
	5.9	1.2
	10.4	3.2
	24.2	0.5
	1.9	5.2
B	0.3	0.1
	0.1	0.1
	0.6	0.3
	1.2	0.6
	1.2	0.1
C	27.0	0.2
	0.5	0.2
	3.5	0.8
	2.5	0.3
	3.0	0.3
D	233.0	0.8
	4.0	0.9
	145.0	3.2
	18.5	2.2
	3.5	0.5
E	5.2	2.6
	67.0	4.3
	19.6	5.3
	223.0	67.1
	13.7	1.4

Note: *E. coli*, faecal streptococci and coagulase positive staphylococci were absent

Table 2. *Changes in total plate count/g of prawns during different stages in production of cooked-peeled-frozen prawns (incubation temperature 30°C)*

Raw prawns, whole, before cooking	:	2,20,000
Whole prawns, immediately after cooking	:	< 100
Whole cooked prawns immediately after cooling	:	200
Cooked prawns after peeling	:	2,400
Cooked, peeled prawns after sorting and grading	:	1,20,000
Cooked, peeled prawns after washing	:	1,00,000

(Contd.)

Table 2. (Contd.)

Cooked peeled prawns after recooking	:	250
Recooked prawn meat after cooling	:	1,000
Recooked prawns after filling in freezing trays and addition of glaze water	:	1,200
-do- after freezing	:	1,300

Note: *E. coli*, faecal streptococci and coagulase positive staphylococci were absent

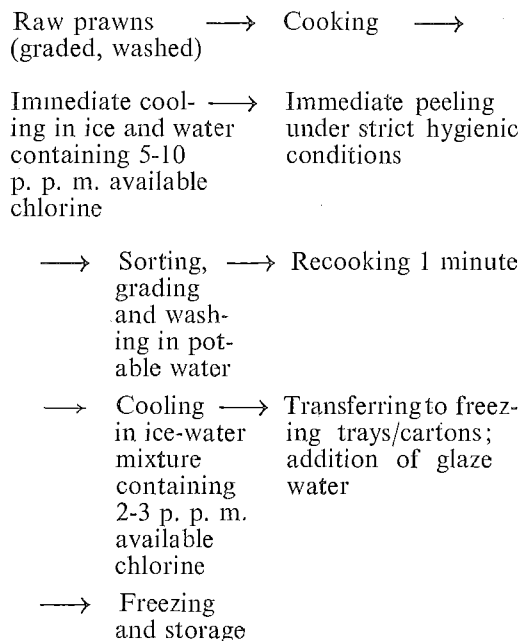
Table 3. *Total plate count of cooked-peeled-frozen prawns produced as per the proposed method*

Batch/Code	Total plate count/g ($\times 10^3$)	
	30°C	37°C
A	1.8	0.1
	6.8	0.6
	6.9	0.6
	17.9	1.0
	1.5	0.7
B	3.2	1.3
	2.4	0.3
	3.7	1.1
	1.2	0.05
	1.6	0.08
C	0.8	0.4
	2.4	0.3
	1.2	0.7
	1.3	0.6
	0.8	0.2
D	1.4	0.7
	1.8	3.8
	2.7	3.9
	0.5	3.2
	0.7	4.4
E	2.0	0.7
	3.9	0.1
	8.6	1.9
	4.9	0.2
	1.0	0.9

Note: *E. coli*, faecal streptococci and coagulase positive staphylococci were absent

the count and remains constant afterwards. It is clear from Table 3 that TPC in the end product is well below the limit and there is very little variation in its level from code to code or from sample to sample.

Flow sheet for production of CP frozen prawns



Recooking is done in boiling 3% sodium chloride brine. Before cooking, the material shall be filled in perforated individual trays which can hold the required weight of shrimp for one slab. The dimensions of the tray shall be such that it can just fit in the freezing tray or duplex carton when inverted. When a freezer load of cooked-peeled prawns is ready, they shall be filled into the perforated trays, covered with perforated lid, recooked, cooled and the material transferred for freezing without contact with other surface.

Other variations of the method like re-cooking the cooked peeled prawns as a lot and then packing or re-cooking at a lower temperature, say about 85°C are also possible but are less safe. The yield from whole prawns in this method is 30-33% compared to 33-36% without re-cooking.

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