GRADING OF FROZEN PRAWNS ACCORDING TO INDIAN STANDARDS

T. K. GOVINDAN

(*Central Institute of Fisheries Technology, Ernakulam, Cochin-11*)

Introduction

India is one of the important prawn producing countries of the world, our annual catches having touched the figure of 1,00,000 metric tons in the year 1968. This is about 10 per cent of our total marine fish landings. At present, almost the entire quantity of these prawns is being exported to other countries in the processed form and earns foreign exchange to the tune of Rs 19 crores a year. The earliest industry to be started in India based on prawns is the dry prawn pulp industry, where cooking, drying and deshelling of the prawns are carried out on a cottage industry scale, the main market for this commodity being Burma, Ceylon, Malaya, Singapore, Hong Kong, etc. Freezing and canning of prawns are of comparatively recent origin having been started in our country only in the middle 1950 s. Table 1 gives the quantities and values of frozen prawn exported from India from 1962 onwards.

TABLE 1. *Export of frozen prawns from India since 1962*

Year	Quantity kg	Value Rs
1962	22,38,190	1,08,20,276
1963	39,66,899	2,12,03,766
1964	58,70,031	3,15,18,242
1965	70,28,121	4,14,21,834
1966	87,83,545	8,87,91,851
1967	1,11.73,489	12,98,08,364
1968	1,43,97,425	15 63,40,498
1969 (January—June)	1,09 54,000	12,66,00,000

U.S.A., Japan, Australia, France, Belgium and U.K. are the important consuming centres of our frozen prawns.

Freezing of Prawns

While considering standardisation of the quality of frozen prawns, it is essential to know how prawns are actually frozen in the trade. The process is briefly described below. Prawns are frozen in different forms, viz., (1) Headless shell-on (also termed Raw HL), (2) Peeled and Deveined (P & D), (3) 'Fan-tail' or 'Butterfly' and (4) Cooked (CPD: cooked, peeled and deveined, CP: cooked and peeled or PC: peeled and cooked). In the first case, the heads alone of the prawns are removed and the veins or viscera are pulled out from the cut head portion. In the second case, the dorsal side of the prawn is cut open and the whole of the shells and the veins are removed. In the third case, the last segment of the shell along with the tail is retained while the vein and the rest of the shell are removed. In the last case, (where usually the smaller varieties weighing above 300 or 400 per kg alone are used) the prawns are either peeled and deveined or only peeled (without deveining), blanched in boiling 10 per cent brine for about 2 to 3 minutes and then frozen. In all cases, the prawns are sorted into different size grades, washed repeatedly, drained and weighed in 2.27 kg lots. The weighed material is filled into freezing trays, ice-water is added to level (glazing) and quick frozen at -40°C in a tunnel or contact freezer.

After freezing, the frozen block is taken out of the tray, dipped in ice-water (reglazing) and packed in wax impregnated cardboard cartons with a polythene lining inside. In some cases, freezing is done after filling the material in the cartons themselves with polythene lining inside, in which case reglazing is not necessary. The frozen material is stored at -18°C and shipped in refrigerated holds maintained at the same temperature. The commercial species of prawns which are used for freezing consist of *Penaeus indicus*, *P. carinatus*, *Metapenaeus affinis*, *M. monoceros*, *M. dobsoni*, *Parapenaeopsis stylifera*, and the fresh water species, *Palaemon carcinus*.

Tests of Quality

At present there are no chemical tests employed for assessing the quality of the raw material received in the factory nor the frozen products turned out by them. The factory personnel are guided by visual characteristics like appearance, colour, smell, etc., in accepting raw material for processing. The reason is that no satisfactory chemical tests which can be applied universally have been evolved yet. The chemical tests generally employed for measuring the degree of spoilage in fish are all time consuming and consist in measuring the products of spoilage like trimethylamine, total volatile nitrogen, volatile acids, volatile reducing substances, etc. While these indices of spoilage can give valuable information about the state of freshness of the prawn or fish in the uniced condition, the picture becomes very complicated when prawns are stored in ice. The freezing factories receive their raw material invariably in the iced condition. This is essential because prawns have either to be transported over long distances before arriving at the factory or have to be held overnight at landing and peeling centres before taking them to the factory. When prawns are iced, their muscle absorbs moisture from the melting ice and simultaneously all the above mentioned products of spoilage which are highly miscible with water are gradually washed out by the melting ice so that determination of these indices of spoilage becomes of no real value in the case of the ice-stored material. So, until some satisfactory, quick, objective tests which can be applied universally are evolved, the processors have to be guided by visual characteristics in selecting their raw material. The same state of affairs holds good in the case of frozen prawns also. The quality of the frozen product depends essentially on the quality of the raw material used and therefore it follows that the same criteria which had to be applied for the raw material have got to be used for determining the quality of the frozen products also.

Need for Quality Control

It is imperative that we should keep up high quality of our products in order to maintain and expand our existing markets and to fetch attractive returns. With a view to creating confidence in our frozen prawn products in the foreign buyers and avoiding possible rejections at the destinations due to substandard quality, the Government of India have introduced compulsory preshipment inspection for this product from March 1965. The criteria of quality employed for this purpose are abridged from the Indian Standards formulated for this product in 1962 (IS: 2237-1962) by the Indian Standards Institution. These standards, even though based only on organoleptic characteristics and microbiological quality, are more exhaustive and elaborate and a study of how frozen prawns are graded according to them is sure to be interesting.

Grading of Frozen Prawn products according to I.S.I. Standards

The standards specify that 'frozen prawns shall be prepared from clean, wholesome

and fresh prawns and shall not have any visible signs of spoilage. The colour of the raw material shall be typical of freshly caught prawns. The meat shall be firm and shall have the typical odour of freshly caught prawn. The material shall be free from any discolouration or off odour'. Grading as per the standards consists in thorough examination of the product in the frozen, thawed and cooked states. The microbiological sampling is first carried out followed by assessment of gross weight and general appearance of the frozen block. One defect which sometimes occurs in frozen prawns and detectable in the frozen state is the presence of white patches due to dehydration (technically termed 'freezer burn'). The number of such patches if any is noted. Further defects can be noticed only on thawing the frozen block which is effected by keeping the block in running water until the prawns can be separated easily. The material is drained and weight noted. Discolouration of shell and meat in the thawed material is one characteristic which affects the overall quality of the product and is quantitatively assessed. Any difference in colour of the shell and meat from the characteristic colour of the freshly caught prawn has to be considered as a defect. Extreme care should be exercised in evaluating this defect as different species of prawns exhibit different characteristic tints of shell and meat in the fresh condition. Also, freshly moulted prawns generally show entirely different tinted shells from those of the mature shelled ones. Deterioration with spoiled pieces is another criterion which affects the overall quality. This is also quantitatively determined by count. The overall odour of the thawed material is then assessed. A good quality material should have the characteristic fresh odour. There can be a state where the characteristic fresh odour may be absent or present only in traces and at the same time the material is free from any unpleasant odour characteristic of spoiled prawn in which case it is considered to be of second quality. A definite presence of off odour means substandard quality. Black spot formation on shell and meat (technically known as 'melanosis') is another defect which appears in frozen prawns. This is also to be evaluated. Broken and damaged pieces sometimes find their way into the frozen block due to sufficient care not being bestowed during sorting. Such pieces are counted. Presence of legs, bits of veins, loose shells, etc., is also considered to be a defect which is caused by insufficient cleaning. These and any foreign matter encountered in the frozen block are taken note of. Another factor which has to be taken into account while grading the frozen prawns is the uniformity of size of the individuals in the block. While this has no bearing on the freshness of the material, it is an important factor to the consumer. While conforming to the count declared on the pack, the prawns should not vary much from the average weight of an individual in the block. Too much variation from the average weight is evaluated as a defect. The texture and flavour of the material on cooking are very important from the point of view of overall quality. The texture of a good quality product should be soft but firm. Toughness of texture means a defect. For determining this, the thawed material (after peeling in the case of the headless variety) is cooked in boiling brine for periods ranging from 6 to 12 minutes depending upon the size of the material and the texture and flavour are determined on this. Marks are deducted for the above mentioned defects (excepting the flavour) which are therefore termed 'scored factors'. Table 2 gives the details of deductions to be made as detailed by the Indian Standards.

The marks to be deducted are calculated according to the table and deducted from a total of 100. Grading is then done by

TABLE 2. *Deductions for scored factors*

State of the material	Factor	Extent of quality variation	Point deductions
Frozen state	Dehydration	Upto 5%	0
		5.1 to 15%	3
		Over 15%	6
THAWED	Discolouration of shell and meat	Nil	0
		Below 2% by count	1
		2 to 5% ,,	2
		Over 5% for every 5% or part	2
	Deterioration with spoiled pieces	Slight off odour with spoiled pieces below 5% by count.	2
		Moderate off odour with spoiled pieces between 5% and 15%	6
		Excessive off odour with spoiled pieces between 15% and 25%	21
	Black spot on shell and meat	Nil	0
		Below 5% by count	1
		Each additional 5% or part	2
	Broken and damaged pieces	Below 2% by count	0
		2 to 3% ,,	2
		For every additional 3%	2
	Legs, bits of veins, loose shells, etc.	Below 3% by count	0
		Above 3% for every additional 3% by count	2
	Foreign matter	One piece	1
		2 pieces	2
		Over 2 pieces	4
	Uniformity of size	Fairly small or fairly large* each 3%	1
		Too small or too large† each 3%	2
Cooked state‡	Texture	Slight toughness	2
		Moderate toughness	4
		Excessive toughness	11

* If the variation between the weight of any prawn and the average weight of an individual in the block is between 25 and 35%, such individuals are classified 'fairly small' or 'fairly large'.

† If the variation is above 35%, such individuals are termed 'too small' or 'too large'.

‡ Cooking time:

For counts upto 33/kg		12 minutes
,,	between 33 and 77/kg	10 ,,
,,	above 77/kg	6 ,,

flavour determination. A pleasant flavour characteristic of freshly caught and cooked prawn means prime quality, absence of such fresh flavour (flat flavour) but free from any flavour of spoiled prawns means second quality and definite flavour of spoiled prawns means substandard quality. The bacteriological condition viz., the total bacterial plate count, and presence of specific organisms in the frozen material is a good index of quality of the material when considered along with the above criteria. While the total plate count alone cannot be taken as an index of quality, a high bacterial count when occurring along with a low organoleptic quality can mean definite spoilage. But there may be cases where the material has got

a high bacterial load but is of good quality organoleptically when it means that the material has been handled in an unhygienic manner which is also generally exemplified by the presence of pathogenic organisms like *Escherichia coli* and *Enterococci*. On the other hand, a really spoiled material can be so treated before freezing that it shows very low bacterial load after freezing. These facts indicate that the bacterial load alone should not be taken as a decisive factor in determining the quality of the frozen product. But along with the other factors, this can give valuable indications about its quality. Hence some limits have been proposed for the total bacterial plate count, *Escherichia coli* and *Enterococci* of the frozen prawn for the different grades of quality based on the results obtained when raw material of known quality is processed under hygienic conditions. The final grading of the frozen material is carried out taking into consideration the grades by all the factors viz., (1) the scored factors, (2) flavour and (3) microbial quality. The requirements of the different grades as given in the Indian Standards are shown in Table 3.

The deductions of marks for the defects are planned in such a way that comparatively more marks are deducted for defects which affects the quality of the material more, so that the total deductions when effected have a direct bearing on the overall quality of the material. As seen from Table 3, the microbiological requirements for the different types of products are different. The peeled and deveined pack is liable to contain a heavier bacterial load than the headless, since all the flesh in the former case is exposed and the chances of taking up external contamination are greater. In the case of

TABLE 3. *Requirements for different grades*

Type of product	Factor	Requirements for grades*		
		I	II	III
HEADLESS	Marks obtained by scored factors	Not less than 85	Between 70 and 84	Less than 70
	Total bacterial plate count	Less than 1.0×10^5/g	Between 1.0×10^5 and 5.0×10^5	Above 5.0×10^5
	E. coli	Nil	Between nil and 20	Above 20
	Enterococci	Nil	Between nil and 100	Above 100
	Flavour	Characteristic of freshly caught and cooked prawn	Absence or slight presence of fresh flavour but free from spoiled flavour	Definite spoiled flavour
PEELED AND DEVEINED	Marks by scored factors and requirements for flavour, *E. coli* & *Enterococci*	Same as for 'headless'	Same as for 'headless'	Same as for 'headless'
	Total bacterial plate count	Less than 2.0×10^5	Between 2.0×10^5 and 1.0×10^6	Above 1.0×10^6
COOKED	Marks by scored factors and requirements for flavour and *Enterococci*	Same as for 'headless'	Same as for 'headless'	Same as for 'headless'
	E. coli	Nil	Nil	1 and above
	Total bacterial plate count	Less than 2.5×10^4	Between 2.5×10^4 and 2.0×10^5	Above 2.0×10^5

* Grade I is best quality, grade II second quality and grade III substandard quality.

cooked frozen pack, the material is liable to be consumed without further cooking and hence stricter limits for microbiological requirements are prescribed.

Conclusion

Even though all the criteria except the microbial characteristics employed in grading frozen prawns according to I.S.I. Standards are subjective in nature, extensive field trials have proved their worth and satisfactory results are achieved with a little bit practical experience on the part of the analysts. Until some reliable and objective chemical indices are evolved, research on which is going on in several laboratories, these standards have to be relied upon for quality assessment of frozen prawn products.