

TECHNOLOGICAL ASPECTS OF PRESERVATION AND PROCESSING OF EDIBLE SHELL FISHES

III. FACTORS INFLUENCING THE KEEPING QUALITY OF CRAB (*SCYLLA SERRATA*) DURING FREEZING AND FROZEN STORAGE.

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The possible factors leading to the loss of flavour and general quality of crab during freezing and frozen storage have been studied. The preprocess ice storage condition of the raw material was found to be one such important factor while the fresh frozen crab meat remained in good organoleptic condition for about 51 weeks at -23°C , the 7 days iced material held frozen was found to have a shelflife of about 21 weeks. The fall in myofibrillar protein noted during frozen storage together with the loss of myosin ATP-ase activity correlated well with the loss of organoleptic qualities.

INTRODUCTION

The pattern of spoilage taking place in the edible crab, *Scylla serrata*, during ice storage and the changes in the proximate composition of the species during different seasons of the year have been worked out and reported in earlier publications (Chinnamma et al. 1970; Chinnamma George & Arul James, 1971). Information on the technology of utilization of crab meat has been scanty. Isolated reports by Sebastian (1970) & Jones (1968) have pointed out immense possibilities for establishing an export trade on the product.

Systematic investigations on the preservation and processing of crabs have therefore been attempted with a view to bring out the various parameters governing their amenability to processing

and storage of the processed product. The present communication deals with the frozen storage characteristics of crab meat, as influenced by preprocess conditions of the raw material.

MATERIALS AND METHODS

Freshly caught crabs were killed, washed thoroughly with water, and packed in crushed ice in an insulated box. Freezing of the meat was carried out at intervals of 0, 1, 4, 7, and 14 days of ice storage after deshelling and separation of the meat. The samples were quick frozen in plate freezer (plate temperature -40°C) for $2\frac{1}{2}$ hrs, with the required amount of water as glaze. The frozen material was wrapped in polyethylene paper and packed in a thick card board box in order to prevent desiccation during subsequent storage at -23°C .

Frozen samples were drawn at intervals; thawed at 4°C for 17 hrs, and analysed for moisture, total nitrogen, nonprotein nitrogen, sarcoplasmic protein, salt soluble protein, and myofibrillar protein in addition to the subjective tests. Myosin adenosine triphosphatase activity was followed in one set of frozen stored samples prepared from fresh material. Moisture content and protein were determined in the sample by the A. O. A. C. method (1960); non-protein nitrogen estimation was carried out by microkjeldahl method in the T. C. A. extract after removal of precipitated proteins. Salt soluble protein nitrogen and myosin were estimated accor-

ding to Dyer et al. (1950). The sarcoplasmic and total myofibrillar proteins were also determined by the method of Frederick, J. King (1966). The adenosine triphosphatase activity of myosin was estimated by the method of Perry (1952).

The organoleptic scoring was made on the thawed material after cooking in 2.5% sodium chloride solution for 10 min. and the quality of the cooked material was judged by an expert taste panel.

RESULTS AND DISCUSSION

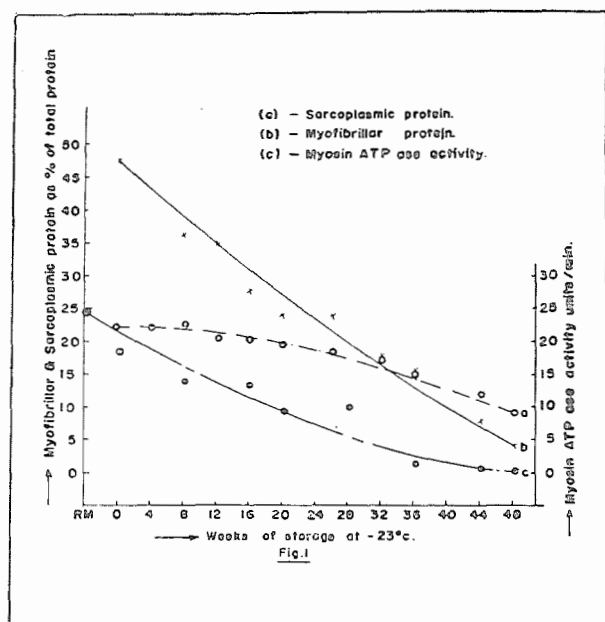
The organoleptic and textural changes in the uniced fresh frozen muscle during storage at -23°C is given in Table I.

TABLE I
 Organoleptic characteristics of frozen crab meat.

Storage time weeks.	Colour	Texture	Flavour.
0	Creamy white	Soft but firm	Good
8	Creamy white	Soft but firm	Good
14	Creamy white	Soft but firm	Good
20	White	Granular	G - F
28	White	Granular	Fair
36	White	Granular	Fair
44	Slight brownish	Granular	Fair
48	Slight brownish	Slight tough	FP
52	Slight brownish	Slight tough	FP

After 36 weeks of storage slight changes in colour and texture are noticed; upto 52 weeks the material remained in acceptable condition at - 23°C. (Table I). A close correlation is noticed between taste panel results and the loss of solubility to structural proteins and loss of myosine ATP -ase activity (Fig.1). The sarcoplasmic

protein showed an appreciable fall from 22% to 17% during 32 weeks of storage; on the other hand, the myofibrillar protein underwent fairly rapid change during the period ie 48% to 17%. Dyer (1953) and Connel (1960) reported that the sarcoplasmic fraction was little affected during cold storage while the myofibrillar protein was mostly affected.



The myosin adenosine triphosphatase activity decreased steadily with increasing storage ie from 24.3 to 0.098 μ gpi/mg-protein/minute during a period of 44 weeks (Fig. I); and this loss of enzyme activity can be taken as a tentative indication of the denaturation of crab muscle. These changes are similar to the observations made by Nikkila and Linko (1954) in the case of herring, by Connell (1962) for cod muscle held in frozen storage and by Buttkeus (1966) for cold stored trout muscle.

The results on moisture, total nitrogen, non-protein nitrogen, weight loss and drip constituents are given in Table II.

TABLE II

Changes in chemical characteristics in frozen crab meat.

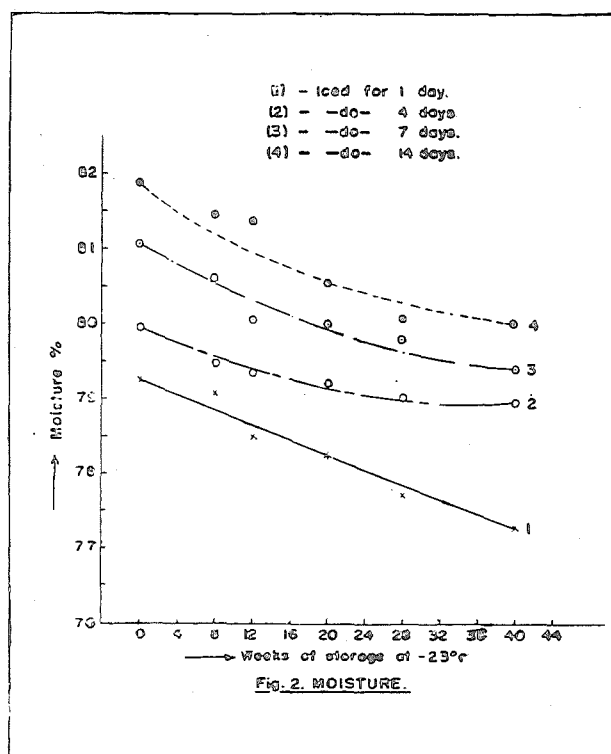
Storage time weeks	Moisture gm%	T. N. mg. %	N. P. N mg. %	wt. loss gm. %	T. N. o f drip (mg./100gm. meat)
Raw material	79.86	2972	686	—	—
0	79.80	2863	693	Nil	121.3
8	79.50	2800	686	2.00	162.9
16	80.65	2894	847	2.75	197.3
20	80.00	2754	721	3.75	222.2
28	79.91	2737	679	4.00	269.5
36	79.32	2662	742	6.98	306.8
44	79.18	2685	742	6.00	284.9
48	80.41	2632	679	11.50	289.2

The observed loss in the moisture content is found to be negligible whereas the total nitrogen registered a steady fall with a corresponding increase in drip characteristics have been shown to bear a direct relationship to the quality of the product, which is invariably affected by

the type of processing (Stansby, 1956) and packing used (Slavin, 1963). Non-protein nitrogen values remained more or less constant throughout the storage periods. Weight loss due to frozen storage increased from 2% to 11.5% after 48 weeks of storage. Similar trends of results were observed by

Sawant & Magar (1961) on different types of fish of Maharashtra Coast.

But the magnitude of these changes is to a great extent depended on the pre-process ice storage conditons of the raw material. The changes taking place during freezing and storage of raw materials having different preprocess ice storage periods are represented in Figs. 2-4. About 2% reduction in moisture is observed in almost all samples during 44 weeks of frozen storage (Fig. 2). The loss of moisture is



accompanied by larger volume of drip collected on thawing of the frozen samples.

The denaturation of protein during freeze storage as measured by the decrease in salt solubility is shown in Fig. 3. A steady fall in values is found during ice storage as evident from Fig. 3 (1-4) during freezing appreciable change is not found but on subsequent storage a gradual fall in values is noticed.

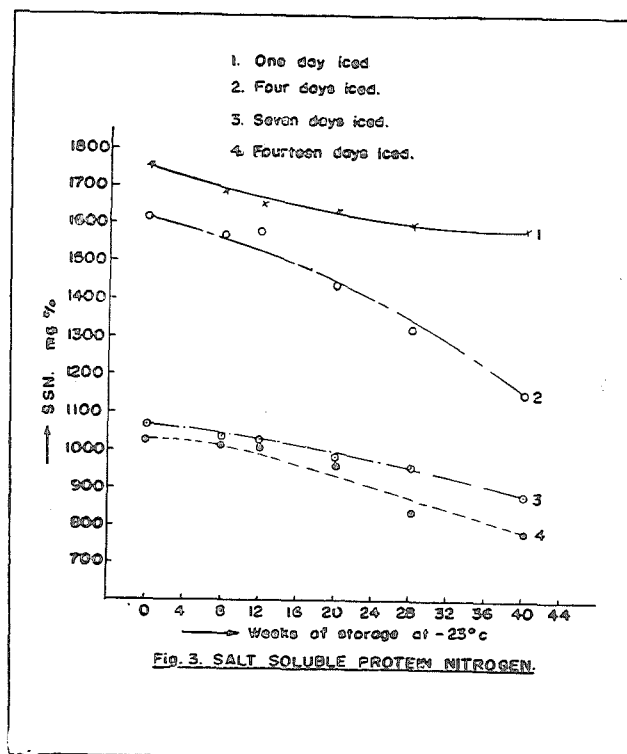
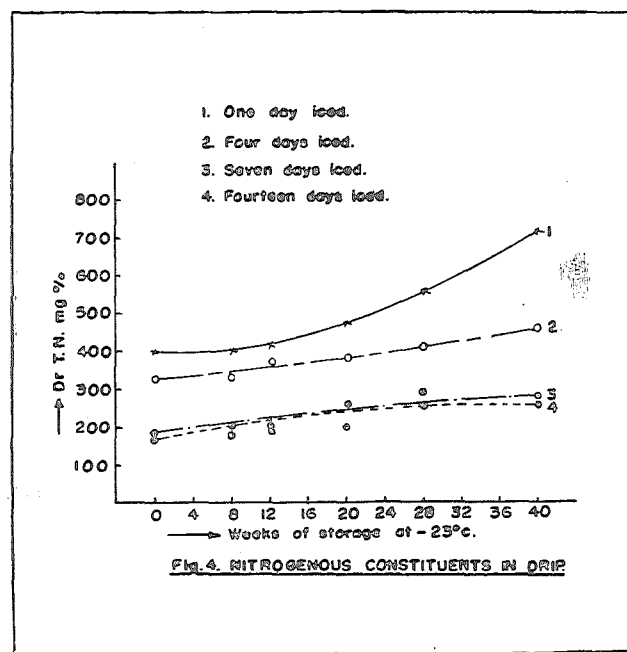
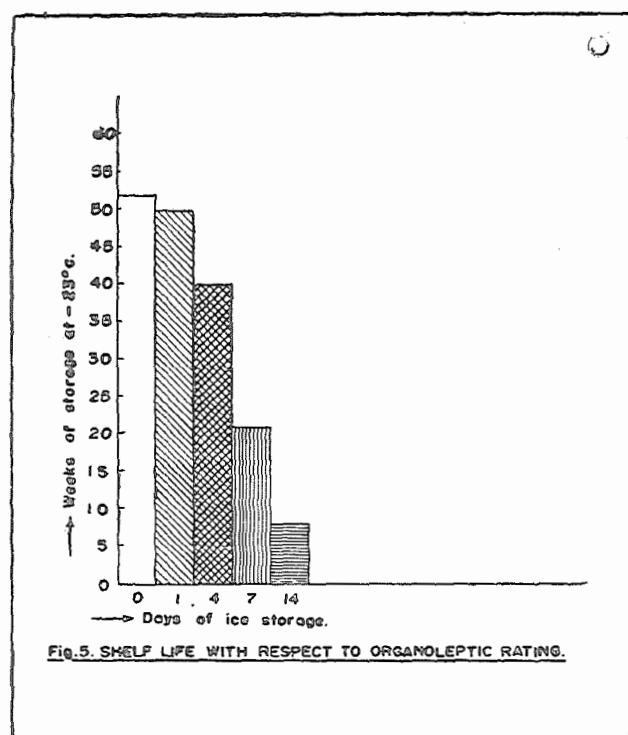


Fig. 4 depicts the nitrogenous constituents in the drip. The values showed an increasing trend with progressive frozen storage, loss of nitrogen in the drip being pronounced in one day iced material, possibly due to lesser quantities of nitrogen being lost during icing.



The organoleptic rating as judged by taste panel assessment is given histogrammatically in Fig. 5. As could be seen, frozen storage quality has a direct bearing on the prefreezing ice storage. One day iced material remained in good condition for about 50 weeks while 7 day-iced material had a shelf-life of only about 21 weeks and 14 day-iced material about 8 weeks.



Based on the information gathered in the above lines, further studies have been made on the standardisation of methods for the freezing of raw crab meat & pre-cooked crab meat and on development of suitable chemical glazes to prevent deteriorative changes accompanying frozen storage. These results will be communicated in a subsequent paper.

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