# Effect of Chilled Sea Water Storage of Oil Sardine (*Sardinella longiceps*) on Quality Changes During Frozen Storage

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The shelf-life of frozen oil sardine *(Sardinella longiceps)* can be improved by preserving the fish immediately after catch in chilled sea water before freezing. Delayed icing caused considerable deterioration in quality and reduced frozen shelf-life. Oil sardine preserved in chilled sea water were found to be suitable for freezing upto 5 days whereas iced samples could be frozen only upto 2 days.

Freshness has significant influence on the shelf-life of frozen stored fish. Shenoy and Pillai (1971) reported that storage life of frozen oil sardine depended on the iced storage period before freezing. Tokunaga and Nakamura (1961) observed that the rate of denaturation during frozen storage would be greater in stale fish than in fresh fish. Chilled sea water preservation of fresh fish has proved to be useful in preservation of freshness of pelagic fishes (Hiremath *et al.*, 1984). The present work was carried out to find the difference in quality and frozen shelf-life of oil sardine preserved in chilled sea water and in ice prior to freezing. The effect of delayed icing was also studied.

## Materials and Methods

Fresh sardines were procured from the purse sine catch on board the fishing vessel and divided into 3 lots. One lot was cooled in chilled sea water (CSW) in 2 insulated boxes. About 130 kg of fish were mixed with 40 kg ice and 30 litres of sea water and agitated manually at intervals until the temperature equilibrium was attained (sample C) On reaching the shore, one box was stored in a cold room at 0 to 5°C (sample C) and from the other box, sea water was drained out and the fish was mixed with ice in the ratio of 1:1 (sample CI). The second lot of fish was directly mixed with ice in the ratio 1:1 in another insulated box on board the vessel. (sample I). The third lot of fresh fish was exposed to ambient temperature for 4 h and then mixed with ice in the ratio 1:1 (sample AI) in an insulated box. All the samples were stored in a chill room at 0 to 5°C.

Fish were taken daily from each of the 4 samples C, CI, I and AI for 6, 5, 5 and 3 days respectively and frozen in the form of blocks of 1 kg. Chilled water was added to serve as glaze. Frozen blocks were packed in polythene bags, sealed and stored at –20°C in cartons. Moisture, protein, crude fat and ash of fresh material were determined by AOAC methods (AOAC, 1970). The frozen samples were analysed for drip loss, salt souble nitrogen (SSN), thiobarbituric acid (TBA) value and organoleptic quality after one month and 4 months storage. Thiobarbituric acid value was determined by the method of De Koning and Silk (1963). Salt soluble nitrogen was estimated by the

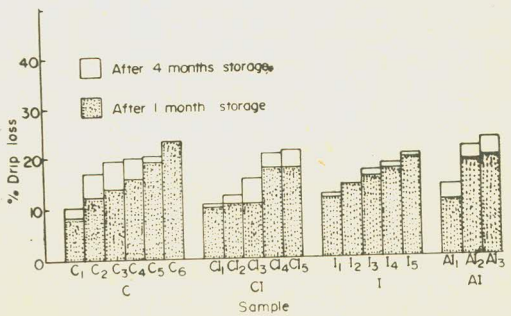


Fig. 1. Changes in drip loss during storage at —20° C

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method of Dyer *et al.* (1950). For free drip, a filleted piece of meat was taken from each of the samples, weighed in an analytical balance accurately and was kept in the refrigerator maintained at 10°C for thawing for 3 h, placing the sample between 2 filter papers tied with a thread. After thawing, the sample was weighed again and percentage drip loss was calculated. For organoleptic analysis the samples of fish were cooked in 2 percent brine, cooled to room temperature and presented to ten trained judges. The judges were asked to score on a six point scale with 10 score points, excellent - 10, good-8, fair-6, border line-4, bad-2 and very bad-0.

## Results and Discussion

The proximate composition of sardine used for the study is given in Table 1. The frozen samples were designated as $C_1$-$C_6$, $CI_1$-$CI_5$, $I_1$-$I_5$, $AI_1$-$AI_3$ depending upon the period of prefreezing storage time in days. The changes in drip loss, SSN, TBA and organoleptic score are presented in Figs, 1 to 4 respectively. From Fig. 1, it is observed that the drip loss in sample $C_1$ was the lowest followed by $CI_1$, $I_1$,$AI_1$ after one month. The drip loss exceeded 20% after 4 months in samples $C_6$, $CI_4$, $CI_5$, $I_5$, $AI_2$ and $AI_3$. Bose (1969) showed that drip exuded in fish *(Saidinella longiceps)* that were frozen stored for 6 weeks was proportional to the length of storage prior to freezing. Present values show that the drip loss is dependent upon the initial quality of the fish and length of chilled storage.

The SSN values in Fig. 2 indicate that the rate of decrease of SSN is significantly dependent upon the initial quality of the fish. The decrease was minimal in samples preserved in CSW and maximum in samples kept at abient temperature before icing.

The TBA values presented in Fig. 3 did not show significant difference between samples. The organoleptic scores (Fig. 4) show that only samples $C_1$-$C_2$, $CI_1$-$CI_2$, $I_1$-$I_2$ scored more than 7 points after one month and all the samples except $C_6$, $CI_5$, $I_5$, $AI_3$ scored more than 6 points after 4 months.

**Table 1.** *Proximate composition of sardine (Sardinella longiceps) used in the experiment (expressed as percent of meat)*

| | |
|---|---|
| Moisture | 74.82 |
| Protein (TN x 6.25) | 19.76 |
| Fat | 3.36 |
| Ash | 1.34 |

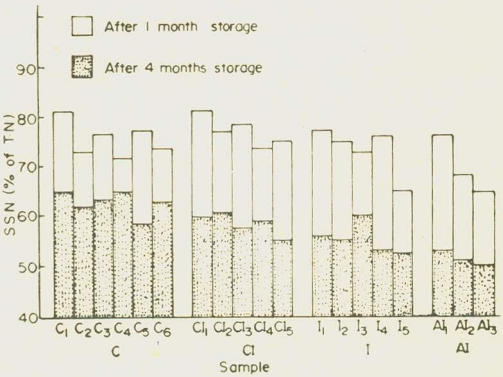


Fig. 2. Changes in salt soluble nitrogen during storage at —20° C

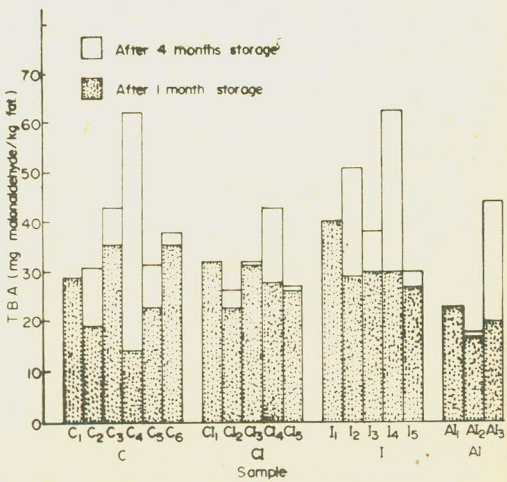


Fig. 3. Changes in TBA values during storage at —20° C

On the basis of the above values, it was concluded that the oil sardines chilled and preserved in CSW could be frozen for 5 days and the sample chilled in CSW and further preserved in ice could also be frozen up to

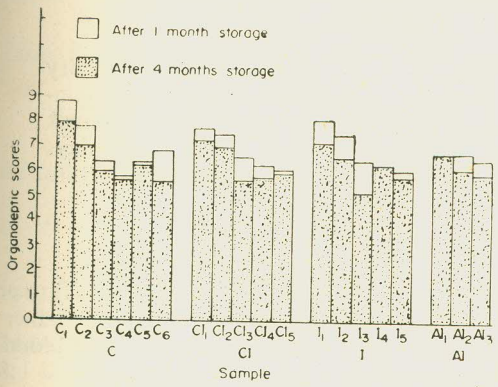


Fig. 4. Changes in organoleptic scores during storage at —20° C

5 days with a little or no difference in quality during frozen storage. The fish chilled and preserved in ice were fit for freezing only up to 2 days. The sample iced after a delay of 4 h could be frozen only up to one day.

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