

PRESERVATION OF *OTOLITHUS ARGENTEUS* AT LOW TEMPERATURE

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ABSTRACT

The studies provided data, on the spoilage pattern of *Otolithus argenteus* during low temperature preservation. Changes in the total volatile bases, hypoxanthine, tyrosine, salt soluble nitrogen, non-protein nitrogen, pH, peroxide value, free fatty acids and thiobarbituric acid number along with organoleptic score have been reported. Organoleptically, fish stored at +20°C remained in acceptable condition upto 12 days while for those stored at 0°C in ice upto 19 days. Of the various indices tested Hypoxanthine, salt soluble nitrogen and total volatile bases nitrogen, in the order of merit can be used as freshness tests for refrigerated fish.

INTRODUCTION

A cursory glance at the scientific literature clearly reveals that most Indian work on low temperature preservation of fish are relegated to commercially important fishes only. The ice storage characteristics of prawns have been extensively studied by Velankar and Govindan (1958 a,b), Velankar and Govindan (1959) Iyengar *et al.* (1960), Velankar *et al.* (1961 a,b), Shaikmohmed and Magar (1961) and Velankar (1964 and 1965). Venkataraman *et al.* (1966) reported the ice storage characteristics of Indian pomfrets. The spoilage of seer fish was studied by Shenoy and James (1974). The freshness of fish, being related to the period of ageing in chilled or frozen storage prior to processing, will determine to a large extent the quality of the processed fish reaching the consumer. This study was designed to provide the information on the type and pattern of spoilage of *Otolithus argenteus* during storage at low temperature at +2°C and 0°C in ice.

MATERIAL AND METHODS

Freshly caught *Otolithus argenteus* of size ranging from 180 to 270mm long were obtained from trawl catches of MFV Harpodon. The material was kept

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in ice immediately after catching in insulated containers and brought to the labo-
ran about 5 to 6 hours.

To study the spoilage pattern of fish, during chilling for longer periods, the material was washed in potable water and divided into two lots. One lot was stored in a domestic refrigerator after arranging the fish in one layer in a tray at +2°C in an upper compartment, beneath the deep freezer chamber of the refrigerator. One tray half-filled with water was also kept in the refrigerator to adjust the humidity of the chamber around 80%. The other lot was kept in sufficient quantity of flake ice in an insulated container kept in a cold storage at 0°C±1°C, by replenishing the melted ice, periodically. Samples were drawn at regular intervals of 2 to 3 days and analysed to study the changes occurring in various biochemical constituents. Moisture, total nitrogen, total nonprotein nitrogen, salt soluble nitrogen, total volatile bases, trimethylamine nitrogen, dimethylamine, tyrosine, peroxide value, free fatty acids, thiobarbituric acid number and pH was determined as described by Rao and Velankar (1985), except that the pH of the ground muscle was determined using Elico pH meter, model L1 - 10, with the combination electrode. The general appearance like brightness of eyes, colour of skin, gills, muscle texture, odour and other organoleptic qualities of the samples were noted between 1 and 10, 10 for absolutely fresh fish, while 4.5 being border line of acceptance and 1 for highly decomposed fish.

RESULTS AND DISCUSSION

The moisture content was found to decrease in samples stored at +2°C. (Table I). It decreased from 79.46 to 78.14% during the storage period of 15 days. However, a slight increase in the moisture was noted from an initial moisture of 79.46 to 81.88% at the end of 19th day storage in ice. Since the samples at +2°C was stored without an overwrap, moisture from the melt water of ice must have picked up by the material. The total nitrogen in the muscle did not vary much during storage at +2°C. It decreased very slightly from an initial value of 3.22 to 3.16% by 15 days time at +2°C. The decrease in total nitrogen was more for those stored at 0°C in ice (Table II). The value of the total nitrogen recorded at the end of 15th day was 2.98% which was lower than those stored at 2°C

The total non-protein nitrogen increased from 0.37% gradually in both the cases; for those stored at +2°C the values were higher than those stored in ice. At the end of 15th day the non-protein nitrogen recorded was 0.54% in case of samples at +2°C but for fish stored in ice it was 0.42% by 19th day.

Table I : Biochemical changes in *Otolithus argenteus* during storage at +2°C.

	Period of storage in days						
	Initial	3	5	7	10	12	15
Moisture %	79.46	79.38	79.20	78.80	78.70	78.28	78.14
Total nitrogen %	3.22	3.22	3.19	3.18	3.18	3.18	3.16
Total non-protein nitrogen %	0.37	0.37	0.42	0.46	0.46	0.54	0.54
Salt soluble nitrogen % (Total nitrogen basis)	69.36	65.64	60.09	52.25	49.06	50.64	50.64
Total volatile bases nitrogen mg %	11.20	11.20	14.00	16.80	25.20	32.20	44.80
Trimethylamine nitrogen mg %	0.44	0.89	0.70	1.66	2.18	2.30	2.42
Tyrosine equivalents mg %	11.11	11.11	14.34	14.42	15.58	20.63	22.22
Hypoxanthine moles/g	0.68	2.85	4.35	—	5.10	—	6.01
Peroxide value milli equivalents / Kg of fat	7.64	19.65	43.29	—	45.52	—	62.07
Free fatty acids %	7.59	9.69	13.47	—	15.37	—	19.81
Thiobarbituric acid number mg malonaldehyde/Kg	0.04	0.16	0.08	0.32	0.20	0.24	0.24
pH	6.6	6.6	6.6	6.6	6.7	6.7	6.8
Organoleptic score	9	8	7	6	6	5	3

Table II : Biochemical changes in *Otolithus argenteus* during storage at +0°C in ice.

	Period of storage in days						
	Initial	3	5	7	10	15	19
Moisture %	79.46	79.38	79.58	80.34	80.12	81.36	81.88
Total nitrogen %	3.22	3.22	3.19	3.07	3.08	2.98	2.98
Total non-protein nitrogen %	0.37	0.37	0.37	0.41	0.42	0.45	0.42
Salt soluble nitrogen % (Total nitrogen basis)	69.36	67.28	63.75	56.66	53.56	52.03	50.34
Total volatile bases nitrogen mg %	11.20	11.20	16.80	18.20	16.80	20.22	25.20
Trimethylamine nitrogen mg %	0.44	0.77	0.77	1.22	1.77	1.56	1.80
Tyrosine equivalents mg %	11.11	12.67	12.67	14.34	14.34	14.72	12.36
Hypoxanthine moles/g	0.68	0.82	0.98	2.10	2.70	3.08	4.50
Peroxide value milli equivalents / Kg of fat	7.64	15.58	17.75	28.11	21.35	37.84	44.97
Free fatty acids %	7.59	8.33	10.58	10.58	15.50	19.69	19.69
Thiobarbituric acid number (mg malonaldehyde/Kg)	0.04	0.04	0.04	0.08	0.09	0.16	0.16
pH	6.6	6.6	6.6	6.6	6.7	6.7	6.7
Organoleptic score	9	8	7	7	6	5	5

Salt soluble nitrogen is a measure of protein denaturation. The initial value was 69.36% which consistently decreased through out the storage periods.

Total volatile based nitrogen increased in both the cases. But the higher range values were recorded for those at +2°C. The values increased from an initial value of 11.20 to 25.20% at the end of 10th day at +2°C. But by 19th day storage in ice the value was 25.20%. The trimethyl amine nitrogen has also shown fairly consistent increase throughout the storage periods. The values recorded were of higher order for those at +2°C It increased from 0.44 to 2.42% by 15 days time. The trimethyl amine nitrogen did not reach beyond 1.80% even at the end of 19th day in ice. Dimethylamine was not able to detect in any of the samples during the entire storage period. The changes in total volatile bases, non protein nitrogen, and trimethyl amine can be due to deaminases present in tissues or to bacterial action.

Strong proteolytic muscle or bacterial enzymes may be responsible for the increase in Tyrosine. Initially it was 11.11% which did not show much variation during storage in ice. But for those stored at +2°C the values were doubled, at the end of 15th day. Hypoxanthine values increased from 0.68 to 6.01 moles/g by 15 days time at +2°C slightly lower range values were obtained for those stored at 0°C in ice. Unlike other indices hypoxanthine registered continuous increase throughout the storage.

Changes in the lipids components were evaluated by following peroxide value, thiobarbituric acid number and free fatty acids. Peroxide value increased from 7.64 to 62.07 milliequivalents per kg of lipids when the material was stored at +2°C Lower values were obtained for the ice stored samples. However, no consistent increase in peroxide values were noticed in the ice storage. Free fatty acids have shown consistent increase in both the cases. They increased from 7.59 to 19.81% and 7.59 to 19.69% in fish stored at +2°C and 0°C, respectively. Thiobarbituric acid number was comparatively lower when the fish was stored at 0°C in ice compared to those stored at +2°C.

The pH of the fish muscle did not show much variation. Initially it was 6.6 which remained constant until about 7 days. At the end of 15th day it increased to 6.8 for those stored at +2°C. However, for the ice stored once until the end of 19th day the pH increased to 6.7 only.

The overall appearance of the fish was better for those stored at +2°C. The eyes were bright with transparent cornea until 15 days at +2°C. The cornea of eyes were opaque just by 6 days when the fish was stored in ice. The organoleptic score decreased from 9 to 5 by the end of 12th day at +2°C and 15th day the samples were tainted ammoniacal, the score decreased to 3. The samples continued to remain acceptable until 19th day and the score was 5.

Fresh or frozen fish when exported to west Asian countries, limits for total volatile bases and trimethyl amine nitrogen is often stipulated. Among the various indices studies the best spoilage indices for refrigerated *Otolithus argenteus* at +2°C or 0°C, in the order of merit is hypoxanthine, salt soluble nitrogen, trimethylamine and total volatile bases.

ACKNOWLEDGEMENTS

I would like to express my sincere thanks to Dr. S. N. Dwivedi, Director, Central Institute Of Fisheries Education, Versova, Bombay for his keen interest and kind permission for publication of this work.

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