EXPERIMENTAL PRESERVATION OF SARDINES (SARDINELLA LONGICEPS), USING CHLORTETRACYCLINE

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Effects of dips in 10 and 50 ppm Chlortetracycline solution on the storage-life of sardines in ice have been studied. 5 ppm-CTC-ice in conjunction with dip in 10 ppm CTC-solution has also been tried. CTC-treatment considerably reduced bacterial number and gave a better appearance to the fish. The high fat content in sardines resulted in rapid development of rancidity. CTC has been found to have no control on the development of rancidity. Hence, CTC treatment of sardines is found to be of limited advantage in extending the storage -life of the fish in ice.

INTRODUCTION

The effectiveness of Chlortetracycline (CTC) for fish preservation has been thoroughly documented by Tarr (1961). The efficacy of the antibiotic on the keeping quality of the fish depends on many factors like the type and species of fish, composition of their native flora and the conditions of storage. In an earlier publication (Surendran and Iyer, 1971 a), CTC at 5 ppm level incorporated in ice, has been reported to enhance the shelf -life of tropical prawns by six days. Visweswariah *et. al.* (1959) had reported that at room temperature, dips in varying concentrations of CTC solutions could not prolong the keeping quality of fresh water fishes. In our present work, effect of CTC in improving the shelf-life of fatty fishes like sardines has been examined.

MATERIALS AND METHODS

1. *Sample preparation*

Fresh oil sardines (*Sardinella Longiceps*) from boats landed at Manassery, Cochin were collected. After washing in tap water, the fish were dipped for 10 minutes in CTC solutions of appropriate strength (10 ppm and 50 ppm) and packed in thermocole- insulated ice boxes with ordinary ice (fish : ice = 1 :1). In some cases, the fish after dip were packed in polythene bags and kept in ice. For comparative study, 5 ppm CTC-ice was also used for storing the treated fish. The ice losses were made up by addition of the respective ices on alternate days.

2. *Evaluation of spoilage*

Samples for analysis were taken under

TABLE I

ORGANOLEPTIC QUALITIES OF THE RAW SAMPLES

Days of storage	Control - Sardines kept in ordinary ice	Sardines dipped in 10ppm CTC solution and stored in ordinary ice	Sardines dipped in 50ppm CTC solution and stored in ordinary ice
0.	Fresh. Bright and lustrous appearance; soft but firm texture, with characteristic fresh ordour. Overall quality excellent.	———	———
2.	A decrease in the brightness. Slightly softer texture, Raw fish odour, overall quality good.	The brightness is decreased, Slightly softer texture and raw fish odour. Overall quality good.	The brightnes is decreased. Slightly softer texture and raw fish odour, overall quality good.
4.	The bright sheen is lost. Surface is covered with slime. The flesh is soft. Satisfactory quality.	The bright sheen is lost. The surface is covered with slime. The flesh is soft. Satisfactory quality.	The brightness is lost. The surface is covered with slime. The flesh has become soft. Satisfactory quality.
8.	Sample has a dull appearance with much blood and slime on the surface, slight foul smell showing bacterial spiolage of the muscle.	No bright appearance. Surface is covered with slime. No foul smell. Sample is still satisfactory.	No bright appearance. Surface is covered with slime. No foul smell is produced. The sample is still satisfactory.
13.	Completely spoiled.	Sample is dull in appearance. Enough slime on the surface. Slight foul smell indicating incipient spoilage.	Sample is dull in appearance. A lot of slime in appearance. No foul smell indicating any spoilage.
16.	———	Spoilt.	Spoilt.

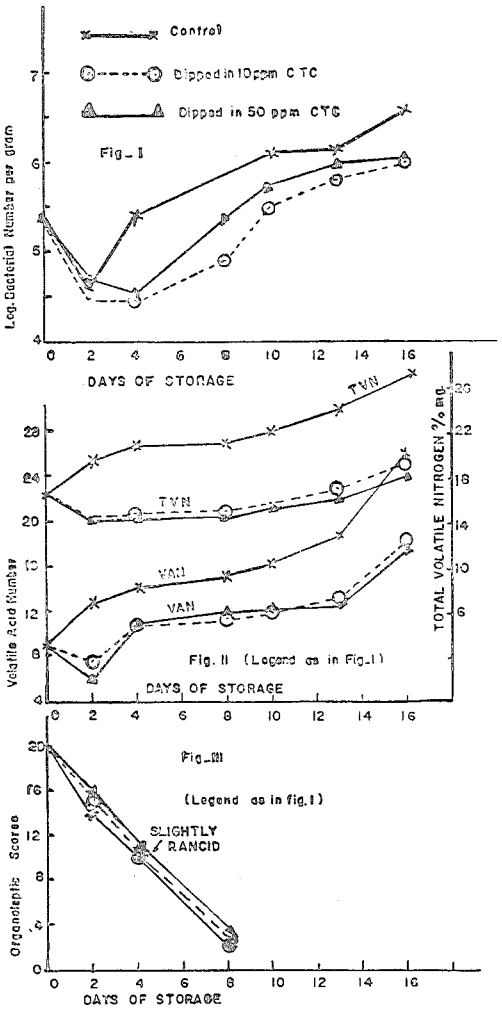
aseptic conditions immediately after treatment with the antibiotic and at specific intervals until 16 days of storage. The muscle with skin was cut from either sides of the fish and about 10 gms were used for the determination of total viable plate count, using sea water Agar (SWA) as the plating medium. (Surendran and Iyer, *loc. cit.*). Total volatile nitrogen (TVN) was determined by the Conway Microdiffusion method (Conway and Byvene, 1933) and volatile acid number (VAN) by the method of A. O. A. C. (1960). CTC in the muscle was determined by the microbiological assay procedure of Tomiyama *et. al.* (1960 a, b). Organoleptic assessment of the samples in the raw and cooked states was also made according to scheme already described. (Surendran and Iyer, *loc. cit.*).

Results and discussion

1. *Effect of CTC - concentration on keeping quality.*

Fig. I - III give the results of a typical series.

The total bacterial load of the control and the two treated samples registered a decrease during the first two days of storage (Fig-I). Later, the bacterial number in the control sample increased rapidly at first and then gradually, while those of the CTC - dipped samples showed a further decrease till the fourth day of storage, followed by a gradual increase. However, the bacterial load on the sample treated with 50 ppm CTC solution was greater than those of 10 ppm dipped sample. The VAN values of the control gradually increased, while those of both the treated sample showed a decrease first, followed by an increase and then remained more or less steady until about the 13th day of storage.



The trends of the TVN values were almost similar to those of VAN values.

Bacterial spoilage became apparent in the control sample by the 8th day, as evidenced by foul smell and slimy apppearance. The treated samples were not spoiled even after 13 days of storage, no difference being noticed between the 50 ppm and 10 ppm dipped samples. This observation, in conjunction with the fact that only by the 13th day of storage, the total bacterial counts of the treated samples reached the same level as that of the control on the 8th day, shows that there is an apparent improvement of 5 days in the keeping quality by CTC treatment. This means that CTC has suppressed the development of

proteolytic flora in the treated samples for at least 5 days. Fig. I shows that 10 ppm CTC - dip was sufficient and more effective than 50 ppm CTC - dip, to bring forth this advantage.

Fig. III shows the organoleptic rating of the samples after cooking. All the three samples developed rancidity by the 4th day of storage and became unacceptable. Obviously CTC-treatment did not prevent the development of rancidity.

TABLE II

CTC - Content of the muscle of Sardines, dipped in CTC Solutions and subsequently stored in ordinary ice.

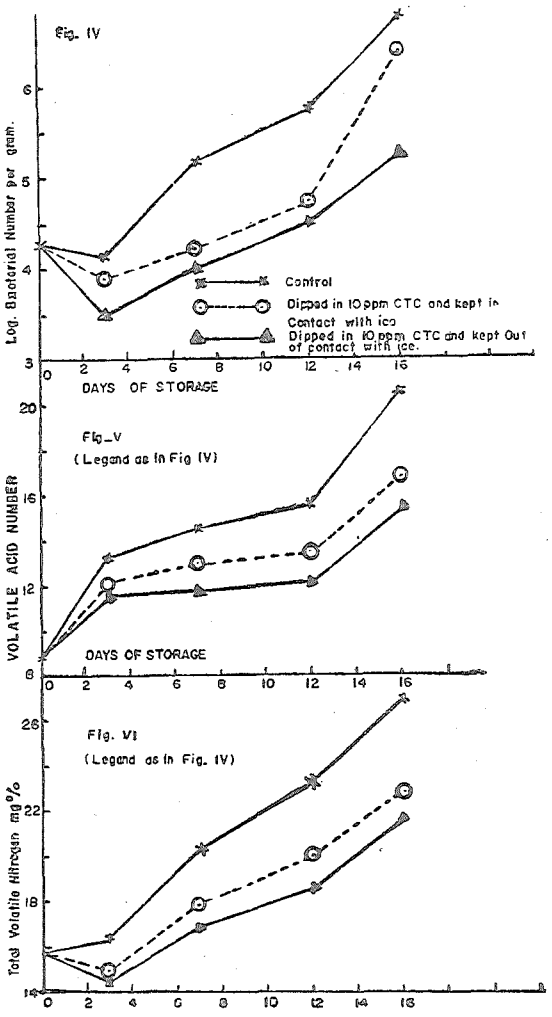
Days of storage	CTC Mg./gm. muscle	
	10ppm Dipped sample.	50ppm Dipped sample
0	1.9830	3.2230
2	1.1280	2.1760
4	0.8859	N D†
8	0.8345	1.6890
10	0.7269	1.0820
13	0.4165	0.8345
16	Nil	0.4165

†not determined.

The residual CTC in the muscle of the CTC-dipped samples is given in Table II. On storage in ice, the CTC content decreased considerably, due to washing effect of ice melt-water.

2. *Effect of the method of icing on shelf-life extension of sardines.*

Sardines were dipped in 10 ppm CTC solution, packed in polythene bags and kept in ice (out of contact). Another lot dipped in 10 ppm CTC was kept in contact with ice. The results of this study are shown in Fig. IV - VI. The bacterial count of the sample kept out of contact with ice was always lower than the other two samples viz. the one treated and kept in contact with ice and the control. The trends in the TVN and VAN values were similar. But, the sample kept out of contact with ice was organoleptically poor, the surface being covered with blood and slime. This sample contained a greater amount of residual CTC (Table-III) due to less chance of leaching- The treated sample, kept in contact with ice was superior to the packed sample in appearance.



In another study, the sardines dipped in 10 ppm CTC for 10 minutes were stored (i) in 5 ppm CTC-ice and (ii) in ordinary ice, for the purpose of evaluation of the effect of CTC–ice storage. Results are shown in Fig. VII-IX. Even

TABLE III

CTC - Content of the muscle of Sardines, dipped in 10ppm CTC Solution and kept in contact and out of contact with ordinary ice

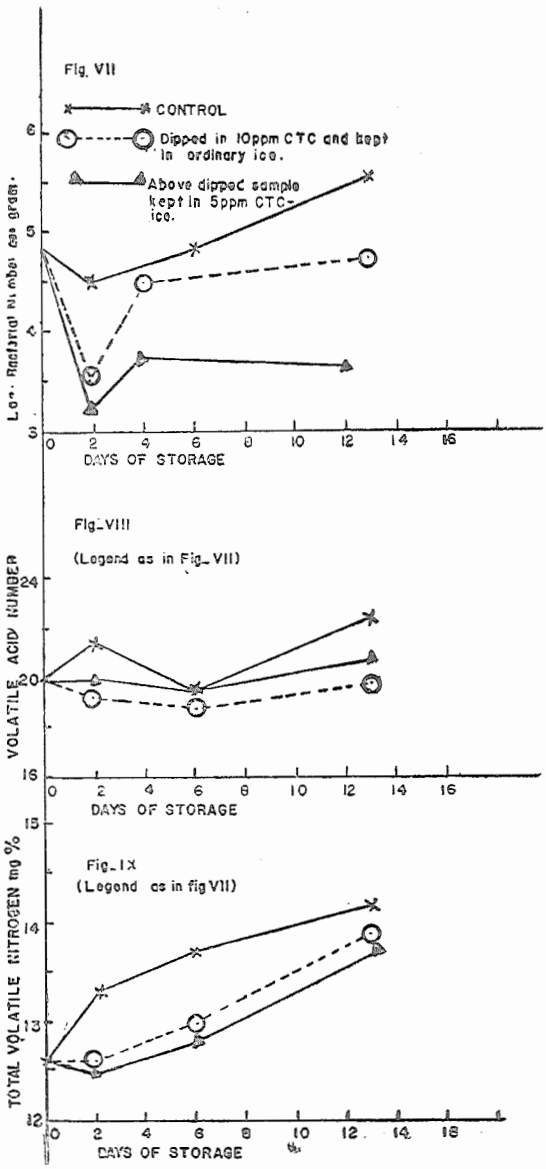
Days of storage	CTC Mg./gm. muscle	
	Kept in contact with ice	Kept out of contact with ice
0	1.9620	1.9620
3	0.9484	1.1490
7	0.9111	0.1280
12	Nil	0.7290
16	Nil	Nil

though the effect of CTC-ice storage is much pronounced on the bacterial count, such effect is not appreciably apparent in chemical indices like VAN and TVN. The CTC-content of the sample kept in antibiotic ice gradually increased, reaching a level of 2.2210 ppm within 13 days (Table IV) due to steady absorption of CTC from the antibiotic ice. The CTC-iced sample had a better appearance and developed foul smell very late (by

TABLE IV

CTC - Content of the muscle of Sardines after dipping in 10 ppm CTC Solution for 10 minutes (i) Kept in ordinary ice and (ii) Kept in 5 ppm CTC - ice

Days of storage	CTC Mg./gm. muscle	
	Dipped in 10ppm CTC for 10mints. and kept in ordinary ice	The same kept in 5 ppm CTC-ice
0	1.2060	1.2060
2	0.9120	1.5260
6	0.5370	1.5600
13	0.1170	2.2210



the 20th day of storage) compared with the other sample.

In the case of non-fatty fishes like cod, haddock and plaice, CTC at 5 to 10 ppm level extended the shelf-life by 8 to 10 days over the control (Shewan, 1962). For prawns, a shelf-life extension of 6 days over the control was obtained when stored in 5 ppm CTC-ice. Since CTC suppresses the bacterial growth of flora of fish, bacterial spoilage is reduced with consequent extension of shelf-life. But in the case of sardines which contains a higher percentage of fat, the

oxidative deterioration of fat is a limiting factor. CTC, though brings forth considerable reduction in the bacterial population of sardines, can not control development of rancidity. Since development of rancidity is observed in a period of 4 days of storage either in ordinary ice or in antibiotic ice, one has to conclude that use of the antibiotic in the preservation of sardines, specially when it contains high fat content, confers no added advantage.

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