Quality Changes in White Sardine, *Kowala coval* (Cuv.) during Frozen Storage

A.D. Serrao, G.G. Hiremath and K.C. Dora

College of Fisheries, Mangalore - 575 001

Experiments were conducted to evaluate the quality changes in white sardine *Kowala coval* (Cuv.) treated with BHA and ascorbic acid and sulphite during frozen storage at -20°C, for a period of 180 days. White sardine iced immediately after harvest and subsequently frozen within 6 to 8 h was in good condition over a period of 6 months at -20°C. There was no significant difference in quality between the control, antioxidant treated and sulphite treated samples during storage.

In Indian fisheries the small pelagic fishes constitute an important position, accounting for more than 49% of the total catch (Anon, 1983). Out of this, the clupeoid group ranks highest in abundance, forming an average of 26% of the total fish landings. Sardines and sardine like fishes are comparatively cheaper than other fishes like tuna, seer, mackerel and pomfrets, but equally nutritious. Though much work has been done on the freezing and frozen storage of different varieties of fishes throughout the world and also in India, little work has been carried out on the aspect of freezing and frozen storage of white sardine. The present study deals with the effect of chemical additives on the quality changes of white sardine during frozen storage over a period of 180 days.

Materials and Methods

In the present study, medium sized *Kowala coval* (Cuvier) commonly known as 'white sardine' were used. The fish was procured directly from the fishing boats at the fish landing centre, Kulai, in very fresh condition, immediately iced and transported to the laboratory in an insulated box. In the laboratory the fishes were thoroughly washed with chilled fresh water, iced and stored in an insulated container at 5°C or below. The interval between catching and freezing was not more than 8 h.

The fish was divided into three equal lots and treated as follows.

1. Untreated control

2. Treated with butylated hydroxy anisole (BHA) and ascorbic acid at 0.01 and 0.1% of dip solution respectively. BHA was dissolved in 50 ml of refined edible oil and mixed with water to form an emulsion using the emulsifier tween 80.

3. Sulphite treatment at 500 ppm level using sodium sulphite.

The treatments were given in the form of 'dip' for a duration of five min. The white sardine thus treated was packed as one kg blocks and glazed with chilled water to cover the fish. The fish was coil frozen at -28°C over a period of 5 h to a core temperature of -15°C. The frozen samples were packed in three-ply carton and stored at -20°C. The samples were analysed on 15, 30, 45, 60, 90, 120, 150 and 180 days. One block of frozen white sardine was taken at random from each of the three sets, namely control, antioxidant treated and sulphite treated. The frozen block was thawed in water and was used for determining the biochemical and organoleptic parameters.

The total nitrogen of the samples was estimated by the method of AOAC (1975). The salt soluble nitrogen (SSN) was es-

timated according to the procedure of Dyer *et al.* (1950) and non protein nitrogen (NPN) content in aliquots of TCA extract folowing the procedure described by Srikar & Chandru (1983). The lipid was extracted by the method of Bligh & Dyer (1959) and the total lipid determined. Silicic acid column chromatography was employed for fractionation of lipids. The neutral lipids were eluted with 200 ml chloroform as the solvent and estimated. Phospholipids were eluted with methanol in chloroform and finally with 100 ml of pure methanol. Phosphorus was determined by the method of Fiske & Subba Rao (1925) and the phosphorus content was multiplied by a value of 25 to get the phospholipid quantitatively. Free fatty acid present in the lipid was estimated following the NCPA method of AOAC (1975). From the chloroform extract, the peroxide value (PV) was determined by the method of Chapman & McFaklane (1943) as modified by Hills & Theil (1946). The thiobarbituric acid values were estimated using chloroform extract by the method of Sinnhuber & Yu (1957). TVBN and TMAN content was determined by the method of Beatty & Gibbons (1937) using Conway's micro diffusion units. 10 g of white sardine meat was homogenised with 50 ml of distilled water, and the pH was measured using a pH meter with a combined electrode (Horiba).

The dressed white saridine was cooked for 6 to 8 min in 2% salt solution, cooled to room temperature, presented to taste panel members and scored on a ten point scale. These values were subjected to statistical analysis.

Results and Discussion

The average total length, standard length and body weight of the fish were 10.3 cm, 8.2 cm and 11.49 g respectively. The proximate composition of fish muscle, TVBN and TMAN values, pH and the per cent content of phospholipids and neutral lipids are presented in Table 1. Changes in percentage of free drip for different samples are shown in Fig. 1. The free drip increased in all the samples which was rapid in the first 30 days. The antioxidant treated sample had the lowest free drip (10.50%) and sulphite treated highest (11.20%) when stored for 180 days.

Table 1. *Chemical characteristics of the white sardine used for the study.*

Moisture, %	74.49
Protein, %	23.19
Crude fat, %	0.74
Ash, %	1.36
TVBN, mg %	0.60
TMA, mg%	Negligible
pH	6.8
Phospholipids (Percentage of total lipids	79.00
Neutral lipids) (percentage of total lipids)	21.00

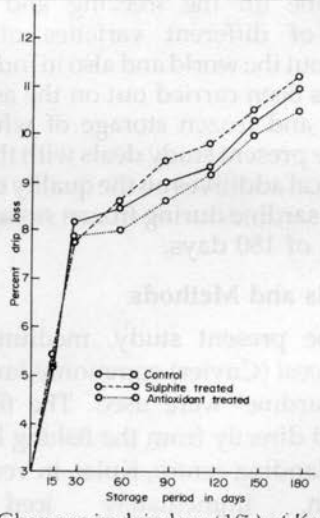

Fig. 1. Changes in drip loss (1%) of *Kowala coval* (Cuvier) treated with sodium sulphite and antioxidants and control, stored at - 20°C

In the present study salt soluble nitrogen as percentage of total nitrogen decreased steadily (Fig. 2). It has an initial value of 70.77% for all the three samples which

decreased to a final value of 50.66, 51.15 and 48.66% for control, antioxidant treated and sulphite treated samples respectively. Fig.3 shows the changes in NPN (as percentage of total nitrogen) during frozen storage. The changes in NPN was almost same in all the three samples.

Figs 4 and 5 shows the changes in peroxide value (PV) and thiobarbituric acid value (TBA) during frozen storage of white

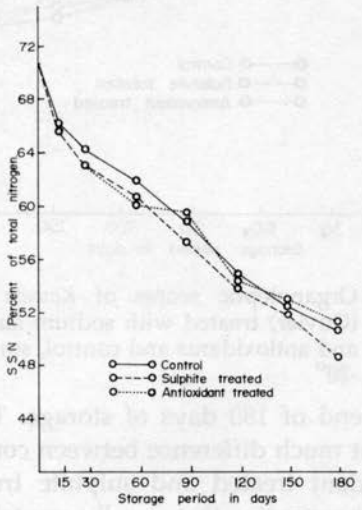

Fig. 2. Changes in salt soluble nitrogen (% of total nitrogen) of *Kowala coval* (Cuvier) treated with sodium sulphite and antioxidants and control, stored at -20°C

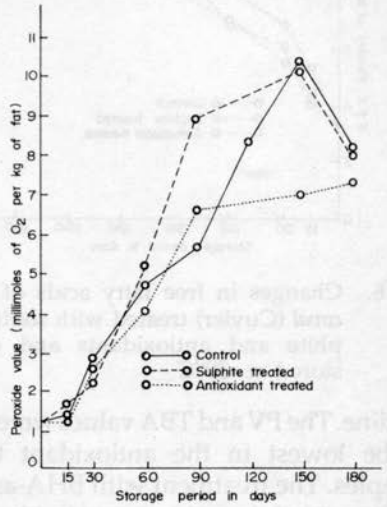

Fig. 4. Changes in peroxide value of *Kowala coval* (Cuvier) treated with sodium sulphite and antioxidants and control, stored at - 20°

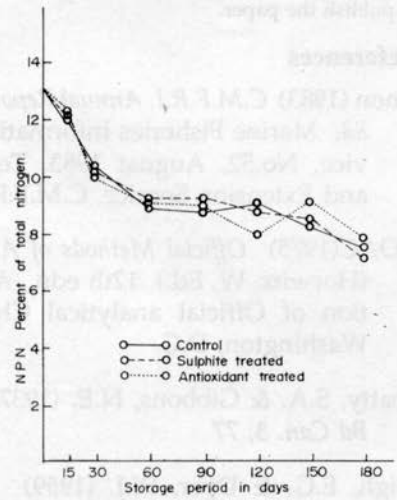

Fig. 3. Changes in non protein nitrogen of *Kowala coval* (Cuvier) treated with sodium sulphite and, antioxidants and control, stored at -20°

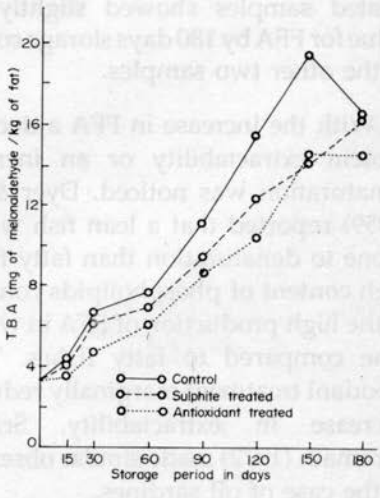

Fig. 5. Changes in thiobarbituric acid value of *Kowala coval* (Cuvier) treated with sodium sulphite and antioxidants and control, stored at -20°C

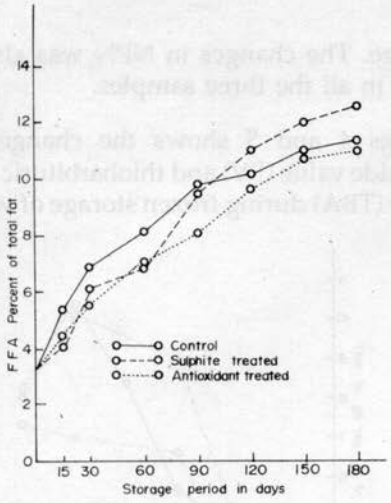

Fig. 6. Changes in free fatty acids of *Kowala coval* (Cuvier) treated with sodium sulphite and antioxidants and control, stored at -20°C

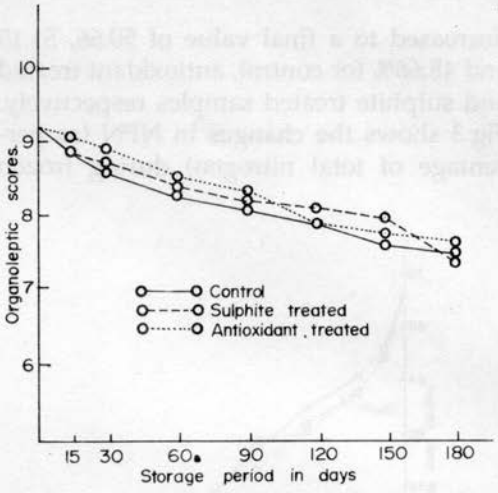

Fig. 7. Organoleptic scores of *Kowala coval* (Cuvier) treated with sodium sulphite and antioxidants and control, stored at -20°

sardine. The PV and TBA values were found to be lowest in the antioxidant treated samples. The treatment with BHA-ascorbic acid retarded the oxidation of lipids during frozen storage. Similar results have also been reported by many workers (Moorjani *et al.*, 1958; Srikar & Hiremath, 1972). Fig. 6 shows the changes in FFA. Sulphite treated samples showed slightly higher value for FFA by 180 days storage compared to the other two samples.

With the increase in FFA a decrease in protein extractability or an increase in denaturation was noticed. Dyer & Fraser (1959) reported that a lean fish was more prone to denaturation than fatty fish. The high content of phospholipids contributed to the high production of FFA in white sardine compared to fatty fishes. The antioxidant treatment marginally reduced the decrease in extractability. Srikar & Hiremath (1972) made similar observations in the case of oil sardines.

The taste panel scores decreased during storage in all the three cases (Fig. 7) and all the three samples were judged as 'good' at the end of 180 days of storage. There was not much difference between control, antioxidant treated and sulphite treated samples regarding the overall acceptability of the fish.

The authors are grateful to Professor P.K.Salian, Director of Instruction, College of Fisheries, Mangalore for his keen interest in the work and for permission to publish the paper.

References

Anon (1983) *C.M.F.R.I. Annual Report 1982-83.* Marine Fisheries Information Service, No.52, August 1983. Technical and Extension Service. C.M.F.R.I.

AOAC(1975) *Official Methods of Analysis* (Horwitz, W, Ed.) 12th edn., Association of Official analytical Chemists, Washington, D.C.

Beatty, S.A. & Gibbons, N.E. (1937) *J.Biol. Bd Can.* **3**, 77

Bligh, E.G. & Dyer, W.J. (1959) *Can. J. Biochem. Physiol.* **37**, 911

Champman, R.A. & McFaklane, W.D. (1943) *Can. J. Res.* (B)

Dyer, W.J. & Fraser, D.I.(1959) *J. Fish. Res. Bd Can.* **16**, 43

Dyer , W. j., French, H. V. & Snow, J. M. (1950) *J. Fish. Res. Bd Can.* **7**, 585

Fiske, C.H. & Subba Row, Y. (1925) *J. Biol. Chem.* **66**, 375

Hills, G.L. & Thiel, C.G. (1946) *J. Dairy Res.* **14**, 340

Moorjani, M.N., Iyengar, J.R. & Bhatia, D.S. (1958) *Fish. Fd Sci.* **7**(2), 31

Sinnhuber, R.O. & Yu, T.C. (1957) *Food Technol.* **12**, 9

Srikar, L.N. & Chandru, R. (1983) *J. Fd Technol.* **18**, 129

Srikar, L.N. & Hiremath, G.G. (1972) *J. Food Sci. Technol.* **9**(4), 191