Effect of Vacuum Packaging on Frozen Storage of Seer Fish Chunks

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This paper gives the changes in vacuum-packed seer fish (*Scomberomorus guttatus*) chunks during frozen storage. Frozen seer fish chunks were packed in pouches made of 12 μ polyester laminated with 150 gauge LDPE to study the effect of vacuum packaging in comparison with air packed samples. All these samples were stored at –20°C and were subjected to biochemical, microbiological and sensory evaluation at regular intervals. The shelf life of vacuum packed seer fish chunks was 12 months, whereas air packed samples were acceptable for a period of 10 months only.

Key words: Seer fish, vacuum packaging, frozen storage life

Vacuum packaging involves the removal of air from the package, then the application of a hermetic seal. Vacuum packaging can considerably extend the shelf life of many foods (Gopal *et al.*, 1999; Lee *et al.*, 1993; Dalgaard, *et al.* 1993; Mendonca *et al.*, 1989). Several workers have reported the beneficial effects of vacuum packaging in improving the shelf life of frozen seafoods (Lee *et al.*, 1993; Ihm *et. al.*, 1992).

Seer fish is one of the highly cherished food fishes of India and constitutes nearly 1.2% of the annual fish landing. Demand for seer fish is very high and storage life in ice is very limited. Freezing is a common method adopted for preserving seer fish, but frozen storage life of seer fish is limited. Studies have shown that vacuum packing improves the shelf life considerably. So, the present study was undertaken to find the effect of vacuum packaging on the shelf life of seer fish during frozen storage.

Materials and Methods

Fresh *Scomberomorus guttatus* procured from fish landing center were brought to the laboratory in iced condition. The fishes were beheaded, gutted and cut into chunks. The chunks were washed in 2 ppm chlorinated water,

drained well and subjected to further processing. Chunks (150±5 g) were packed in pouches made of 12 μ polyester and 300 gauge polyethylene. The physical properties of packaging materials used are given in Table 1. One batch of chunks was packed under air (AP) and the other batch was packed under vacuum (VP). Immediately after packing, all the packs were frozen at – 40°C and stored at – 20±2°C. Samples were drawn from each lot at regular intervals for analysis. All the packs were analysed for sensory, microbiological and biochemical parameters.

Table 1. Physical properties of the packaging material

1.	Tensile strength*	- Machine Direction - Cross Direction	363 $kg.cm^{-2}$ 349 $kg.cm^{-2}$
2.	Elongation at break (MD) Elongation at break (CD) (IS: 2508, 1984)		80% 80%
3.	Heat seal strength (MD) Heat seal strength (CD) (IS: 2508, 1984)		249 $kg.cm^{-2}$ 194 $kg.cm^{-2}$
4.	Water Vapour transmission rate (IS: 1060-Part II, 1960)		3.62$g.m^{-2}.24\ h^{-1}$ at 37°C at 90 ±2% RH
5.	Oxygen transmission rate (OTR) (ASTM 1975)		65 $CC.m^{-2}.atmosphere^{-1}.24\ h^{-1}$ at room temperature (28-32°C)

MD : Machine direction; CD : Cross direction

Moisture, Crude protein, ash and fat were determined according to methods described in AOAC (1975). Total Volatile Base Nitrogen (TVB-N) and Trimethyl Amine Nitrogen (TMA-N) were determined by micro-diffusion method (Conway, 1950). Determination of salt-soluble nitrogen (SSN), thio barbituric acid (TBA) value and free fatty acid (FFA) were carried out by the methods of Dyer *et al.* (1950), Tarladgis *et al.* (1960) and AOCS (1989), respectively. Bacteriological analysis of samples was done by the methods of Tomilson (1995).

Sensory evaluation was based on characterization and differentiation of the various sensory characters such as appearance, texture, odour and flavour. Score was given based on 9-point hedonic scale as described by Peryam & Pilgrims (1957). A score of 4 was taken as the borderline of acceptability.

Results and Discussion

Proximate composition of fresh seer fish was 73.03% moisture, 3.45% crude fat, 21.13% crude protein and 1.60% ash. The changes in moisture content during iced storage in all the samples were not very significant (Fig. 1). This may be attributed to water vapour barrier of the packaging material used. It was observed that the TVBN and TMAN values increased gradually throughout the storage period and vacuum packed samples had lower values compared to air packed samples (Figs. 2 & 3). Kim & Hearnsberger (1994); Kim *et al.* (1995); Parkin & Brown (1983) and Reddy *et al.* (1995) also made similar observations. Vacuum packed samples showed lower values of TBA in comparison to air packed samples (Fig.4) due to the absence of air in vacuum packed samples, as also observed by Huang *et al.* (1991; 1994).

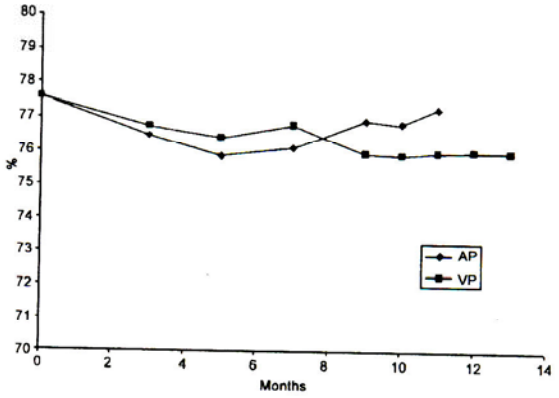

Fig. 1. Changes in moisture in seer fish chunks at -20°C

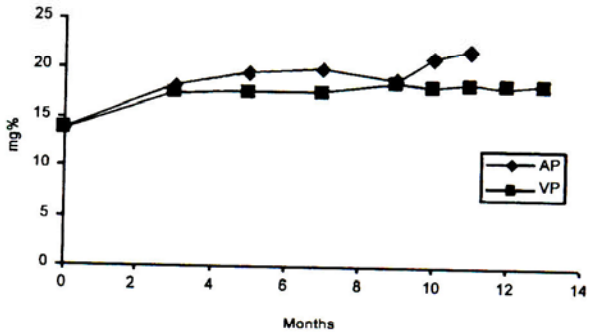

Fig. 2. Changes in TVBN in seer fish chunks at -20°C

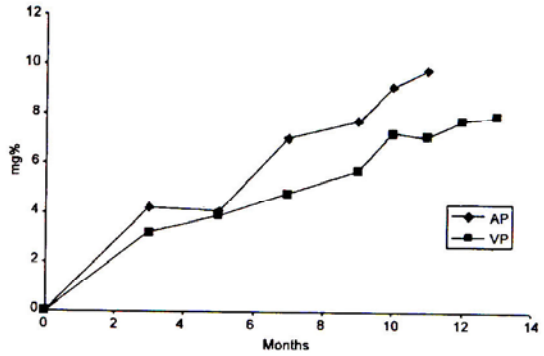

Fig. 3. Changes in TMAN in seer fish chunks during storage at -20°C

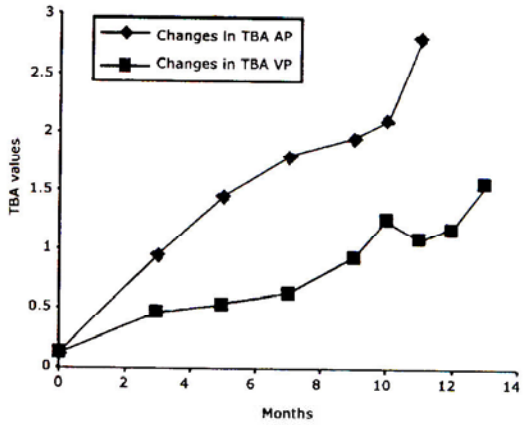

Fig. 4. Changes in TBA values in seer fish chunks during storage at -20°C

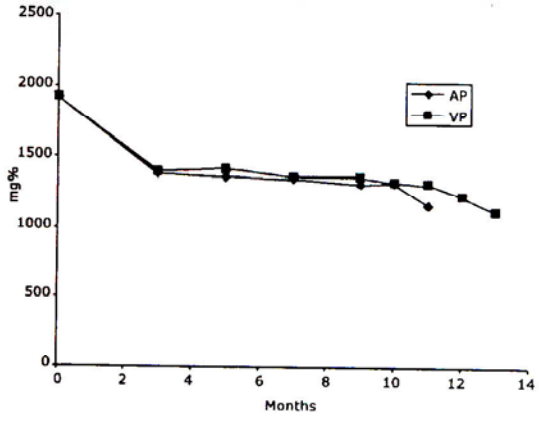

Fig. 5. Changes in SSN in seer fish chunks during storage at -20°C

There was no significant change in SSN values in all the samples indicating that there was no denaturation of proteins during storage (Fig. 5). The increase in free fatty acid values in air packed samples was more significant as compared to vacuum packed samples (Fig. 6). Similar results were also observed by Huang *et al.* (1992) and Sikorski *et al.* (1990). Fresh seer fish as well as chunks during storage did not show the presence of *Clostridium botulinum* and its toxin was also not detected, indicating that the vacuum packed frozen seer fish chunks were safe for human consumption. There was a gradual decline in sensory scores in both air and vacuum packed samples (Fig. 7). Air packed samples were acceptable upto 10 months, whereas vacuum packed samples had acceptability for 12 months at -20°C. An extension of 2 months of shelf life was noticed due to packing under vacuum. Lee *et al.* (1993); Ihm *et al.* (1992); Josephson *et al.* (1985), have also reported extension of shelf life of fish under vacuum during frozen storage.

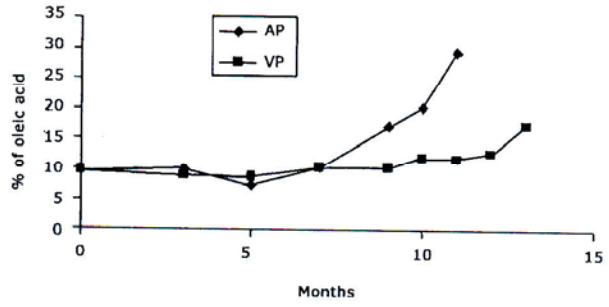

Fig. 6. Changes in FFA in seer fish chunks during storage at -20°C

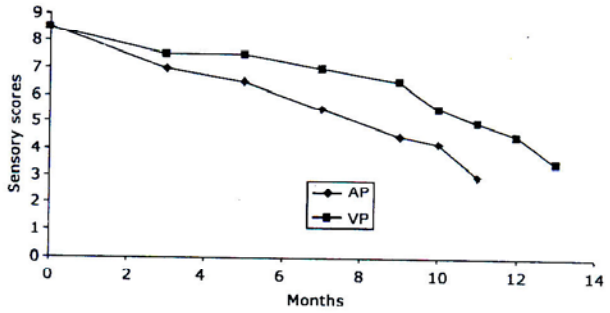

Fig. 7. Changes in Sensory scores in seer fish chunks during storage at -20°C

Vacuum packing has extended the shelf life of seer fish chunks by 2 months, compared to air packed samples. Apart from extension of shelf life, vacuum packing and storage at frozen temperatures has not favoured the growth of *Clostridium botulinum*, indicating that it is safe to consume vacuum packed frozen stored fish.

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