

Storage Studies of Fried Fish Fillets

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Storage characteristics of fried fillets of mackerel (*Rastrelliger kanagurta*) and silver pomfret (*Pampus argenteus*) packed in pouches of 12 μ plain polyester laminated with 118 μ LD-HD co-extruded film under vacuum and air at ambient temperature (23-29°C) are presented. Appreciable changes were not observed in the chemical characteristics during storage. A gradual decrease in the organoleptic rating was noticed in both products. Vacuum packed samples always rated higher than the other. Fungus was absent in vacuum packed samples. Total viable count increased gradually in all samples during storage with predominance of Gram positive spore formers. Vacuum packed samples had a shelf life of 16 days at ambient temperature.

Key words: Fried fillets, pouches, vacuum packing, storage, spore formers

There is an increasing world demand for ready to serve and ready to cook products from fish. Rapid industrialisation and consequent urbanisation provide ample scope for development of market for such products in India. However, ready to eat products of reasonable shelf life are yet to gain popularity. Systematic studies on their nutritional quality and storage characteristics are required before popularising such products. Joseph *et. al.* (1993) reported the storage characteristics of ready to serve fried shrimp. This paper presents the storage characteristics of fried fillets of mackerel and silver pomfret packed in pouches under air and vacuum at ambient temperature.

Materials and Methods

Fresh mackerel (*Rastrelliger kanagurta*) and silver pomfret (*Pampus argenteus*) of average weight 110 and 120 g respectively were procured from landing centre and iced immediately. After dressing and thorough cleaning, each fish was cut into two pieces and were mixed separately with a mixture of spices containing 3% chilly powder, 0.2% turmeric powder, 0.3% tartaric acid, 0.5% calcium propionate and 2% common salt on the weight of the fish, kept at 5°C for 30 min for maturing and then fried in refined groundnut oil at 170-180°C till a dark brown colour was attained. The fried fish were cooled to room temperature and 50 g each was packed in pouches made of 12 μ plain polyester laminated with 118 μ LD - HD co-extruded film. Half the packets with each fish was vacuumed and sealed. Sealed packs of the other half served as control. Pouches were stored at ambient temperature and periodically analysed.

Moisture, total nitrogen, ash, peroxide value (PV) and fat were determined by the methods of AOAC (1975) and total volatile basic nitrogen (TBVN) by the method

of Conway (1947). Free fatty acids (FFA) (AOCS, 1946) is expressed as oleic acid percentage. pH was measured using a digital pH meter after blending 10 g sample with 100 ml distilled water for 30 seconds. Total viable count was determined as per IS: 2237 (1971) and total anaerobic plate count as per the method of Wills (1977). The fried samples warmed for 5 min at 8°C were assessed by a trained panel of six members, scoring being done on a 10 point hedonic scale.

The suitability of the packaging film for food contact application was determined as per IS: 9845 (1981) and FDA (1983), water vapour transmission rate as per IS: 1060 Part II (1960) and Oxygen transmission rate as per ASTM (1975). Tensile strength and elongation at break in machine and cross directions were determined as per IS:2508 (1984) and heat seal strength using a tensile strength tester as per ASTM (1973).

Results and Discussion

Yield of fried fillets from mackerel and pomfret was 35 and 36% respectively. Fried mackerel had 33.67% moisture, 23.21% fat, 37% protein and 3.1% ash. Corresponding values for fried pomfret were 35.1, 22.57, 36.88 and 3.35%.

Table 1. Changes in chemical parameters of fried mackerel during storage

Storage period, days	Moisture, %		TVBN, mg/100 g		PV, meq of O ₂ /kg fat		FFA, as oleic acid %		pH	
	A	V	A	V	A	V	A	V	A	V
0	33.70	33.70	30.8	30.8	1.11	1.11	0.96	0.96	6.19	6.19
1	29.87	33.98	33.6	30.8	1.50	0.73	1.01	1.06	6.19	6.16
3	35.20	40.65	30.8	30.8	2.17	1.82	1.32	1.54	6.06	6.15
6	35.82	33.07	26.6	26.6	3.03	0.96	1.03	1.47	6.07	6.10
9	37.01	35.82	33.6	28.0	2.38	0.84	1.20	1.09	6.07	6.02
11	39.27	35.16	33.6	36.4	1.05	1.37	1.07	1.27	6.10	6.05
14	38.58	37.92	33.6	33.6	1.92	1.37	1.07	1.27	6.10	6.05
16	D	39.68	D	33.6	D	1.39	D	1.31	D	6.07
21	D	38.78	D	34.5	D	1.49	D	1.40	D	6.08

A= Air., V= Vacuum., D= Discarded

The packaging film used had low water transmission rate of 1.60 g/sq. m/24 h at 90% RH and 37°C and oxygen transmission rate of 75 ml/sq. m/24 h/atmosphere making it ideal for vacuum packaging application. The average water and heptane extractives of the pouch are below the prescribed limits of 50 mg/litre (FDA, 1983) and hence is suitable for food contact applications.

The changes in chemical characteristics of fried mackerel are given in Table 1 and those of pomfret in Table 2. Variations in moisture between individual pieces of fish were observed, as it was not possible to bring all pieces to same moisture level during frying. Appreciable changes were not observed in the chemical characteristics of both products during storage.

Table 2. Changes in chemical parameters of fried pomfret during storage

Storage period, days	Moisture, %		TVBN, mg/100 g		PV, meq of O ₂ /kg fat		FFA, as oleic acid %		pH	
	A	V	A	V	A	V	A	V	A	V
0	35.10	35.10	18.2	18.2	3.06	3.06	0.86	0.86	6.25	6.25
2	34.89	40.04	18.2	18.2	1.23	1.74	0.58	0.73	6.14	6.12
5	36.49	38.53	21.0	21.0	2.46	1.70	0.43	0.65	6.11	6.07
8	34.49	38.91	23.8	23.8	0.98	3.19	1.27	1.95	5.95	5.96
10	35.54	43.18	23.8	23.8	1.63	1.77	1.18	1.79	6.05	6.10
14	42.25	41.63	26.6	26.6	2.40	3.08	1.35	3.08	6.13	6.16
16	33.70	41.13	26.6	26.6	1.57	1.09	1.11	1.16	5.65	5.78
20	D	39.08	D	29.4	D	1.37	D	1.26	D	5.89

Table 3. Organoleptic score of fried mackerel and pomfret during storage

Storage period, days	Mackerel Organoleptic score		Storage period, days	Pomfret Organoleptic score	
	A	V		A	V
0	7.5	7.5	0	8.0	8.0
1	7.2	7.4	2	7.5	7.7
3	6.1	6.5	5	7.0	7.5
6	6.0	6.2	8	5.1	6.2
9	4.2	6.1	10	4 (fungus)	5.2
11	4 (fungus)	5.5	14	D	5.0
14	D	5.0	16	D	4.5
16	D	4.2	20	D	4.0
21	D	4.0			

Table 4. Total viable count of fried mackerel and pomfret during storage.

Storage period (days)	Total viable count (mackerel)		Storage period (days)	Total viable count (pomfret)	
	A	V		A	V
0	5.98 x 10 ¹	5.98 x 10 ¹	0	5.0 x 10 ¹	5.98 x 10 ¹
1	5.6 x 10 ²	1.21 x 10 ²	2	1.0 x 10 ²	1.21 x 10 ²
3	7.79 x 10 ³	6.77 x 10 ³	5	7.0 x 10 ⁵	6.77 x 10 ³
6	7.30 x 10 ⁵	6.83 x 10 ⁵	8	1.43 x 10 ⁵	6.83 x 10 ²
9	3.74 x 10 ⁵	2.76 x 10 ⁵	10	1.08 x 10 ⁶	2.76 x 10 ⁵
11	8.2 x 10 ³	8.76 x 10 ⁵	14	D	8.76 x 10 ⁵
14	D	—	16	D	—
16	D	8.40 x 10 ⁶	20	D	8.40 x 10 ⁶
21	D	3.0 x 10 ⁶			3.0 x 10 ⁶

Organoleptic ratings of both products during storage are given in Table 3. A gradual decrease in the rating occurred in both. However, the ratings of vacuum packed samples were always higher than those of control samples. Fungus was absent in vacuum packed samples throughout storage. Fungus was noticed in control samples of mackerel on the 11th day and pomfret on 10th day. Vacuum packed samples were acceptable for 16 days.

Total viable count increased gradually in all samples during storage though without appreciable differences (Table 4). Gram positive spore formers predominated in all cases. Yeast cells were also observed in some, but no anaerobe was detected in any sample.

Studies indicate that under vacuum in suitable packaging, fried fish fillets can be stored safely for 16 days at ambient temperature.

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