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Storage of Fish Paste Heat-processed in Retort Pouch

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Fish paste was prepared by finely grinding textured cooked fish meat, starch, sugar, milk powder, colouring matter and flavour. It was packed in flexible pouches, heat-processed in air-steam pressure in an overpressure autoclave and stored at ambient temperature. It was acceptable upto 36 weeks. Afterwards it became unacceptable due to changes in texture and spreadability. No peroxide formation was noticed upto 36 weeks storage.

Key words: Fish paste, packaging, storage

Fish paste is a high value 'convenience' 'heat and eat food' popular in Southeast Asia. It is processed mainly by mixing fish and salt and allowing to ferment. This results in the formation of either a paste or a liquid, which is separated from the residue and is used as flavouring (FAO, 1971; Adams *et. al.*, 1985; Clucas & Ward, 1996). Different fish and shrimp yield paste/sauces with characteristic flavour and odour. Fish paste can also be prepared without fermentation. Frozen fish paste is not relished because during storage, texture and spreadability are adversely affected (unpublished). Therefore studies were conducted on storage of heat-processed fish paste in retortable pouch.

Materials and Methods

Fresh jew fish (*Johnius soldado*) collected from Fisheries Harbour, Cochin was used. Mince prepared from the fish was washed with twice its volume of cold water (14-16°C), drained and kneaded with salt and trisodium polyphosphate. It was then cooked in water, drained and cooled. Corn starch was gelatinised by boiling after adding 10 times its weight of water and cooled. The cooked mince was ground to a fine paste. Gelatinised starch, hydrogenated vegetable oil, sugar, milk powder, a speck of lemon yellow and cardamom concentrate were added (Table 1) and grinding continued until the mixture became a fine paste.

175 g paste was filled manually in pouches made of 125 μ plain polyester laminated with 280 gauge cast polypropylene using a 5 cm bore bottom funnel. Air from the filled pouches was exhausted by steam flushing (Madhwaraj *et. al.*, 1992). Heat penetration was measured by introducing a thermocouple into the pouch through glands fixed in the pouch. The thermocouple cables were connected to a digital temperature scanner and recorder. The pouches were arranged in aluminium trays and loaded into a retort modified by providing overhead air-steam pressure and water

Table 1. Recipe of fish paste

Ingredients	%
Fish mince	77.92
Fat	7.80
Starch	7.80
Sugar	2.34
Skim milk powder	2.14
Salt	1.43
Poly phospate	0.40

cooling under pressure. The pouches were heat processed for 60 min at 112°C for an F_0 6.83. F_0 was determined by the equal time interval procedure described by Patashnik (1953). The pouches were further packed in bags made of metalised polyester laminated with 150 gauge low density polythene. They were kept at ambient temperature (27-30°C) for evaluating the changes in bacteriological, biochemical and organoleptic characteristics during storage. Sensory evaluation of the paste was carried out by serving fish paste with bread to a taste panel consisting of 8 members and the overall acceptability was determined using hedonic scale 1 to 9 (Amirine *et. al.*, 1965). Products with scores below 4 were considered unacceptable.

Moisture, protein, crude fat, total ash and free fatty acids (FFA) were estimated by AOAC (1984) method and peroxide value (PV) by the method of Tarr (1947). *Escherichia coli, Vibrio cholera,* Salmonella and Staphylococcus were determined by APHA (1976) methods. Viscosity was measured using Brookfield viscometer at ambient temperature. Sterility was tested as per IS : 2168 (1971).

Suitability of the pouches for food contact application was tested by the methods described in IS : 9845 (1981) and FDA (1983). Water vapour transmission rate (WVTR) was determined as per IS : 1060 (1960). Oxygen transmission rate was determined as per ASTM (1975). Tensile strength and elongation at break in machine and cross directions were determined as per IS : 2508 (1984). Peeling strength was determined using Zwick Universal Testing Machine as per ASTM (1972). Internal burst for seal integrity was determined using internal burst testing apparatus prescribed by Duxbury *et. al.* (1970).

Results and Discussion

F_0 value recommended for heat processed fish products are in the range 5-20 (Frott & Lewis, 1994). In the present study the F_0 value of 6.83 was arrived at by trial

Table 2. Proximate composition of fish paste

Moisture, %	78.74
Protein, %	10.01
Fat, %	4.31
Ash, %	0.85
Carbohydrate, mg / 100 g	4.06

and error method, taking into consideration the colour, texture and spreadability of the product. A higher F_0 was found to affect the colour and texture.

Table 1 presents the recipe of ingredients used for the preparation of fish paste. Proximate composition of the fish paste is shown in Table 2. It had protein and fat contents of 10% and 4% respectively. The high content of fat is due to the fat added to make the product smooth and spreadable. Sensory score, initial and during storage, is shown in Fig. 1. Sensory score decreased from an initial 7.4 to 3.5 during 40 weeks storage. The product was in acceptable condition upto 36 weeks. It became unacceptable afterwards due to poor spreadability and poor texture.

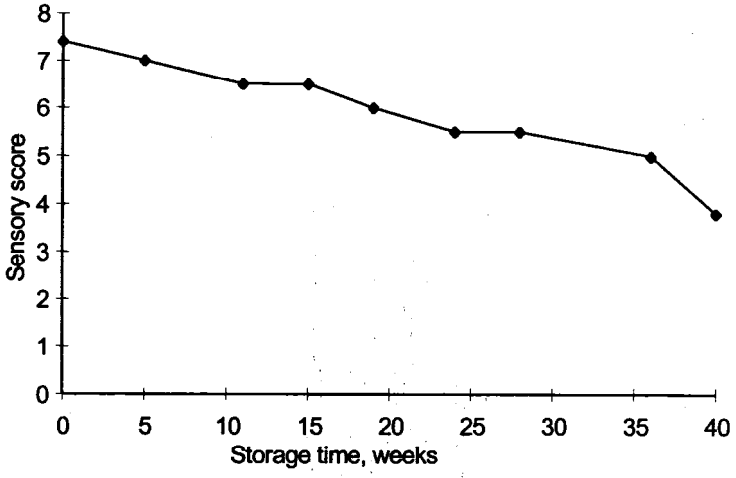

Fig. 1. Sensory score of fish paste during storage at ambient temperature

Table 3 shows the chemical changes in the characteristics of fish paste during storage. There was no significant change in any of the chemical indices. The TVBN values were almost same throughout the study indicating that enzyme action was almost stopped. The product had peroxide value of 1.35 m eq/kg fat only after 40 weeks. FFA remained more or less same throughout storage.

Table 3. Biochemical changes of fish paste during storage

Period of storage weeks	Moisture %	T.V.N. mg/100 g	P.V. milli eq. of O_2/kg. fat	F.F.A. % as oleic acid	Alpha-amino nitrogen, mg/100 g
0	79.33	14.0	nil	1.33	14.0
5	78.91	14.0	nil	1.20	14.0
11	78.84	14.0	nil	1.13	14.0
15	78.80	15.4	nil	1.31	14.0
19	80.10	15.4	nil	1.32	14.0
24	78.91	15.4	nil	1.28	14.0
28	78.94	15.6	nil	1.30	14.0
36	78.77	18.2	nil	1.30	17.5
40	79.07	18.2	1.35	1.57	17.0

Microbiological examination of the product revealed that *E. coli, Staphylococcus, V. cholera* and *Salmonella* were absent in all samples. The samples remained sterile throughout the study.

Physical properties of the laminate used for the study are given in Table 4. It had low water vapour and medium oxygen transmission rate. It had high tensile strength both in machine and cross directions as also good heat seal strength. The pouch withstood burst strength pressure of 117 kpa. The average water extraction value of the pouch was below the limits of 50 mg l^{-1} (FDA, 1983) and hence suitable for food contact applications.

Table 4. Physical properties of PEST / cast PP film used in the study

Thickness	12 μPEST/280 gauge cast polypropylene
Tensile strength	MD : 410 kg/cm^2 CD : 400 kg/cm^2
Elongation at Break	MD : 70% CD : 40%
Heat seal strength	MD : 345 kg/cm^2 CD : 360 kg/cm^2
Peeling strength	MD : 480 g/25 mm width CD : 500g/25 mm width
Oxygen transmission rate	335 cc/m^2/24 h at 1 atm.pressure difference
Water vapour transmission rate	2.7 g/m^2/24 h at 90% RH and 37°C
Overall migration residue (Water extactives, 121°C for 2 h)	4.12 mg/litre
Pouch Burst strength	117 kpa

MD - Machine Direction; CD - Cross Direction

The study showed that the fish paste is acceptable as bread spread or similar types of products. The large quantity of low value fish with white flesh available in India can be used for making good quality paste.

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