Journal of Food Technology 3 (3): 449-452, 2005

Development of Soup Powder from Squid *Sepioteuthis lessoniana* and Shelf-life Assessment During Storage in Laminated Packaging Material

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Abstract: The soup power was prepared using squid *Sepioteuthis lessoniana* and their quality was assessed during storage in laminated packaging material. The FFA content (% Oleic acid) increased slowly during the storage period. The TMA-N and TVB-N contents were also increased with the extension of storage period. The Total Plate Count (CFU/g) of the soup powder increased during the storage period. Pathogenic bacteria such as *E.coli*, Vibrio sp., Salmonella sp., were absent in the samples. The soup powder was acceptable throughout the storage period of 9 months as they organoleptically scored well above the acceptability level.

Key words: Squid, soup powder, shelf life

INTRODUCTION

The molluscan group includes bivalves, gastropods and cephalopods. Cephalopods consist of cuttle fish, squid and octopus and among these the cuttle fish and squid are acceptable like fin fishes and crustaceans. The recoverable edible portion of fin fishes and shell fishes ranges from 20-50% and 20-40% while it is high in cephalopods and it is 60-80%. The proportion of edible portion consists of 50% trunk and 30% arms. The high protein and low fat content of the meat of cephalopods make them suitable for human consumption. The water content of squid is normally between 77-80% of the body weight and the protein content between 17-20%. The tougher texture of cephalopod meat is due to fine muscle fibres, fine connective tissues and no fat tissues.

Most of the cephalopods are consumed fresh and in cooked form. The Japanese eat cuttlefish meat and sometimes squid meat raw (sashimi) with sauce. The cephalopods are mostly exported as frozen form and a small portion as dried or canned products. Development of value added products from seafood is an important need in fish processing. Most of the cephalopods are consumed fresh and in cooked forms. Preference of ready to cook or ready to serve type products is on the increase [1]. Many ready to serve products have been prepared from fishes, prawns and bivalves. For better utilization, instant soup powder was developed from the big fin squid *Sepioteuthis lessoniana*. The storage studies of big fin squid soup powder packed in laminated pouches and stored at ambient temperature are discussed in this paper.

MATERIALS AND METHODS

Fresh squid *Sepioteuthis lessoniana* were procured from Tuticorin fishing harbour and was brought to the laboratory in an icebox. The meat was cleaned, dressed and the edible portions such as mantle and arms were cut in to small pieces and were washed thoroughly in running tap water. The cut meat was dried at 40-50°C in mechanical meat drier for 2 days. The dried meat was powdered in a pulverizer and it was used for the preparation of instant soup powder using the ingredients mentioned in Table 1.

The onions and garlic were skinned and cut into small pieces. Then it was fried in ghee until golden brown color. It was cooled and then blended using warring blender and then mixed thoroughly with the meat powder. The mixture was dried in the hot air oven for 2 to 3 h. The well-dried mixture was again powdered in the electrical blender and sieved. All the other ingredients were added to this and the soup powder was packed in laminated pouches and stored at ambient temperature. The physical properties of the laminated pouches were analyzed at CIFT Cochin. Water Vapour Transmission rates of the laminated pouches were determined as per ISI method [2] as modified by Gopal and Govindan[3]. Oxygen Transmission rates were determined as per ASTM D 1434[4] and tensile strength and elongation at break in machine and cross directions were determined as per IS: 1060[2-5]. Heat seal strength was determined as per ASTM standards.

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Table 1: Standard recipe for the preparation of instant soup powder

S. No	Ingredients	Quantity in grams
1	Meat powder	300.0
2	Onion	180.0
3	Garlic	30.0
4	Dalda	60.0
5	Milk powder	150.0
6	Glucose	60.0
7	Pepper	30.0
8	Dehydrated vegetables (Beans and Coriander)	2.0
9	Monosodium glutamate	0.3
10	Carboxy Methyl cellulose	1.5
11	Sodium benzoate	0.9
12	Corn flour	120.0

The biochemical parameters were carried out using standard methods. The spoilage indicators such as Tri-methylamine-N (TMA-N) and Total volatile bases-N (TVB-N) were estimated by following the Conway micro-diffusion method of Beaty and Gibbons[6]. Free fatty acid (FFA) content was estimated by using the titration method of Ke et al.[7]. The pH level was measured using the digital pH meter Model 101 E Deep vision. Moisture content was measured by drying the material in the hot air oven at (50-60°C).

Enumeration of Total Plate Count (TPC) was done as per the methods of APHA [8]. Enumeration of pathogenic bacteria like *E.coli* (MPN Technique), *Vibrio* and Salmonella were carried out by following the methods of USFDA[9]. For enumeration of bacteria, 10 g of sample was macerated in 90 mL of normal sterile saline (0.85%) water to obtain decimal dilution. Serial dilutions were prepared by adding 1 mL of this to 9 mL of the same diluent. 1 mL of the appropriate dilutions was plated on respective media and incubated at room temperature for 24 h.

A panel of 6 members did the sensory evaluation by assessing the appearance, colour, odour, taste, texture, flavour and overall acceptability. The overall score was given on 9 point Hedonic scale [10]. If the sensory score was above 5, it was considered good and if it was below 4, it was considered poor.

RESULTS AND DISCUSSION

The soup powder prepared using the squid *Sepioteuthis lessoniana* meat was good in taste and highly nutritious food. The spoilage indicators like pH, moisture, TMA-N, TVB-N and FFA were analysed during the storage period and the results are shown in Fig. 1. The percentage of moisture content of soup powder packed in laminated pouches showed an increasing trend during storage at ambient temperature. Similar increasing trend in moisture content of dehydrated fishery products has been reported by several authors[1,11]. The FFA (%oleic acid) slightly increased from an initial value of 0.197 to 0.537%

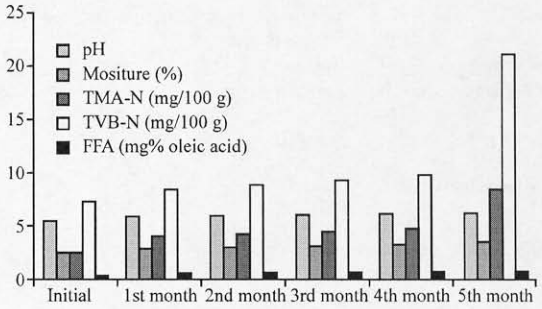

Fig. 1: Biochemical changes in squid soup powder during storage

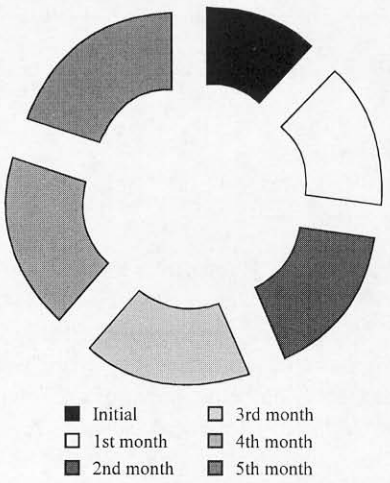

Fig. 2: Total plate count in squid soup powder during storage period

oleic acid. The spoilage indicators like TMA-N and TVB-N showed an increasing level but remained within the acceptable limits during the storage period. The levels of TMA-N and TVB-N were within the acceptable limit ranged from 2.43-8.4 mg/100 g and 7.2-21 mg/100 g.The acceptability limit of TMA-N and TVB-N for squid is 3-10 mg/100 g and 30-40 mg/100 g [12].

The physical properties of the laminated pouches are given in Table 2. The laminated pouch material enabled the soup powder to retain the color, flavour, odour, taste and other characteristics of soup powder over a period of 5 months. The moisture uptake is very low in the laminated pouches. This is may be due to the low water vapour transmission rates. This had a little higher oxygen transmission rate but the FFA was low at the end of the storage period. The heat seal strength of the laminated pouches was also high. Similar results for prawn soup powder packed in 250 g LDPE-HDPE co-extruded film. From the results, the laminated pouches used have overall

Table 2: Gives the physical properties of the laminated pouches used for storing instant soup powder at ambient temperature

physical properties of the laminated pouches		
Tensile strength (kg cm^{-2})	MD	1500
	CD	895
Elongation at break (%)	MD	30
	CD	90
Heat seal strength (kg cm^{-2})	MD	100
	CD	80
Water vapour transmission rate (g/m^2/24 h at 90% RH and 37°C)		3
Oxygen transmission rate (cc /m^2/24 h at 1 atmos. press. difference)		2300
Overall migration Residue (Water Extractives) (mg L^{-1})		3.2

Table 3: Sensory scores of the soup powder at ambient temperature

	Organoleptic characters						
Storage period	Appearance	Colour	Odor	Taste	Texture	Falvour	Overall acceptability
Initial	7.7	7.9	8.0	8.4	7.9	8.0	8.1
1st month	7.5	7.8	8.5	8.5	8.0	8.2	8.0
2nd month	8.0	8.5	8.6	8.75	8.5	8.5	8.4
3rd month	8.75	8.67	8.92	8.67	8.92	8.67	8.62
4th month	8.5	8.25	8.4	8.0	8.25	8.5	8.25
5th month	8.0	8.2	8.0	7.8	8.0	7.6	8.0

extractive values below the specified limits given by FDA and IS specifications and hence this 12 μ PET/20 μ BOPP are suitable for squid soup powder packaging.

Figure 2 shows the changes in total plate count of the soup powder. The Total plate count of the soup powder was low in the initial period and increase in count was observed during the storage period. Pathogens such as *Vibrios, E. coli* and *Salmonella* were not detected. The Total Plate Count showed a gradual increase in count during storage period. Venugopalan and James[11] have reported that the Total Heterotrophic Bacteria (THB) of soup powder was safe according to limits. When compared to the tolerance limit it was less and the soup powder was a good quality product and safe for human consumption.

Addition of condiments reduces the *Staphylococcus aureus* was reported by Kumar and Gupta [13]. Patterson and Ayyakannu[14] have reported a reduction in the total heterotrophic bacterial count during storage of instant soup powder from *C. ramosus*. Decrease of the THB during storage may due to the use of preservation as well as condiments, Viz. onions, garlic and black pepper. Salwin reported that the moisture content of certain dehydrated foodstuffs have got maximum storage life.

The sensory evaluation of the soup powder is shown in Table 3. The soup powder has a good colour with a characteristic flavour. The sensory score obtained was good and no remarkable changes in colour, flavour, taste and other characteristics were observed till the end of the storage period.

The mean panel scores for all the sensory characteristics remained within the acceptable limit throughout the storage period. The product had a maximum score on the 3rd month and showed a gradual reduction in scores at the end of the storage.

Low density polythene which is widely used for packaging fish soup powder has many disadvantages like high gas and water vapour transmission rates and the tendency to absorb fat thereby reducing the heat sealing strength [1]. In the present study, the soup powder packed in laminated pouches had a good storage life of 5 months and safe for human consumption. Gopal et al.[1] reported a shelf life of months to prawn soup powder stored in LDPE-HDPE co-extruded film pouches

ACKNOWLEDGEMENT

Authors are grateful to Dr. J.K. Patterson Edward, Director SDMRI for encouragement and facilities for this work. Thanks are also due to SDMRI research scholars for their support during organoleptic analysis of the soup powder.

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