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Storage Studies of Retortable Pouch Processed Squid (*Loligo duvaucelli*) Rings in Curry Medium

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Abstract

This study is focused on the use of flexible retortable pouch as an alternative to rigid cans for packing small sized squids (*Loligo duvaucelli*). Curry was used as the packing medium and thermal process requirement of squid rings was evaluated by conducting heat penetration studies. The chemical composition of squid indicated that the protein content averaged to around 16%. The filled pouches were heat processed in an overpressure retort at a temperature of 115.6°C. The retorting time was 69 min to obtain F_o value of 7.45 min. The rate of heat penetration showed that the f_h value for the product was 19 min. The total volatile basic nitrogen (TVBN) and trimethyl amine nitrogen (TMA) showed a marginal increase in the product during the 90 days of storage. The product was found acceptable after the storage period of 90 days with respect to sensory analysis.

Key words: Retortable pouch, squid rings, thermal processing, storage studies

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Introduction

The successful commercialization of retort pouch in many countries (Tsutsumi, 1972; Dibbern, 1973) has encouraged researchers all over the world to determine the feasibility of pouches for packing various foods (Chia et al., 1983; Chai et al., 1984). Retortable pouch in general, consists of a laminate of three film *viz.*, polyester, aluminium foil and cast polypropylene (Griffin, 1987).

The main advantage of pouches over conventional metal cans is high surface area to volume ratio which permits faster heat transfer to the cold point. Thus processing time is reduced and sterility is achieved with improved flavour, colour and texture compared to products packed in metal cans. Chia et al. (1983) reported 32, 34 and 37% less processing time for retort pouched Pollock, rainbow trout, and shrimps compared to the respective canned products. Durance & Collins (1991) reported a reduction of 48% process time for chum salmon in pouches than in cans. Heat penetration characteristics for curry packed fish in retortable pouch have been reported by Sonaji et al. (2001).

Gopal et al. (1986) have studied the suitability of flexible pouch for packing fish pickles. A new packaging medium namely curry was suggested as an alternative to the conventional brine and oil pack for different species of fish (Rai et al., 1971; Vijayan & Balachandran, 1986; Vijayan et al., 1998). Freshwater fishes were packed in retortable pouch and the properties of the indigenous packaging materials were compared with imported pouches (Ali et al., 2001). The processing conditions have been standardized to produce an acceptable rohu in curry in retortable pouch (Sonaji et al., 2001). Comparison of quality of fishery products processed in cans and pouches revealed that pouched products had firm texture and higher score with respect to other sensory parameters. The status and potential of retort-processed foods in India have been summarized by Nandanasabapathy et al. (2001).

The cephalopods are exported in different forms such as whole, whole cleaned, peeled, rings, tubes and tentacles. As the price of squid depends on its size, smaller ones are relatively cheap and better price can be realized if processed into value added products. Canning of squids (Varma & Joseph 1980; Parshwanath, 1989) indicated that the squids consti-

tute a good raw material for heat processed foods. The objective of the present investigation was to utilize small sized squids for retortable pouch packed products and to study the quality changes of the product during storage.

Materials and Methods

Small sized squids (*Loligo duvaucelli*) caught by trawl net along the west coast of India and landed at Mangalore, were used for the study. Mean mantle length of squid used was 15 ± 1 cm, weighing 30-35 g. Immediately after harvest, the squids were washed in fresh water, iced and transported to the laboratory and processed immediately.

The ingredients used for the curry medium is given in Table 1. The spices were fried under low flame in a frying pan, ground to fine powder and made into a paste. The curry paste was mixed with curry powder and diluted with 3 litres of water. The tamarind in the curry recipe was soaked in warm water, squeezed and strained to get about a litre of concentrated extract. The total quantity of curry was about 7 kg after heating, which was sufficient for 56 pouches. During filling, the pouches were first filled with blanched squid rings (in 2% salt solution for 5 min) and hot curry was poured over it. Retortable pouches of size 17 x 15.5 cm with configuration of 12.5 μ polyester, 12.5μ aluminium foil and 80 μ cast polypropylene (M.H. Packaging, Ahmedabad, India) were filled with 125 g blanched squids and 125 g curry medium. Thermocouple (Ellab SSA- 12050-G700-TS stainless steel) tip was inserted into the geometric centre. Residual air was removed by steam exhausting and the sealed containers were processed in an over pressure autoclave (John Fraser and Sons Ltd, UK. Model No. 5682) at 115.6°C. Cold point temperature was monitored in three different pouches using a data recorder (Ellab CFT 9008, Denmark). The process was carried out to obtain a F_o value of 7.45 min which was found optimum for curry packed squid rings. Heat penetration studies were carried out at Central Institute of Fisheries Technology, Cochin, Kerala. The thermal parameters were calculated by formula method (Stumbo, 1973). After processing, the samples were taken for quality analysis at monthly intervals.

Moisture, crude protein, fat and ash content of the squid rings and retortable pouch packed products were determined by the AOAC (1995) method.

Total volatile basic nitrogen (TVBN) content and trimethyl amine (TMA) nitrogen content were determined according to Beatty & Gibbons (1937), using the Conway micro diffusion method. The free fatty acid (FFA) content expressed as percentage oleic acid was estimated as per Olley & Loveren (1960). Five grams of meat was macerated with 45 ml distilled water and the pH was measured (Systronic 324 pH meter, Ahemdabad, India).

The sensory analysis of finished products was carried out using descriptive analysis (for colour, odour, taste, texture and overall quality) (Larmond, 1977) by 10 trained panelists. The finished product was warmed to about 60°C at the time of panel test.

Statistical analysis of biochemical data was carried out at 5% level of significance using one-way analysis of variance as described by Snedecor & Cochran (1962).

Results and Discussion

The proximate compositions of raw, blanched and processed squid are given in Table 2. The protein content of squid was 15.75% and ash content was 2.24% which was little higher than that reported by Parswanath (1989). The change in proximate composition after blanching showed a decrease in moisture content to around 8%, with an increase in protein, fat and ash contents.

TVBN and TMA content of squid were found to be 13.07 and 1.86 mg% respectively. The normal limit

Table 1. Ingredients used for curry medium

Curry powder (for 1 kg powder)	
Chilly (short)	300 g
Chilly (long)	100 g
Coriander seeds-round	300 g
Cumin (Jeera)	75 g
Fenugreek	75 g
Mustard	100 g
Black pepper-round	50 g
Curry paste (for 4 kg of paste)	
Fresh coconut gratings	2.9 kg
Garlic	0.25 kg
Tamarind (without seed and fibre)	0.65 kg
Salt	0.20 kg

Table 2. Proximate composition of raw, blanched and retort-pouch packed products

Parameters	Raw material		Product
	Fresh	Blanched	
Moisture (g 100 g^{-1})	80.05 (1.93)	72.00 (2.32)	71.61 (1.50)
Protein (Nx6.25) (g 100 g^{-1})	15.75 (0.96)	22.10 (1.10)	17.50 (0.99)
Fat (g 100 g^{-1})	1.02 (0.04)	1.43 (0.03)	4.38 (0.11)
Ash (g 100 g^{-1})	2.24 (0.08)	3.14 (0.09)	3.84 (0.05)

Values in parenthesis denotes standard deviation, n = 3

prescribed for TVBN and TMA is 30-35 mg 100 g^{-1} and <15 mg 100 g^{-1} respectively (Connell, 1995). Based on the results of biochemical characteristics, the squids were found wholesome and acceptable. The sensory analysis of the products showed no substantial changes in sensory characteristics over 90 days.

The relationship between the temperature of the heating/cooling medium and the product temperature during the thermal process in the overpressure retort is given in Fig.1. The retort come-up time was 8 min. The data on F_o and cook value of squid rings in curry indicated that a retorting of about 69 min at a fixed retort temperature of 115.6°C attained an F_o value and cook value of 7.45 min and 116.7 min respectively (Fig. 1A&B). Fish curry processed to F_o value of 8.43 min gave an acceptable product with desired texture and sensory characteristics (Gopal et al., 2001).

Thermal process parameters of squid rings in curry medium are given in Table 3. The semi log heat penetration graph revealed a f_h value of 19 min, which indicates the faster heating rate through the retortable pouch. The f_h value was found to be 25 min for ready-to-eat black clams processed at 121°C for a total process time of 44 min (Bindu et al., 2007). The heating lag factor was found to be 0.8884. The actual process time (B) as per formula method was found to be 55.36 min. Corrections (for come-up time) are applied to compensate the time required to bring the retort to the desired temperature. Ball & Olson (1957) suggested that 42% of come up time should be considered as process time at the retort temperature.

The proximate composition of the retortable pouch packed squid rings in curry showed a protein content of 17.5% and fat content of above 4%

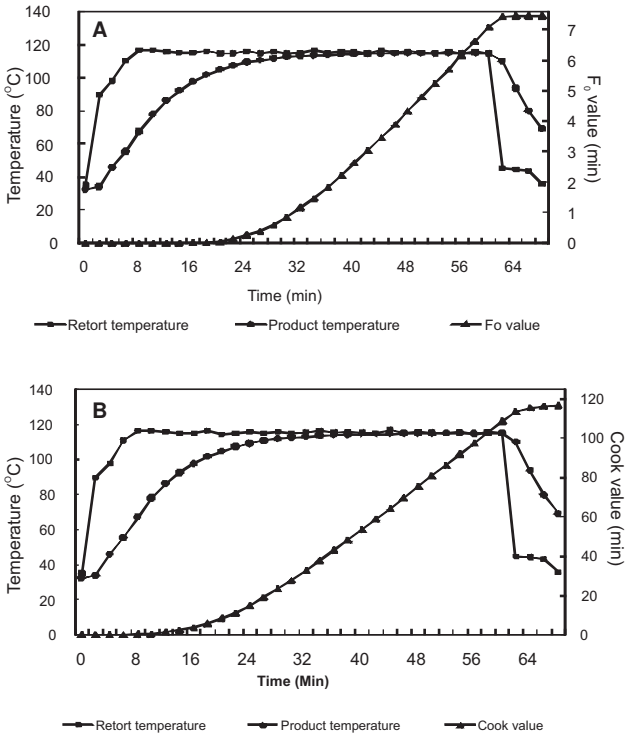

Fig. 1 A. Heat penetration and F_o value of retortable pouch packed squid rings in curry
B. Heat penetration and cook value of retortable pouch packed squid rings in curry

(Table 2). The higher fat and ash content were attributed to the coconut gratings incorporated curry medium. The solid weight was 125 g. The pH of the product was found to be between 5.5 and 5.6. The change in biochemical characteristics of curry packed squid rings in retortable pouch during storage is given in Fig. 2. During storage, the TVBN values changed from 20 to 24.3 mg 100 g^{-1} and TMA content from 3.45 to 4.98 mg 100 g^{-1}. There was significant increase (p<0.05) of FFA during the

Table 3. Thermal parameters for curry packed squid rings in retortable pouches

Parameters	Squid curry
F_o (min)	7.451
f_h (min)	19
j_h (min)	0.8884
B (min)	55.36
J_c	1.4
g	1.05
U	30.35
I = Initial deficit temp	71.8
PID = Pseudo initial deficit temperature	80
Come up time (min)	8

f_h : Heating rate index

j_h : Heating lag factor

g : Temperature deficit

U : Time in min. for sterilization at retort temperature

storage period (Fig. 2). The investigation of Chia et al. (1983) has revealed that heat processing results in an increase in the content of ammoniacal nitrogen in trout, pollock and shrimp. Koval'chuk (1954) has observed an increase in the rate of breakdown of proteins, amino acids and other nitrogenous compounds during thermal processing. The sensory analysis showed a marginal decrease (not significant at 5% level) in all attributes after a period of 90 days of storage.

The results of this study indicate that retortable pouch is a promising alternative to metal cans for processing of squid rings in curry.

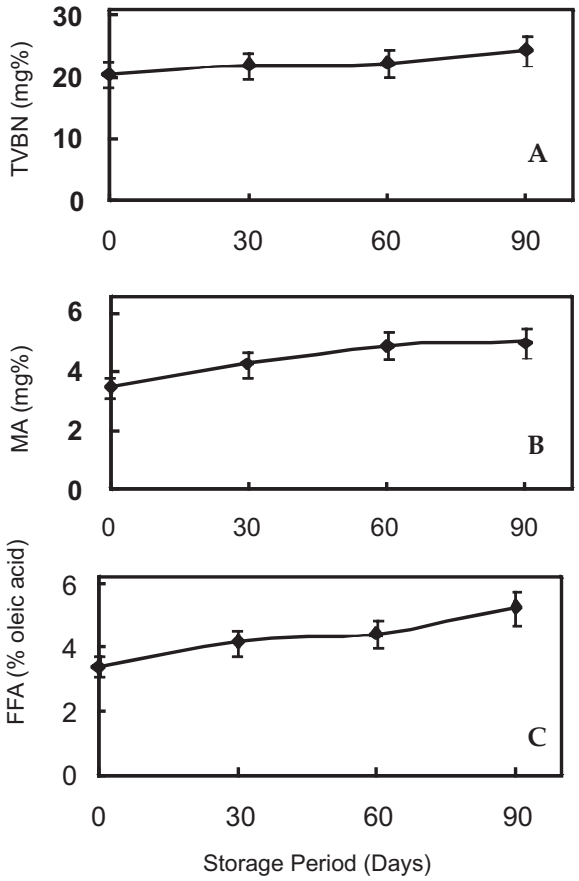

Fig. 2 Changes in biochemical characteristics during storage of curry packed squid rings in retortable pouch

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