Studies on Frozen Storage of Cuttle Fish Fillets

JOSE JOSEPH and P. A. PERIGREEN
Central Institute of Fisheries Technology, Cochin - 682 029

The freezing and cold storage characteristics of cuttle fish fillets have been studied. The yield of fillets from cuttle fish was about 35% and the fillet had an average moisture content of 76.85% and fat 0.82%. During storage at –20 ± 1°C for 16 months the salt soluble nitrogen of the fillets decreased from 85.1 to 35.36%, the non-protein nitrogen from 24.61 to 20.84% and alpha amino nitrogen from 252 to 140 mg/100 g. Initially the fillets were white in colour, showed signs of desiccation by 4 months storage which increased on further storage and the fillets finally became dull white with yellow discolouration inside. The firm and chewy texture of the cooked fillets changed to rubbery even though the product was slightly sweet at the end of the storage period of 16 months.

Cephalopods are one of the important marine products exported from India. The annual landing is about 17,000 tonnes. At present only 1,800 tonnes of cephalopods are exported (Anon, 1983). There is practically no internal consumption of cephalopods. This points out that large quantity of raw material is wasted every year. Cephalopods are susceptable to rapid spoilage and this is one of the main reason why the exploited material is not fully utilized for processing. Studies were conducted on the handling and processing of squid in India (Joseph *et al.*, 1977; Joseph & Perigreen 1985; Reghunath, 1984), but little work has been done regarding processing of cuttle fish except the study of its iced storage behaviour by Sastri & Srikar (1985). This paper describes the studies conducted on the frozen storage behaviour of cuttle fish fillets and various problems encountered during frozen storage.

Materials and Methods

Cuttle fish, *Sepia aculeata,* collected from trawl catches onboard fishing vessel, were washed in sea water and kept under finely powdered ice in insulated boxes in the fish hold for 2 h. Soon after landing it was brought to the laboratory, washed again in chilled water and extremely fresh and uniform sized materials were used for the studies. For the preparation of fillets, incision was made on the back of the cuttle fish with a knife and cuttle bone and viscera were removed. The head and tentacles were also pulled out at the same time. The mantles were cleaned and cuts were made on both sides of the fin which were then torn off along along with the skin. The fillets were again washed and rolled into tubes, frozen in contact plate freezer at –40°C, dipped in glaze water around 0°C, individually wrapped in polythene sheets, packed in cartons and stored at - 20 ± 1°C.

The samples were thawed for analysis in sealed polythene bag and kept in running water for 60 min. Moisture, fat, ash, total nitrogen (TN) and non-protein nitrogen (NPN) were determined by the methods of AOAC (1975). The method of Dyer *et al.* (1950) was followed for studying the protein extractability. The alpha amino nitrogen of the sample was determined from the trichloracetic acid extract by the method of Pope and Stevens (1939) and total volatile base nitrogen (TVBN) by the microdiffusion method of Conway (1947). Organoleptic studies were conducted by a taste panel of 10 members using the sample cooked in 2% boiling brine for 10 min.

Results and Discussion

The percentage yields of various parts of cuttle fish are given in Table 1. The yield of fillet is about 35%. Table 2 gives the chemical composition of cuttle fish fillets. It contained low fat and high quantity of NPN and alpha amino nitrogen. The sweet

taste of cuttle fish fillets can be attributed to the high amount of alpha amino acids. The initial TVBN value is low and protein extractability is high (about 85%.)

Table 1. *Percentage yield of various parts of cuttle fish*

Fillet	34.62
Head and tentancles	31.87
Guts	14.29
Skin and fin	13.74
Cuttle fish bone	5.40

Table 2. *Chemical composition of cuttle fish fillets*

Moisture %	76.85
Fat %	0.83
Ash %	4.53
TN %	3.45
SSN %	3.15
NPN %	0.91
TVBN mg/100 g	3.26
Alpha amino nitrogen mg/100 g	252.00

The biochemical changes during frozen storage of cuttle fish fillets are given in Table 3. A steady decrease in salt soluble nitrogen (SSN) from 85.1 to 35.36% was noticed during storage for 14 months. In squid the solubility was relatively high (60%) after 15 months storage (Joseph *et al.*, 1985; Moral *et al.*, 1983). The NPN was around 24% of total nitrogen for the first 10 months storage and the percentage moisture was 76–77% during the same period. Afterwards a decrease in both the values was noticed. This indicated loss of waterholding capacity of the muscle which resulted in increased drip loss and lower moisture content. The amount of NPN fraction leached in the drip also increased concurrently. A slow increase in the TVBN values was noticed and at the end of storage the value remained almost same which may be due to the increased leaching of the TVBN in the thaw drip. Alpha amino nitrogen showed a steady decrease throughout the storage and the sweet taste of the sample decreased proportionally. This indicated the possibility of high leaching of amino acids which contributed to the sweet taste.

A detailed description of the sensory parameters and the average score are given in Table 4. The colour of the fillet in the inside portion turned pale yellow by 7 months storage and the intensity of which increased on further storage. Desiccation started by 4 months storage and the high quanlity was lost as far as taste, texture and appearance were concerned. By 10 months frozen storage the surface colour also started fading and colour of the cooked meat turned dull white. Though it was initially sweet in taste, a slight musty after taste was noticed by 10 months storage and the texture became rubbery. It remained in this condition on further storage except the increase in the intensity of discolouration of thawed and cooked fillets and slight decrease in taste. Though significant desiccation, discolouration and texture changes took place by 16 months storage the product was in the limit of acceptability regarding flavour. The

Table 3. *Biochemical changes during storage of frozen cuttle fish fillets*

Months	Moisture %	SSN % of TN	NPN % of TN	TVBN mg/100 g	Alpha amino nitrogen mg/100 g
0	76.55	85.1	24.61	3.26	252
1	77.58	80.2	28.63	4.90	266
4	76.35	75.9	26.35	7.80	232
7	76.25	67.4	24.93	12.00	204
10	76.92	55.7	23.81	14.00	190
12	75.82	45.8	22.80	15.00	182
14	75.60	31.6	22.93	16.80	180
16	75.0	35.36	20.84	16.80	140

Table 4. *Sensory observations*

Months	Colour and appearance of fresh/cooked fillets	Flavour	Cooked fillets Texture	Score
0	White fillets	Sweet	Firm, chewy	8.0
1	White fillets	Sweet	Firm, chewy	7.5
4	Slight dull appearance in the inside of certain fillets, slight desiccation in a few samples	Moderately sweet	Firm, slightly rubbery	7.0
7	Slight dull yellow appearance in the inside of the fillets, desiccation on the surface. Cooked fillet slight dull appearance	Slightly sweet	Firm, slightly rubbery	5.0
10	Yellow colour inside the fillet. Fading of white colour on the surface. Desiccation in all samples. Cooked meat dull colour	Slightly sweet, musty after taste	Rubbery	5.0
12	The slight dull yellow colour spread inside the fillet. Moderate desiccation in all pieces. Cooked meat dull colour	Slightly sweet, slight off taste	Rubbery	4.5
14	Dull yellow colour extensive desiccation cooked meat dull pink colour	Slightly sweet, slight off after taste	Rubbery	4.5
16	Yellow discolouration inside the fillet, dull colour on the surface, extensive desiccation on the surface. Cooked meat pinkish brown	Slightly sweet, slight off after taste	Hard to chew	4.0

desiccation made the product unacceptable aesthetically.

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