

Studies on Storage Characteristics of *Clarius batrachus* at Different Temperatures

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Storage characteristics of *Clarius batrachus* at three different temperatures, namely 37, 22 and 0°C (ice) are reported. Changes in moisture content, total volatile nitrogen, adenosine monophosphate, inosine monophosphate and total bacterial count during storage were studied. Organoleptically the fish had shelf-lives of 6h, 8.5h and 15 days at 37, 22 and 0°C respectively.

The iced storage characteristics of many fresh water fishes of India have been studied by Nair *et al.*, 1971, Nair & Dani 1975; Gupta & Govindan 1975, Bandyopadhyay *et al.*, 1985 and Joseph *et al.*, 1988. Storage characteristics of fresh water fishes at different temperatures seem to have not been studied so far in India though they are of commercial importance and handled at different temperatures.

The present study is to observe the postmortem changes of *Clarius batrachus*, a commercially important cat fish at ambient temperature of $22 \pm 2^\circ\text{C}$ and $89 \pm 3\%$ R.H., incubation temperature of $37 \pm 1^\circ\text{C}$, 100% R.H. and in ice (0 to 2°C).

Materials and Methods

Live *Clarius batrachus* weighing between 180 and 205 g were collected from Calcutta markets. The first lot of fish was killed immediately by hitting on the heads and kept at ambient temperature $22 \pm 2^\circ\text{C}$ and R.H. $89 \pm 3\%$. The second lot of fish was similarly killed and kept at incubation temperature of $37 \pm 1^\circ\text{C}$, 100% R.H. The third lot of fish was killed by putting crushed ice on them and stored in a tea-chest insulated with one inch thick expanded polystyrene slabs wrapped in 150 gauge high density polythene sheets. The ratio of fish to crushed ice used was 1:2. Reicing was done

every day.

Samples were drawn at intervals for bacteriological, biochemical and organoleptic analysis. Muscle from the antero-dorsal portion of the fish was taken for bacteriological and organoleptic analysis. For biochemical analysis only the white meat of antero dorsal portion of the fish was taken.

Moisture was estimated by the method of AOAC (1975) and volatile nitrogen (TVN) by the microdiffusion technique of Conway (1947). Total bacterial count (TBC) of the muscle was determined by the standard pour plate method using peptone-glucose agar (pH 7.2 incubated at $37 \pm 1^\circ\text{C}$). The nucleotide measurements were carried out by the method of Spinelli & Kemp (1966). All the absorption measurements were made with a Sequois Turner Model 340 Spectrophotometer. The organoleptic evaluation of the cooked meat was carried out by seven taste panel members according to the method of Miyachi *et al.* (1964).

Results and Discussion

Tables 1 and 2 shows the post-mortem changes of *C. batrachus* at 22°C and 37°C respectively. Rigor mortis sets in after 40 to 45 min. at 22°C and after 25 to 30 min. at 37°C . The duration of rigor mortis was 3 to 3.25h and

Table 1. *Changes in C. batrachus at ambient temperature (22 ± 2°C)*

Hours after death	Organoleptic score of cooked meat	TBC/g	TVN mg/100g	Nucleotides $\mu\text{mole/g}$	
				AMP	IMP
0	10.0	9.8×10^1	10.39	0.06	1.53
3	8.5	1.17×10^2	10.63	0.05	1.45
4	8.0	1.32×10^3	11.27	0.04	1.36
6	7.0	1.54×10^4	12.98	0.03	0.78
8.5	5.0	1.62×10^5	19.87	0.01	0.31

Table 2. *Changes in C. batrachus at incubation temperature (37 ± 1°C)*

Hours after death	Organoleptic score of cooked meat	TBC/g	TVN mg/100g	Nucleotides $\mu\text{mole/g}$	
				AMP	IMP
0	10.0	9.8×10^1	10.39	0.06	1.53
3	8.0	5.98×10^3	12.36	0.04	0.88
4	7.5	8.61×10^4	15.69	0.03	0.59
6	5.0	1.90×10^5	22.93	0.01	0.27

Table 3. *Changes in C. batrachus under ice storage*

Number of days in ice	Organoleptic score of the cooked meat	Moisture %	TBC/g	TVN mg/100g	Nucleotides $\mu\text{mole/g}$	
					AMP	IMP
0	10.0	78.70	2.26×10^1	10.60	0.06	1.54
3	8.0	79.72	1.40×10^2	11.27	0.06	1.50
8	6.5	79.96	1.84×10^3	11.60	0.05	1.23
10	6.0	80.15	5.68×10^3	12.08	0.04	0.84
15	5.0	81.27	4.45×10^4	15.28	0.03	0.51
18	Below 5.0	82.31	8.31×10^4	17.04	0.01	0.28

2.25 to 2.5 h at 22 and 37°C respectively. During the period of entire study, the conditions of eyes, gills and skin did not show any significant change. The cooked meat in both cases was found to be sweet after 3 h of storage. The sweetness decreased on subsequent storage. The decrease in sweetness was more pronounced at 37°C than at 22°C. On the basis of the organoleptic evaluation of the cooked meat, the fish was found to be at the border line of acceptability after 6h of storage at 37°C and 8.5h of storage at 22°C. The loss in the acceptability was due to soft texture and flat taste, though no off

flavour was evidenced in any of the sample. The total volatile nitrogen increased appreciably at 37°C than at 22°C showing a maximum of 22.93 and 19.87 mg N/100g respectively at the border line of acceptability. The IMP content of the fresh fish was found to be 1.53 $\mu\text{mole/g}$ which decreased gradually at a slow rate to a final value of 0.31 $\mu\text{mole/g}$ after 8.5h of storage at 22°C whereas the IMP value was 0.27 $\mu\text{mole/g}$ after 6h of storage at 37°C which justified the marked decrease in the characteristic flavour of the fish muscle. The total bacterial count of the fish muscle increased in both cases.

During iced storage, there was no significant change in the gills till 8 days of storage. However, the skin of the fish showed pale discolouration. Table 3 shows the changes in the biochemical and bacteriological parameters during iced storage.

The moisture content of the muscle gradually increased from initial value of 78.7% to 82.31%. The total bacterial count increased to 8.31×10^4 /g till the end of iced storage. There was appreciable increase in the total volatile nitrogen with a maximum value of 17.04 mg/100g when the fish was found unacceptable. The decrease in the nucleotides was observed to be gradual from an initial content of 0.06 μ mole AMP and 1.54 μ moles IMP to 0.01 μ mole AMP and 0.28 μ mole IMP per g. of fish after 18 days of iced storage. Organoleptically the fish was acceptable upto 15 days in ice.

Like other fresh water fishes *C. batrachus* is seen to deteriorate in the similar manner showing gradual increase in TBC, TVN and gradual decrease in nucleotides and organoleptic acceptability. None of the changes was found to be remarkable giving an inference that the fish deteriorates at a faster rate. The fish was found to be acceptable for 8.5h at 22°C, 6h at 37°C and 15 days in ice. By reducing the temperature from 37°C to 22°C, the shelf life was extended only by 2.5h but from 22°C to ice storage temperature the shelf-life could be extended by 14 days.

The first author is grateful to Shri M. R. Nair, Director,

Central Institute of Fisheries Technology, Cochin for permitting to undertake M. Tech study.

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