



EFFECT OF IMMEDIATE ICING ON THE QUALITY CHARACTERISTICS OF BAGDA (*PENAEUS MONODON*)

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Abstract: The quality changes in Bagda (*Penaeus monodon*) stored with ice in bamboo and plastic basket for 24 hours immediately after harvest was observed through visual, biochemical and microbial assessments. As indicator of freshness TVB-N and TMA-N were measured at 0h, 12h, and 24h. The concentration of TVB-N ranged from 5.34±0.0212 to 8.045±0.049 mg/100g in bamboo basket and 4±0.0283 to 7.825±0.0354 mg/100g in plastic basket. TMA-N concentration was found as 2.66±0.0141 to 4.045±0.0071 and 1.345±0.0071 to 5.2±0.0424 mg/100g in bamboo and plastic basket respectively. Data indicated that all the values increased with storage time, quality of shrimp started to decline slowly within 24 hours and remained acceptable in both bamboo and plastic baskets even on 24th hour. Standard Plate Count (SPC) of shrimp stored with ice immediately was 0.18×10⁵ and 0.12×10⁵ in bamboo and plastic baskets, respectively. SPC of shrimp stored with ice after 24 hours was 0.17×10⁵ and 0.23×10⁵ in bamboo and plastic baskets, respectively.

Key Words: Organoleptic assessment, TVB-N, TMA-N, SPC.

Introduction

Bangladesh is an agrarian country with great fisheries potential. The country has about 1,41,353 hectare coastal shrimp farm (DoF, 2001). Shrimp is one of the most important fisheries resources produced in coastal water-bodies. Bangladesh exports about 40% frozen shrimp to U.S.A. and 42% to E.U. countries and 12% to Japan (DoF, 2001).

Despite good value in the foreign market, shrimp farmers in Bangladesh do not get expected return from their harvest due to poor post-harvest handling and management of shrimp. Poor post-harvest results in both quantitative and qualitative losses shrimp. Here qualitative losses occur through autolysis and microbial spoilage due to improper preservation during the transportation of shrimp from farms to processing center. The spoilage process in shrimp results in the changes of organoleptic, biochemical and microbiological parameters.

The quality of post harvest shrimp depends on many factors, such as intrinsic composition, degree of spoilage, damage, deterioration during harvesting, cleaning, washing, handling, preservation, processing, storage, transportation, distribution and marketing (Azam, 2004). A prolonged shelf life and quality can be maintained even under natural conditions in the cold countries then in tropical ones. In tropical and warm countries like Bangladesh, the quality of shrimp can be

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maintained better and shelf-life substantially increased through the introducing of a uniform cold chain system from harvesting to marketing (Abedona, 1982). After harvesting the shrimp from the farms, the fishermen usually use bamboo basket or plastic basket insulated with hogla mat or banana leaves for packing shrimp with or without ice during transportation and distribution. Quality of shrimp mainly depends on storage temperature. The higher the storage temperature, the greater the spoilage of shrimp. There are a great variation in the usage of ice (ratio of ice to shrimp), which usually are i.e., 1:0.5, 1:1, 1:2. However it is necessary to know the effect of storing quality of shrimp with ice in plastic and bamboo basket. In addition to this information on the changes of ice-stored shrimp under various time intervals is therefore needed in order to avoid qualitative and quantitative losses. The present investigation was undertaken to assess the effect of immediate icing (0 hour) on the overall quality of Bagda (*Penaeus monodon*) stored for a period of 24 hours in bamboo and plastic baskets.

Materials and Methods

Sample collection and preparation: Shrimp (*P. monodon*) samples which ranged 50-75 gm in individual weight, was collected from a gher near the Koiya Bazar of Dumuria Thana, Khulna District in May, 2004. Just after harvest, samples were iced, kept in an aluminum container and then brought to the Quality Control Laboratory of Fisheries and Marine Resource Technology (FMRT) Discipline, Khulna University for the experiment. In order to find out the organoleptic changes with time in immediate iced storage, at first the samples were assessed and overall acceptable limit was also scored following Shewan and Ehrenbreg (1977). The Shrimp were stored in an insulation box and kept in ice at a ratio of 1:1 (ice: shrimp). Storage environment was maintained by draining the insulated boxes for melted ice intermittently and more ice was added to keep the temperature at 0°C throughout the entire storage period. Ice was changed every hour and drainage of melted ice was ensured. The samples from the box were withdrawn, with the distinct organoleptic changes, at intervals of an hour to determine the bio-chemical parameters i.e., TVB – N and TMA – N.

Organoleptic analysis: Organoleptic score sheet was prepared following Shewan and Ehenberg (1977) for finfish. From the developed organoleptic score sheet, an overall acceptability ranking was done. The organoleptic characteristics emphasized on odour, carapace color, carapace texture, eye and shell color characteristics. While conducting the organoleptic analysis, the room temperature ranged between 28 °C to 31°C.

Biochemical analysis: TVB-N and TMA-N were determined according to the procedure stated in the manual of Siang and Kim (1992).

TVB-N determination: Three Conway's units were thoroughly cleaned with a detergent (wheel) to remove any containment. To the edge of the outer rim of each unit, sealing agent (Vaseline) was applied. Using a micropipette, 1 ml of inner ring solution was pipetted into the inner ring of each unit. In to the outer ring of each unit, 1 ml of the sample extract was pipetted. One ml of saturated K₂CO₃ solution was carefully pipetted into the outer ring of each unit, carefully to prevent any entering in the inner ring, and immediately the units were covered and closed with clip. The solutions in each unit was then mixed gently, to prevent any solution mixing from one ring to the other. The units were then placed in an incubator at 37° C for 60 minutes. After that, the units' covers were removed and the green colored inner ring solution was titrated with 0.02N HCl using a burette (50 ml) until turned to pink. An average titrate volume of HCl was found from the results of three titrations for each muscle sample. For each value the TVB-N values were calculated. A blank test was also carried out using 1ml of 1% TCA, instead of sample extract.

TMA-N determination: Trimethylamine in fish muscle was determined by the Conway technique, which is same as TVB-N determination but prior to addition of potassium carbonate, 1 ml of 10% neutralized formalin was pipetted to the extract to react with ammonia and thus only the TMA-N was allowed to diffuse over the unit.

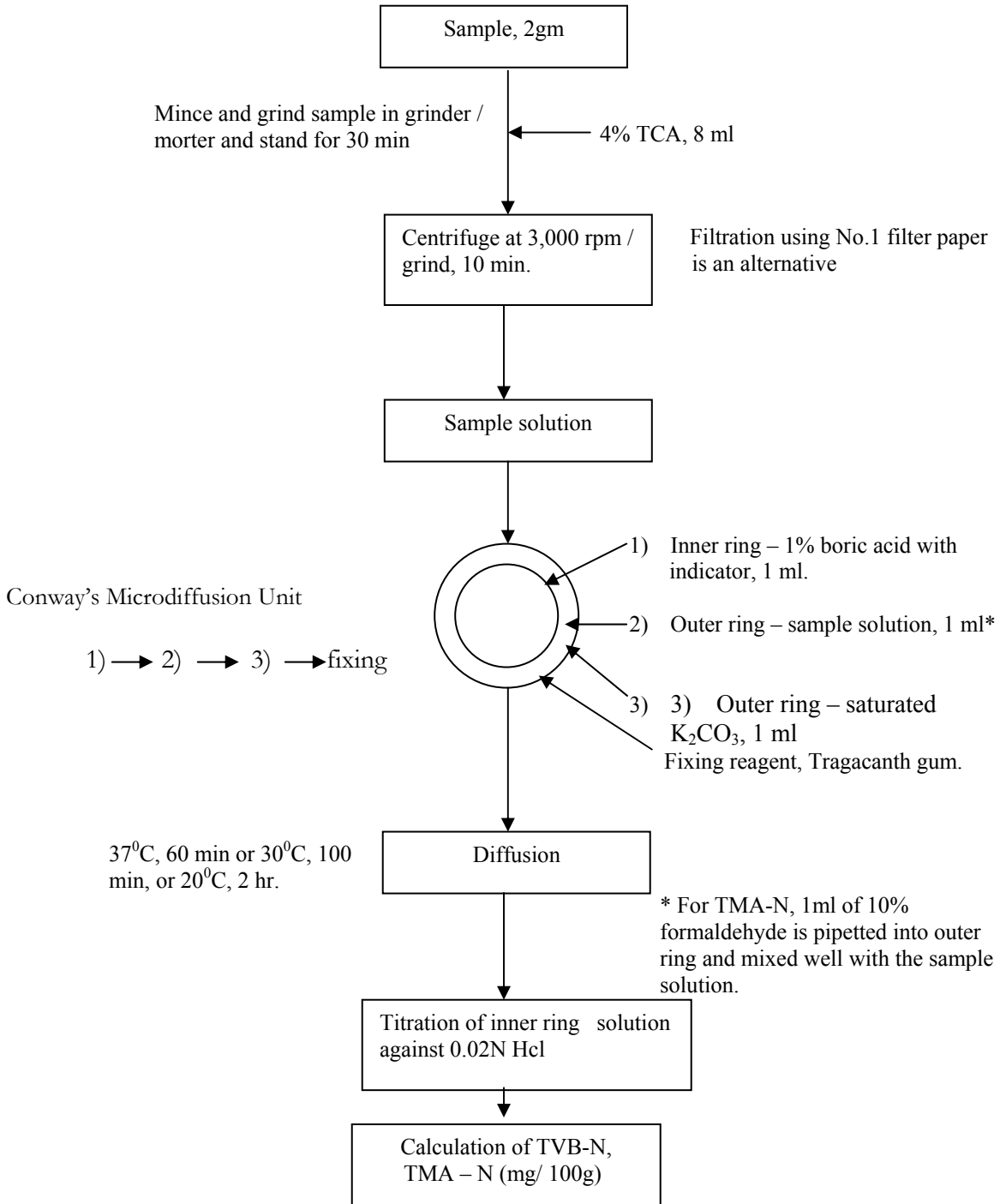


Fig: ??? Analytical procedure for TVB-N and TMA-N

Microbiological analysis

Microbial analyses were done according to the procedure of ICMSF (1988).

Results

Organoleptic changes

Figure 1, 2 and 3 illustrate the organoleptic changes in *P. monodon* stored in plastic and bamboo basket during a period of 24 hours of storage in ice. The organoleptic evaluation and scoring were started after 1 hour of collection of shrimp and the average score on the 1st hour was 10 as provided by the panelist. The initial average score on the 2nd hour was 9.8 in plastic basket but it was 10 in bamboo basket. This score gradually decreased over the range of 24 hours (Fig 3).

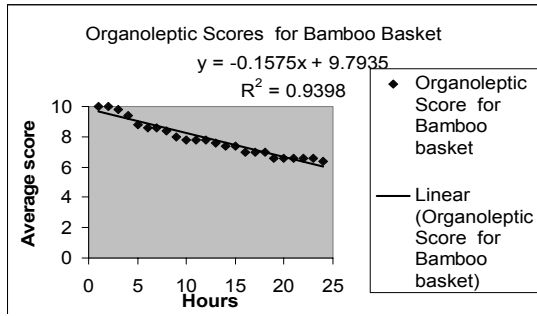


Fig 1. Changes of overall acceptability of *P. monodon* with time in case of Bamboo Basket.

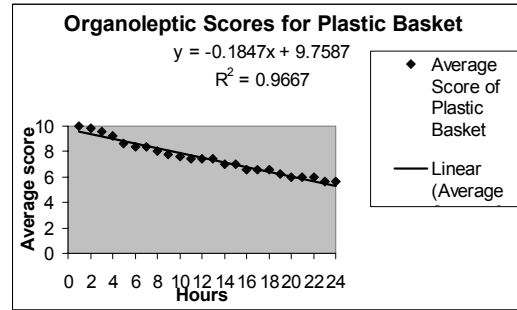


Fig 2. Changes of overall acceptability of *P. monodon* with time in case of Plastic Basket

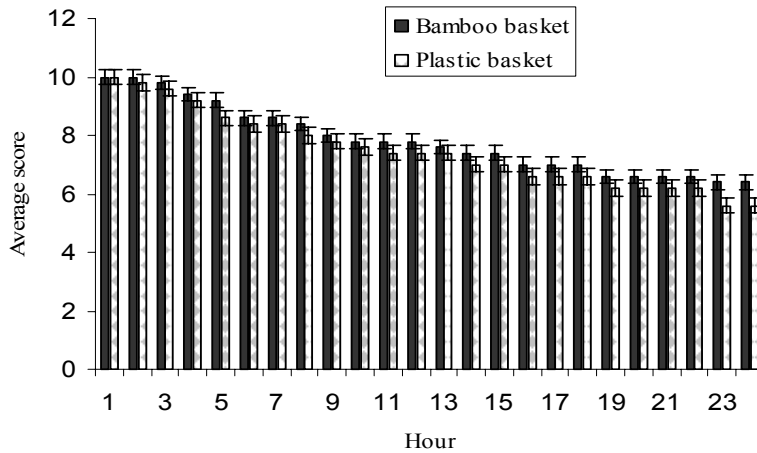


Fig 3. Organoleptic scores of shrimp stored in bamboo and plastic baskets at ambient temperature.

Bio-chemical assessments of *P. monodon* stored in ice:

TVB - N

The amount of TVB – N was determined over a period of 24 hours storage in ice, which ranged between 5.34±0.0212 mg/ 100g and 8.045±0.049 mg/ 100g (bamboo basket) and 4±0.0283 mg/ 100g and 7.825±0.0354 mg/ 100g (plastic basket). After 12 hour TVB-N content was observed 6.71±0.1414 mg/ 100g in bamboo basket and 5.3±0.0212 mg/ 100g in plastic basket. Comparative study between two baskets with hours is shown in Fig 4.

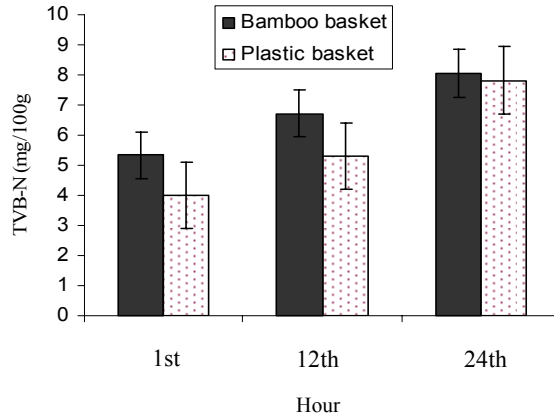


Fig 4. Comparative study of TVB-N content in shrimps stored in bamboo and plastic baskets.

TMA - N

On the 1st hour of storage period when the shrimp were fresh, TMA-N content in *P. monodon* was low 2.66 ± 0.0141 mg/ 100g in case of bamboo basket and 1.345 ± 0.0071 mg/ 100g in case of plastic basket. The TMA-N value was 2.675 ± 0.0212 mg/ 100g in bamboo basket after 12 hours and 4.01 ± 0.0212 mg/ 100g in case of plastic basket. After 24 hours TMA-N content was observed 4.045 ± 0.0071 mg/ 100g in bamboo basket and 5.2 ± 0.0424 mg/ 100g in case of plastic basket. These values were within acceptable limit even at the end of storage period.

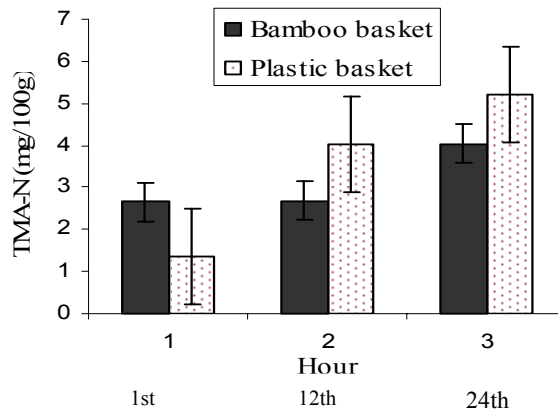


Fig 5. Comparative Study of TMA-N content between two baskets.

Microbiological analysis

Standard Plate Count (SPC) for shrimp stored in plastic and bamboo basket

The mean value of standard plate count is shown in Table-1. The counts were converted to log₁₀ value in order to present the value within the acceptable figure. Standard plate count was relatively low amounting to log₁₀ value 4.43 and 4.38 in bamboo and plastic basket respectively. This value

was found lower than the acceptable limit. These results indicate the freshness and acceptability of shrimp. However the condition of shrimp remains fresh relatively in plastic basket than bamboo basket in case of immediate icing.

Table-1. Standard Plate Count for bamboo and plastic basket.

Storage Hour	Bamboo Basket			Plastic Basket		
	SPC(cfu/g)	LOG ₁₀ Value	Acceptability	SPC(cfu/g)	LOG ₁₀ Value	Acceptability
1 st	0.18×10 ⁵	4.26	Highly Acceptable	0.12×10 ⁵	4.08	Highly Acceptable
12 th	0.27×10 ⁵	4.43		0.24×10 ⁵	4.38	
24 th	0.17×10 ⁵	4.23		0.23×10 ⁵	4.36	

Discussion

Marked changes were seen specially after 7 hours in bamboo basket and after 5 hours in plastic basket when the quality converted highly acceptable to moderately acceptable and the acceptability changed in 23rd hours in bamboo basket and remained unchanged until 24th hours, however, in case of plastic basket acceptable limit was observed after 5 hour from the initial period of observing. In that case acceptable limit transferred to moderately acceptable in 19th hour in plastic basket which remaining unchanged within 24 hours.

The level of TVB-N increases after spoilage begins, both enzymatically and due to bacterial attack. The use of TVB-N as an index of spoilage was first proposed by (Shewan, 1977). The low value of TVB-N is an indication of freshness of shrimp or fish while the high value may be due to action of autolytic enzymes and spoilage bacteria (Adebona, 1982). During iced storage, the TVB-N content in Bele (*Glossogobius giuris*) and puti (*Puntius stigma*) were 11.45 mg/ 100g and 17.84 mg/ 100g respectively as fish were treated as highly acceptable (Rubbi, *et.al.*, 1985). Kimura and Kiamakura (1934) recommended TVB-N levels of 10 mg/ 100g or less for fresh fish, 20 – 30 mg/ 100g for beginning of spoilage and over 30 mg/ 100g for spoiled fish. Azam, *et.al.*, (1997) recorded a very high TVB-N value (17.03 mg-N) initially for tilapia. The TVB-N value of the present study is well with the range recommended of Kimura and Kiamakura (1934).

Comparative study indicates that TVB-N was higher in bamboo basket on the 1st and the 12th hour than that for plastic basket while it was similar on the 24 hours for both bamboo and plastic basket. The fishy odor is produced when TMA-N reacts with fat in the muscle of shrimp/ fish (Davies and Gill, 1936). In the course of spoilage, many off-odors are produced by bacteria, indicating the onset and development of spoilage (Reineccius, 1979). More TMA-N is produced from TMAO by bacterial action than by fish tissue enzymes (Jones, 1954). At least 94% of TMA-N in spoiling fish originates from TMAO (Beatty, 1938). The result obtained in this experiment, indicated that at the end of 24 hours shrimp in both baskets indicates the acceptable condition according to Reineccius (1979). Beatty (1938) suggested a TMA-N content of 4–6 mg/ 100g as the critical value for the edibility of fish, while Brown and Dorn (1977) recommended 10 – 15 mg/ 100g for human consumption. There is also wide variation in critical values suggested for individual species, like 5 – 7 mg/ 100g for herring (Sigurdsson, 1955) and 1 –5 mg/ 100g for haddock (Castell and Triggs, 1955). The level of TMA-N studied in the present investigation was bellowing the limits suggested by Beatty (1938).

The accepted limit of SPC is 10⁶cfu/g (ICMSF, 1988). SPC of freshly harvested shrimp ranged from 6.8×10⁴ to 1.5×10⁵ as observed by Lobrerra *et. al.* (1990). These counts are within the range of reputed values (10³-10⁵) of shrimp from temperature environments (Matches, 1982) although

Lannelongue (1982) mentioned counts as high as 10^6 - 10^7 . Result of this present study showed that freshly harvested shrimps can meet existing standards for SPC which is 10^6 /g (ICMSF, 1988). Shrimp collected from all the three districts (Bagerhat, Khulna, and Satkhira) and from all the points (Gher, Depot, Agent, and P. Plant) indicated value within 10^5 cfu/g, is acceptable limit even when being practiced normally (Azam, 2004). Bacterial counts on brackish water *P. monodon* immediately after harvesting ranged from 2.23 to 4.20 (expressed as \log_{10} cfu/g) at 20° C and 3.36-4.20 at 37° C (Reilly *et. al.*, 1985). The lower counts of bacteria of the brackish water species is probably due to the method of harvesting and to the avoidance of extensive handling and on board storage of marine prawns (Reilly *et. al.*, 1985).

Organoleptic characteristics in this experiment remain better in bamboo basket than plastic basket but SPC was relatively higher in bamboo basket. The determination of organoleptic assessment, TMA-N, TVB-N and SPC could provide an adequate system for the assessment of freshness and quality of *P. monodon* stored in immediate ice and even for all the fish species. As Bangladesh is a developing country, economic condition of the farmer's is relatively lower than other developed country. Thus, it is considered the transportation materials should be cheaper. Careful handling of bamboo basket is therefore essential. Quality of two baskets remained acceptable condition during immediate icing for a period of 24 hours. The research work emphasized on the quality of *P. monodon* i.e., how long time it can retain its edibility characteristics when stored in ice. The quality of bagda (*P. monodon*) obtained from this investigation is quite acceptable to the processing industries for export.

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