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EFFECT OF ALOE VERA TREATMENT ON QUALITY OF INDIAN SHAD (Tenualosa ilisha) DURING CHILLED STORAGE

R. M. Kadri¹, S. M. Zofair¹, V. B. Mulve1, Shabir Ahmad Dar¹, J. K. Gohel¹, K. G. Baraiya², D.K.Meena²*

¹College of Fisheries, Veraval, Junagadh Agricultural University, Gujarat, India, ²Central Inland Fisheries Research Institute, Barrackpore, Kolkata, West Bengal, India

*Corresponding author: dkmeenafnb@gmail.com

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ABSTRACT
An attempt was made to study the use of Aloe vera gel extract treatment on hilsa fish, Tenualosa ilisha, storing with ice in insulated box. A dip treatment of 18%, 20% and 22% Aloe vera gel extract for 2 hrs before chilled storage in ice was applied to fish. Subsequently, significant changes in value of T3 (22 %), TMA-N, as 1.50 ± 0.16 to 7.62 ± 0.24 (mg/100g), TVB-N, 7.35 ± 0. to 19.78 ± 0.34 (mg/100g), PV 0.66 ± 0.09 to 2.17 ± 0.09 (m.equ/kg), FFA, 1.16 ± 0.01 % to 2.98 ± 0.06 % with microbiological and sensory parameters were observed. Moreover, all treated fish showed shelf life of 15 days without noticeable sign of spoilage as compare to 12 days records for untreated fish. Study also revealed that 22% Aloe vera gel extract before putting in ice box may extend the shelf life of fish.

Key Words: Aloe vera, Antimicrobial, Antioxidant, Chilled storage, Hilsa fish

INTRODUCTION
Fish is an extremely perishable aquatic food item (Agbon et al., 2002). It begins to degrade and irreversible change that result in spoilage. Fish is highly susceptible to deterioration without any preservative or processing measures (Okonta and Ekelemu, 2005). It has been reported that immediately the fish dies, a number of physiological and microbial deterioration set in thereby degrade the fish (Emokpae, 1979). In tropical environments, spoilage will proceed very rapidly. Since it is irreversible, it cannot be stopped completely after death. However, techniques are available to slow down the decomposition or spoilage of fish so that it reaches the consumer in reasonably acceptable condition. Preservation in ice is one of the most efficient ways of retarding spoilage. The rate of deterioration during ice storage of fish varies with species, depends on the concentrations of substrates, metabolites in the tissue, microbial contamination and conditions of storage after catching (Pacheco-Anguilar et al., 2000).

Hilsa (Tenualosa ilisha) is one of the most important tropical marine fish commonly known as Indian shad. For hilsa, icing is widely preferred method for short term preservation. In recent time, bio-preservation is a novel food preservation method used for extension of shelf life and enhanced safety of foods by the use of natural or controlled microbiota and/or antimicrobial compounds (Ananou et al., 2007). In post harvest technology, bio-preservation aims at extending shelf life of fruits and vegetables by utilizing plant-based products which have been used in food engineering for a long time. Aloe vera gel is one of the promising bio-preservative which has a great potential to become a common use for most fresh fruits and vegetables. Aloe Vera contains phyto-components compounds such as vitamins, nutrients and anti-nutrient compounds (Maenthalsong et al., 2007). Currently, the most widely used part from Aloe Vera (L.) is the part a gel, whereas its peel not yet utilized optimally. Moreover, it has reported that the skin of Aloe Vera has antioxidant activity (Miladi and Damak, 2008). Similarly, Adushan (2008) reported that in aloe also can act as antioxidant compounds, for preservation of food.

T. ilisha is a commercially important fish, which is usually marketed in the form of chilled whole condition. Extension of shelf life of T. ilisha during chilled storage is important parameters not only for its market value but also for further processing it into other value added products in distant market. Extension of chilled storage life of fish with an effective dose of Aloe vera treatment, a natural preservative, during chilled storage will be helpful to the processor as well as the consumer for getting quality products. The objectives of current study were to investigate the effect of A. vera gel extract dip treatment on hilsa fish (Tenualosa ilisha) for extension of shelf life of ice preserved short duration transportation and long term ice preserved storage.

MATERIALS AND METHODS
Fresh hilsa (Tenualosa ilisha) measuring were 22.12 ± 0.81 cm,101.35 ± 2.47 gram procured from
Veraval fishing harbor and transported to laboratory in ice condition (1:1). Fresh A. vera harvested from local agricultural farms of Veraval city A. vera were taken to laboratory for subsequent preparation.

**PREPROCESSING FRESH OF HILSA (T. ILISHA) AND PREPARATION OF A. VERA GEL**

In the laboratory, the fishes were washed with potable chilled water to remove dirt, particles, and individual fish weight and length was recorded accordingly. After washing fishes were used for chilled storage. The gel extraction process was carried out under hygienic condition in the processing hall. The plant was washed with potable water and gel was extracted from core portion of the plant.

**DETAILS OF EXPERIMENT**

The first experiment was conducted to standardize the dose of A. vera gel extract for treatment. Fishes in triplicate were treated respectively with 10, 15 and 20 %, extract for 2 hours, stored in ice box for 15 days. Based on chemical, microbiological and sensory analysis the 20 % treatment was found to be the best.

Second experiment was conducted with 18, 20 and 22 % gel extract treated with fish to evaluate the most effective concentration.

**SENSORY ANALYSIS**

Sensory evaluation of the samples was conducted every day by five trained panel members. Total plate count (TPC), TVB-N (Total Volatile Base Nitrogen) were carried out at the interval of 3 days for a period of 15 days after chilled storage (Snedecor and Cochrann, 1967).

**PROXIMATE COMPOSITION**

Moisture, ash, crude protein and total lipid of fish samples were determined according to the prescribed methods (AOAC, 2006) TVB-N and TMA free fatty acids (FFA) in the samples were determined following to the standard method (Beatty and Gibbson, 1937; Takagi et al., 1984). The peroxide value of the lipid was determined from the lipid extract using iodometric method (Jacobs, 1958).

**MICROBIAL TEST**

**TOTAL PLATE COUNT**

The microbiological characteristic of fresh fish was assessed according to standard method. The fish samples were tested for total plate count of bacteria on NA (nutrient agar). TPC/g sample = Average count x 2 x dilution factor.

**SENSORY CHARACTERISTICS**

Organoleptic evaluation of the fresh fish was carried out by highly experienced judges on 9-point hedonic scale (Joseph and Iyer, 2006). Analysis was conducted on randomly selected samples immediately after removal from chilled storage.

**RESULTS AND DISCUSSION**

**PROXIMATE COMPOSITION OF FRESH FISH**

The proximate composition of the fresh hilsa fish (T. ilisha) was analyzed. The protein content was 17.976 ± 0.16 % which more or less coincides with the recent findings (Mazumder et al., 2008). The lipid content of 11.9 ± 0.96% was noted. Saha and Guha in their study of 34 species estimated highest amount 19.4% of fat in hilsa (Saha and Guha, 1989). Moisture content of 67.88 ± 0.36 % was well accordance to the previous findings (Nabi and Hossain 1989). Ash content was found to be 1.94 ± 0.20% which is corollary to the result of Abimbola et al. (2010).

**QUALITY CHANGES DURING CHILLED STORAGE OF A. VERA TREATED FISH**

**NITROGENOUS COMPOUNDS**

**CHANGES IN TMA-N DURING CHILLED STORAGE**

TMA content of hilsa increased from initial 1.60 ± 0.10 (mg/100g) to 10.78 ± 0.20 (mg/100g) in control on 12th day of chilled storage period whereas in 18%, 20%, 22% treated samples like T1(18%), T2(20%) , T3(22%) the level of TMA-N increased from 1.60 ± 0.10 (mg/100g) to 9.32 ± 0.08 (mg/100g), from 1.47 ± 0.11 (mg/100g) to 8.34 ± 0.16 (mg/100g), from 1.50 ± 0.16 (mg/100g) to 7.62 ± 0.24 mg% respectively (Table 1). TMA level in all treated sample remained much below as compared to the level of control for the same period. The results showed the effectivness of A. vera treatment in minimizing the development of TMA due to bacterial activity. The results of the present study are in agreement with the findings of Ishida et al. (1976) who reported that at low temperature storage, such as refrigeration above 0°C TMA-N formation slows down noticeably. After 12th day TMA-N content in control increased from 10.78 ± 0.20 (mg/100g) to 16.37 ± 0.29 mg/100g on 15th day of chilled storage which is higher than the limit of acceptability as suggested (Connell, 1975), whereas all treated samples were found to be comparatively less, well within the acceptable limit of TMA-N, after 15th day of chilled storage (Fig. 1) than control. This might be attributed to the inhibitory effect of A. vera gel extract on the growth of bacteria. The interaction effect of A. vera gel treatments and chilled storage period (days) were found to be significant (p<0.05).

**CHANGES IN TVB-N DURING CHILLED STORAGE**

TVB-N is a product of bacterial spoilage and the content is often used as an index to assess the keeping quality and shelf life of seafood products. After 15 days of storage there was significant difference in TVB-N value of control and treated sample. Initial value of TVB-N for T0 was 7.42 ± 0.09 (mg/100g) which reached to 28.98 ± 0.80 (mg/100g) at the end of 15 days of chilled storage period. Whereas in treated T1(18%), T2(20%) , T3(22%) the level of TVB-N increased from 7.35 ± 0.11 (mg/100g) to 23.24
CHANGES IN FREE FATTY ACID (FFA) DURING CHILLED STORAGE

Formation of free fatty acids (FFA) during frozen storage of seafood is a factor that leads to the deterioration of protein quality. It has been reported that FFA value increased in common sole (Solea solea) during ice storage (Yesim et al., 2011). In the present study initial value of FFA for T0 was 1.17 ± 0.01 % oleic acid which progressed to 4.95 ± 0.10 % at the end of 15 days of chilled storage period. Significant changes (p < 0.05) were observed in FFA for T1 (18%), T2 (20%) and T3 (22%), the level of FFA increased from 1.17 ± 0.01 % to 3.18 ± 0.06 %, from 1.17 ± 0.01 % to 2.98 ± 0.06 % respectively during a total of 15 days of chilled storage. Low value of FFA in treated sample in comparison to untreated fish clearly indicates inhibitory effect of A. vera gel extract on the lipolysis. Present study shows significant difference of FFA value between untreated sample and treated sample, that might be attributed to antioxidant effect of A. vera gel extract contributing factor. Aloe vera is rich in bioactive compounds some of which are antioxidants those are broadly used in food engineering as preservative such as mannans, antrachinon, c-glycoside, antron, antrakuinon and lectine (King et al., 1995; Eshun and He, 2004). Low value of FFA in treated fish may be due to such antioxidant compounds present in A. vera gel extract.

INDICES OF RANCIDITY

CHANGES IN PEROXIDE VALUE (PV) DURING CHILLED STORAGE

Peroxide value (PV) is used to express the oxidative state of lipid contents of the foods. PV value is the measure of first stage of oxidative rancidity. In the present study the changes in PV value in all chilled samples showed increased trends with intermittent fluctuation during chilled storage period.

Table 1: Changes in TMA-N (mg %) during chilled storage study of T. ilisha

<table>
<thead>
<tr>
<th>Storage day</th>
<th>T0 (Blank)</th>
<th>T1 (18%)</th>
<th>T2 (20%)</th>
<th>T3 (22%)</th>
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<td>8.34</td>
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<td>16.37</td>
<td>13.43</td>
<td>12.14</td>
<td>11.47</td>
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</table>

Table 2: Changes in TVB-N (mg %) during chilled storage study of T. ilisha

<table>
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<th>Storage day</th>
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<th>T2 (20%)</th>
<th>T3 (22%)</th>
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Table 4: Changes in overall acceptability during chilled storage of *T. ilisha*

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<tr>
<th>Storage day</th>
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<th>T2 (20%)</th>
<th>T3 (22%)</th>
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<td>4.46</td>
<td>4.95</td>
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<td>3.47</td>
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<tr>
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<td>2.08</td>
<td>2.97</td>
<td>3.85</td>
<td>3.99</td>
</tr>
</tbody>
</table>

Fig 4: Changes in overall acceptability during chilled storage of *T. ilisha*

Similar result has been found by Winarni *et al.* (2012) where Indian mackerel treated with 20% *Aloe vera* was considered as the most effective treatment. At the end of 15 days storage time, all treated fish except untreated were acceptable by the panelist. Control treatment fish were rejected by the panelists at 11th day of storage. At such concentration fishes were not rejected by the panelist. This effect was possibly due to the complex substances of *Aloe vera* such as aloin which has antibacterial, antifungal and anti-inflammatory activities (Lorenzetti *et al.*, 1964; Das *et al.*, 2011).

These results indicated that treatment with *Aloe vera* gel extract stabilized the sensorial, microbial and chemical properties of hilsa during chilled storage. Moreover, it further extends the chilled storage life for another additional 4 days.

**CONCLUSIONS**

Changes in the chemical, microbiological and sensorial attributes of treated hilsa varied among concentrations. Higher the concentration less the level of spoilage. 22% *Aloe vera* gel extract treatments were found to be the best among treatments to reduce changes in chemical, microbial and sensorial attributes as well as shelf life than the control during chilled storage. The use of *A. vera* gel extract was found to be effective in minimizing deteriorative changes, both chemically and sensory attribute stored for 15 days at 0°C. In general, use of *A. vera* gel extract treatments in hilsa holds promise to improve overall quality in terms of chemical, microbiological and sensory characteristics as well as shelf life of *T. ilisha* during chilled storage of 15 days. *A. vera* has also got good keeping quality as a natural preservative for short duration transportation. The findings of the present study, *A. vera* as a whole ignite a keen interest among the researchers, and other entrepreneurs to explore its chemical and biochemical properties. One addition study provides an insight to investigate such natural plant based products with their exhaustive properties as preservatives.

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