Research Journal of Animal, Veterinary and Fishery Sciences _____E-ISSN 2320 – 6535
Vol. **4(6),** 1-6, June **(2016)** *Res. J. Animal, Veterinary and Fishery Sci.*

Changes of Moisture and TVB-N value of herbal (Chilli and turmeric) treated dried Bombay duck (*Harpodon nehereus*) during storage in Gunny Bag and Polythene Bag

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Available online at: www.isca.in, www.isca.me
Received 26th April 2016, revised 12th May 2016, accepted 13th June 2016

Abstract

Traditional fish drying is affected by various problems. Blowfly infestation during drying period and insect infestation during storage period are the main problems associated with dried fish. In open sunlight five treatments T_1-T_5 of Bombay duck were produced and studied. Storage period was three months in two different condition polythene bag and gunny bags. Initial moisture and protein percentage was highest in T_1 treatment where lipid was highest in T_2 and ash content in T_3 treatment. Initial TVBN value was highest 10.50mg/100g in T_1 treatment and lowest 7.75mg/100g was in T_4 treatment. After the storage period moisture regain was highest in T_1 treatment in both polythene and gunny bag. TVBN varies 48.1mg to 52.65mg/100g fish in polythene bag where as in gunny bag it were 47.1mg to 56.1mg/100g fish.

Keywords: Organoleptic quality, Storage period, TVBN, Insect infestation, Moisture content.

Introduction

Bombay duck is one of the important marine fish used for drying. About 60% of total protein demand is fulfilled by fish and fishery products. Among the various processing technique drying is very old and traditional technique. About 20% of the total fish caught are processed by drying. Approximately 622 metric tons dried fish is exported annually from Bangladesh through the country earn Tk. 250.05 as foreign currency[1]. Although drying is an easy and cheap method for the processing of fish but there are a lot of problems are associated with it. The traditional dried products are often unsatisfactory for human consumption[2]. One of the major problems of fish drying in humid and warm condition is blowfly and beetle infestation[3]. Under humid condition unsalted dried fish may loss its weight up to 30% due to beetle infestation[4]. To avoid such insect infestation and microbial contaminations, commercial dry fish processors often apply several harmful insecticides in fish[5]. The most popular and commonly practiced preventive and curative control measure is the use of harmful chemical pesticides, in spite of having serious lethal effects on consumer's body. Most commonly used pesticides are DDT and nogos[6]. Beside these synthetic chemicals such as paradichlorobenezene, naphthalene, chloropyrifos, dichlorovos and malathion[7] are frequently used in dried fish in Bangladesh. Studies on the storage and conservation it is found that the mixture of organochlorine (DDT and heptachlor) is used in dry fish in Bangladesh[8]. Use of unsafe insecticides and their excessive dosages in dried fish create serious health problems to the consumers[9]. For these problems proper method of drying by using various no harmful additives such as salt or chili powder and turmeric powder can be the good techniques for fish drying. Main objective of the present research was to develop the quality of dried fish and its storage condition by applying herbal pesticides for complete replacement of harmful chemical pesticides.

Materials and Methods

Sampling: For the research purpose the fresh Bombay duck were collected from Cox's bazar, BFDC (Bangladesh Fisheries Development Corporation) landing center and transported to the Faculty of Fisheries of BAU (Bangladesh Agricultural University) in an insulated ice box where the ice and fish ratio was 1:1. These fishes were caught in marine set beg net (MSBN) in the Moheskhali area of Cox's Bazar district, Bangladesh.

Sample preparation: Fishes were simply gutted by using knives and scissors and removed entire viscera. Then the raw materials were washed with portable tap water to remove blood, slime and other undesirable substances. After draining out water from washed raw materials, they were split longitudinally and soaked for 12 hours using different herbal and salt solutions.

Description of drying: A triangular simple bamboo made frame was made in open air for drying purposes. Viscera of fish sample was removed and cleaned. Then the sample was washed with potable clean water. After draining out of water, fishes were divided into five treatments (Table-1). Then the treated sample were hanged in the bamboo made frame in such a way that the all body surface of fish were exposed to surrounding air until the drying is completed.

Table-1
Treatments used for drying

Treatment	Description
T_1	Control, no herbal or salt treatment is used
T_2	Fish samples treated with 2% salt
T_3	Fish samples treated with 4% salt
T_4	Fish samples treated with 1% turmeric and 1% chili powder
T_5	Fish samples treated with 2% turmeric and 2% chili powder

Estimation of nutritional factors: Moisture: Moisture content was determined by using a thermostat oven. Muscle taken from the different parts of the fish body and weighed (W) then it was taken in a crucible and it was weighted with sample (W_1) and kept in the oven for 24 hr. at 105^0C and then it was placed in desiccators, after cooling the it was again weighted (W_2) . Percent of moisture were calculated by using the simple formula:

$$\text{Moisture } (\%) = \frac{W1-W2}{W} \times 100$$

Total Volatile Base Nitrogen (TVB-N): The TVB-N value was determined with certain modifications of the methods given by AOAC[10].

Exactly 10 g of the ground sample were weighed and then mixed with 90 ml of 6% Perchloric acid ($HClO_4$). The samples were homogenized for two minutes with a blender under cooled condition and extracted sample was collected. Then the 100 ml sample was taken in a Kjeldahl flask where 6 drops of phenolphthelin indicator and few glass beads were added where 10 ml 20% NaOH also mixed in sample in homogenously in drop by drop. Then the flask was placed for distillation and the distillation continued up to 15 minutes. The distillate was collected in a conical flask 50 ml of 3% H_3BO_3 and 1 drop of mixed indicator also added. Distillation was done in 70^0C and it was confirmed by changing its color violate to greenish. Finally the distillate was titrated with 0.01 (N) HCl and the end point was confirmed by regaining the violet color of the mixed indicator. The TVB-N value was calculated by using the following formula:

$$TVB - N \left(\frac{mg}{100g}\right) = \frac{Milliliter\ of\ titrant\ used\ x\ 0.014\ x\ 0.01\ x\ 100}{Sample\ wt.}$$

Results and Discussion

Organoleptic Changes: The changes in organoleptic characteristics of natural, salt and herbal treated dried Bombay duck (*Harpodon nehereus*) products during storage in polythene bag and gunny bag. The herbal treated dried Bombay duck (*Harpodon nehereus*) stored in polythene bag had fishy odor, whitish color, firm and flexible texture. Fishes were free from insect infestation and there is no broken pieces immediately after preparation. Overall quality of the products was excellent.

The overall organoleptic characteristics of T_2, T_3, T_4 and T_5 treated dried Bombay duck (*Harpodon nehereus)* products stored in polythene bag and gunny bag at ambient temperature was excellent in respect of color, texture and free from insect infestation and presence of broken pieces up to first 15 days. After 30 days of storage, the color turned into whitish to slight brownish but after 60 days of storage, there were some more changes in the color which turned in to brownish with slightly rancid odor. Quality of the products was considered good by the panel of examiners because of its firm and flexible texture. The organoleptic characteristics were more or less remained unchanged even after 90 days of storage.

On the other hand, normal dried (T_1 treated) Bombay duck products stored in polythene bag and gunny bag at ambient temperature were in excellent condition during first 45 days of storage on the basis of organoleptic characteristics. After 45 days, slightly changes occurred with color, odor, and texture and also observed presence of broken pieces without insect infestations was observed. At this stage, the product could be considered as good and acceptable for consumption. After 90 days of storage, some changes occurred in all organoleptic characteristics where the color of the products turned into brown with slight rancid odor and the texture of the dried fish were softer with broken pieces. At this stage the product is also acceptable for human consumption.

As the time of storage increase the color of the products was changed from whitish to brownish and it may be for the oxidation of lipid. This is more evident in product stored in gunny bag compared to that stored in polythene bag. This is quite clear from the present study that lipid oxidation presence of oxygen was more prominent than that of products stored in polyethylene bag. Brining reduces the micro-organisms count on dry fish[11]. For this reason, after 90 days of storage the organoleptic quality of the T_1 T_2 and T_3, T_4 and T_5 treated dried Bombay duck is good and highly acceptable for human consumption. The results obtained from our experiment is supported to a previous study of polythene storage of silver jew fish (*Johnius argentatus*) and ribbon fish (*Trichiurus haumela*) stored in polythene bag for 90 days at room condition[12].

Changes in Moisture Content in Different Storage Conditions: During storage in polythene bag and gunny bag the initial moisture content of herbal treated Bombay duck product was ranged from 16.08% to 18.56% and the highest value was found in normal dried Bombay duck and lowest value in T_3 treated dried Bombay duck. After 90 days of storage in polythene bag the moisture content of dried Bombay duck reached in the range of 24.59% to 26.52% and the highest value was found in normal dried Bombay duck product and lowest

value was found in T_3 treated Bombay duck. After 90 days of storage in gunny bag the moisture content of herbal treated dried Bombay duck was ranged from 29.95% to 32.75% and the highest value was found in T_1 treated and lowest value in T_3 treated dried Bombay duck. In both storage condition the moisture content of normal dried Bombay duck sample increased rapidly during storage compared to the T_2 and T_3, T_4 and T_5. During the storage period, moisture content increased in both sealed polythene and gunny bag. But the increment in gunny bag was more prominent than the product stored in sealed polythene bag. The phenomenon of increasing moisture content in gunny bag is due to absorption of moisture from surrounding atmosphere.

Table-2
Moisture content of various treatment

Storage Technique	Treatment	Storage time (Days)						
		1	**15**	**30**	**45**	**60**	**75**	**90**
Polythene bag	T_1	18.56	20.65	21.7	22.03	24.5	25.6	26.52
	T_2	16.55	18.34	19.93	21.03	23.1	24.5	25.01
	T_3	16.08	18.1	19.8	20.9	22.9	23.8	24.59
	T_4	16.6	18.5	19.9	21.2	23.5	24.7	25.51
	T_5	16.65	19.05	20.7	21.5	23.7	24.6	25.05
Gunny Bag	T_1	18.56	22.5	24.7	26.9	28.8	30.5	32.75
	T_2	16.55	19.5	22.8	25.1	27.6	28.9	30.3
	T_3	16.08	19.35	21.95	24.71	26.1	27.99	29.95
	T_4	16.6	19.5	22.07	24.3	26.7	28.5	30.34
	T_5	16.65	19.3	22.5	24.7	27.01	28.9	30.5

*Values represent averages of triplicate samples

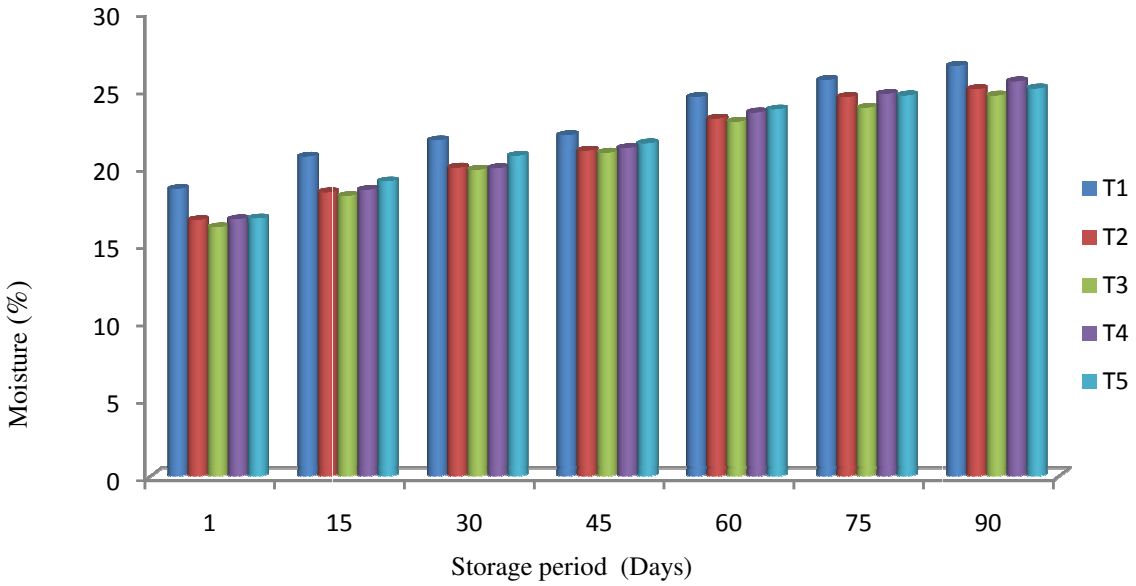

Figure-1
Changing of moisture content with time interval of storage in polythene bag

Changes of Total Volatile Base Nitrogen (TVB-N) in Different Storage Conditions: There was a great extent of differences in TVB-N values between two types of storage conditions. During storage in polythene bag and gunny bag the initial TVB-N value of herbal treated Bombay duck products ranged from 7.89 to 10.05 mg/100g where the highest value was found in T_2 treated dried Bombay duck and lowest value in T_5 treated Bombay duck. After 90 days of storage in polythene bag the TVB-N value dried fishes was ranged from 52.65 to 48.1 mg/100g and the highest value was found in normal dried Bombay duck and lowest value was in T_5 treated Bombay duck products. After 90 days of storage in gunny bag the TVB-N value of dried fishes was ranged from 47.1 to 56.1 mg/100g and the highest value was found in T_1 treated and lowest value was found in T_5 treated Bombay duck products. The TVB-N value of herbal treated dried products stored in polythene bag increased slowly compared to that of products stored in gunny bag and at the end of 90 days of storage period. But these values obtained from both polythene and gunny bags stored products were much lower than the recommended value of 100-200 mg/100g for variety of dried and salted fish products[13].

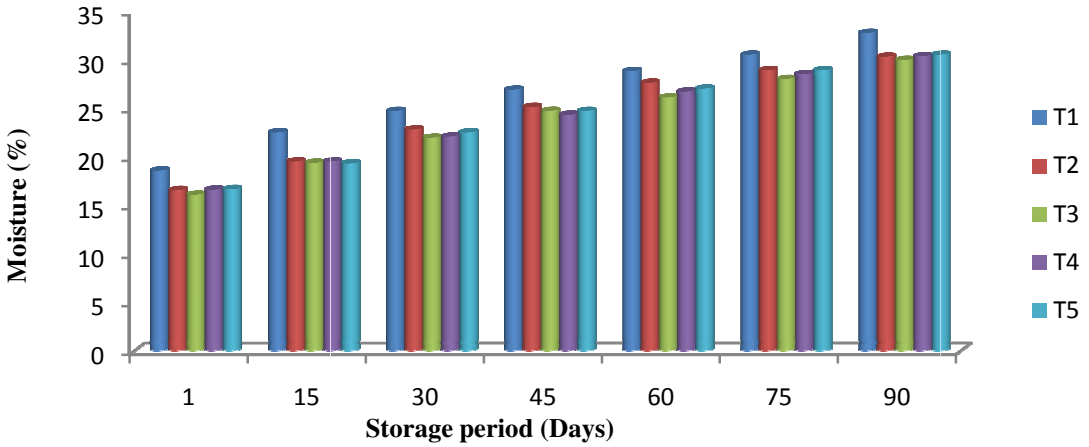

Figure-2
Changing of moisture content with time interval of storage in gunny bag

Table-3
TVB-N values of various treatment

Storage Technique	Treatment	Storage time (Days)						
		1	**15**	**30**	**45**	**60**	**75**	**90**
Polythene bag	T_1	8.95	30.5	35.7	40.3	44.1	47.5	52.65
	T_2	10.5	33.1	38.5	42.3	44.2	47.9	50.3
	T_3	9.88	31.3	37.6	41.2	44.2	46.1	48.9
	T_4	7.75	29.9	36.1	38.9	42.1	44.96	48.5
	T_5	7.89	30.31	38.2	39.9	43.7	45.5	48.1
Gunny Bag	T_1	8.95	31.2	36.5	39.4	45.3	51.3	56.1
	T_2	10.5	30.7	35.2	38.1	44.9	48.2	50.01
	T_3	9.88	31.1	34.9	38.1	44.6	47.9	49.7
	T_4	7.75	30.9	34.5	37.9	44.55	47.01	48.3
	T_5	7.89	31.2	34.6	36.9	44.01	46.05	47.1

*Values represent averages of triplicate samples

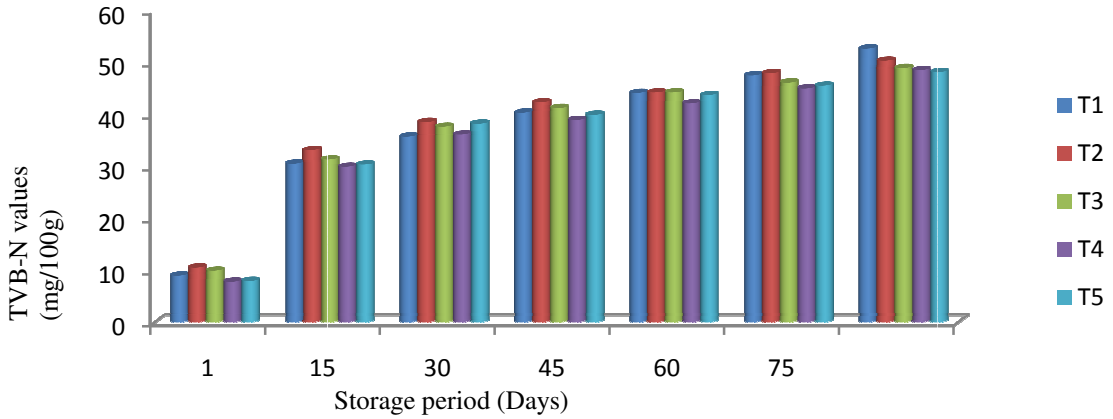

Figure-3
Increasing pattern of TVB-N with time interval storage in polythene bag

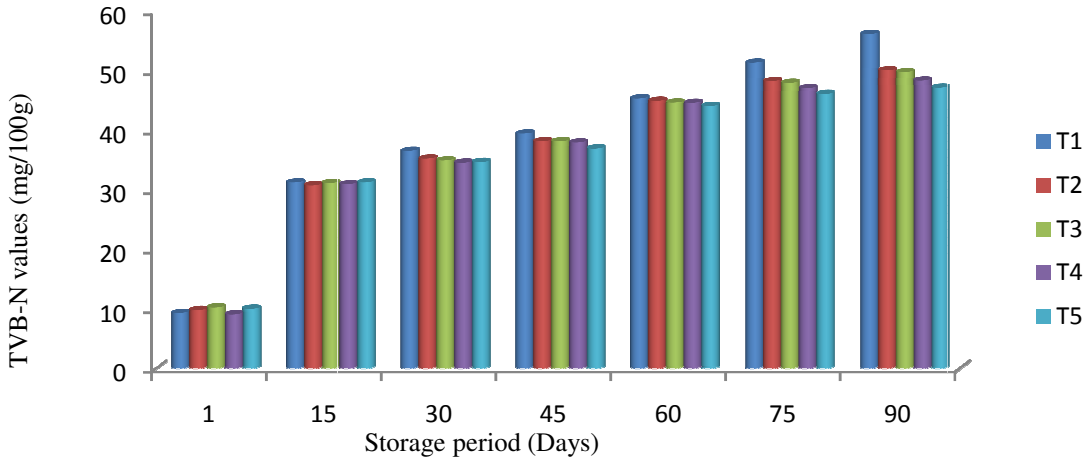

Figure-4
Increasing pattern of TVB-N value with time interval storage in gunny bag

During storage, salt and herbal treated dried products remained in good condition compared to normal dried products. Dried products stored in polythene pack remained in good condition for longer period of time compared to those in gunny bag. But products stored in gunny bag lost its quality quickly even after 30 days of storage. The results of the present study revealed that the normal dried products are more susceptible to lipid oxidation and insect infestation compared to salt and herbal treated dried products, and stored in gunny bag are more susceptible to lipid oxidation and insect infestation compared to those stored in polythene bags.

Conclusion

The major problem in sun drying of fish is the blowfly infestation. Turmeric, chili and salt treatment are worked as the repellent against the infestation. Fish processors illegally use different kind of insecticide and pesticide to control the blowfly infestation. If these pesticides can be replaced by these herbal treatments during the processing of the Bombay duck then it will be a great work for the protection of public health. As the above research shows that the herbal treatment has no significant negative impact on the moisture absorption and changes in TVB-N values so the researchers think turmeric, chili and salt may be the good additives during the during of Bombay duck.

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