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Effect of insulated bags for minimizing post-harvest losses

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Abstract
Effort has been made to minimize the post-harvest losses during the transportation of fishery products for the short distance period. Ice was used in insulated bags with fish which helps in lowering the temperature. The insulated bag was made up of three layers, outer resin which does not allowed outside water to come in, middle thermo-foam which worked an insulator material, inner PVC sheet which does not allow inner melted water to come out. Insulated bag maintain fish body temperature 24.10 ºC after 6 hrs storage.

Keywords: Fish, insulated bag, polythene packaging, freshness, quality changes

Introduction
In India, fisheries have always been playing a pivotal role in food and nutritional security of people especially in rural areas. It has significantly contributed towards the improvement of the nutritional status of the populations, since fish has proved as an ideal health food, which is within the reach of the common man [1]. Global demand for fish derived products [2].
In ambient conditions, the fish becomes unfit for human consumption in about 8 to 12 hrs after they are taken out of water mainly for tropical country like India. Hence, it is imperative to cool them down with crushed ice as early as possible after they are caught, in order to retain their freshness for the maximum length of time. When the ice melts, the melt water washes away the slime and bacteria from the exterior of fish which may create postharvest losses [3]. They assessed the percentage of losses at various handling, marketing channels up to consumer level. Researchers reported that post-harvest fish losses, suffered by small-scale traders in India were excessive during monsoon [4].
Icing is usually done in insulated ice-boxes which are effective but are not handy for use by fishermen on small traditional craft, fish vendors and consumers. Fish caught by the traditional fishermen using smaller boats are usually kept directly on the deck or in non-insulated bags. Ice boxes are not preferred as they are very inconvenient to be kept on these small boats. In the domestic fish markets, fish are generally displayed on wooden or plastic planks exposed to the open air thereby attracting flies and dust contamination. The ice placed on the planks melts faster as it is in contact with the ambient air temperature. The insulated bags are useful to the small scale traditional fishermen. Recently, Visakhapatnam Research Centre of ICR-CIFT has developed an insulated fish bag for preserving the quality of fish during local transportation and retail vending. The insulated fish bag helps in maintaining the quality of fish when used with proper icing. It is easy to carry, avoids dust contamination, avoids flies and is reusable. The fish bag is made up of three layers which prevent easy melting of ice for a period of six hours. It is useful to fisher women involved in vending of fish by moving in city residential areas and also during transport of fish from fishing harbour to fish markets. In this present work, simple interventions in the form of plastic sheets, insulated bags are designed with an objective to avoid spoilage and contamination, thereby maintaining the freshness and quality of the fish during transportation.

Experimental Methods
The bag was made at College of Fisheries, Junagadh Agricultural University, and Veraval by using three layers *viz*., an outer waterproof covering, a middle insulation foam layer and an inner plastic lining. Outer water proof covering is made up of cotton coated resin polystyrene

lining that minimizes the seepage of melt ice water, does not allow outside water to enter into the bag and also allows for easy washing. The middle layer is made up of thick expanded polyethylene foam (thermo foam) which is an insulator material and helps in slowing the melting of ice thereby maintaining the lower temperature required for preserving the quality of iced fish. The inner PVC layer prevents the contact of fish with the thermo foam thereby maintaining the quality of fish and makes the bag easy to wash. A consumer fish bag with dimensions 13 inch length, 12 inch breadth and 5 inch width was designed for used.

The croaker fish (*Jhonius dussumieri*) was kept with ice in normal polythene bag according to local market which was considered as T1 and insulated bag considered as T2 separately. The instrumental analysis like temperature, freshness, whiteness and biochemical parameter like TMA-N and TVB-N were taken during the storage period of 6 hours. The proximate composition and morphometric characters like total length, standard length, etc. were also taken.

The freshness of fish was determined by recording the electrical resistance of skin and muscle flesh by using the distell fish freshness meter, which is known as torry meter [5]. Distell fish freshness meter has reading from 0 to 16. In this meter, highest value is indicate the freshness of fish and lowest value stands for spoilage [6]. Colour values were expressed using the International Commission on Illumination 'L' (lightness), 'a' (+a is red, -a is green) and 'b' (+b is yellow, -b is blue) [7]. The temperature was taken by using digital thermometer. The total volatile nitrogen (TVB-N) and trim ethylamine nitrogen (TMA-N) were determined by the micro diffusion method [8].

Table 1: Raw material characteristics of Croaker (*J. dussumieri*)

Sr. No.	Parameters	Mean value of T1	Mean value of T2
1	Total length (cm)	17.50 ±1.30	19.33 ± 1.72
2	Standard length(cm)	13.5 ± 1.88	15.25 ± 1.53
3	Weight of fish (gm)	100.0 ± 3.05	120.0 ± 1.73

Table 2: Proximate composition of Raw material (*J. dussumieri*)

Sr. No.	Parameters	Mean value
1	Moisture	80.59 ± 0.909
2	Protein	19.25 ± 1.88
3	Fat	0.150 ± 1.05
4	Ash	0.143±0.02

Table 3: Temperature and freshness analysis

Hours	0		2		4		6	
Treatments	T1	T2	T1	T2	T1	T2	T1	T2
Fish body temperature (˚C)	30.00	30.20	26.40	22.50	23.70	23.40	30.30	24.10
Bag temperature (˚C)	30.00	30.20	21.20	20.31	24.20	21.54	29.12	18.50
Freshness scores	11.70	14.30	9.20	12.50	8.40	11.10	7.80	10.70

Table 4: Colour analysis during the storage period

Hours	0		2		4		6	
	T1	T2	T1	T2	T1	T2	T1	T2
L	53.64±2.6	53.89±2.3	51.62±2.6	53.62±1.00	47.78±0.81	50.82±0.3	45.28±0.7	49.1±0.1
A	2.51±1.36	2.52±0.4	1.92±0.04	1.24±0.41	1.40±0.50	2.20±0.30	1.3±0.6	2.00±0.3
B	5.28±0.21	5.24±0.12	3.32±0.5	4.29±1.3	1.80±0.73	3.16±0.7	1.42±0.2	3.12±0.6

Table 5: Biochemical and Sensory changes of croaker covered in a polythene under ice (T1) and ice packed insulated bag (T2)

Hours	Treatments	TMA-N (mg% per 100 gm)	TVB-N (mg% per 100 gm)	Hedonic scale scores
0	T1	1.42±0.28	16.64±0.32	9.00±0.57
	T2	1.38±0.31	16.87±0.38	9.00±0.57
2	T1	2.69±0.43	18.20±0.29	7.00±0.533
	T2	1.86±0.32	17.84±0.42	8.00±0.432
4	T1	5.86±0.76	21.93±0.44	6.00±0.22
	T2	3.26±0.65	19.34±0.53	8.00±0.18
6	T1	7.36±0.78	23.87±0.58	6.00±0.43
	T2	3.61±0.43	19.74±0.46	7.00±0.18

Fish packed in polythene bag (T1)

Fish packed in insulated bag (T2)

TMA-N and TVB-N analysis

Colour analysis by using colorimeter

Fish after 6 hrs. in insulated bag

Freshness analysis by using Torry meter

Experimental findings and analysis

The physical characteristics of fresh fish are presented in Table 1. The fish length was 17.50 ± 0.30 cm and average weight was 100.00 ± 3.05 g in T1 where as in T2 the length was 19.33 ± 1.72 cm and weight was 120.0 ± 1.73. Similar physical characteristics result for *J. dussumieri* was noticed by author [9]. The length of the fish was in the range between 6.2-22.9 cm and weight 40 g to 120 g. The proximate composition of the fresh croaker (*J. dussumieri*) is shown in Table 2 and Figure 1. The protein content recovered was 19.25 ± 1.88% which coincides with the findings of researcher [10]. The fat content of 0.150 ± 1.05% was noted. Moisture content of 80.59 ± 0.909% (mean ± SD) agrees with the findings of researcher [11]. Ash content was found to be 0.143±0.02% (mean ± SD). Similar composition of protein, ash, fat and moisture content of 16.74%, 1.56%, 1.36% and 78.1% respectively was described by researchers [12]. The initial body temperature of fish T1 was and after 6 hrs. It remained same. The temperature was fluctuate during the increasing with the time. Quite similar result was found by researchers [13]. The body temperature of fish in T2 was 30.2°C initially and after 6 hrs. It maintained the temperature of 24.1°C (Table-3). It showed that during the increasing time period the body temperature of fish was increased in polythene packaging but the temperature remained controlled in insulated bag. The temperature of the bag was more in T1 but it maintained low temperature in T2 where the drip loss was loss. It may reduce the bacterial load. Researchers reported a varying drip loss in freeze-chilled raw whiting, mackerel and salmon fillets packed in modified-atmosphere and control air packs [14]. Proper and steady cooling is the key to good quality, long shelf life and high value of seafood. The freshness of fish of T1 was 11.7 initially but after 6 hrs. The freshness was 7.8 whereas the freshness of T2 fish was 14.30 initially and after 6 hrs. The value was 10.70. The freshness value was found more in fish in insulated bag than fish in polythene bag.

Colour is the important physical characteristics of chilled fish products and directly related to the acceptability of food products. In Table -4 showed that the colour of fish was analysed by using colorimeter. In initial hour the fish was showing good iridescent shining appearance but after 6 hrs. The fish which was packed under insulated bag gave good appearance whereas the fish packed with plastic polythene bag gave white dull patches like appearance in skin. So, treatment T2 fish colour is maintain but T1 fish colour changes the quality. Researchers reported that the fillet was shown better colour than control during study on shelf life assessment of modified atmosphere packaged turbot (*Psetta maxima*) fillets. There was not much more difference between a-value and b-value [14].

The sensory quality of the fishes are given Table 5. After 6 hrs. the mucus of fish covered with polythene was changes whereas the fish packed with insulated bag showed remain fresh. The gill colour of insulated bag packed fish was slightly reddish but in polythene packed fish, it was pale yellow. In case of eye it gave shrunken dull opaque appearance in T2 but in T2, it showed milky cornea appearance which is not acceptable by consumers. According to overall acceptability T2 gave better sensory result as compared to T1. It was observed that total volatile nitrogen, trimethyl amine nitrogen of the fish packed with polythene and insulated bag holds did not show much difference as compared with the sensory observations. Researcher [15] recommended a level of 30-40 mg% TVB-N in sea foods as a limit of acceptability and the acceptable level of TMA in sea foods to be 10-15 mg% [16]. The TVB-N content of treated sample T2 was 19.74 mg% and the polythene packed samples T1 value was 23.87 mg% after 6 hours. It showed that sample packed in insulated bag was found lower spoilage indication as compared to polythene packed. Researcher had reported a value of (TVB-N) 30-33 mg/100 g for *Pandalus borealis* [17]. The TMA-N content was remain under the critical limit in both T1 and T2.

Conclusions

It is well known that improper handling of fish accounts for huge post-harvest losses. Simple interventions were suggested to prevent postharvest losses during storage and transport. By using the insulated bags during transport of fish from harvest point to the landing centre and from the landing centre to fish markets and the use of fish display cabinet at fish markets can help to prevent or minimize the post-harvest losses of harvested fish and shellfish. By using insulated fish bags along with ice, the fish is chilled immediately, maintained the fresh condition for a minimum of 6 hrs. Duration. Thus, the major problem of temperature abuse, incidence of flies, off-odours and dust contamination are minimized in these simple interventions.

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