TRANSPORTATION OF FISH - I — A PRELIMINARY STUDY ON INSULATED CONTAINERS AND THEIR EFFICACY IN LONG DISTANCE TRANSPORTATION

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Polythene lined thermocole insulated plywood boxes (second-hand teachests) could be successfully used for the transport of fresh iced fish. It was found that a minimum of 25 mm. thermocole insulation was necessary during summer (April to June) and 15 mm. during winter (November to March). By using these insulated boxes the initial fish to ice ratio could be brought down to 1 : 0.75 and still further to 1 : 0.5 at the height of winter in January & February. These second-hand teachests are robust and are able to stand a minimum of five trips to and fro.

The moulded polystyrene boxes are not suited for long distance transport.

Another redeeming feature in the entire operation was, there was practically no loss of fish due to spoilage in transit. 100% of the fish transported was in acceptable condition and could be marketed. In the non-insulated boxes used by the trade, the loss due to spoilage ranged from 10% to 25%, and this could be completely eliminated by the use of these insulated boxes.

INTRODUCTION

India has a coast - line of 5000 kilometres. Scattered along this coast- line there are more than 1000 fish landing centres.

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Out of the present total landed quantity of more than 1.8 million tonnes of marine, fresh water and brackish water fishes, nearly 60% is consumed fresh.

Both the Government of India and the State Governments have an ambitious programme to step up the production of fish and shell fish to nearly 3 million tonnes before the end of the Vth plan.

With this anticipated increase in the production of fish the allied problems of handling, processing, preservation and transportation will have to be tackled effectively, so that the fishermen and the trade may reap a remunerative price. An intensive study of the bio-chemical and bacteriological changes that take place during icing, storage and transport must go hand in hand with the rapid development in the production. It is with this object in view that a programme of an "All India Co-ordinated Project on Transportation of Fresh Fish" has been initiated.

A survey conducted at Howrah, a major fish consuming centre, has revealed that about 50-80% of the fish arriving in the markets are of sub-standard quality, when the period of journey from the production centre to Howrah varied from 24 hours to 120 hours (Anon, 1971). This shows the tremendous economic loss incurred by the trade and fishermen due to improper methods of handling, icing, chilling, processing, packing and transport.

With a view to improving the method of packing, various packing materials like wood, plywood, bamboo and aluminium are being extensively tried by different agencies. At the C. I. F. T. Sub-station, Veraval, a thermocole lined plywood box was developed and was put to extensive trials (Venkataraman, 1965). Rao & Perigreen (1964) had tried to improve the ordinary bamboo basket by giving it suitable polythene lining. Central Food Technological Research Institute, Mysore, has also developed few boxes. Similarly low density and high density polythene materials have also been tried. With attempts to improve the packing material going on at different places, the thermocole lined plywood box developed at C. I. F. T. Sub-station, Veraval, has been put to extensive trials in the Gujarat and Maharashtra regions, and has been well received by the fishing industry.

With a view to collect a comprehensive picture on the feasibility of using these containers for long distance transport of iced fish, pre-chilled fish and frozen fish and also to study the changes in the quality of fish taking place during actual transport and to develop new containers, a vigorous programme was launched at Veraval.

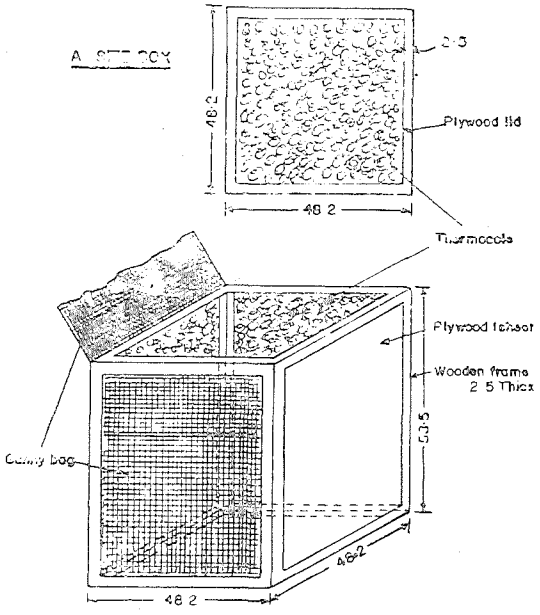
This paper deals with the results of experimental trials done with the insulated boxes for the transport of iced fish from Veraval to Bombay and Delhi, the extent of meltage of ice during different seasons with different insulations and different initial fish to ice ratios and the durability of such containers.

Materials and Methods

The following sizes of plywood boxes

(second hand teachests) were used for the study.

Type	Sizes	Capacity
A	48.2 x 48.2 x 58.5 cm.	110 kg.
B	45.5 x 45.5 x 51.0 cm.	80 kg.
C	40.5 x 40.5 x 45.5 cm.	40 kg.
D	43.2 x 41.0 x 41.5 cm.	40 kg.

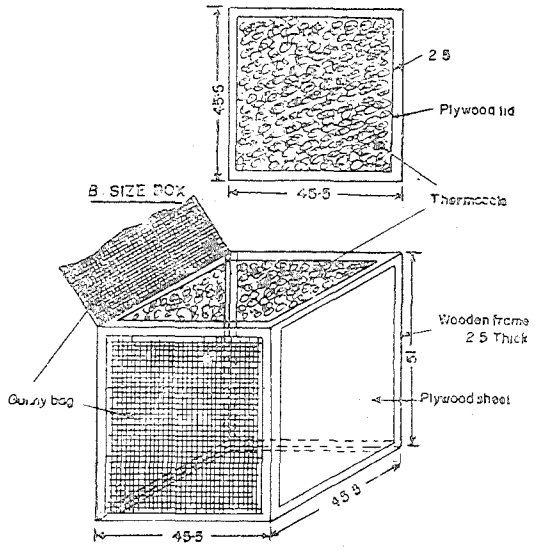


These boxes were insulated with polythene covered thermocole slabs (on all six sides). The polythene cover was provided to prevent the direct contact of water with the thermocole slabs.

Thermocole of the following thicknesses were used.

15 mm. normal and high densities.
25 mm. normal and high densities.

The box was finally wrapped with gunny cloth to give additional strength and protection against damage in transit.



Few moulded polystyrene boxes having a thickness of 25 mm. were also tried. The polystyrene boxes were given a covering with gunny. In two cases these boxes were given a covering with wooden cratings. Two different sizes of box, 60 x 38 x 24 cm. and 78 x 40 x 23 cm, were used.

Absolutely fresh fish received from the departmental fishing vessels were packed with ice and despatched to Bombay and Delhi in ordinary non-insulated rail wagons. The following varieties of fish which figure very prominently in the commercial catches of the Gujarat coast were utilised for the study. Hilsa *(Hilsa ilisha* and *Hilsa toli)*, silver pomfret *(Pampus argenteus)*, black pomfret *(Parastromateus niger)*, dhoma *(Otolithus* spp.*)*, spotted seer *(Scomberomorus guttatus)*, eel *(Muraenesox* spp. *)* dai *(Chirocentrus dorab)* etc. were studied. The fish to ice ratio of 1:1, 1:0.75 and 1:0.5 were used.

TABLE I

Percentage of meltage of ice during transportation Veraval to Bombay in 'A' type box

Month	Fish to ice ratio 1 : 1		Fish to ice ratio 1 : 0.75		Fish to ice ratio 1 : 0.5	
	Thickness of insulation					
	25 mm.	15 mm.	25 mm.	15 mm.	25 mm.	15 mm.
January	—	—	—	59.58	80.88	63.74
February	—	—	—	63.42	—	—
March	—	80.35	—	85.47	—	—
April	—	85.57	—	—	—	—
September	—	62.38	—	94.30	—	—
October	58.37	—	—	85.00	—	—
November	—	52.26	—	75.56	—	91.71
December	—	—	62.48	66.95	—	72.06

TABLE II

Percentage of meltage of ice during transportation Veraval to Bombay in 'B' type box

Month	Fish to ice ratio 1 : 1		Fish to ice ratio 1 : 0.75		Fish to ice ratio 1 : 0.5	
	25 mm.	15 mm.	25 mm.	15 mm.	25 mm.	15 mm.
January	—	—	—	96.56	—	—
February	—	78.74	—	—	78.18	82.41
March	—	—	—	—	—	83.31
September	69.01	—	—	—	—	—
October	—	78.42	—	—	—	—
November	—	—	—	—	—	—
December	47.14	60.30	—	—	—	—

TABLE III

Percentage of meltage of ice during transport Veraval to Delhi in 'A' type box.

Month	Fish to ice ratio 1 : 1		Fish to ice ratio 1 : 0.75		Fish to ice ratio 1 : 0.5	
	25 mm.	15 mm.	25 mm.	15 mm.	25 mm.	15 mm.
January	—	—	—	91.89	84.48	89.99
February	—	—	—	92.68	—	100.00*
March	48.72	—	—	—	95.66	91.68
May	—	97.75	—	—	—	—
September	78.25	87.50	—	—	—	—
October	—	—	46.80	58.02	—	—
November	—	69.08	—	92.94*	—	93.96
December	—	—	—	—	—	97.41

* Arrived late by 24 hours.

TABLE IV

Percentage of meltage of ice during transport Veraval to Delhi in 'B' type box.

Month	Fish to ice ratio 1 : 1		Fish to ice ratio 1 : 0.75		Fish to ice ratio 1 : 0.5	
	25 mm.	15 mm.	25 mm.	15 mm.	25 mm.	15 mm.
January	—	—	—	51.05	—	93.01
February	—	89.99	—	—	—	—
March	—	—	—	95.41	76.19	80.95
April	58.14	91.05	—	94.12	—	96.14
May	—	96.88	—	—	96.01	—
October	—	63.63	—	—	—	—
November	—	61.69	—	—	—	—
December	—	83.10*	—	—	—	—

* Arrived late by 24 hours.

RESULTS AND DISCUSSION

The average values of the ice meltage percentage in the insulated containers are given in the Tables I to IV. Tables I & II illustrate the percentage of ice melted in the 'A' and 'B' boxes, for a journey from Veraval to Bombay taking about 24 hours, during the different months of the year with thermocole insulation of 15 mm. and 25 mm. thicknesses and fish to ice ratios ranging from 1:0.5 to 1 : 1. It is evident from the Table that the minimum meltage of ice in the case of 25 mm. thermocole insulation with 1 : 1, 1 : 0.75 and 1 : 0.5 ratios of fish to ice are in the months of December, January and February respectively. In the winter months of October to February the meltage of ice with 25 mm. thermocole never exceeded 81% level in any of the fish to ice ratios tried, whereas in the case of 1 : 0.5 ratio of fish to ice and 15 mm. thermocole insulation it had gone up to 91.71%. In the summer month of April the meltage of ice shot up to 85% in the case of 15 mm. thermocole insulated containers with 1 : 1 ratio of fish to ice and above 94% in the case of 15 mm. thermocole insulated container with 1:0.75 ratio of fish to ice. This shows that 15 mm. thermocole insulation is not sufficient in summer. But it can be effectively used in the winter months of November, December, January and February, when the meltage of ice was well below 70%.

Tables III and IV illustrate the percentage meltage of ice in 'A' and 'B' type boxes for a journey from Veraval to Delhi taking about 40 hours, during the different months of the year with thermocole insulation of 15 mm. and 25 mm. thicknesses and fish to ice ratios ranging from 1:0.5 to 1:1. The Tables show that in the case of 25 mm. thermocole insulation with 1:1 fish to ice ratio the meltage of ice are 48.72 to to 58.14% in the months of March and April whereas in the case of boxes having 15 mm. thermocole insulation the figures are 91.05% and 98.60% in the months of April and May. In the winter months with 1:1 ratio of ice to fish and 15 mm. thermocole insulation the meltage of ice was below 70% and even in the case of consignment which was held up enroute for 24 hours, (i.e. the total journey time of about 64 hours) the ice meltage did not exceed 84%. In the case of 25 mm. insulated box with 1:0.75 fish to ice ratio the percentage of ice melted was 46.80 in the month of October whereas its values were 51.05 in January, 58.02 in October and 92.94 in November when the consignments reached late by about 24 hours. With 15 mm. insulation the values were 95.41% and 94.12% in the hot months of March and April respectively. With 1:0.5 fish to ice the values were well above 75% with 15 mm. and

TABLE V

Durability of plywood boxes

Type of box	Average trips made	Maximum trips made by a single box
A	3	5
B	3	5
C	2	3
D	2	3

TABLE VI

Performance of moulded polystyrene boxes.

Month	Box size	Destination	Fish to ice ratio	Percentage of ice melted	Condition of fish	Condition of box
1	2	3	4	5	6	7
February	78 x 40 x 23 cm. (with gunny covers)	Bombay	2 : 1	100.00	Good	Box completely broken
,,	60 x 38 x 23 cm. (gunny covers)	Delhi	2 : 1	93.76	Good	-do-
March	78 x 40 x 23 cm. (gunny covering and packing in wooden crates)	Delhi	3 : 1	83.35	Good	Box partially broken
,,	-do-	Bombay	4 : 1	—	—	Not received at Bombay

25 mm. thick insulations. This shows that with 1:1 and 1:0.75 fish to ice 15 mm. thick thermocole insulation is sufficient in winter whereas 25 mm. insulation is required in summer.

Table V illustrates the durability of the second hand teachests. The average and maximum trips made by the different types of boxes (to Delhi and Bombay) are given in Table V. It is evident from the Table that both the 'A' and 'B' type boxes have made an average of 3 trips and a maximum of 5 trips. The other two types of boxes have made an average of 2 trips and maximum of 5 trips. This shows that second-hand teachests are quite strong and can be reused, thereby considerably reducing the expenditure on purchase of new boxes.

Table VI illustrates the performance of the moulded polystyrene boxes. The Table shows the meltage of ice is more with 2:1 fish to ice though the fish has remained in good condition. However the box could not stand the rough handling and was damaged beyond repair even in the first trip. It must be completely sheathed by a strong material if it has to be used for transport of fish This will considerably increase the cost of the box.

The moulded polysterene box is extremely light with excellent insulation properties. As such it can be used for storing fish and prawn on board fishing boats and in factories and for carrying materials from one place to another inside the factory.

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