APPLICATION OF CHILLED SEA WATER IN A SMALL-SCALE FISHERY PROJECT: A CASE STUDY

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Abstract

The Camarines Area Fishing Cooperative (CNAFC) in Mercedes, Philippines is organized and operated by its members who are small-scale fishermen. The main purpose of the CNAFC is to facilitate marketing of the members' catches in order to ensure higher returns. To assist the marketing, the quality of higher market value fish had to be improved.

For this purpose a simple chilled sea water (CSW) tank was constructed using locally available materials and skills at a cost of about U.S. $1000, for holding capacity of 850 kg. of fish.

The CSW tank is being regularly used and its usage enables the fishermen to obtain 10% higher prices at the 350 km. distant market in Manila.

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1. INTRODUCTION

The Camarines Norte Area Fishing Cooperative (CNAFC) had to improve their handling of fish supplied by the members who are small-scale fishermen in order to facilitate collective marketing of fish and obtain better prices for their products.

Fast chilling of fish after landed and storage under chilled conditions for up to 3 days was attempted and successfully implemented by constructing and operating a simple chilled sea water (CSW) tank. The storage in CSW tank was used mainly for fish of high market value such as groupers, fusiliers, pomfrets, shrimps, spanish mackerel, small-size yellowfin tuna. The CNAFC is actually using this fish preservation method for the above mentioned fishes and transporting the CSW chilled fish repacked in boxes with ice to 350 km distant wholesale market in Manila.

Due to better quality of this fish, and in particular better texture, it is obtaining in average 10% higher prices at the wholesale markets as compared to the same species delivered in ice but not previously cooled in the CSW-tank.

The CSW-tank which has a capacity of storing 850 kg of fish was constructed at a total cost of about U.S. $1,000.

2. CHILLED SEA WATER TANK

Design

A 10 cm thick steel reinforced concrete tank was constructed with the floor which had 2% slope and a drainage pipe of 2 inch (5.08 cm) in diameter. See figures 1 and 2.

The CSW-tank was constructed so as to be watertight, corrosion resistant and easy to clean. A half an inch (1.25 cm) thick marine plywood was chosen as lining mainly because it was easy to work with, relatively cheap and available in the area. Nontoxic epoxy polyamide coating on the plywood was used in order to minimize water absorption and to obtain a smooth surface. This coating was chosen also as it is simple to apply. Fiberglass-reinforced polyester resin could also be used providing that required skill was available.

To obtain the required structural support for the application of the plywood lining, steel angle profiles coated with epoxy polyamide to avoid corrosion were used. Internally all the joints of the plywood were carefully covered with epoxy resin in order to achieve complete watertightness.

As insulating material 5 cm thick polyurethane slabs of the following characteristics were used:

Heat conductivity	:	0.020 kcal/mh^{o}C
Density	:	40 kg/m^{3}
Compression strength	:	3,000 kg/m^{2}

Good ability to withstand organic solvents attack.

The polyurethane slabs were protected by a combined vapour barrier of asphalt and aluminum-sisal foil against infiltration of moisture in order to maintain the insulation value.

As the piping had to be easy to clean and resistant to corrosion the polyvinilchloride (PVC) pipes were used. A conventional all iron 1 1/4 inch hand pump was installed to provide proper CSW circulation needed to avoid temperature stratification.

The selection of this simple circulating system was due to its low price, ready availability and simple maintenance and repair.

The suction and discharge flow area consist of perforated pipes. The total area of perforations on each pipe (suction or discharge) was equal in order to avoid difference of CSW pressure, it was also slightly larger than the cross area of the pipe.

Cost

The following is a breakdown of the total construction costs for the CSW-tank:

(i) Materials	Philippine Pesos
- Polyurethane slabs	948
- P.V.C. pipe and fittings (1 1/4" diameter)	413
- 2" diameter galvanized pipe, gate valve and fittings for drainage system	125
- Vapour barrier and asphalt	462
- 1/2" and 3/4" thick marine plywood	853
- 4 x 8 x 6" hollow blocks, sand, gravel, cement and 3/8" x 20 steel bars	833
- Epoxy polyamide coating	1,176
- Epoxy resin	593
- Magnetic rubber gasket and related	115
- Self tapping screws and hinges	107
- Aluminum and steel angle bars	332
- Hard wood	78
- Miscellaneous	161
- Hand pump	315
Sub-total material	6,511

(ii) Labor

- Construction of tank and foundation
- Installation of vapour barrier, insulation, lining and cover
- Installation of pumping system
- Application of epoxy polyamide coating to the internal surface of the unit in order to achieve proper watertightness of the lining

Sub-total labors	765
	7,276

(iii) Total cost

At the exchange rate of ₱7.35 = U.S. $1.00 the U.S. dollars equivalent of the total cost was U.S. $990.00.

Operation

This CSW-tank is based on the principle of chilling the fish with clean sea water or potable water and ice, recirculated by means of a simple manual water pump. The heat transfer is mainly by forced convection and the water to ice to fish ratio used was 1:2:4 (by weight). The tank was properly cleaned and disinfected always before usage.

The fish was stored 2 to 3 days without any significant decrease in the quality. Two or three days were enough to collect a truckload of fish for transport to Manila wholesale market.

At least 15 minutes before loading fish in the tank, clean sea water with ice was put into the tank and the recirculation started until the mixture reaches a uniform temperature. Fish was loaded into the tank and the mixture of ice and clean sea water was recirculated for about 1 hour depending on size and initial temperature of the fish. In order to avoid temperature stratification it was necessary to recirculate the CSW every 8 to 12 hours when the fish was stored in the tank for longer periods.

Cleaning of the CSW-tank was started as soon as the fish was unloaded from the tank and the system was still wet, otherwise slime and dirt would dry hard and be extremely difficult to remove. The piping system was flushed out and cleaned with alkaline detergent solution. Following that the system was flushed with clean sea water and disinfected with a noncorrosive germicidal solution which was left for up to 12 hours or less, if the tank was going to be used again. Subsequently the piping system was always flushed with clean sea

water in order to remove the germicidal solution before the new sea water, ice and fish mixture was added.

3. CONCLUSIONS

The advantage to the small-scale fishermen of CNAFC in Mercedes by using this CSW - tank for chilling fish were:

- Reduced labor requirements for chilling fish
- Faster chilling rate than with ice alone
- Reduced damage of fish due to pressure
- Minimized the shrinkage losses.

All these factors contributed to enable the CNAFC to deliver better quality of fish and obtain in average 10% higher prices for the CSW-stored fish at the wholesale market in Manila.

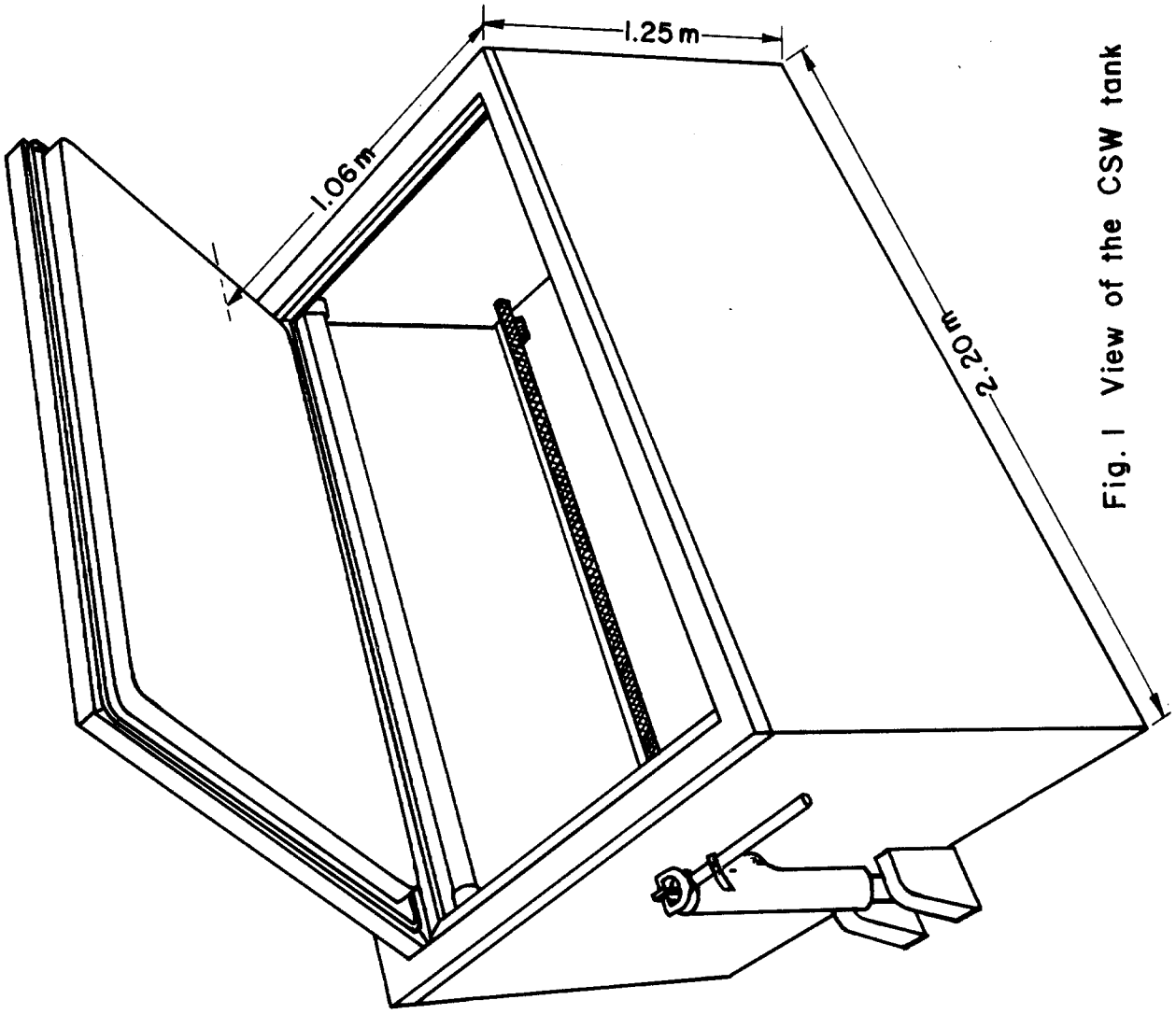

Fig. 1 View of the CSW tank

Fig. 2 Cross section of the CSW tank