

Development of Ice plants in India-a stride in the quality management in fisheries sector

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Introduction

Ice plants play a major role in fish quality management during transportation and processing. Ice plants started to emerge in the late years of 19th century as conventional block ice plants and since then have showed dramatic signs of development and now the modern tube ice, flake ice and slurry ice plants have been introduced to the fishing industry. The arrival of these modern ice plants is a good sign for the fisheries sector in terms of maintaining the quality standards of the fish being handled right from the site of catch to the harbour and then to factories. Many ice plants of different capacities and facilities are being supplied by many companies of both Indian and foreign origin. The paper is an attempt to provide a glance to the various ice plant facilities available in the fisheries sector in India.

History of ice plants in India

The details on the introduction of ice plants to India are not well documented, but it is estimated that it happened sometime during 1870s. Reports indicate that ice was imported from America to India before the first company "The

International Ice Company" was established in Madras in 1874 but nothing much is known about it. Latter by 1886, the South India Ice Factory started at Periamet, Madras (now Chennai). WB Keene and John Ramsay Unger started the Crystal Ice Factory, Egmore and this business expanded under John's son and by 1946, included cold-storage facilities for fish, meat and fruit. Ice factories flourished after that and now have evolved to cater the need of various industries. The advancement of Ice factories have revolutionized fisheries sector with the introduction of different types of ice plants like tube ice plants, flake ice plants etc.

Block Ice Plants

Block ice plants are the most widely available source of ice for the fishing industry in the country. These ice plants are densely established in the coastal regions mainly for satiating the need of fisheries sector. Fishing vessels and harbours purchase ice daily from these factories much more than any other sector. These plants are established with various production capacities either independent or attached to the seafood factories to cater the need

of ice to the industry. For the manufacture of block ice, tapered rectangular cans filled with water are immersed in a tank of refrigerated brine. The brine which is cooled to about -5°C by a refrigeration process extracts the heat from the water and produces block ice within the can. The cans are then removed from the tank and thawed for a short time in a tank of water to release the block from the can. The blocks are then stored in a cold room and can be crushed when required. The freezing period is typically between 16 to 24 h although plants known as rapid-block are available that have freezing periods of a few hours only. The quick freeze is achieved by the direct evaporation of the refrigerant in a jacketed mould fitted with finger evaporators. The blocks are released by a hot gas defrost and are sub cooled to a temperature of -8°C. Rapid block plants require far less floor space than brine tank systems. In India till date the block ice plants are acting as an immediate source of ice especially in the coastal areas for supplying the ice to the fisheries sector and other types of plants such as tube ice and plate ice plants are yet to establish themselves in the sector. The Marine Products

Export development Authority (MPEDA) is providing financial aid for construction of ice plants.

Merits and demerits

- Requires more labours for its operation
- Need atleast 16-24 hours for ice production
- Requires more establishment costs for the construction of plants

Containerised ice plant

The block ice plants have developed to a stage of containerised ice plants which are now being introduced to fisheries. Containerised ice plants have many advantages over the conventional block ice plants which mainly include low energy consumption, less land and manpower requirements, hygienic operation etc. An image of containerised ice plant is shown in Figure1. The main features of the containerised ice plants include the following:

Cost-effective: There is no need for a suitable building which saves the initial construction investment, labour cost and time. Besides, the whole system is completely installed within a container and is fully automatic so less labour is needed for both operation and installation.

Easy installation: Pre-assembled and well-tested ice plants installed in 20ft or 40ft containers are ready once access to water and electricity is provided. No complicated on-site installation work is needed. Once filled with refrigerant, the machine can start functioning immediately

after being attached to water and electricity facility.

Movable: Containerized ice plant can be easily transported by truck or rail, making it particularly useful in remote locations or those that need to move ice making facilities from one project site to another. India is blessed with long sea shore areas fish farming centres and hence catching centres also changes from place to place depending on various reasons, like seasonal changes. Under these circumstances the entire plant can be easily moved to the required location.

Convenient transportation: The cargo container is suitable for ocean container shipping and it saves the operation of packing into or taking out the ice machine from the container. Thus it prevents the ice plant from getting damaged during the long-distance transportation.

High-quality cargo container: The block ice machine is installed into brand new ISO certified standard ocean freight container. With decent modification to reinforce the structure, the container is ready to be handled by heavy machines operating in lifting and transporting. PVC coated cargo container makes sure the ice machine inside is sheltered from the wind and rain.

Stable operating environment: The container provides a relatively closed operating environment and maintains appropriate inside temperature. It ensures stable and efficient ice making process.

Compact & Space-saving: All equipments are installed in the container compactly, fully utilizing the internal space of the container. Compared with installing the non-containerized ice making machine on the workshop, the containerized ice maker saves much space. It only takes about 13.2 m²(20 ft container) and 26.4 m²(40 ft container).

Technical advantages of Direct Refrigeration system over the conventional plant with brine

Energy efficiency: In the conventional plants, brine solution is first cooled and in turn it cools water in the ice cans, where as in this system, water directly gets cooled thereby avoiding a second media(brine),causing substantial power saving in the formation of ice blocks .Also ,there will be power saving due to the reduced start up period, as well as by avoiding additional running of the plant for maintaining brine temperature in the tank.

Safety: This technology is much safer and much more environmental friendly than the conventional method because environment friendly refrigerant gas R-404 is used instead of ammonia. So no fear of toxic ammonia leak and the consequent risk.

Water conservation: Since this technology does not require thawing of ice blocks, no additional water is required for thawing and needs only the exact quantity of water for the formation of ice blocks.

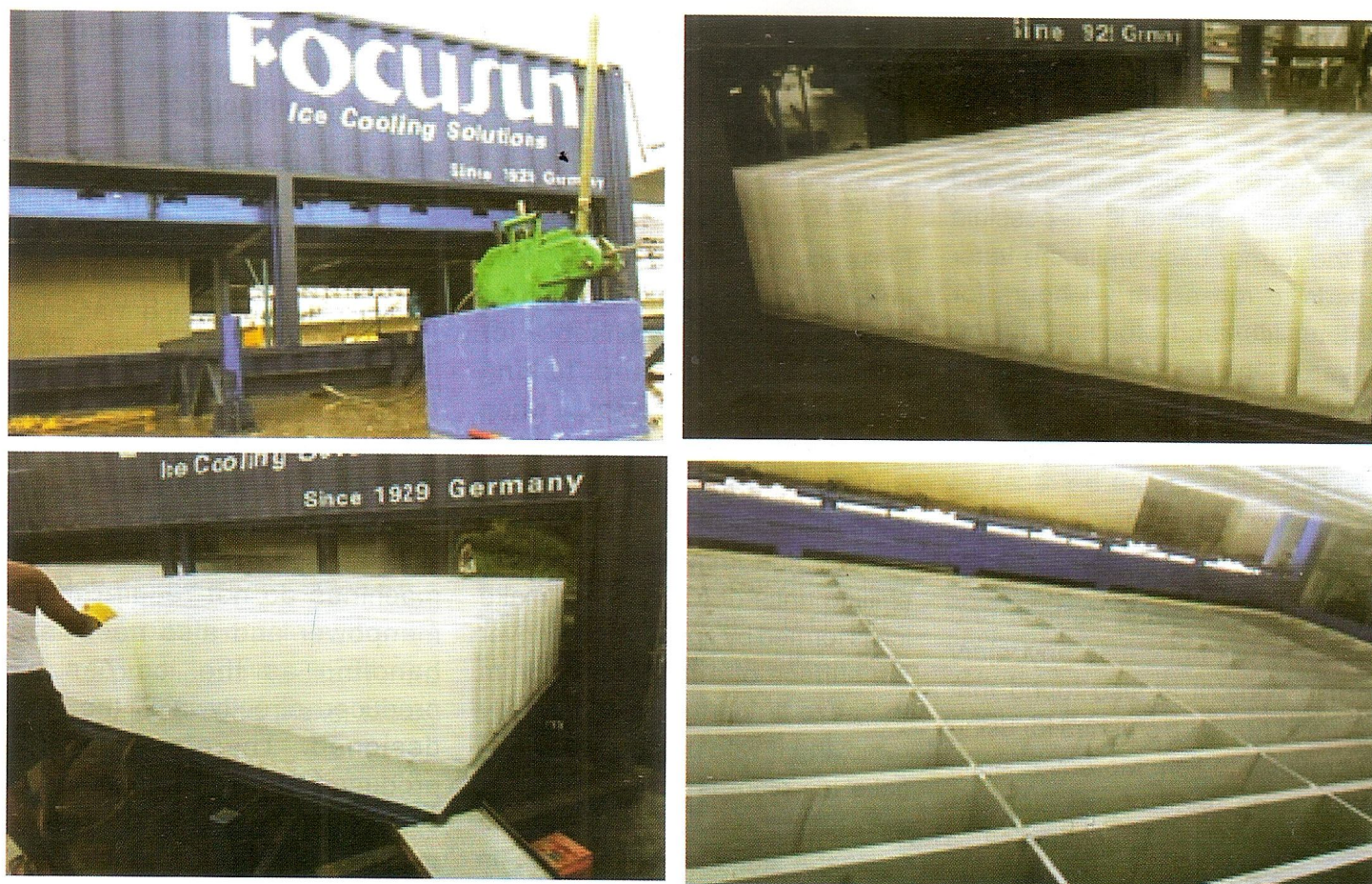


Fig. 1. Images of Containerised Ice Plant at Kalamukku Landing Centre, Kochi

Hygiene: Since there is no rusted ice cans, brine tank with unhygienic wooden platforms, the ice blocks will be most hygienic. In the entire process there will not be any human touch either with water or with ice blocks.

Convenience: Since the entire plant is accommodated in a container, it does not require any civil sheds, and thereby avoiding the coastal regulations. Further, since the unit can be stationed very near to the fishing boats at fishing harbours, Fish landing centres etc, it will be highly beneficial to the fisher folks.

Ease of use: It has become a big hassle to procure manpower for lifting of ice blocks. Even for a small

plant, it requires about 4 to 5 persons for lifting of ice blocks, whereas with this technology, since there is no lifting and the operation of the plant is fully automatic, a single operator can operate and distribute ice blocks all by himself.

Harvesting: One third or half of 24 hours production can be harvested at a time, whereas in the conventional plants, generally 2 blocks manually at a time and if it is hoisted electrically, the maximum number is 22 blocks at a time. Maximum harvesting at a time saves precious time.

Tube ice

Tube ice is the new development in the fishing industry as many of

the seafood factories have already resorted to it for getting regular ice production in the plants. Tube ice is formed in a vertical shell and tube vessel by passing water down through the tubes which are cooled by the circulation of refrigerant on the outer surfaces as shown in Figure 2. When the ice reaches the desired thickness the water flow is stopped automatically, the refrigerant is removed to a surge drum and hot gas is circulated around the tubes causing the ice tubes to melt and slide down. As the ice falls from the tubes it is broken by a rotating knife blade to a desired size. The ice tubes are about 50 mm in diameter with a wall thickness of 10-12 mm.

Advantages of tube ice

1. Immediate supply: The major advantage of tube ice over the block ice is that the continuous and immediate supply of ice is possible in the former case while the latter needs to run about 24 hours for getting ice ready for use. In the case of tube ice machine, the ice production can be expected within 15 minutes from starting the machine and ice can be received in batches at repeated intervals.
2. No injury to fish: Tube ice is having smooth outer surface and therefore will not cause any injury to fish body. It is also found that ice need not to be crushed for using in crates with fish. Moreover since there is no need of crushing, no loss of ice will be happen due to crushing process.
3. Hygienic production: The most advantage of tube ice machine is

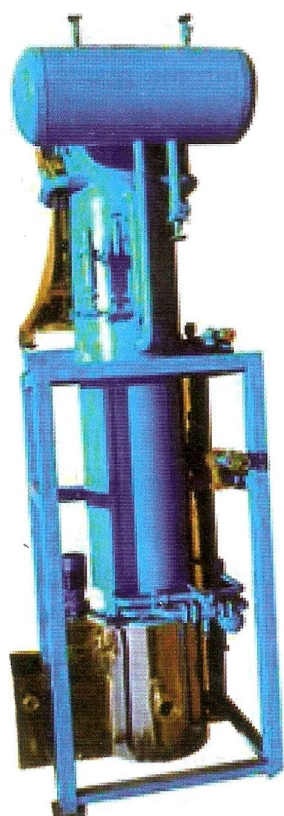


Fig. 2. Image of Tube ice unit

that ice can be produced with less handling and therefore the quality of the ice is much superior to that of block ice plants.

Flake ice

Flake ice machine is widely used in IQF seafood plants but the use of this ice is not advisable for fishing harbours and fishing vessels as it may melt easily when compare to block ice and tube ice. But is highly useful where immediate chilling is required and thereby find immense use in the chilling units of IQF plants. Flake ice is formed by spraying water over the surface of a refrigerated drum to freeze it and then mechanically removing it with a blade. Image of flake ice plant is shown in Figure 3. In some models the drum rotates against a stationary scraper on its outer surface; in others the scraper rotates and removes ice from the inner double-walled stationary drum. No water is sprayed on the drum immediately in front of the scraper, so that the water is

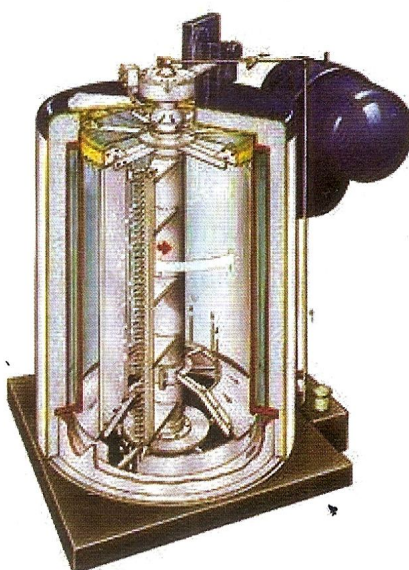


Fig. 3. Diagrammatic representation of Flake ice machine

completely frozen and dry on removal. Ice produced by this method is commonly 2-3 mm thick.

Flake ice machines are fabricated and supplied in capacity ranging from 1 TPD to 50 TPD of ice by various companies in India. All water used by flake ice machines is converted to ice, therefore there is no wastage or spillage.

Advantage: Most of the seafood factories are having this flake ice machine especially in IQF factories. Unlike tube ice machine, flake ice machines do not require much manpower and also need less handling as the ice can be produced directly in to the area designed. Therefore the ice produced by these machines is considered to be best in terms of quality and hence it is widely used inside the factories especially for IQF. Moreover the space needed for establishing the ice plants is considerably less in comparison to that of Block ice plants.

Slurry ice

It is a new addition in the seafood industry in India and a couple of companies in Mumbai are already supplying the plants to the industry. Slurry ice is a high performance heat transfer agent that can be applied in many traditional cooling applications. Slurry ice is a water-based solution mixed with ice crystals which can be produced by mixing water with a freezing point suppressant and then cooling this mixture so the ice crystals can be formed. The subsequent temperature of the slurry ice solution depends on the percentage and type of additives used to suppress the freeze point.

Common suppressants include sugars, salts, glycols, and alcohols. The microscopic ice crystal size provides a large total surface area for very efficient heat transfer.

It provides the following advantages:

- ▶ Product is cooled faster - the smooth round shape of the small crystals ensures maximum surface area contact with the product and as a result, faster heat transfer.
- ▶ Better product protection - the smooth, round crystals do not damage product, unlike other forms of sharp, jagged ice (flake, block, shell, etc.).

▶ Even cooling - unlike other irregular shaped ice which mostly conducts heat through the air, the round shape of the slurry crystals enables them to flow freely around the entire product, filling all air pockets to uniformly maintain direct contact and the desired low temperature.

▶ The slurry ice machine can be fixed onboard fishing vessels hence they no need to collect ice from harbour before going for fishing.

▶ Slurry ice provides low temperature between -20 C and -40 C ensuring rapid cooling for fish.

▶ Onboard ice machines can produce ice slurry using seawater.

Conclusion

Ice plants have become one of the most important components in the entire chain of handling, transportation and processing of fish. Understanding the prime importance of availability of good quality ice for the seafood industry, various types of ice plants are being produced and supplied in the country besides Importing of ice plants from countries like China, Germany etc. It is high time the state and central governments agencies to come up with suitable assistance schemes to help the entrepreneurs to establish more ice plants in the fishing harbours and landing centres.

Contact details of a few Ice plant machinery manufacturers in India

1 Block Ice

Singhsons Refrigeration

No. 115, Hiranandani Industrial Estate, Kanjurmarg West, Mumbai - 400078, Maharashtra

Prithvi Precision Engineering Private Limited

G-4, B-Wing, Shri Pandit CHS Limited, Balrajeshwar Road Mulund West, Mumbai - 400080, Maharashtra

Summit Engineering Corporation

No. 34- A, Metcalfe Street, Kolkata - 700013, West Bengal

Sigma Overseas

4561/16, Ground Floor, Ansari Road, Darya Ganj, New Delhi - 110002, Delhi

Tracon Systems

New No. 39, Old No. 7/ V, North Mada Street, Theradi Thiruvottriyur, Chennai - 600019, Tamil Nadu

2 Containerized Ice

Frenco Engineers

CRA-51, Chukkingal Road, Palarivattam, Cochin-682025. e-mail : info@frencoengineers.com.

3 Tube Ice

Push Engineering Pvt. Ltd.

Plot No. 7 & 8, Gat No. 125/126/127 Pirangut, Tal. Mulshi, Pune - 412115, Maharashtra

Gurdev Icecans Refrigeration Industries

No. 20 Rainbow I. E., Opposite Seepz, Behind Floral Deck Plaza, MIDC, Andheri East, Mumbai - 400093, Maharashtra

Prithvi Precision Engineering Private Limited

G-4, B-Wing, Shri Pandit CHS Limited, Balrajeshwar Road Mulund West, Mumbai - 400080, Maharashtra

Tracon Systems

New No. 39, Old No. 7/ V, North Mada Street, Theradi Thiruvottriyur, Chennai - 600019, Tamil Nadu

Summit Engineering Corporation

No. 34- A, Metcalfe Street, Kolkata - 700013, West Bengal

4 Flake Ice

Singhsons Refrigeration

No. 115, Hiranandani Industrial Estate, Kanjurmarg West, Mumbai - 400078, Maharashtra

Ayush Refrigeration Verified Supplier

Sardar Estate, Isanpur Narol Road, Ahmedabad - 382345, Gujarat

Prithvi Precision Engineering Private Limited

G-4, B-Wing, Shri Pandit CHS Limited, Balrajeshwar Road Mulund West, Mumbai - 400080, Maharashtra

Premier Refrigeration Limited

Akurli Industrial Estate, Akurli Road Next To Big Bazar, Kandivli East, Mumbai - 400101, Maharashtra

Summit Engineering Corporation

No. 34- A, Metcalfe Street, Kolkata - 700013, West Bengal

5 Slurry Ice

Allstate Group

No. 901, Maker Chambers, V Nariman Point, Mumbai - 400021, Maharashtra

Industrial Refrigeration Private Limited

No. 901, Maker Chambers V, Nariman Point, Mumbai - 400021, Maharashtra

ABP Engineers & Consultants

91, Perumal Nagar, Thirumudivakkam Industrial Estate, Thirumudivakkam, Chennai - 600044, Tamil Nadu

Mayekawa India Private Limited

Omer Mansion, Room No. 2c, 3rd Floor 29 A Weston Street, Kolkata - 700012, West Bengal



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