

Fluid Ice Systems

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In recent years fluid ice (also known as slurry ice, flow ice, liquid ice, slush ice or gel ice) has been establishing itself as a food refrigerant. New techniques and equipment have succeeded in increasing the refrigeration capacity of fluid ice, which in its simplest form is a mixture of water, ice and brine. The latest Fluid Ice Systems (FIS) can mix ice, water and brine in various proportions, as well as producing ice crystals of different sizes. Total ice crystal surface area in the ice mixture has a decisive effect on its refrigeration capacity.

Fluid ice can be mixed to produce different temperatures and ice volume. The user can select a suitable temperature for the product and mix in the correct volume of ice needed to maintain it during the refrigeration process or for the product storage time.

Refrigeration properties of FIS

The refrigeration properties of FIS appear to be as follows

10 times faster cooling rate than conventional freshwater ice

6 times faster cooling rate than brine ice
4 times faster cooling rate than in RSW systems (Refrigerated sea water)

Freshwater ice melts at 0°C - the standard freezing point. Brine or saltwater is used to achieve better conductivity of energy in the ice mixture, since salt lowers the melting point of the mixture to below 0°C . The small size of the ice crystals creates a very large surface area of ice which the salt is able to reach, in effect forcing it to melt. Melting the ice requires a considerable amount of energy, which the mixture absorbs from its immediate environment. Fluid ice interacts very favourably with insulated fish containers, since they ensure that the energy required to melt the ice is not taken from anywhere else than the product which is stored in them. The fast rate at which the product cools down to its optimum storage temperature gives micro-organisms and enzymes much less time to multiply.

Many food company managers have taken advantage of FIS and realize the great potential this technique offers for

maintaining higher raw material quality. One example is the well known Scottish fish farming company Marine Harvest, which uses FIS to transport fresh salmon in 1,000-litre insulated fish containers from on-growing cages to the packaging station. A powerful fluid ice mixture ensures swift, effective refrigeration of the fish, while the insulated containers ensure that the fluid ice only reaches the product when the ice melts. The fish cools by some $10-12^{\circ}\text{C}$ in a short space of time, which ensures that the freshness of the product is delivered all the way to the customer.

One of Iceland's newest and most sophisticated additions to the trawler of RSW refrigeration. The trawler is fitted with equipment capable of producing up to 270 tonnes of fluid ice per 24 hours. Fluid ice ensures powerful refrigeration and also maximum product quality.

Furthermore, fluid ice is used for numbing salmon before it is slaughtered, instead of carbon dioxide. People who use this technique say refrigeration in fluid ice before slaughtering has a better effect on the fish and

reduces stress and lactic acid formation in its muscles. The effect of fluid ice has been to increase output from refrigeration and bleeding tanks in salmon harvesting, since it delivers a much higher production of refrigeration than RSW systems which have been used for the same purpose.

Fluid ice is used in fish tubs for refrigeration on board boats and other vessels. The product cools down very rapidly in the fluid, which enters both the belly and head of the fish. This yields a more attractive flesh texture and red gills, while product quality and

storage life are enhanced. Also, everything suggests that weight loss is lower than dry-icing of catches, possibly even none at all.

Flexible technique

FIS is a highly flexible technique which has boosted the usefulness of ice. The user can control the temperature and tailor the volume of ice in the mixture to different lengths of storage time. Fluid ice is easy to pump over long distances, to link up to automatic systems such as raw material graders, to use for maintaining controlled temperatures in raw

material stores, for automatic icing into insulated containers, tubs or boxes and spraying of products on lines to prevent heating during processing – and much more besides.

This description is only a brief outline of the many uses and properties of fluid ice, which clearly offers huge potential. FIS systems have opened up a wide range of applications and reduced investment costs in equipment for fluid ice production.

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