



## Creators of Bubble Slurry™ Ice

**Rapid and sufficient chilling of FISH prevents injuries, trauma, infections and rot. The result is a larger catch of better quality FISH with a longer shelf life.**

Good slaughter management affects fish welfare and quality. In order to maximize earnings and to meet customer demands, attention should be given to:

**Product Quality, Consumer Safety, and Animal Welfare.**

Fish begins to spoil immediately after it has been caught or harvested, caused by rapid rigor mortis, enzyme activity, parasites and bacteria. The spoilage process becomes noticeable by an increasingly unpleasant smell, an unappetizing appearance, the softening of its texture, and an unpleasant taste. Spoiled fish has no nutritional value due to a loss of protein, oil and fat. Consuming spoiled fish is a serious health hazard.

	Good Slaughter Management Results in:	Poor Slaughter Management Results in:
Animal welfare	Rapid, "more humane kill"	Trauma and suffering
Appearance	Unblemished appearance Solid texture Shiny skin Brightly colored	Injuries and blemishes Gaping of flesh Slimy skin Dull and discolored
Sensory Qualities	Fresh smell Mouth-watering taste Firm on touch	Unpleasant odor Stale flavor Softening of the flesh
Quality	Weight retention Prevention of bacterial growth Long shelf life Higher income Consumer satisfaction	Weight (fluid) loss Bacterial proliferation Short shelf life Rapid decay Health hazard



Spoilage can be dramatically delayed by:

- rapidly lowering the core (= internal) temperature of fish to 0°C (32°F) as soon as it has been caught or harvested, and
- keeping that temperature at 0°C (32°F) from-catch-to-consumer, the "cold chain".

The shelf life of fish can be increased with:

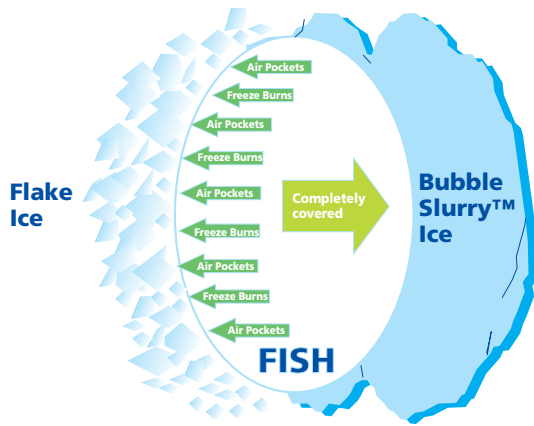
- thirty to fifty percent, if chill-killed\* in 15-30 minutes after catch or harvest;
- one day for each 1°C (or 2°F) below 8°C (46°F) core temperature.

\* "chill-kill is slaughtering fish by hypothermic shock, created by immersion in liquid or slurry ice"(such as Crytec's Bubble Slurry™ Ice

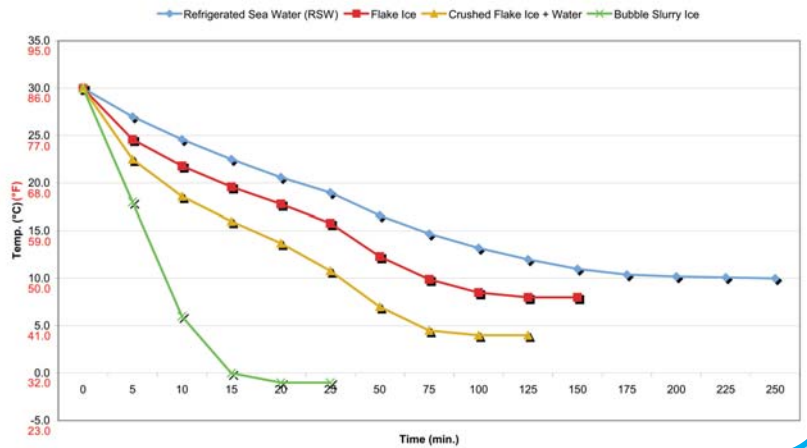
Fish quality also depends on a less traumatic slaughtering method. By rapidly chill-killing fish in Bubble Slurry™ Ice, it struggles less, which prevents injuries, flesh gaping, weight loss, and unwanted biological and chemical reactions that degenerate the fish quality.

Showing the difference between Flake Ice and Bubble Slurry™ Ice

Graphic display of how rapid Bubble Slurry™ Ice chills compared to other methods. In the experiments 330g (12oz) Seabream with an initial fish temperature of 30°C (86°F) was used.



### Chilling Seabream



Traditional fish cooling methods, such as using RSW (Refrigerated Sea Water), flake ice or other forms of hard ice, usually do not chill-kill fish fast enough (see graph above), leaving the core temperature of fish at too high values.

Slurry ice is a suspension of a crystallized, water-based, ice solution. It has better cooling capabilities than the traditional methods because of a larger heat exchange surface area, providing a 3 to 5 times larger cooling capacity.

The first generation slurry ice machines have not changed much during the past 25 years. They use a commonplace icemaking technology, which requires the use of knives or scrapers to harvest the ice, and consume a substantial amount of electricity. As a result of this forceful and complex icemaking process, these first generation machines have a poor reliability record.

Crytec's second generation slurry ice machines produce a unique Bubble Slurry™ Ice, a mix of microscopically small ice crystals, air or gas bubbles, and water. Its temperature is around -2.5°C (+27.5°F) without freezing up or coagulating. Its physical properties permit it to be pumped through pipes or tubes up to 100 m (300 ft). The patented icemaking process of Crytec's Wiped Surface Crystallizer does not require intense scraping or pressures to make the Bubble Slurry™ Ice mix. Crytec's machines produce more pure ice than any of its competitors per unit of electricity, physical size/footprint or price. Crytec's Bubble Slurry™ Ice machines are not only seen as a replacement of traditional icemakers, but also as the best alternative for the first generation slurry ice machines.

Crytec has installed Bubble Slurry™ Ice machines on fishing vessels in Mauritania, Netherlands, Norway and Russia, and on fish breeding farms in Greece, Israel, Italy, Mexico and Turkey.



As requested by fishing boat owners we have designed a tandem set of 2 CR-004 Bubble Slurry™ Ice machines, operated by 1 controller. The system guarantees continual Bubble Slurry™ Ice production while at sea, and allows the use of one single CR-004, if a catch is small.

Specifications are subject to change without notice.  
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