



CORNERSTONE  
INTERNATIONAL  
BEYOND LIMITS

# Super Cooling System

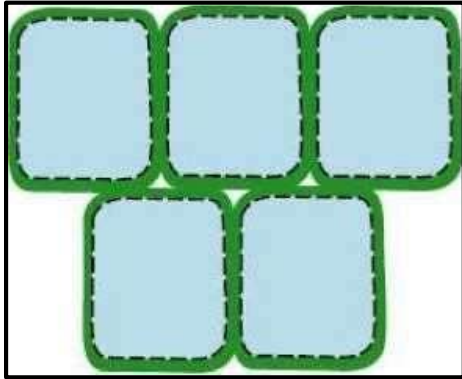
# Problem with Freezing

## Effects Of Freezing

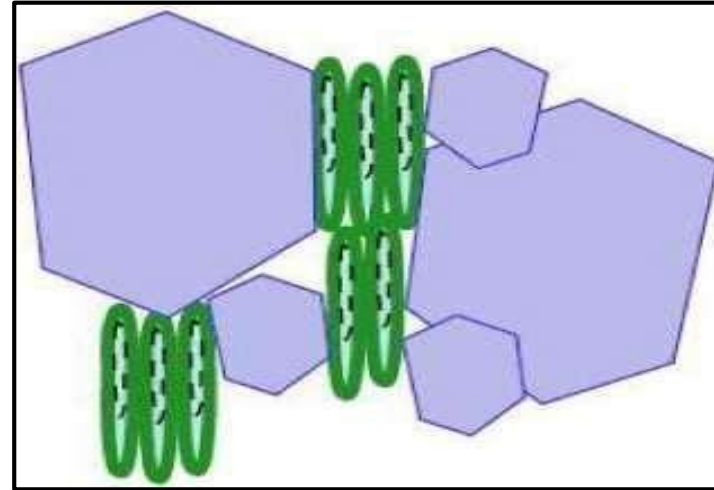
- **Damage caused to cells by ice crystal.**
- **Freezing causes negligible changes to pigments, flavours or nutritionally important components.**
- **When water in the cells freezes, an expansion occurs and ice crystals cause the cell walls to rupture.**
- **The texture of the produce is generally much softer after thawing when compared to non-frozen produce.**
- **Chemical changes that can cause spoilage and deterioration of fresh fruits and vegetables will continue after harvesting.**
- **Development of rancid oxidative flavours through contact of the frozen product with air.**

# Problem – Effect of Freezing on Cells

## Fresh



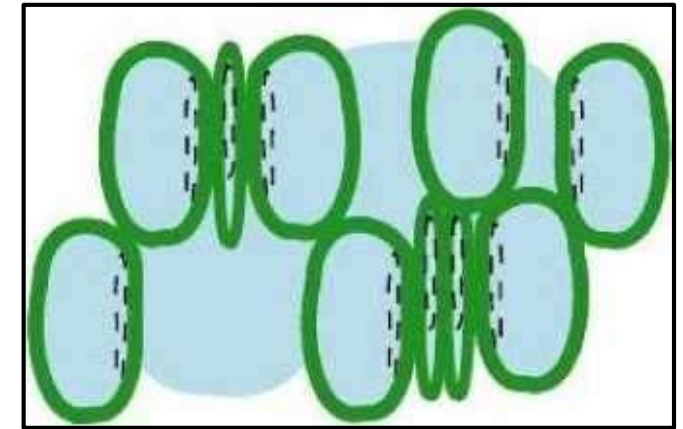
## Frozen



### Freezing

- Growth of ice crystals.
- Compression of cells.
- Extra crosslinks in CWM.

## Thawed



### Thawing

- Partial reswelling of CWM.
- Melt water in extracellular space.

### Texture softening

- Loss of turgor
- Separation of cells (loss of pectin).
- Softer Cell Wall Material (CWM).

# Problem with Freezing

Physical Changes and Quality	Effect
Dehydration or weight loss	Moisture lost
Recrystallization	Toughening of tissue
Retrogradation	Starch loses moisture
Protein Denaturation	Decrease of protein solubility , diminishing the nutritional value.
Freezer Burn	Unsightly white colour
Glass Formation	Decrease in sugars and an increase in starch
Functional Properties	1. Firmness decreased, rupture strain increased, and consequently crispness decreased
	2. Flavour change
	3. Dry and cottony texture in fish

# Problem with Freezing

Chemical Changes and Quality	Effect
Rancidity	1. Loss of colour, and development of off-flavours
	2. Oxidation in muscle tissue
Colour Loss	Change due to biochemical or physicochemical mechanisms
Flavour and Aroma Loss	1. Due to a rapid decomposition and diffusion of esters
	2. Chemical production of H <sub>2</sub> S, presence of sulphur compound
	3. In Seafood, enzymatic decomposition, textural breakdown and resulted in a cottony or spongy texture
Vitamin Loss	1. Destruction of vitamin C (ascorbic acid)
	2. Vitamin B losses sometimes occur in frozen meat products
Release of Enzymes	Disruption of the tissue
Hydrolysis	Reducing sugars
Acetaldehyde Formation	Textural changes in fish species



# Global food waste

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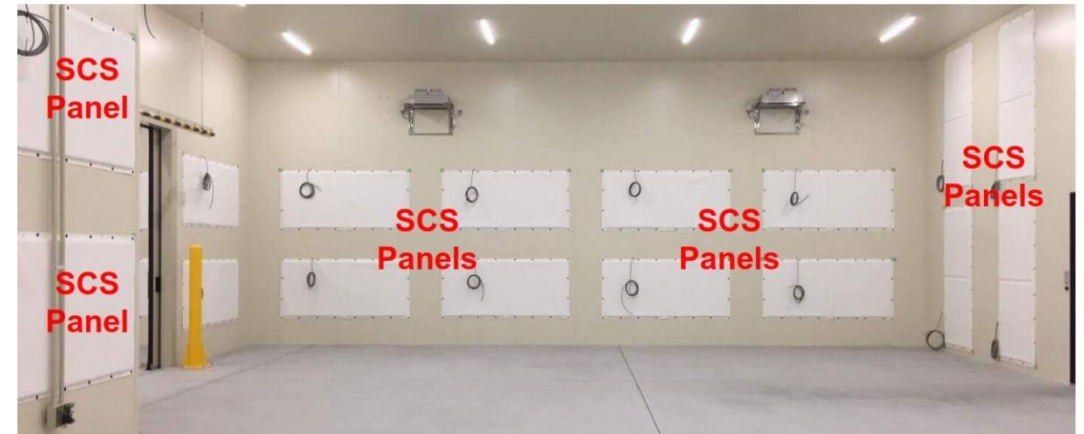
- 45% fruit and vegetables
- 35% fish and seafood
- 30% grains
- 20% meat
- 20% dairy

# THE SOLUTION – SUPERCOOLING

## Cold Chain Warehouses

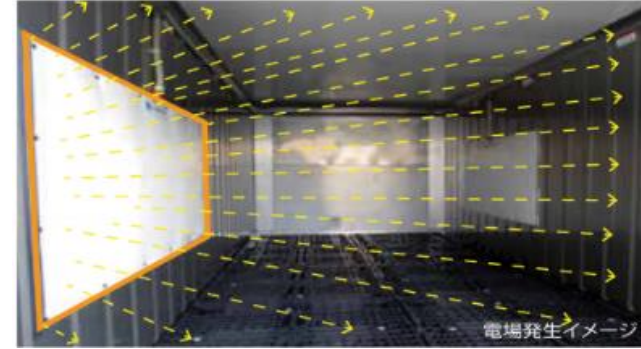
# Super Cooling

- Simple
- Efficient
- Minimal space
- Flexible design
- Japanese innovation



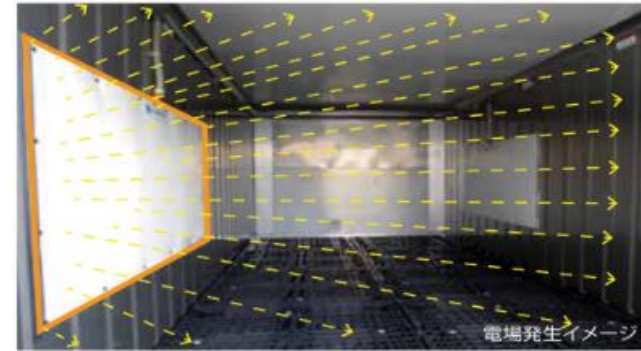


# What is Super Cooling System (SCS)?



- The SCS technology uses electric field to create an environment preventing water molecules from bonding together to form ice crystal.
- Hence, food will not freeze below subfreezing temperature ( $0^{\circ}\text{C}$  to  $-7^{\circ}\text{C}$ ) and will retain 99% of its moisture.
- The cell in fresh produce, meat and fish are still alive and breathing when they are stored in the refrigerators. The cell will stay alive for a period of time before the cell die and they will start to decay.

# What is Super Cooling System (SCS)?



- By installing a Super Cooling System the electric field will stimulate the enzyme in the cell to further slow down the breathing thus prolonging the shelf-life further.
- SCS also maintains the moisture, freshness and further.
- No need to thaw food, saves time in food preparation.
- Contains the spreading of mouldy spore in fresh produce, reduces spoilage.

# Industry usage



Restaurants



Cruise ships



Wholesale suppliers



Fruit and vegetable processors



Abattoirs



Distributors



Freight companies

# Product success

Chicken

Beef

Fish

Cut fruit and vegetables

Flowers

# Super CoolingSystem

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FOOD PRESERVATION  
TECHNOLOGY



REDUCE WASTE



IMPROVE FOOD  
QUALITY



INCREASE PROFIT  
MARGINS



# Food preservation

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- Delays bacterial growth
- Retains moisture
- Increases shelf life
- Maintains texture and flavour



# Improves food quality

Bacterial growth rate comparison between Supercooling system and a standard fridge.

		Chicken Fillets		Tenderloins		Wings	
		Super cool	Fridge	Super cool	Fridge	Super cool	Fridge
<b>Day 8</b>	SPC	2,300	690,000	4,500	26,000	4,700	740,000
	Coliforms	2	53	10	100	2	11
<b>Day 11</b>	SPC	19,000	4, 100, 100	20,000	3,200,000	38,000	890,000
	Coliforms	7	84	30	110	28	400
<b>Day 14</b>	SPC	66,000	1,500,000	110,000	5,400,000	52,000	5,400,000
	Coliforms	63	940	90	300	70	640

**SPC:** Total number of bacteria

**Coliforms:** Indicates hygiene of product

# Making sense of the numbers

Bacterial growth rate comparison between Supercooling system and a standard fridge.

		Chicken Fillets		Tenderloins		Wings	
		Super cool	Fridge	Super cool	Fridge	Super cool	Fridge
<b>Day 8</b>	SPC Coliforms		300X 27X		6 X 10 X		157X 6 X
<b>Day 11</b>	SPC Coliforms		216 X 12 X		160 X 4 X		23 X 14 X
<b>Day 14</b>	SPC Coliforms		23 X 15 X		49 X 3.3 X		23 X 9 X

**SPC:** Total number of bacteria

**Coliforms:** Indicates hygiene of product

# Increase profit margins



Reduced labour costs



Purchase in larger volumes/ stock management



Decrease power costs





# Our Technology



- **SCS panels can be retrofitted onto any existing commercial refrigerator, freezer, and cold storage facility avoiding costly modifications or new builds.**
- **Flexible modular design customizable to allow deployment to wide range of storage facility.**
- **‘Plug and Play’ installation process ensures easy installation and minimal operational disruptions.**

PRIVATE & CONFIDENTIAL

CLASSIFICATION	ITEM	RECOMMENDED TEMPERATURE (°C)	HUMIDITY (%)	PERIOD (NO OF DAYS)
Fruit	Apricot	-0.5	90 ~ 95	7 ~ 21
Fruit	Apple	1 ~ 2		250 ~ 300
Fruit	Avocado	4.4 ~ 13	85 ~ 90	14 ~ 56
Fruit	Blueberry	-0.5	90 ~ 95	14
Fruit	Banana (ripe/mature)	12 ~ 14	90 ~ 95	180
Fruit	Chestnut (Tsukuba)	0		210 ~ 240
Fruit	Fig	0	85 ~ 90	7 ~ 10
Fruit	Grape (from Europe)	-1	90 ~ 95	30 ~ 180
Fruit	Grape (from USA)	-1	90 ~ 95	30 ~ 180
Fruit	Grape (from Japan)	2	90 ~ 95	120
Fruit	Grapefruit (from Florida)	10 ~ 15		42 ~ 56
Fruit	Grapefruit (from California)	14 ~ 15.5		42 ~ 56
Fruit	Green Ume (Shirakaga)	15		14
Fruit	Kiwi	0 ~ 2	90 ~ 95	90 ~ 150
Fruit	Loquat	0	90	21
Fruit	Lemon (from Japan)	4		90
Fruit	Melon (Cantaloupe)	4 ~ 5		30
Fruit	Melon (Honeydew)	2 ~ 2.5		25 ~ 30
Fruit	Mandarin Orange	3 ~ 4		50 ~ 180
Fruit	Mango (from Japan)	2 ~ 2.5		25 ~ 30
Fruit	Orange (from Florida)	0 ~ 1	85 ~ 90	56 ~ 84
Fruit	Orange (from California)	4 ~ 9	85 ~ 90	21 ~ 56
Fruit	Plum	0	90 ~ 95	14 ~ 35
Fruit	Peach (Ohkubo)	0 ~ 2	90 ~ 95	28 ~ 30
Fruit	Pear (Bartlet)	0		90
Fruit	Japanese Pear (Kikusui/Shinko)	0 ~ 2		90 ~ 180
Fruit	Japanese Pear (Twentyth century)	0 ~ 2		270 ~ 360
Fruit	Pineapple	7 ~ 13	85 ~ 90	14 ~ 28
Fruit	Persimmon (Fuyu-gaki)	0	90	180
Fruit	Persimmon (Hiratanenashi-gaki)	0	90	90
Fruit	Strawberry	0 ~ 2	85 ~ 90	10 ~ 15
Fruit	Watermelon	10	85 ~ 90	14 ~ 28
Vegetable	Asparagus	1 ~ 2	95	21 ~ 30
Vegetable	Broccoli	4	95	40 ~ 50
Vegetable	Beat	0	95 ~ 100	
Vegetable	Brussels Sprouts	0	90 ~ 95	20 ~ 30
Vegetable	Cabbage (Stored early)	0 ~ 4	90 ~ 95	90
Vegetable	Cabbage (Stored later)	0 ~ 4	90 ~ 95	30 ~ 60
Vegetable	Chinese Cabbage	0	90 ~ 95	60 ~ 120

Vegetable	Cauliflower	0	95	28 ~ 35
Vegetable	Cucumber	8 ~ 10	90 ~ 95	10 ~ 14
Vegetable	Celery	0~0.6	95	16 ~ 30
Vegetable	Chinese Yam	3 ~ 5		240 ~ 300
Vegetable	Dropwort	0 ~ 1.7	90 ~ 95	3 ~ 4
Vegetable	Eggplant	8 ~ 10	90 ~ 95	7
Vegetable	Ebible Chrysanthemum	0		5 ~ 10
Vegetable	Green Pepper	7 ~ 10	90 ~ 95	14 ~ 21
Vegetable	Green Beans	7 ~ 8	90 ~ 95	7 ~ 10
Vegetable	Green Soybeans	0	95	15 ~ 20
Vegetable	Greenpeace	0	90 ~ 95	7 ~ 14
Vegetable	Garlic	0	65 ~ 70	300 ~ 360
Vegetable	Ginger	13 ~ 15		180 ~ 300
Vegetable	Japanese Mustard	0		15 ~ 20
Vegetable	Japanise Radish (without leaves)	0	90 ~ 95	60 ~ 120
Vegetable	Japanese Zinger (Mioga)	0		6 ~ 10
Vegetable	Leek (Chinese Chive)	0	90 ~ 95	30 ~ 90
Vegetable	Leek (Green Onion)	0	90 ~ 95	7 ~ 10
Vegetable	Leaf Lettuce	0		
Vegetable	Lettuce	0	95 ~ 100	28 ~ 42
Vegetable	Mushrooms	0	90	6 ~ 8
Vegetable	Mushrooms - Shiitake	-2	90	30
Vegetable	Onions	0 ~ 1	65 ~ 75	240 ~ 365
Vegetable	Okra	10 ~ 15	90 ~ 95	10 ~ 15
Vegetable	Peas	0	90 ~ 95	28
Vegetable	Parsly	0	90 ~ 95	30 ~ 50
Vegetable	Potato (May queen)	3	90	210 ~ 240
Vegetable	Potato (Irish cobbler)	3	90	240 ~ 300
Vegetable	Pumpkin	10 ~ 13	70 ~ 75	60 ~ 90
Vegetable	Sweet Corn	0 ~ 1	95	30
Vegetable	Spinach	0 ~ 1	95 ~ 100	30
Vegetable	Sweet Potato	13 ~ 16	85 ~ 90	120 ~ 210
Vegetable	Tomato (Green)	13 ~ 18	85 ~ 90	7 ~ 21
Vegetable	Tomato (Red)	2 ~ 7	85 ~ 90	4 ~ 7
Vegetable	Taro	7 ~ 10		60 ~ 120
Vegetable	Turnip	0	90 ~ 95	120 ~ 150

# Putting Super Cooling System to the Test - Broccoli

**Broccoli stored in commercial refrigerator installed with SCS  
at 4°C after 50 days**



*The above result is obtained from storing the Broccoli in correct environment and it may vary from country to country.*



# Putting Super Cooling System to the Test - Cabbage

**Cabbage stored in commercial refrigerator installed with SCS  
at 4°C after 50 days**



*The above result is obtained from storing the Cabbage in correct environment and it may vary from country to country.*



# Putting Super Cooling System to the Test – Napa Cabbage

**Napa Cabbage stored in commercial refrigerator installed with  
SCS**

**at 4°C after 50 days**



***The above result is obtained from storing the Napa cabbage in correct environment and it may vary from country to country.***

# Putting Super Cooling System to the Test - Scallions

**Scallions stored in commercial refrigerator installed with SCS  
at 4°C after 50 days**



*The above result is obtained from storing the Scallions in correct environment and it may vary from country to country.*

# Putting Super Cooling System to the Test - Asparagus

**Asparagus stored in commercial refrigerator installed with SCS  
at  $-1^{\circ}\text{C}$  after 35 days**



*The above result is obtained from storing the Asparagus in correct environment and it may vary from country to country.*

# Putting Super Cooling System to the Test - Peach

**Peaches stored in commercial refrigerator installed with SCS  
at 2°C after 30 days**



*The above result is obtained from storing the Peaches in correct environment and it may vary from country to country.*



# Putting Super Cooling System to the Test – Strawberry

**Strawberries stored in commercial refrigerator installed with  
SCS  
at 2°C after 15 days**



*The above result is obtained from storing the Strawberries in correct environment and it may vary from country to country.*

# With Super Cooling



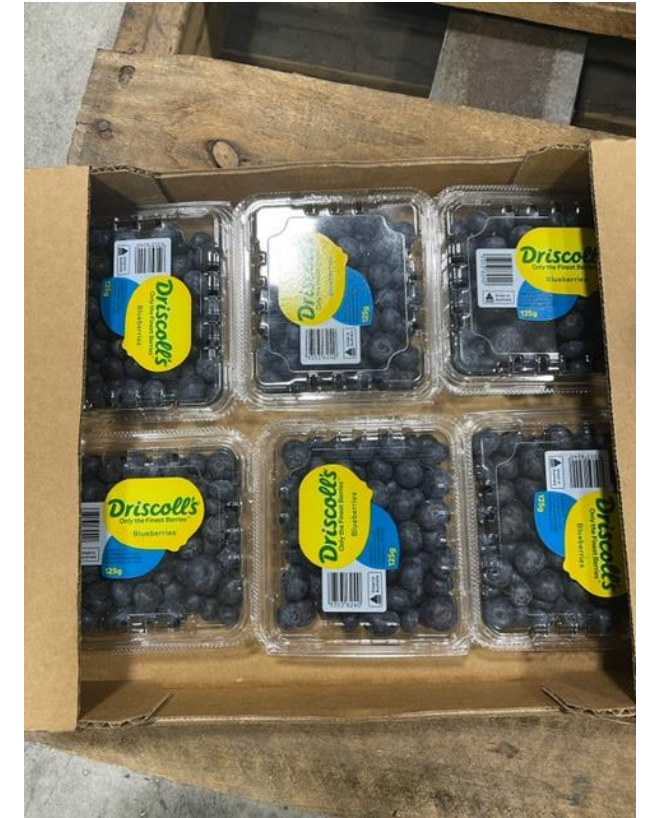


# Normal cool room



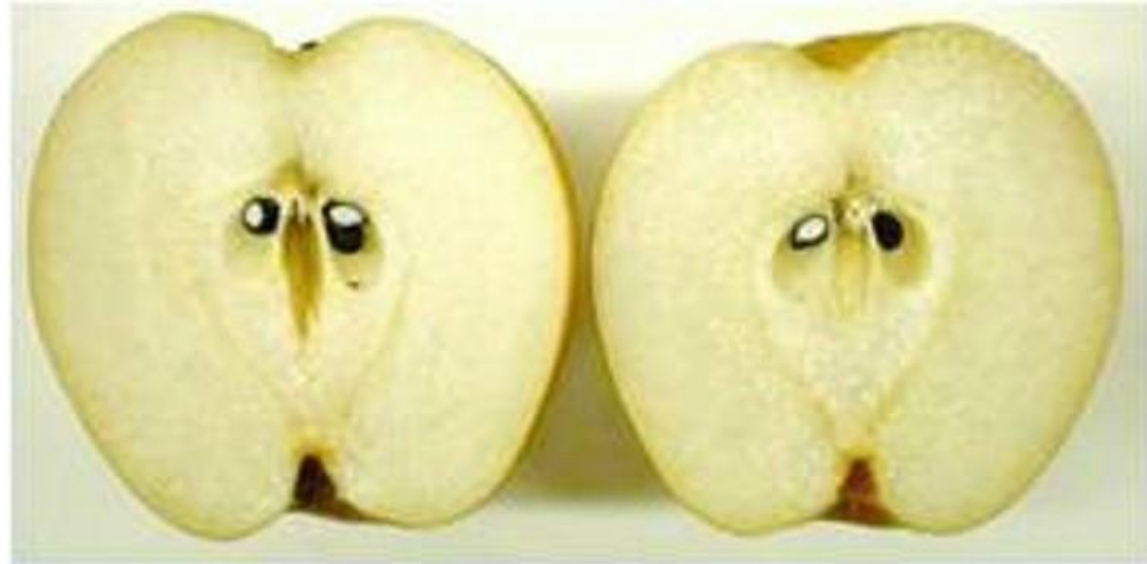


# With Super Cooling



# Putting Super Cooling System to the Test - Pear

**Pears stored in commercial refrigerator installed with SCS  
at  $-2^{\circ}\text{C}$  after 180 days**



*The above result is obtained from storing the Pears in correct environment and it may vary from country to country.*

# Putting Super Cooling System to the Test - Lemon

**Lemons stored in commercial refrigerator installed with SCS  
at 4°C after 90 days**



*The above result is obtained from storing the Lemons in correct environment and it may vary from country to country.*



# Putting Super Cooling System to the Test - Apple

**Apple stored in commercial refrigerator installed with SCS  
at 2°C after 300 days**



*The above result is obtained from storing the Apple in correct environment and it may vary from country to country.*

# Putting Super Cooling System to the Test - Kiwi

**Kiwi stored in commercial refrigerator installed with SCS  
at 1°C after 150 days**



*The above result is obtained from storing the Kiwi in correct environment and it may vary from country to country.*



# Putting Super Cooling System to the Test - Grapes

**Grapes stored in commercial refrigerator installed with SCS  
at 2°C after 120 days**



*The above result is obtained from storing the Grapes in correct environment and it may vary from country to country.*

# Putting Super Cooling System to the Test - Mango

**Mango stored in commercial refrigerator installed with SCS  
at 2°C after 20 days**



*The above result is obtained from storing the Mango in correct environment and it may vary from country to country.*

# Putting Super Cooling System to the Test - Melon

**Melons stored in commercial refrigerator installed with SCS  
at 2°C after 30 days**



*The above result is obtained from storing the Melons in correct environment and it may vary from country to country.*



# Putting Super Cooling System to the Test - Aging of Wagyu Beef

**Aging of Wagyu Beef stored in commercial refrigerator installed with  
SCS**

**at  $-3^{\circ}\text{C}$  after 35 days**



**“BIFUTEKI NO KAWAMURA in JAPAN” a steakhouse chain specializing in the finest Kobe Beef uses SCS to age their Wagyu Beef.**

*The above result is obtained from storing the Wagyu Beef in correct environment and it may vary from country to country.*

# Putting Super Cooling System to the Test – Canadian Tuna

**Fresh Canadian Tuna stored in commercial refrigerator installed with  
SCS  
at  $-2^{\circ}\text{C}$  after 7 days**

**(1)**

**WITHOUT  
SCS,  
temperature  
at  $4^{\circ}\text{C}$ .**



**(2)**

**WITH  
SCS installed.  
(preserved the  
freshness of  
the Tuna)**

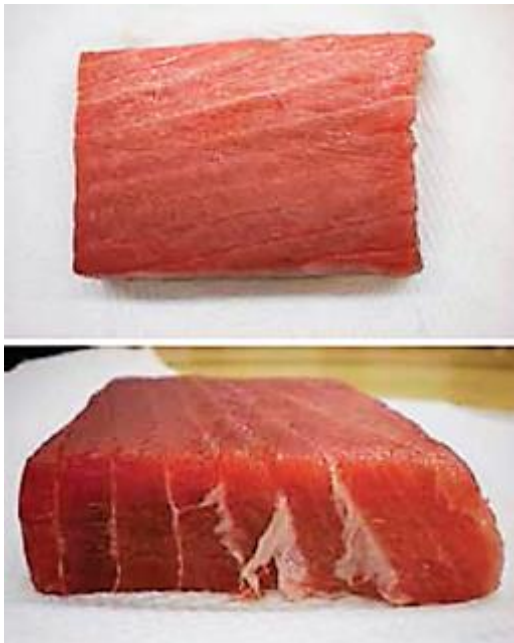
*The above result is obtained from storing the Fresh Canadian Tuna in correct environment and it may vary from country to country.*



# Putting Super Cooling System to the Test - Tuna

## Fresh Tuna Toro and Tuna Lean stored in commercial refrigerator installed with SCS at $-2^{\circ}\text{C}$ after 5 days

**Tuna Toro**



**Tuna Lean**



*“There is no problem in the taste and no fishy smell.”*

*“I am surprised that after taking out the tuna and left out in the open for one and a half hours at room temperature there is no discoloration at all.”*

**A Sushi Chef who operated 13 Sushi restaurants in Germany.**

***The above result is obtained from storing the Tuna in correct environment and it may vary from country to country.***

# Putting Super Cooling System to the Test – Sea Urchin

## Sea Urchin stored in commercial refrigerator installed with SCS at $-2^{\circ}\text{C}$ after 14 days



**WITH SCS Installed**

- *Physical appearance of sea urchin is preserved.*
  - *No shrinkage.*
  - *No discoloration.*



**WITHOUT SCS**

- *Sea urchin turned black.*
  - *Shrinkage.*

***The above result is obtained from storing the Sea Urchin in correct environment and it may vary from country to country.***

# Putting Super Cooling System to the Test – Red Tipped Grouper

## Red Tipped Grouper stored in commercial refrigerator installed with SCS at $-2^{\circ}\text{C}$ after 21 days



*There is no fishy smell when the fish is processed into fillets and they are ideal to be used for Sashimi*

*The above result is obtained from storing the Red Tipped Grouper in correct environment and it may vary from country to country.*

# Putting Super Cooling System to the Test - Yellowtail

## **Yellowtail stored in commercial refrigerator installed with SCS at $-1^{\circ}\text{C}$ after 4 days**



*There is no fishy  
smell when the  
fish is processed  
into fillets.*

*The above result is obtained from storing the Yellowtail in correct environment and it may vary from country to country.*



# Putting Super Cooling System to the Test – Fresh Flowers

## Chrysanthemum stored in commercial refrigerator installed with SCS after 30 days



*The above result is obtained from storing the Chrysanthemum in correct environment and it may vary from country to country.*



# Putting Super Cooling System to the Test – Fresh Flowers

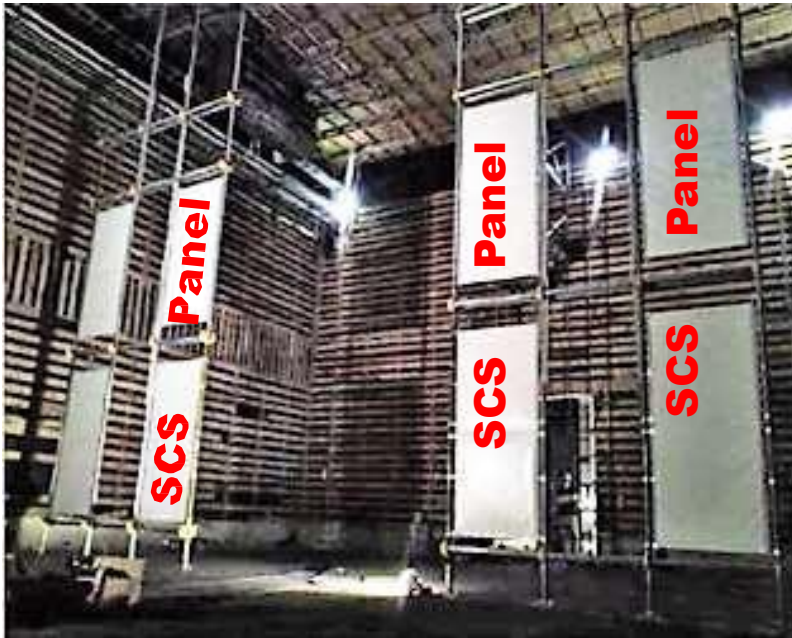
**Carnation stored in commercial refrigerator installed with SCS after 30 days**



*The above result is obtained from storing the Carnation in correct environment and it may vary from country to country.*

# Case Study 1 – Cold Storage Warehouse

**SCS panels in a cold storage warehouse to preserve 8,000 cartons of onions.**



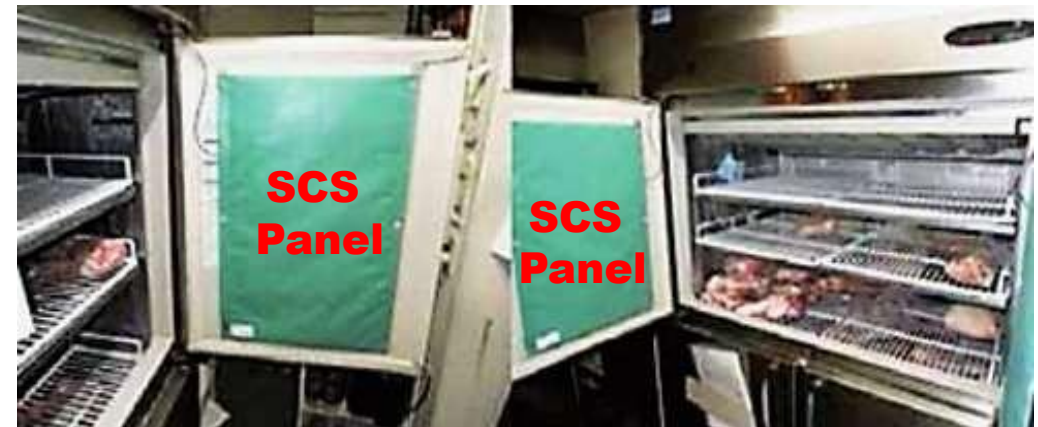
**The Super Cooling System installed in the cold storage warehouse prevents the onion from growing shoots.**



# Case Study 2 – Restaurant

**A steakhouse chain specializing in finest Kobe Beef.**

**The restaurant installed SCS in their cold storage facilities to help with the beef ageing process.**



## Case Study 3 – Catering

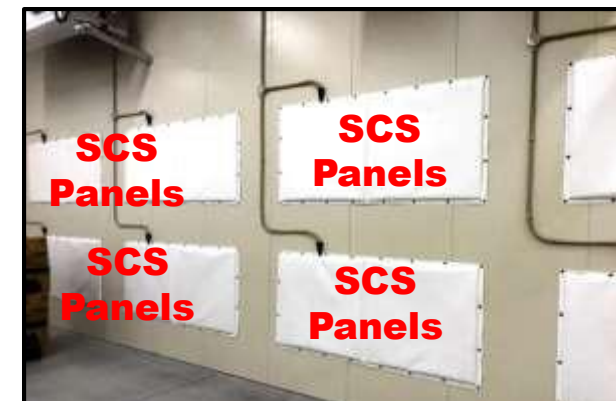
**DAIICHI Hotel in Tokyo faces time constraints frequently when preparing for hotel banquets. With the installation of SCS in their cold storage facilities, the chefs are able to prepare the food in a quicker pace because no defrosting is required. By not defrosting needlessly, the wastage of ingredients are greatly reduced.**





# Project References

## A 10,000 Square Meters Cold Warehouse Commissioned in Tokyo, Japan.



# Project References

**Ageing of Wagyu Beef stored in commercial refrigerator installed with SCS at  $-3^{\circ}\text{C}$**



**“This was done in a steakhouse chain specializing in finest Kobe Beef.**

# Electricity Consumption

**The power consumption for a SCS Power Supply Unit is 50 VA (Volt-amperes).**

**The power consumption for a SCS Panel is 6 VA (Volt-amperes).**

## Examples

**Power supply unit and 1 panel :  $50VA + 6VA = 56VA$**

**Power supply unit and 2 panels :  $50VA + 12VA = 62VA$**

**Power supply unit and 3 panels :  $50VA + 18VA = 68VA$**

## 1VA = 1 Watt

**For example we use 3 panels and 1 Power Supply Unit for 24 hours it will consume 68 VA  
or 68 Watts which is 1.632KWH.**

**If we assume \$0.2/KWH is Singapore current electricity price, then one day the  
electricity consumption will be \$0.33 per day.**



## B2B —CoolRooms



Growers



Cold Chain Logistics



Wholesalers



Trawlers



Retailers

## B2B —Home Refrigeration Manufacturers



Home Refrigeration

# B2B Customers.





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