

# Report of experiences and lessons learned from the validation of two Japanese solutions of food preservation

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**TRANSLATION DONE BY DEEPL**

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## CONTEXT



As a result of the work developed by **SAIOLAN in the** framework of the **ORHI Project**, in relation to the identification and assessment in Japan of innovative technologies aimed at improving food preservation, there are two technologies we have been working with during 2020:

- **HYOKAN** in the field of refrigeration and
- **TECHNICAN** in the field of deep freezing

We will now briefly describe both the technical principles on which they are based and the specific fields of application, as well as the results achieved so far in the use of demonstration equipments for both technologies with which we have been working. In both cases, they are technologies that have demonstrated their capacity to obtain good performance in food preservation and commercial success over the last few years in Japan and other far Eastern countries.

## 2. HYOKAN SUPPLY



<b>Company</b>	<b>HYOKAN SUPPLY</b>
<b>Product</b>	Refrigerators for the HRC channel and cold stores
<b>Technology</b>	<p>Generation of a high-voltage, low-intensity electric field that prevents water molecules in food, flowers, etc. from freezing at <math>-3^{\circ}\text{C}</math>.</p> <p>It allows:</p> <ul style="list-style-type: none"> <li>• Extend the shelf life of fresh food by several days (even weeks in some cases).</li> <li>• Exceptional meat aging conditions (strong flavour enhancement without germ proliferation and weight loss).</li> </ul>
<b>Application</b>	In animal (fish, meat) and plant foodstuff (fruit, vegetables) and flowers
<b>References</b>	> 1,000
<b>Web</b>	<a href="http://www.hyokan-supply.com">www.hyokan-supply.com</a>

## 2. HYOKAN SUPPLY – Available range



HRC channel refrigerators



Showcases in flower shops



Cold stores

2. HYOKAN SUPPLY - Results achieved: **STRAWBERRIES**



Day 24<sup>th</sup>

Refrigerator



Source: Tests carried out at Agricultural Corp. Midori no Sato (Japan) with organic farming products

Day	Weight (g)			
	Refriger.		Hyokan	
	g	%	g	%
1 <sup>st</sup>	204		235	
4 <sup>th</sup>	203	-0,5	235	0
10 <sup>th</sup>	198	-2,9	234	-0,4
24 <sup>th</sup>	191	<b>-6,4</b>	233	-0,9
35 <sup>th</sup>	-	-	231	<b>-1,7</b>

Time	Sugar content (°Brix)	
	Refriger.	Hyokan
Day 1	17,2	17,2
Day 10	14,3	16,5
Day 24	11,3	15,1

## 2. HYOKAN SUPPLY - Results achieved

## SPINACH



Day	Sugar content (° Brix)	
	Refrige. 5°C	Hyokan 0°C
1 <sup>st</sup>	5,7	5,7
6 <sup>th</sup>	6,2	6,9
14 <sup>th</sup>	6,1	6,6
20 <sup>th</sup>	6,2	6,6
27 <sup>th</sup>	5,9	6,4

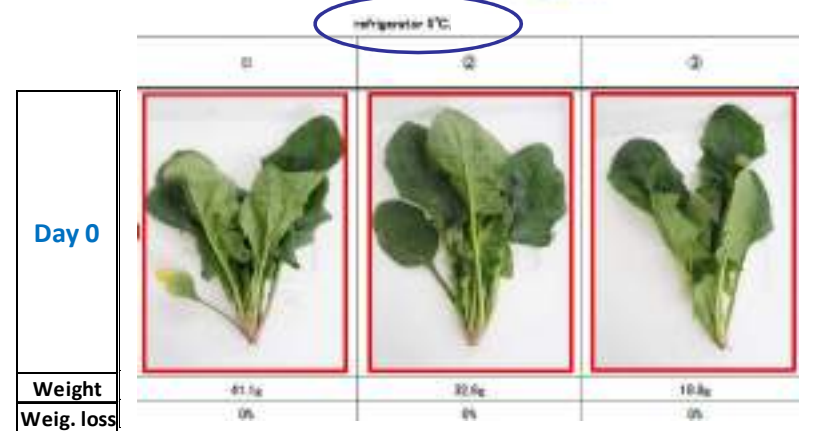
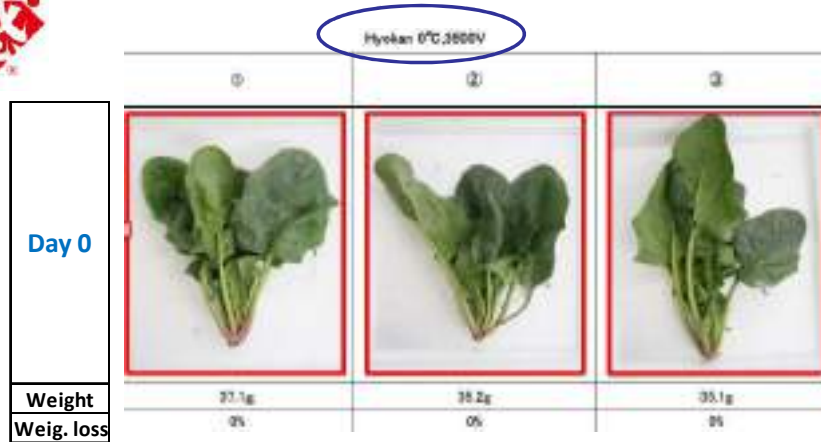
Day	C Vitamine (mg/100 g)	
	Refrige. 5°C	Hyokan 0°C
1 <sup>st</sup>	58	58
6 <sup>th</sup>	51	63
14 <sup>th</sup>	22	55
20 <sup>th</sup>	17	57
27 <sup>th</sup>	15	47

Day	Weight loss (%)	
	Refrige. 5°C	Hyokan 0°C
6 <sup>th</sup>	3,2	1,0
14 <sup>th</sup>	8,0	4,3
20 <sup>th</sup>	11,0	5,0
27 <sup>th</sup>	14,3	7,2

Source: Tests conducted at Bicchu Farm (Japan).

2. HYOKAN SUPPLY - Results achieved

SPINACH



Source: Tests conducted at Bicchu Farm (Japan).



2. HYOKAN SUPPLY - Results achieved **CARROTS**



HYOKAN: 0°C/3.5 kV

Source: Tests carried out at Designer Foods Corp. (Japan)

2. HYOKAN SUPPLY - Results achieved

**BROCOLI**

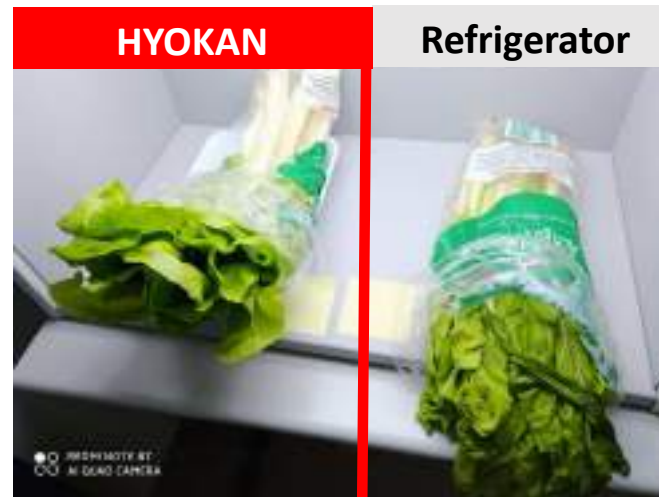


HYOKAN: 0°C/3.5 kV

Source: Tests carried out at Designer Foods Corp. (Japan)

2. HYOKAN SUPPLY - Results achieved

LETTUCE AND CHARD



Weight loss at day 8 <sup>th</sup> (%)		
	Lettuce	Chard
Hyokan	5,8	0,3
Refrigerat.	12,7	13,3



Source: Tests carried out at the Lertiker Technology Centre (Euskadi).

## 2. HYOKAN SUPPLY - Results achieved

## MUSHROOMS

Day 0



**HYOKAN**

Refrigerator

Day 5



**HYOKAN**

Refrigerator

**HYOKAN:** -0.7°C/88 % humidity/3.5 kV  
**SNOW:** 2.6°C/92% humidity

Day 10



**HYOKAN**

Refrigerator

Day 14



**HYOKAN**

Refrigerator

Source: Tests carried out at the Lertiker Technology Centre (Euskadi).

## 2. HYOKAN SUPPLY - Results achieved

## FISH



**HYOKAN**

Refrigerat.



**HYOKAN**

Refrigerat.



**HYOKAN**

Refrigerat.



**HYOKAN**

Refrigerat.

Weight loss at day 8 <sup>th</sup> (%)				
	Atlantic Mackerel	Mackerel	Hake	Monkfish
<b>HYOKAN</b>	0,4	0,2	0,4	0,8
Refrigerator	6,0	10,0	16,4	11,3

Histamine after 6 days in HYOKAN (ppm)	
Atlantic Mackerel	< 5
Mackerel	< 5

Source: Tests carried out at the Leartiker Technology Centre (Euskadi).

## 2. HYOKAN SUPPLY - Results achieved

## BEEF



After 1 month, darkened by oxidation



After 1 month, it keeps its natural colour



Source: information from HYOKAN sales brochure.

## 2. HYOKAN SUPPLY - Results achieved

## BEEF



### AGING

Free AA content (mg/100g)				
	Initial	At 31 days	At 60 days	0 to 60 days

Aspartic Acid	0,5	0,9	2,8	460 %
Glutamic Acid	5,5	13,7	25,9	<b>371 %</b>
Alanine	26,3	39,1	50,4	92 %
Arginine	6,5	11,6	18,2	180 %
Asparagine	2,0	4,4	8,2	310 %
Cysteine	2,9	4,7	5,4	86 %
Glycine	8,4	10,0	15,1	80 %
Glutamine	67,1	67,2	66,1	-1 %
Proline	1,6	4,3	10,2	538 %
Serine	4,5	11,6	20,3	351 %
Tyrosine	4,5	9,8	13,2	193 %
<b>Total non-essential AA</b>	<b>129,8</b>	<b>177,3</b>	<b>235,8</b>	<b>82 %</b>

Free AA content (mg/100g)				
	Initial	At 31 days	At 60 days	0 to 60 days

Phenylalanine	3,7	10,2	17,3	368 %
Histidine	3,0	5,8	9,4	213 %
Isoleucine	3,1	8,1	14,5	368 %
Leucine	5,8	15,9	27,3	371 %
Lysine	7,4	13,3	24,3	228 %
Methionine	1,9	6,7	11,4	500 %
Threonine	3,7	7,7	14,0	278 %
Valine	4,3	10,4	19,3	349 %
<b>Total essential AA</b>	<b>32,9</b>	<b>78,1</b>	<b>137,5</b>	<b>318 %</b>
<b>Total free Amino Acids</b>	<b>162,7</b>	<b>255,4</b>	<b>373,3</b>	<b>129 %</b>

During aging in HYOKAN, the flavours are further reinforced by the greatly increased AA content.

Source: Inspection Agency: Hokkaido Tokachi Area - Regional Food Processing Technology Center

## 2. HYOKAN SUPPLY - Results achieved

## BEEF



## AGING

### Fungi test after 90 days in HYOKAN

	Beginning	After 3 days	After 7 days
Coliform bacteria count	Negative	Negative	Negative
Count on standard plate	3 M or less/g	3 M or less/g	3 M or less/g

Meat aging in HYOKAN is achieved under conditions that prevent spoilage due to germ proliferation and weight loss caused by crusting or drying out.

Source: Inspection Agency: Hokkaido Tokachi Area - Regional Food Processing Technology Center



## 2. HYOKAN SUPPLY - Results achieved

## CHICKEN MEAT

Day 0



Day 5



HYOKAN: -0.7°C/88 % humidity/3.5 kV  
SNOW: 2.6°C/92% humidity

Day 10



Day 14



Source: Tests carried out at the Leartiker Technology Centre (Euskadi).

## 2. HYOKAN SUPPLY - Conclusions

- Technical solution that has demonstrated **high performance** in the various tests carried out, **both in the preservation of fresh food** (fruit, vegetables, meat and fish), as well as **in beef aging**.
- **Technology available for a local company** willing to incorporate it into its product portfolio for **commercial exploitation in the European market, subject to a prior agreement with HYOKAN SUPPLY.**

### 3. TECHNICAL



Company	<b>TECHNICAL</b>
Product	IQF <b>TOMIN</b> freezer. Range from 20 kg/h single units up to 3 t/h tunnels.
Technology	Ultra-rapid freezing by immersion at -28°C in an ethanol/water mixture 70/30
Advantages	It achieves high performance in cold transmission what makes the size of ice crystals generated in the food moisture is very small (only 5 µm), so that food is not damaged and, when thawed, remains fresh.
Limitations	It is necessary that food is bagged to avoid ethanol infiltration.
Application	Freezing of foodstuffs without loss of freshness (especially meat and fish)
References	> 2,000 (present in 35 countries)
Web	<a href="http://www.technical-international.co.jp">www.technical-international.co.jp</a>



### 3. TECHNICAN – Available range

Compact equipment

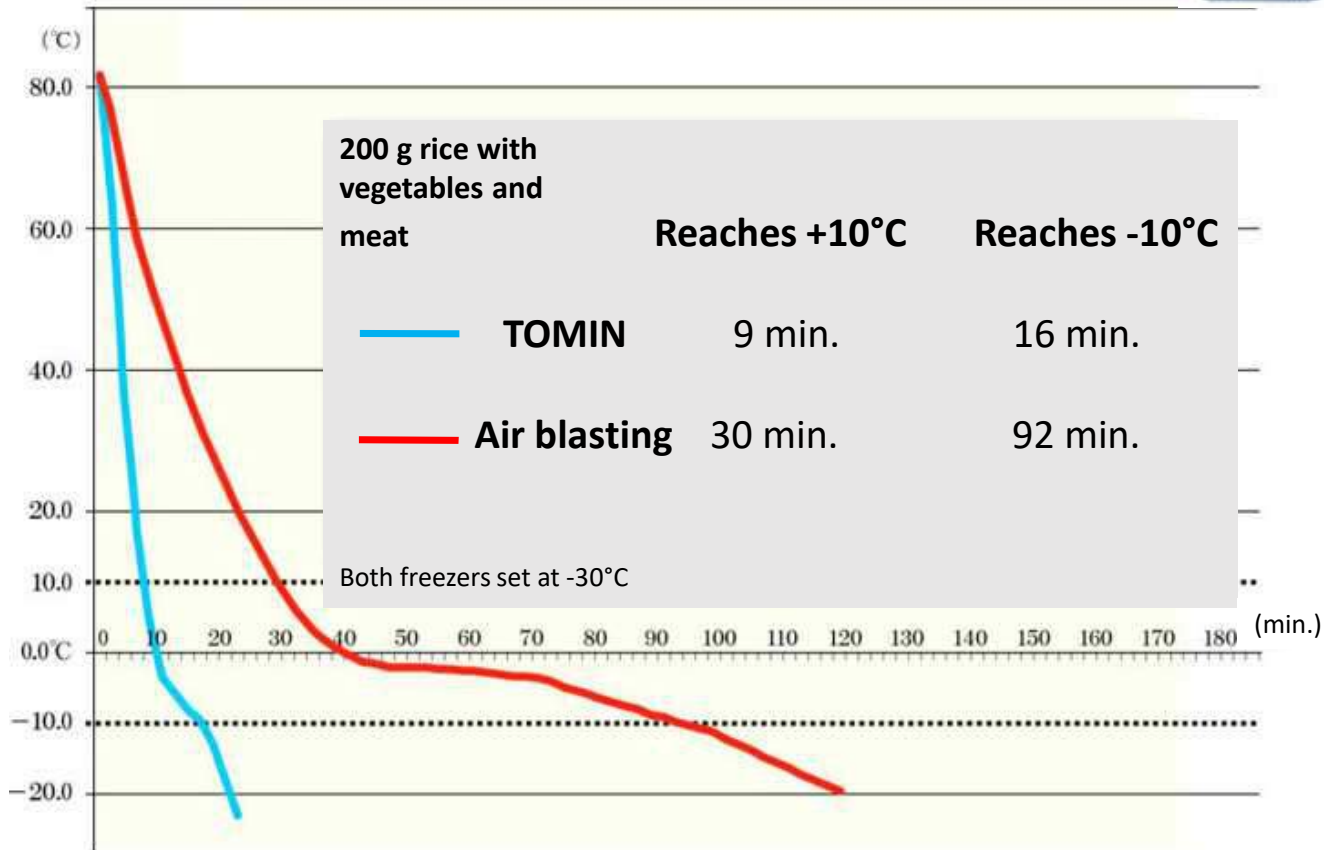


Freezing lines



Source: information from TECHNICAN sales brochure.

### 3. TECHNICAL - Performance



Source: information from TECHNICAL sales brochure.

### 3. TECHNICAL - Freezing technologies

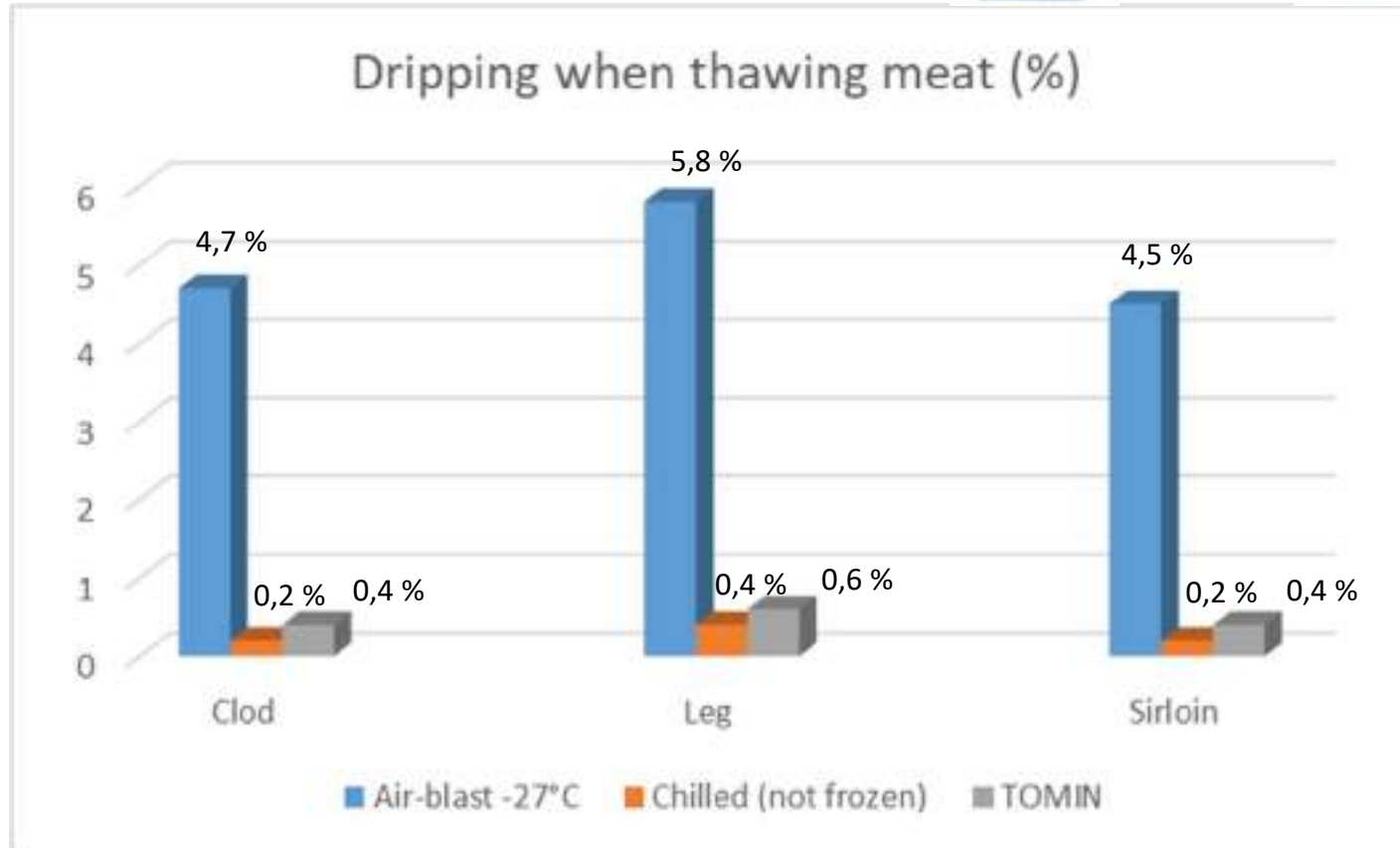


FREEZING METHOD	ADVANTAGES	DISADVANTAGES
<b>TOMIN</b>	<ul style="list-style-type: none"> <li>* Enables optimal freezing quality</li> <li>* No dripping</li> <li>* Non-cold working environment and ease of operation</li> </ul>	<ul style="list-style-type: none"> <li>* Packaging necessary to allow immersion in alcoholic solution</li> </ul>
<b>Conventional freezing (airstream)</b>	<ul style="list-style-type: none"> <li>* Massive application (from commercial to household)</li> <li>* Easy to use</li> <li>* Cheap</li> </ul>	<ul style="list-style-type: none"> <li>* Needs longer freezing time</li> <li>* Dripping, affects loss of freshness and flavour</li> <li>* Low yield</li> </ul>
<b>Marine refrigeration (storage at very low T)</b>	<ul style="list-style-type: none"> <li>* Very low T, allows for much higher quality freezing than air freezing</li> <li>* Allows freezing of bulk food (i.e. tuna)</li> </ul>	<ul style="list-style-type: none"> <li>* Limitations on use and where to do it</li> </ul>
<b>Dry ice (CO<sub>2</sub> gas freezing)</b>	<ul style="list-style-type: none"> <li>* Very fast freezing that allows high quality preservation</li> </ul>	<ul style="list-style-type: none"> <li>* Necessary to remove gas after the process if freezing unpacked products</li> <li>* A dry ice cost is assumed for each freezing operation</li> <li>* Dry ice storage facilities required</li> </ul>
<b>Liquid Nitrogen</b>	<ul style="list-style-type: none"> <li>* Allows high quality freezing</li> </ul>	<ul style="list-style-type: none"> <li>* High running costs</li> <li>* Possible cracking of products over 12 mm thickness</li> </ul>

Source: information from TECHNICAL sales brochure.








### 3. TECHNIGAN - Drip loss on thawing



Source: information from TECHNIGAN sales brochure.

### 3. TECHNICAL - Drip loss on thawing



TOMIN	Air-Blasting
	
	
	

Source: information from TECHNICAL sales brochure.



### 3. TECHNICAL - Freezing Tests



Source: images taken during tests carried out at Congelados de Navarra.

### 3. TECHNICAL - Conclusions



- Innovative technical solution in the field of **industrial freezing**, capable of achieving an excellent quality of food preservation, especially **meat and fish**. It has not proved advantageous for freezing fruit and vegetables (with the exception of mandarin oranges and strawberries). It has the **limitation that products bagging** is recommended to avoid ethanol infiltration.
- **Technology available** for a local company willing to incorporate it to its product portfolio **for its commercial exploitation in the European market, after prior agreement with TECHNICAL.**

SAIOLAN



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