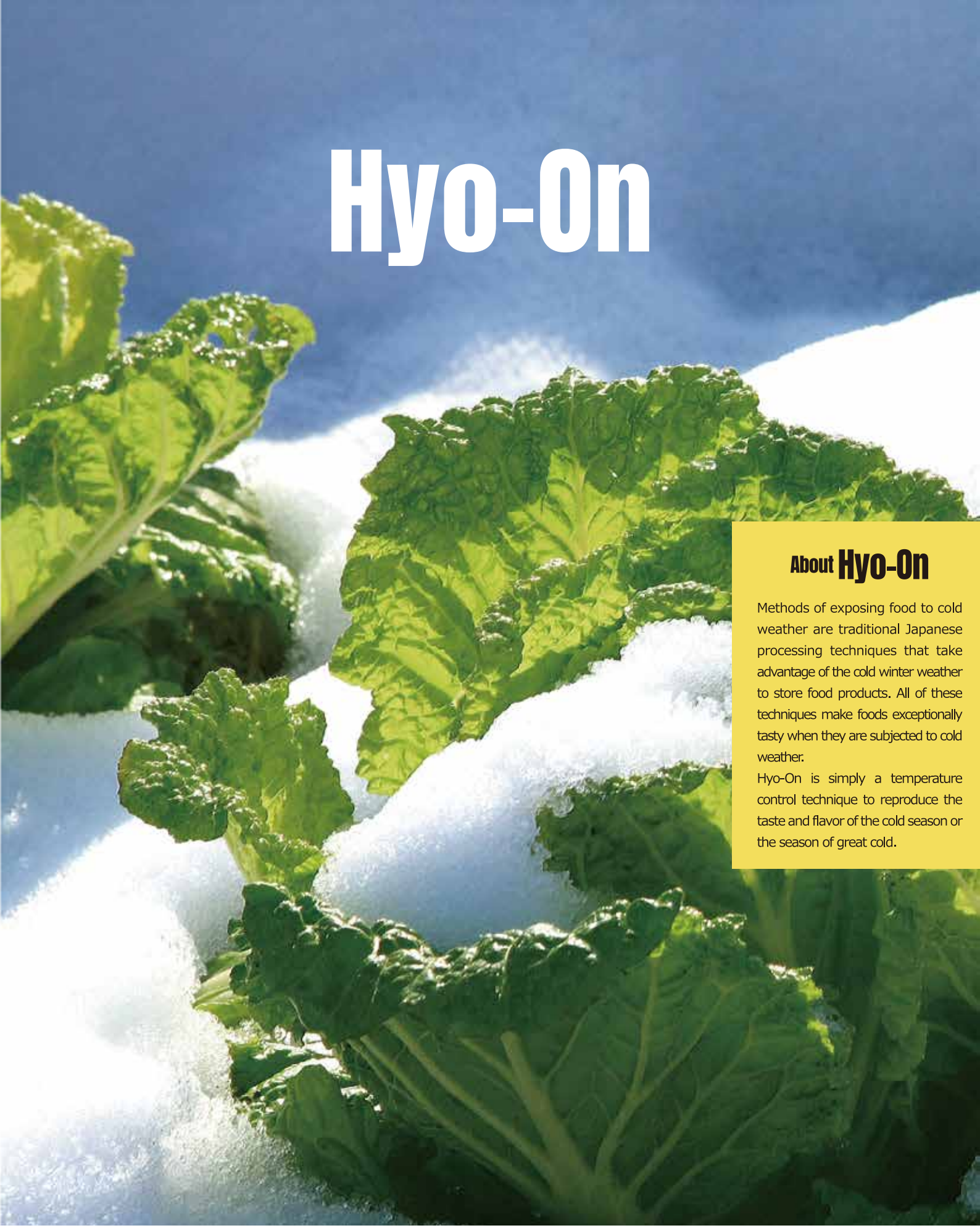
Hyo-On



About Hyo-On

Methods of exposing food to cold weather are traditional Japanese processing techniques that take advantage of the cold winter weather to store food products. All of these techniques make foods exceptionally tasty when they are subjected to cold weather.

Hyo-On is simply a temperature control technique to reproduce the taste and flavor of the cold season or the season of great cold.

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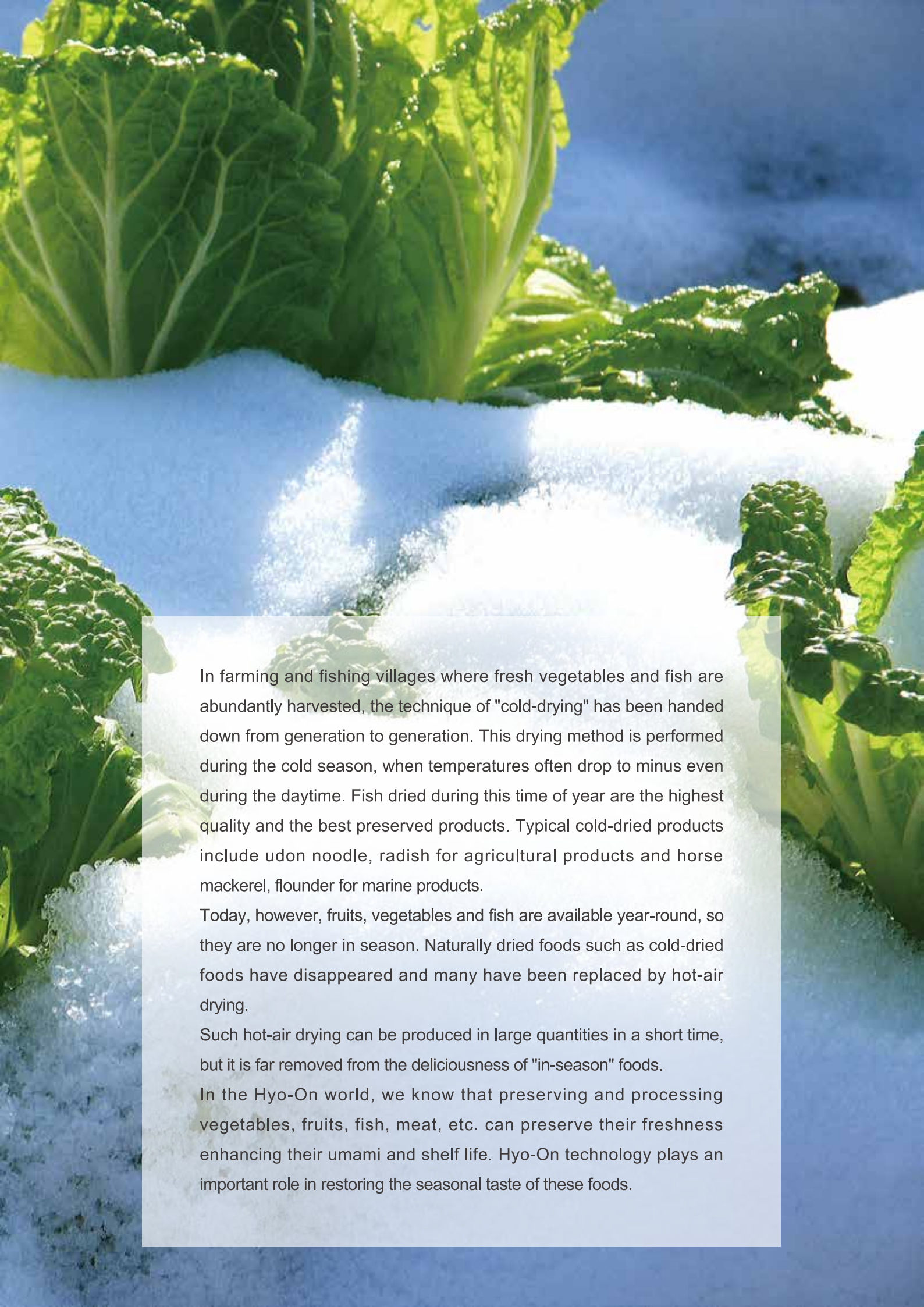


In farming and fishing villages where fresh vegetables and fish are abundantly harvested, the technique of "cold-drying" has been handed down from generation to generation. This drying method is performed during the cold season, when temperatures often drop to minus even during the daytime. Fish dried during this time of year are the highest quality and the best preserved products. Typical cold-dried products include udon noodle, radish for agricultural products and horse mackerel, flounder for marine products.

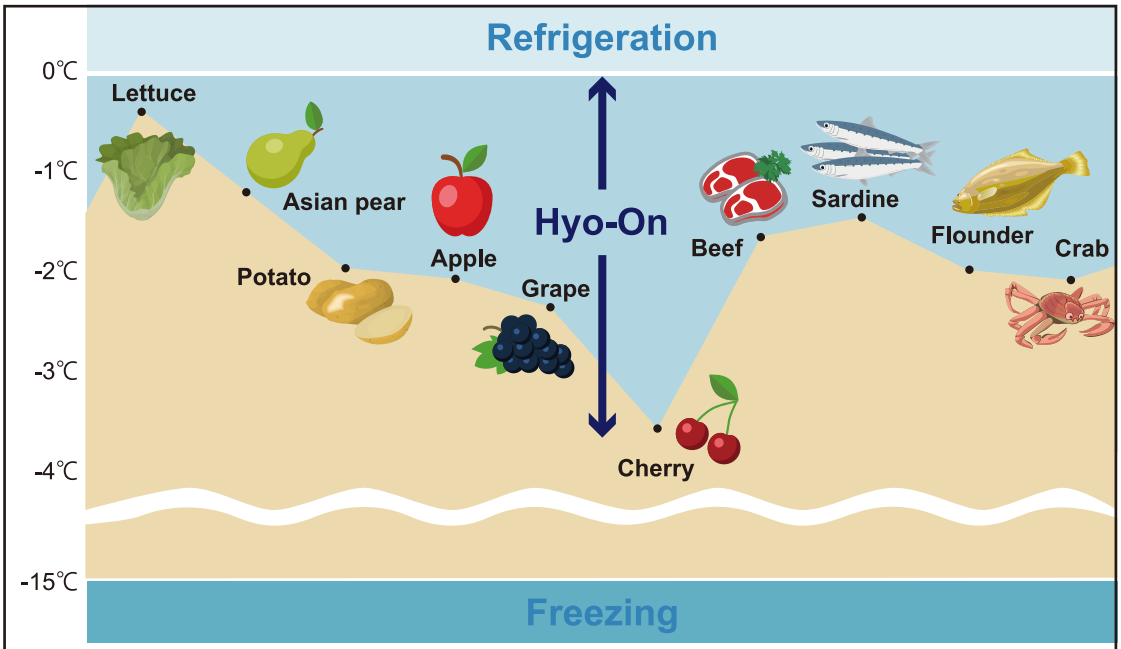
Today, however, fruits, vegetables and fish are available year-round, so they are no longer in season. Naturally dried foods such as cold-dried foods have disappeared and many have been replaced by hot-air drying.

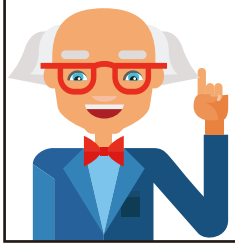
Such hot-air drying can be produced in large quantities in a short time, but it is far removed from the deliciousness of "in-season" foods.

In the Hyo-On world, we know that preserving and processing vegetables, fruits, fish, meat, etc. can preserve their freshness enhancing their umami and shelf life. Hyo-On technology plays an important role in restoring the seasonal taste of these foods.

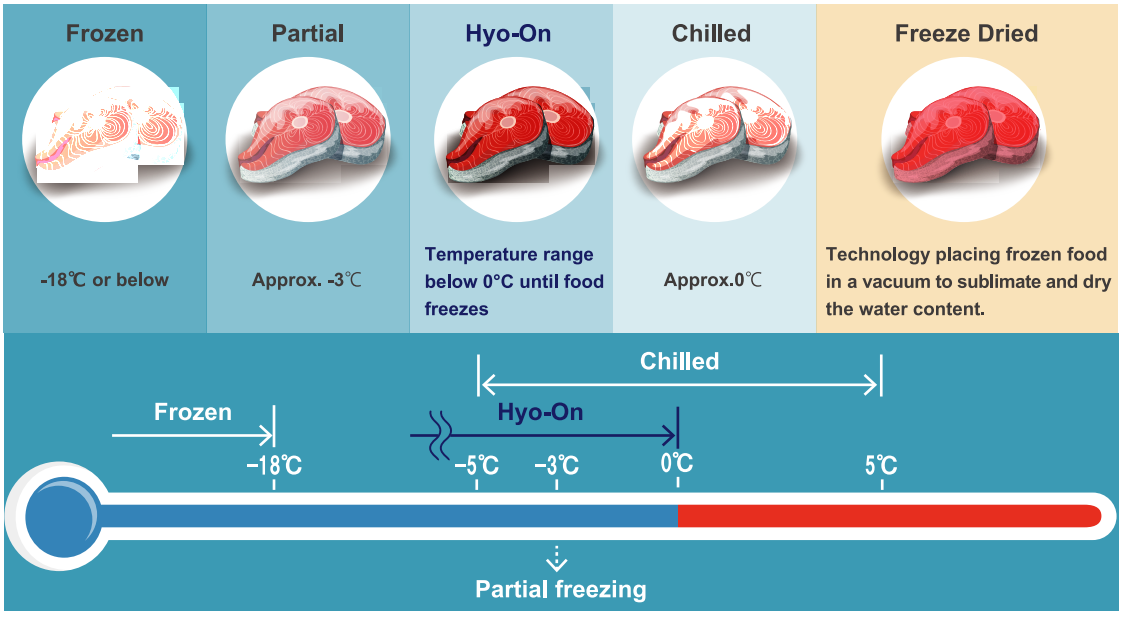
What is Hyo-On?

There is a third temperature range that is neither refrigerated nor frozen. Japanese call it Hyo-On for the temperature range that does not freeze even though it is below 0℃.





Do you know at what temperature water freezes? Yes, water starts to freeze at 0℃. However, unlike water, foods such as vegetables, fruits, fish and meat do not freeze at 0℃. This is because each food has a different temperature at which it begins to freeze. The temperature range from below 0℃ to the temperature at which each food starts to freeze (freezing point) is called the Hyo-On range.



What can be done with Hyo-On?

The Hyo-On Association members can license the intellectual property rights to Hyo-On technology if they wish, and can develop new Hyo-On aged products.
The Hyo-On Laboratories Inc. will support the commercialization of Hyo-On foods through the following process.

Membership in the Hyo-On Association of Japan

▼

Confirmation of Hyo-On environment, installation, and modification

▼

Establish a basic agreement for the use of intellectual property rights

Apply for and obtain certification as Hyo-On foods

▼

Sell as Hyo-On foods (display registered trademark and certification mark)

Examples


Teriyaki Mackerel

The greasy meat of the cold mackerel is tender and moist.


Bean-jam Pancake

The baked dough is moist and soft, and has a good melting feeling.


Sweet Potato

The surface is moisturized and the taste is smoother than the conventional one.


Soybean Paste (Miso)

Browning is suppressed compared to conventional refrigerated aging.


Coffee Beans

Increased free amino acid content as well as aroma components after roasting.


Boiled Ginger for Sandfish

The original umami and texture of sandfish have improved.


Fruits and Vegetables

Extend the sales period maintaining the freshness of freshly picked.


Aged Beef

Block meats are aged increasing umami and sweet free amino acids.


Aged Chicken

Increased free amino acids such as glutamic acid and alanine.


Aged Pork

The fat melts in the mouth, the meat becomes soft, and the umami is strong.


Grifola Frondosa

More umami ingredients than conventional products, and the taste is strong.


Bread Dough

Flavor of wheat flour is stronger than that of the usual method.


Aged Dried Fish

Amino acids increase, making the body fluffy and moist.


Healthy Tea

Weaker astringency and a stronger sweetness, making it easier to drink.


Korean Pickles (Kimchi)

kimchi with a good balance of sweetness and spiciness with suppressed acidity.


Raw Mackerel

The texture and umami were improved, and the drip was alleviated.


Marinating Seafood

After filling with marinade vinegar, Hyo-On aging is performed.


Minced Fish

Chewier and has improved umami compared to conventional products.


Apple Pie

The puff pastry is easy to loosen and has a good texture.


Roast Beef

The umami of the meat increases becoming a mellow taste.

Characteristics

Aged in an unfrozen state until just before freezing, food is kept fresh and the growth of harmful microorganisms is inhibited. The living cells store umami ingredients to protect themselves from freezing, increasing the umami taste of food. In addition, the moistening effect of food ensures that the moisture content of food is evenly distributed throughout the food, thereby reducing uneven heating during cooking.

Keeping FRESHNESS

Storage at temp.below 0℃ significantly slows the growth of microorganisms, which keeps the foods fresher and longer than typical refrigerated storage.

Increasing UMAMI

To protect themselves from freezing, organisms convert proteins and starches in their bodies into free amino acids and glucose. This is the element of umami.

Moistening EFFECT

Under the Hyo-On range, free water and semi-bond water penetrate into foods and the moisture in foods is evenly distributed and moisturized as a whole.

Definition of Hyo-On

Hyo-On refers to the unfrozen temperature range from 0°C to the freezing point, and high-quality foods obtained in this temperature range are defined as Hyo-On stored foods, Hyo-On aged foods, Hyo-On dried foods, Hyo-On fermented foods, Hyo-On concentrated foods and Ecological Hyo-On. In addition, equipment that enables the introduction of Hyo-On technology to foods and other products is defined as Hyo-On equipment.

Hyo-On stored foods

Fresh foods such as fruits, meats, vegetables, seafood, or tea and sake that value freshness is good for Hyo-On storage keeping freshly picked deliciousness longer than refrigerated.

Hyo-On aged foods

It is widely used for fresh and processed products such as meat and seafood.
For example, sweet scent and mellow taste are produced by aging green coffee beans at Hyo-On.

Hyo-On dried foods

It is used in marine products such as Atka mackerel and Pacific saury.
When dried at Hyo-On, the umami is increased creating the taste of cold season.

Hyo-On fermented foods

It is used in bread, fermented soybeans and pickles.
For example, fermenting bread dough at Hyo-On enhances the deliciousness of wheat creating a chewy texture.

Hyo-On concentrated foods

It is used in seasonal fruits such as strawberries and kiwis. Since Hyo-On concentration does not heat, the ingredients are finished with the color and freshness remaining.

Ecological Hyo-On

Southern foods being prone to chilling injury in Hyo-On range are desirable to be processed assessing the low temperature limit in the positive temperature range.

Hyo-On equipment

Slurry Ice
Each ice is a fine sphere with a diameter of 0.1 to 0.5 mm and a temperature of -1°C to -2°C. The sherbet-like ice made with the latest technology can maintain exactly the temperature range of Hyo-On.

Hyo-On storage
A Hyo-On storage has accurate temperature control by the air circulation system. Normally, conventional refrigerators have temperature fluctuation about ±5℃, but the Hyo-On storage maintains the accuracy within ±0.5℃.

Hyo-On Foods

Hyo-On technology is the storage and processing of food using the Hyo-On temperature range, and foods stored and processed in that range are Hyo-On foods. Hyo-On technology allows customers enjoying Hyo-On foods that are safe, secure, and full of natural flavor without synthetic preservatives or other additives.

In Japan, there is a Hyo-On Laboratories Inc. that certifies Hyo-On foods produced by companies and individuals who have properly mastered Hyo-On technology, allowing consumers to purchase high-quality foods that have successfully passed the certification screening process with confidence.

Branding

Many companies with wide range from individual producers to major manufacturers are working on the development of Hyo-On. Not only processed foods but also the commercialization of fresh food such as vegetables, fruits, fresh fish, etc. is progressing rapidly.

The number of foods using Hyo-On technology has been increasing year by year, and now there are more than 851 items (as of 2022).

Certification

Certification allows the use of product labels such as "Hyo-On," "Hyo-On aged," and "Hyo-On stored" on products. Hyo-On certification is granted only when the product meets the certification criteria including a food taste score, so that the characteristics of the food such as "tastier," "matured," and "freshness maintained" can be widely promoted with the reliability of scientific evidence.

Submit application for certification

Document review and quality inspection

- Is the Hyo-On technology used in the manufacturing process?
- Is there a clear difference in quality from conventional products?
- Are synthetic preservatives and synthetic coloring agents added?

Hyo-On Foods Certification Council

- Accreditation is done by third-party certification.
- The council is composed of members from various fields from academics to consumers who are familiar with the food industry.
- The Council also incorporates the SDGs as part of its commitment to the demands of society.

Certification

Issuance of Hyo-On Foods Certification

Mechanism

Enzymes break down proteins into amino acids, glycogen into sweet glucose, and the energy source ATP (adenosine triphosphate) into IMP (inosine monophosphate) from macromolecules to small molecules. In the case of meat, fat is broken down into aromatic fatty acids.

In the protein and glycogen state, there is no umami or sweet taste, but when these are converted into small molecules, the human tongue perceives "good taste" through the five tastes: sweet, bitter, sour, salty, and umami.

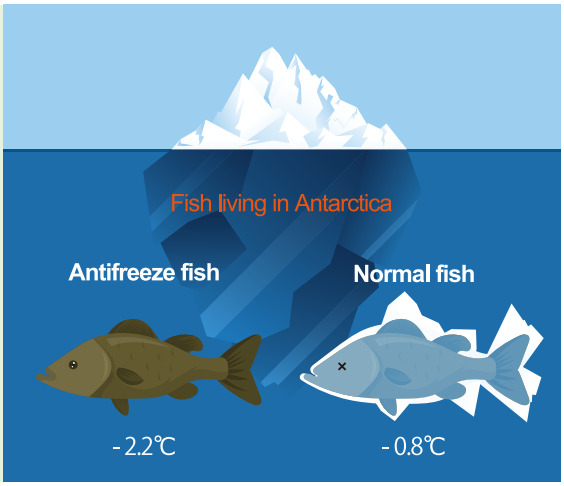
When foodstuffs are exposed to temperatures below 0℃, a defensive reaction to prevent freezing converts macromolecules into small molecules, and the foodstuffs begin to store antifreeze substances containing amino acids and sugars which are umami components.

Hyo-On is an application of this mechanism and has attracted attention from food manufacturers for its ability not only increasing umami ingredients, but also keeping food fresh and reducing harmful microorganisms.

BEFORE Aging		AFTER Aging
Protein	→	Amino acid
Glycogen	→	Glucose
ATP (adenosine)	→	IMP (inosine)
Fat	→	Fatty acids

Antifreeze protein

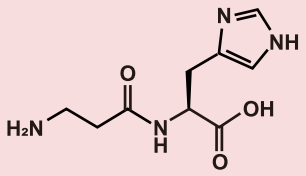
Most tropical fish freeze when their body fluid temp. reaches -0.8℃, but Antarctic fish do not freeze even when their body temp. reaches -2.2℃. This is because Antarctic fish have antifreeze proteins. The freezing point of organisms varies depending on the region in which they live, but what is currently known is that when the temperature falls below 0℃, antifreeze is produced and accumulates in the body, and this antifreeze lowers the freezing point of the organism, instinctively protecting themselves.



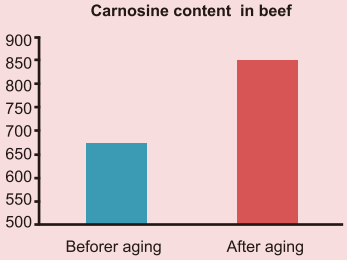
Increase in functional components

In February 2020, the "Method for Increasing Antioxidant Capacity of Fresh Foods and its High Freshness Distribution Method," which had long been studied by the Hyo-On Laboratories Inc., was granted a patent (Patent No. 6670154).
This patent is for a method to increase and maintain antioxidants (carnosine, chlorogenic acid, and gingerol) in fresh foodstuffs by storing and processing them in the Hyo-On range. It is expected to become the third pillar of Hyo-On technology, following freshness retention and high quality (enhanced flavor and texture).

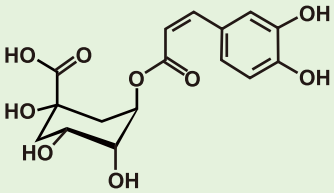
Carnosine



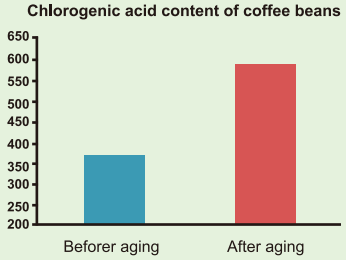
Carnosine is an ingredient found in various meats such as beef and pork, and is also known as imidazole dipeptide (a peptide consisting of two amino acids bonded together) as a generic name for other ingredients. Joint research conducted by the Kyushu Okinawa Agricultural Research Center of the National Agricultural Research Organization and the Hyo-On Research Institute, Inc. has confirmed that beef stored in Hyo-On contains higher levels of carnosine than beef stored in refrigerated temperatures.



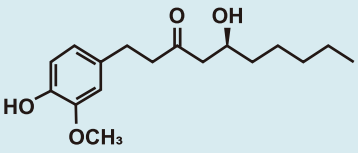
Chlorogenic acid



A type of polyphenol found in the leaves and seeds of various plants, chlorogenic acid is abundant in coffee beans, potatoes, and sweet potatoes. It is known for its functionality in inhibiting the rise in blood glucose levels and the breakdown and absorption of fat. As for the effects of introducing Hyo-On technology, it has been confirmed that Hyo-On treating green coffee beans prior to roasting increases chlorogenic acid, resulting in coffee with a richer aroma and flavor.



Gingerol

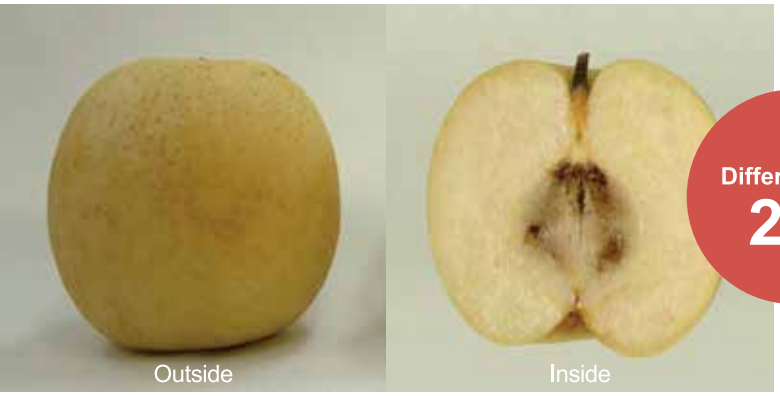


A pungent ingredient found in ginger rhizomes is known to have functional components such as anti-thrombogenic and anti-tumor effects. It also has a warming effect by dilating blood vessels at the ends of body and promoting blood flow. As for the effects of Hyo-On, it has been confirmed that the treatment increases zingerol and enhances flavor and pungency. In addition to being used as product development, the functional ingredients of Hyo-On can be marketed as a new product feature.

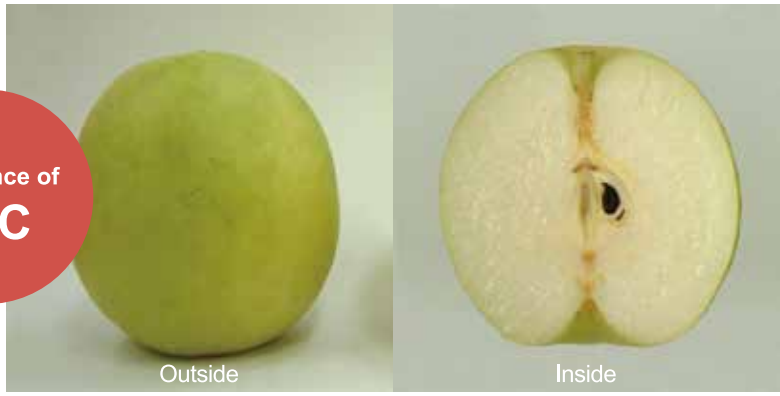
Keeping FRESHNESS

When food is stored in the Hyo-On range, it has the advantage that perishable foods can be stored for a long period of time in a freshly picked state.

Storage 9 months (freezing point -1.5°C) in refrigeration (+1°C)



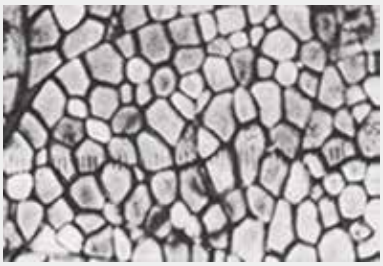
Storage 9 months (freezing point -1.5°C) in Hyo-On (-1°C)



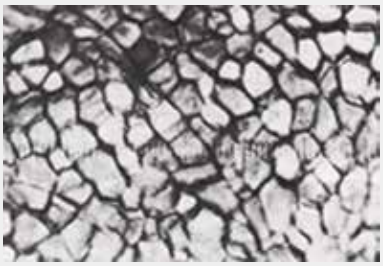
Difference of 2℃

Observing beef cells with a microscope

After storing beef at Hyo-On storage (-1℃), partial freezing storage (-3.5℃) and freezing storage (-20℃) for 5 days, the cells were observed under a microscope.
As the result, Hyo-On beef is almost the same as it was at the beginning of storage. On the other hand, damage and deformation were observed at partial freezing storage and freezing storage. Unlike partial freezing storage and freezing storage, Hyo-On storage proved to keep cells alive.



At the start of storage



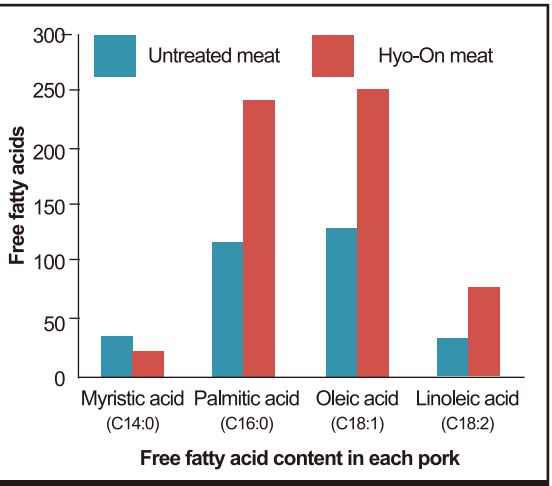
Hyo-On (-1℃)

Partial freezing (-3.5℃)

Frozen (-20℃)

Increasing UMAMI

Comparison of Hyo-On aged meat and untreated meat was conducted for Pork (Rib roast at freezing point -1.0℃).The proportion of unsaturated fatty acids in free fatty acids was 51.8% for untreated meat and 55.5% for Hyo-On meat increasing the unsaturated fatty acids (oleic acid, linoleic acid) while decreasing saturated fatty acids (myristic acid) in Hyo-On meat. This increased unsaturated fatty acids make the fat delicious by lowering the melting point of meat and making better for fat melts in the mouth.



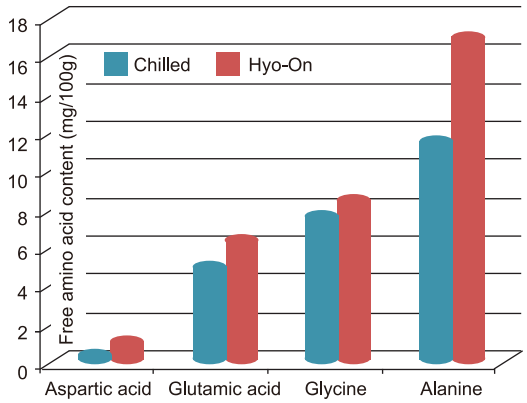
Fat melting point

In order to investigate how the increased proportion of unsaturated fatty acids with low melting points effect the deliciousness such as melting feeling of fat and the greasiness in the mouth, the melting point of fat was measured. As the result, the temperature of untreated meat was 39.7℃, while Hyo-On meat was 35.1 ℃ confirming that the melting point was dropped by 4.6℃.

The lipids of untreated meat were white and turbid in a semi-solid state while the lipids of Hyo-On meat were in the form of a clear, low-viscosity liquid.

Hyo-On aging effect on Pork

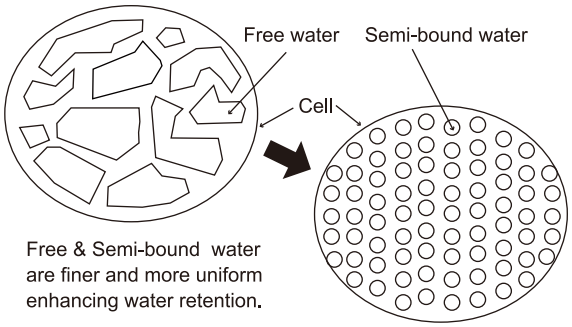
- Hyo-On aging increases the amount of sweet and tasty free amino acids.
- Thorough hygienic control keeps the number of bacteria in the product at 10^2-10^3/g.



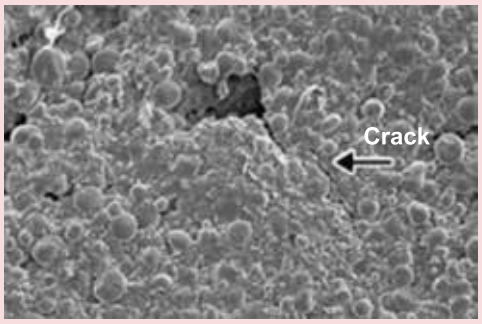
Moistening EFFECT

Moisture is classified into three types: bound water, semi-bound water and free water. Under the Hyo-On range, free water and semi-bond water penetrate more into food details increasing affinity with each ingredient. In other words, moisture in food is evenly distributed throughout the food and is moisturized as a whole.

Image of moisture homogenization



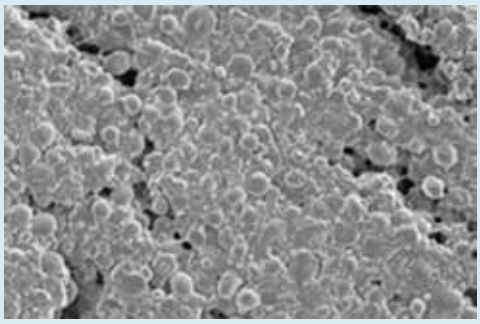
Cold air drying



Cracks due to uneven moisture content

Untreated chestnuts

Hyo-On drying



Moisture is more even and moist

Hyo-On treated chestnuts