

Establishment of the **Fresh-Aging Method**[®]
for Precise Control of Water Activity

Taste Modifier[®]



- 1 Drying that prevents uneven drying Patent No. 7037202
- 2 Ozone effect using an ozone UV lamp Patent No. 6104106



**Next-Generation Cold-Air Dryers are changing
the conventional wisdom of dried seafood**

Developer/Manufacturer: GSK Co., Ltd.

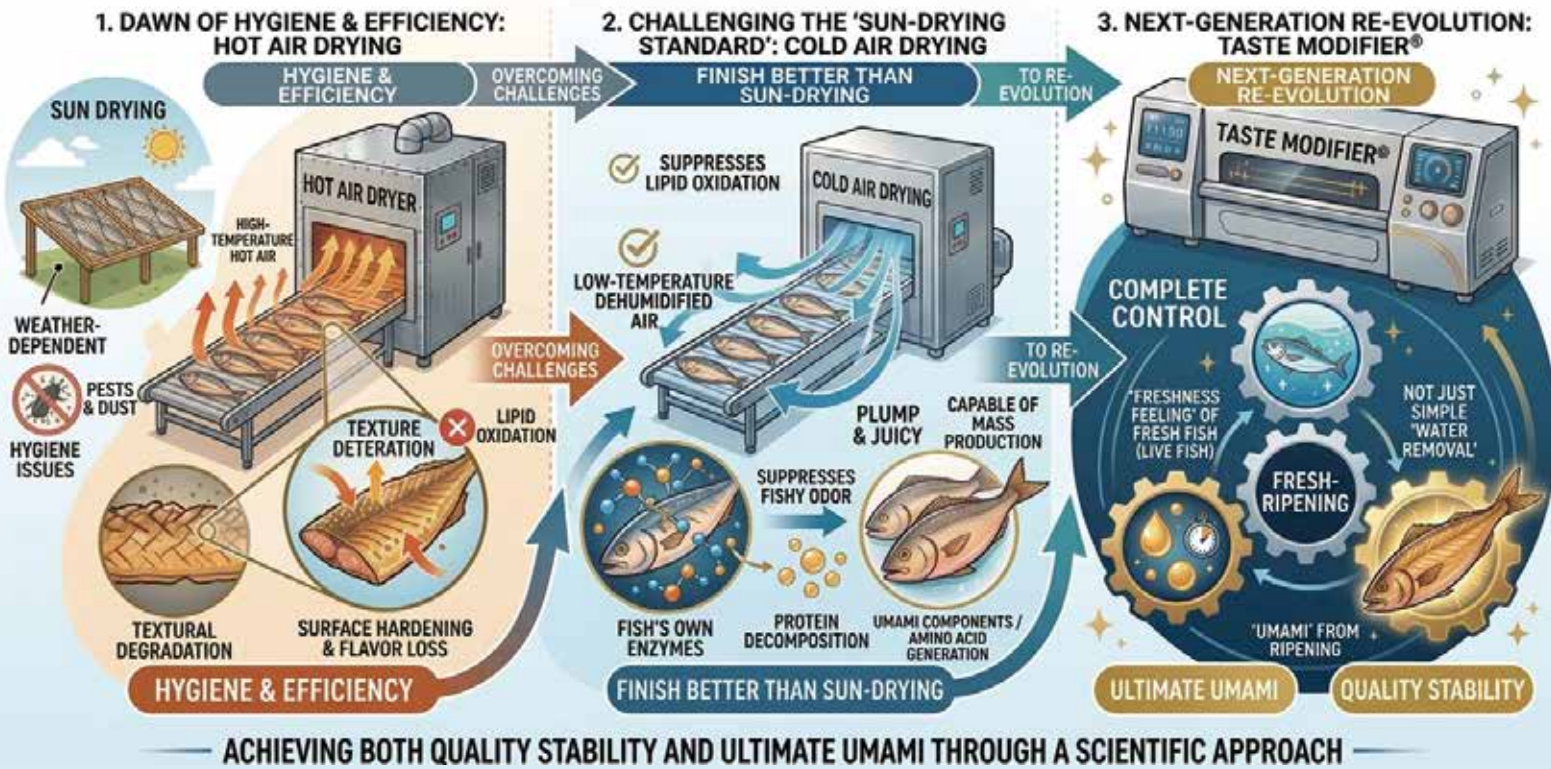


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The Evolution of Dried Fish Production Technology

Beyond traditional sun-drying, modern technology now harmonizes the pinnacle of umami with uncompromising quality stability.



Fresh-Aging Method

How "Taste Modifier®" is redefining the standards of dried fish



What is Taste Modifier®?

An Innovative Low-Temperature Cold-Air Dryer for the Perfect "Soft Dried Fish"

- Twin Dehumidification Technology for precision flavor concentration.
- 4-Way Circulation Airflow to eliminate uneven drying.



- 1 Drying that prevents uneven drying—Patent No. 7037202
- 2 Ozone effect using an ozone UV lamp—Patent No. 6104106



Taste Modifier® is an innovative low-temperature cold-air dryer designed to maximize food potential and achieve the ideal “soft dried fish.” Its core feature, “Twin Dehumidification” technology, precisely maintains an optimal environment (17°C and 45% humidity) to concentrate umami. By extracting moisture evenly from the center of the ingredients, it creates a deep, rich flavor profile. Furthermore, the “4-Way Circulation Airflow” distributes a consistent 2 m/s breeze throughout the chamber completely eliminating uneven drying.

Technology of Twin Dehumidification × 4-Way Circulation Airflow × Ozone Sterilization
ULTIMATE AGING TECHNOLOGY: "Fresh-Aging Method"
Delivering the ultimate plump and juicy "Soft Dried Fish" experience

The deliciousness and safety of food are determined by the state of the water it contains (water activity). The Fresh Aging Method lowers the chamber temperature from the conventional 20°C to 17°C, and through the heat of vaporization, the temperature of the food during drying drops to around 10°C bringing out its full flavor. While conventional “aging” carries a risk of spoilage, the “Fresh-Aging Method” maintains freshness while suppressing bacterial growth concentrating only the umami flavor.



Case Study

“Pinning the Island’s Future on Dried Fish: The Challenge of Ms. Watanabe

Shikinejima is a small with a circumference of about 12 kilometers. On this island, Hiroko Watanabe of “Shikinejima Osakana Service” is working to preserve the pride of the local fishermen and revitalize the island.

“I want to increase the fishermen’s income even a little and revitalize the island.” Driven by this single-minded determination, Ms. Watanabe carefully handcrafts processed seafood products one by one using fresh fish landed on the island.

Ms. Watanabe strives to fuse traditional craftsmanship with the innovative “Taste Modifier® (Fresh-Aging Method®).” Her overnight-dried red squid is particularly renowned. Through precise moisture control achieved by this technique, she has successfully eliminated the characteristic “toughness” of squid resulting in a surprisingly tender texture and a concentrated, rich umami flavor.



Ms. Watanabe with KF-2000 HACCP specifications

* This is an excerpt from an article published in the “Nikkan Suisan Keizai Shimbun” on December 28, 2021.

Other Case Studies

Roadside Stations (Markets)

Awaji Tourism Development Corpo. (Hyogo)



Roadside Station “Awaji”



Dried squid in a freezer case

Municipalities / Remote Islands

Iheya Island (Okinawa)



Ferry terminal



Cooked on an electric griddle

In-store product demonstrations

Super Ozeki (Tokyo)



In-store product demos



Freshly dried, homemade fish

Rare dried sweet potatoes

Suruga Sea Bream (Shizuoka)



KF-1000 Potato Dryer



Vacuum-sealed and frozen

Near the Fishing Port

Kanema Hamaya Shoten Co., Ltd. (Hokkaido)



Hanasaki Fishing Port



Atka Mackerel being dried

Tsukiji Fish Market

Nisshin Co., Ltd. (Tokyo)



KF-1000 used for Demo

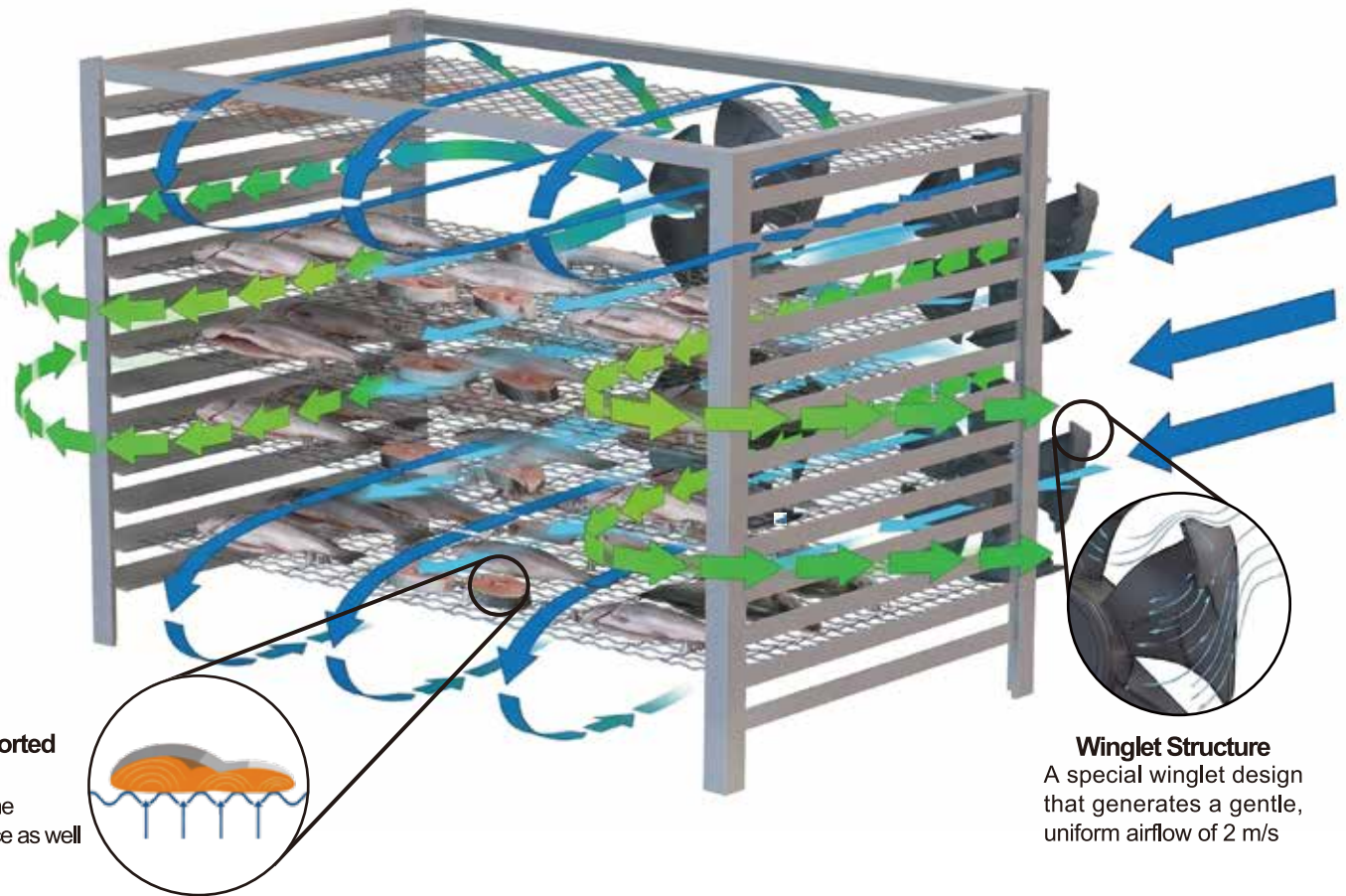


Showcase of dried fish

Mechanism

The Taste Modifier[®] features a design in which cooled, dehumidified air flows directly through the “main compartment” (food storage area). The air, having efficiently absorbed moisture from the food, passes between the inner and outer walls and returns to the rear of the fan, creating a thorough circulation path. This “4-sided circulation” system, which eliminates stagnant airflow, achieves exceptionally high airflow efficiency.

The fan, which is central to the airflow, incorporates a “winglet” structure inspired by aircraft technology. By minimizing interference between fans, it delivers a gentle, uniform airflow of 2 meters per second throughout the entire interior. Furthermore, the wire shelf structure, which supports food items at specific “points,” ensures that air is distributed evenly from both the top and bottom. This guarantees consistent, high-quality results regardless of where items are placed inside the unit.

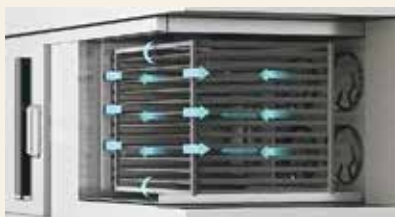


Point-supported mesh



Thanks to a structure that supports the ingredients at multiple points, air flows evenly not only from above but also from below enabling consistent, high-quality cooling and dehumidification.

4-way air circulation



Precision air channels on all four sides—top, bottom, left, and right—ensure an efficient, unobstructed airflow that dries food evenly.

Winglet Fan



Winglets are aerodynamic devices derived from aircraft technology that reduce airflow interference between adjacent fans ensuring that air reaches deep into the interior.

Comparative Experiment on Uneven Drying

These are the results of an experiment comparing the performance of a “conventional fan” and a “new winglet fan.”



Date : September 1, 2021
 Location : GSK Headquarters Laboratory
 Instrument : Anemomaster Pro 6030-00 (manufactured by Kanomax)
 MMs Points : Air velocity measured across 12 vertical levels and 9 horizontal areas within the chamber

Evaluation Criteria (Color Guide)

| Color (Shade) | Airflow | Value (m/s) | Impact on Drying |
|---------------|------------|---------------|--------------------------|
| Dark Blue | Too Strong | 2.6 or higher | Risk of over-drying |
| Medium Blue | Optimal | 1.0–2.5 | Optimal drying condition |
| Light Blue | Too Weak | 0.9 or lower | Slow, causing unevenness |

Conventional vs. New Model

Issues with the Conventional Fan

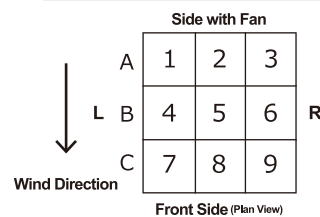
Extreme unevenness: While some areas experience extremely high wind speeds of 4.3 m/s, many others receive only 0.5 m/s of airflow creating conditions highly prone to “uneven drying.”

Location-based bias : Wind speeds tend to be extremely weak, particularly on the right side (Areas 3, 6, 9).

Improvements to the New Winglet Fan

Uniform airflow : Airflow remains within the optimal range (1.0–2.5 m/s) across most areas.

Eliminating variability : The areas where airflow was previously weak have been reduced allowing for efficient drying.



Wind Speed Data by Location (Conventional) (m/s)

| | Plane A | | | Plane B | | | Plane C | | |
|------------|---------|-----|-----|---------|-----|-----|---------|-----|-----|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 12th Shelf | 2.6 | 2.2 | 0.7 | 2.9 | 1.9 | 0.6 | 4.3 | 2.2 | 0.7 |
| 10th Shelf | 2.7 | 2.2 | 1.4 | 3.3 | 2.1 | 0.6 | 4.2 | 3.3 | 0.5 |
| 8th Shelf | 2.4 | 3.0 | 2.1 | 3.2 | 3.2 | 2.0 | 3.1 | 3.6 | 0.5 |
| 6th Shelf | 2.2 | 2.8 | 2.4 | 2.2 | 3.3 | 1.8 | 1.1 | 3.6 | 0.5 |
| 4th Shelf | 2.0 | 2.4 | 1.9 | 1.0 | 3.0 | 2.1 | 1.0 | 3.5 | 1.2 |
| 2nd Shelf | 1.3 | 2.4 | 1.5 | 1.1 | 3.1 | 1.2 | 1.0 | 3.7 | 1.2 |

Wind Speed Data by Location (Winglet) (m/s)

| | Plane A | | | Plane B | | | Plane C | | |
|------------|---------|-----|-----|---------|-----|-----|---------|-----|-----|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 12th Shelf | 2.1 | 2.0 | 2.9 | 1.7 | 2.2 | 2.5 | 1.6 | 1.2 | 2.4 |
| 10th Shelf | 2.3 | 1.6 | 2.8 | 1.8 | 1.6 | 1.6 | 1.7 | 1.0 | 2.0 |
| 8th Shelf | 3.0 | 3.2 | 2.3 | 1.6 | 1.8 | 2.1 | 1.4 | 1.5 | 1.7 |
| 6th Shelf | 2.5 | 3.4 | 2.1 | 1.8 | 2.5 | 1.6 | 1.6 | 1.2 | 1.4 |
| 4th Shelf | 2.8 | 2.2 | 2.9 | 1.8 | 1.7 | 1.6 | 1.7 | 1.4 | 1.7 |
| 2nd Shelf | 3.0 | 2.0 | 2.2 | 2.0 | 1.7 | 1.8 | 1.8 | 1.6 | 1.9 |

[Conclusion: Benefits of the New Fan]

The new winglet fan minimizes airflow variability ensuring consistent delivery throughout the unit. This allows food to be dried uniformly and to a high standard, regardless of shelf level or placement.

Key Features



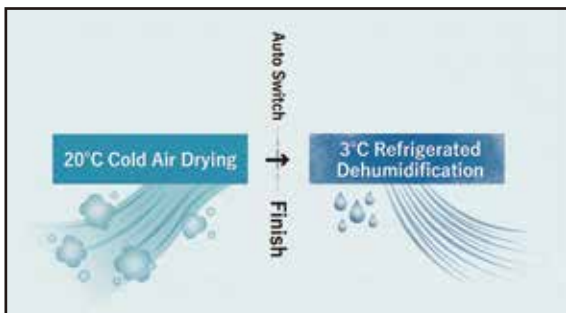
Unmatched Drying Speed and Evenness

Winglet fans × 4-sided circulation airflow

A gentle breeze of 2 m/s circulates evenly from all directions—top, bottom, left, and right—to prevent uneven drying caused by the placement of food items.

Twin Dehumidification System

By maintaining an ideal environment of 17°C and 45% humidity, moisture is efficiently removed not only from the surface but also from the center of the food.



“Auto-Switch” Feature That Preserves Freshness

Seamless Transition from Drying to Refrigeration

Once the set drying time ends, the unit automatically switches to a refrigerated dehumidification mode at 0–3°C. This prevents moisture from re-condensing ensuring that food stays fresh until you take it out.



HACCP-Compliant

Fully Washable Interior

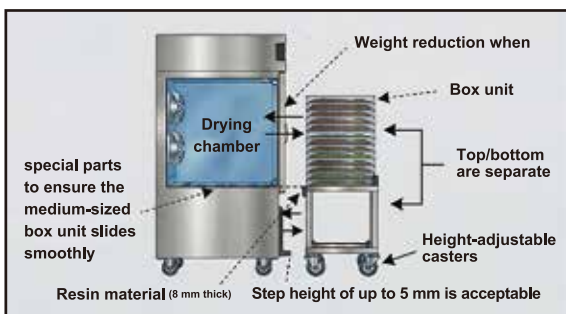
Features reinforced resin insulation for easy water washing.

Mercury-Free Ozone UV Lamp

Sterilizes the interior with high-concentration ozone (0.7 ppm).

Air-Tight Structure

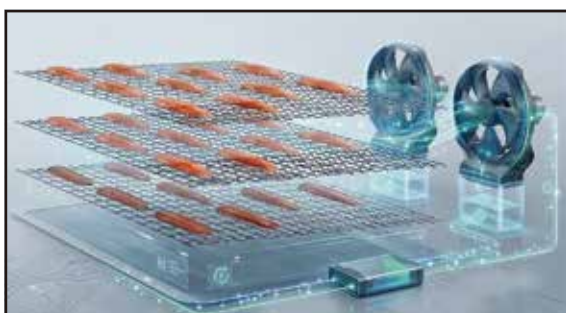
Incorporates a drain plate to thoroughly prevent outside air from entering.



A System That Dramatically Improves Work Efficiency

Cart Separation System (Optional)

Since the box units can be replaced all at once, this system significantly reduces the effort required for loading/unloading.



Superior energy efficiency

Minimal power consumption

The unit operates efficiently and keeps electricity costs low even during refrigeration at temperatures between 0 and 3°C.

Power Consumption (Table)

| Model | Cool air drying mode | Refrigerated dehumidifying mode |
|-----------|----------------------|---------------------------------|
| KF-2000 | 2168W | 1718W |
| KFR-5000W | 3504W | 2654W |

Cold-air drying VS Hot-air drying

Changes in flavor components

This study compares cold-air drying, now the mainstream method for producing salted-and-dried horse mackerel, with traditional hot-air drying to clarify its impact on taste-contributing components.

Experimental Methods

Conditions : A comparison was conducted under two conditions: cold-air drying (20°C) and hot-air drying (50°C).
 Sample : Fresh horse mackerel caught along the coast of Toyama Prefecture was used.
 Analysis Items : Analysis of nucleic acid-related substances (such as inosine acid), free amino acids (FAA), moisture content, and salt content, as well as a sensory evaluation after roasting.

Source: Journal of the Japanese Society for Food Science and Technology, 63(3):117–126 (2016)

Key Results

Differences in the drying process

Umami compounds : While the content decreased rapidly in hot-air drying until 5 hours after drying, it remained stable in cold-air drying until 8 hours later, and even after 20 hours, more than 60% of the salt content remained.
 Bitter and sweet compounds : In hot-air drying, the levels of amino acids that impart bitterness over time (such as valine and leucine) increased significantly reaching approximately four times the levels observed in cold-air drying after 20 hours.

Changes resulting from roasting (semi-dried product: dried for 2 hours)

Residual inosine acid : There was a tendency for more inosinic acid to remain in the cold-air-dried group.
 Changes in amino acids : The levels of lysine and histidine decreased significantly as a result of roasting; this is believed to be due to the promotion of the Maillard reaction with sugars.

Sensory evaluation and conclusions

| | Hot-air drying zone (approx. 50°C) | Cool-air drying area (approx. 20°C) |
|---|--|--|
| Sensory evaluation of roasted dried fish after 20 hours of drying | As IMP levels drop sharply, the number of Hx cases exhibiting bitterness increases | The decrease in IMP was small, and Hx and FAA did not increase significantly |
| Sensory evaluation of roasted dried fish after 2 hours of drying | The bitterness becomes stronger, and the sweetness becomes weaker | The sweetness increases and the bitterness decreases |

Results of sensory evaluation : Cold-air dried samples tasted significantly sweeter and less bitter than hot-air ones.
 Overall Evaluation : The cold-air drying group also received significantly higher overall appeal ratings.

[Conclusion]

Compared to hot-air drying, cold-air drying is more effective at preserving inosinic acid—a compound responsible for umami—and helps suppress the increase in bitter compounds. These differences in flavor components directly influence the perceived “intensity of sweetness” and “palatability” when the product is consumed, and scientific evidence confirms that cold-air drying is effective in improving the quality of salt-dried products.

The Secret of Umami

Enhanced fish umami is primarily driven by amino acid production via autolysis, nucleotide (inosine) accumulation, and their resulting synergistic effect.

Conversion of an Energy Source into “Umami”

When a fish dies, the supply of ATP — the energy source that powers muscle movement—ceases, and the fish begins to decompose. During this process, it transforms into inosinic acid (IMP), the key component responsible for umami.

The Breakdown of Proteins into Amino Acids

The phenomenon in which enzymes naturally present in fish break down their own proteins into amino acids is called “autolysis.” During this process, the levels of free amino acids, which is known for its umami flavor in kelp, increase.

Multiplication,” Not Just “Addition”

The greatest benefit of aging is the synergistic effect created by the coexistence of glutamic acid and inosinic acid. When these combine, the intensity of umami perceived by the brain increases by a factor of ten or more.

Optimizing Freshness in Distribution

This study investigated drying methods and ozone sterilization for horse mackerel examining the link between water activity and surface bacteria.

Background and Objectives of the Exam

【Background】

Freshness : Preferences shift toward fresher, "one-night" or "semi-dried" textures.

Hygiene : Sun-drying is often avoided due to dust and insects.

Technology : Ozone-equipped dryers for hygienic, delicious fish are gaining popularity.

【Objective】

This experiment evaluated several items to accurately assess hygiene conditions across the entire process, from production to distribution.

Bacterial Testing

Surface bacterial counts for cold and hot-air dried horse mackerel.

Water Activity

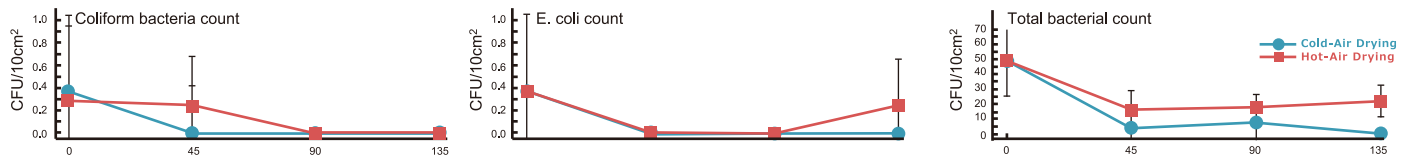
Surface bacterial counts for cold and hot-air dried horse mackerel.

Ozone Sterilization

Evaluating the sterilization efficacy of UV-generated ozone.

Source: Journal of the Japanese Society for Food Science and Technology, 63(3):117–126 (2016)

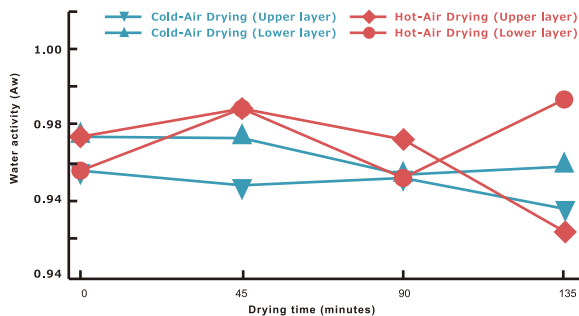
Comparison of Bacterial Inhibition Effects : Cold-Air Drying vs Hot-Air Drying



【Conclusion】

In the production of dried fish, it has been confirmed that cold-air drying allows for more uniform drying than hot-air drying and more effectively inhibits the growth of general bacteria, E. coli, and coliform bacteria.

The Relationship between moisture content and bacterial count in dried fish



【Conclusion】

When drying dried horse mackerel, hot-air drying results in uneven water activity across different parts of the fish, whereas cold-air drying uniformly reduces water activity in both the surface and inner layers. Consequently, cold-air drying is more effective than hot-air drying at inhibiting bacterial growth and improving shelf life.

The Efficacy of Ozone Sterilization

| Condition | Total bacterial count *1) |
|-------------------------------------|---------------------------|
| No drying | 23.4 ± 14.4 |
| Cool air drying (without ozone) *2) | 3.1 ± 2.8 |
| Cool air drying (with ozone) *3) | 1.4 ± 1.9 |

*1) Mean (CFU/10 cm²) ± S.D. (n=6)

*2) Chamber temperature: 19–23°C, humidity: 45–55% (90-minute drying period)

*3) Chamber ozone concentration: Mean approx. 0.35 ppm (90-minute drying period)

This study verified the bactericidal efficacy of ozone generated by the UV-lamp system built into the cold-air dryer.

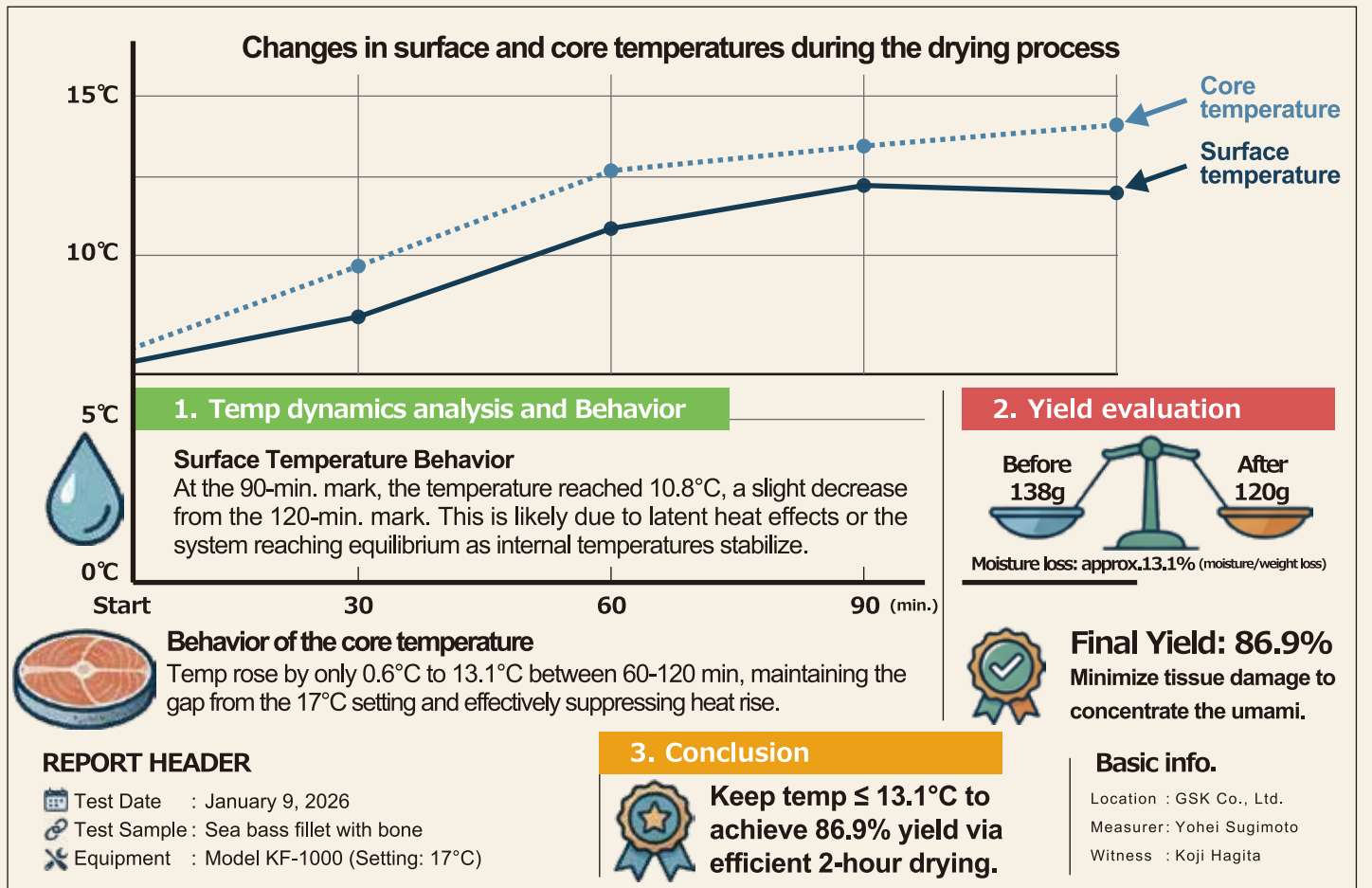
Source: Journal of the Japanese Society of Food Science and Technology, 63(3):117–126 (2016)

【Conclusion】

Using the dryer's built-in ozone generator reduced bacterial counts to approximately half those of the non-ozone group confirming a significant sterilization effect. Consequently, cold-air drying—especially with ozone—is an extremely effective method producing more hygienic and uniform dried fish than conventional hot-air drying.

Product temperature measurement using the Fresh-Aging Method

In the Fresh-Aging Method®, temperature measurement is vital for controlling self-cooling via latent heat of vaporization. These metrics evaluate the ability to maintain ingredients at 10°C within a 17°C airflow. This precise control defines the quality of Soft-Dried Fish, distinguishing it from traditional drying or simple refrigeration.



Role of temp (Fresh-Aging method)

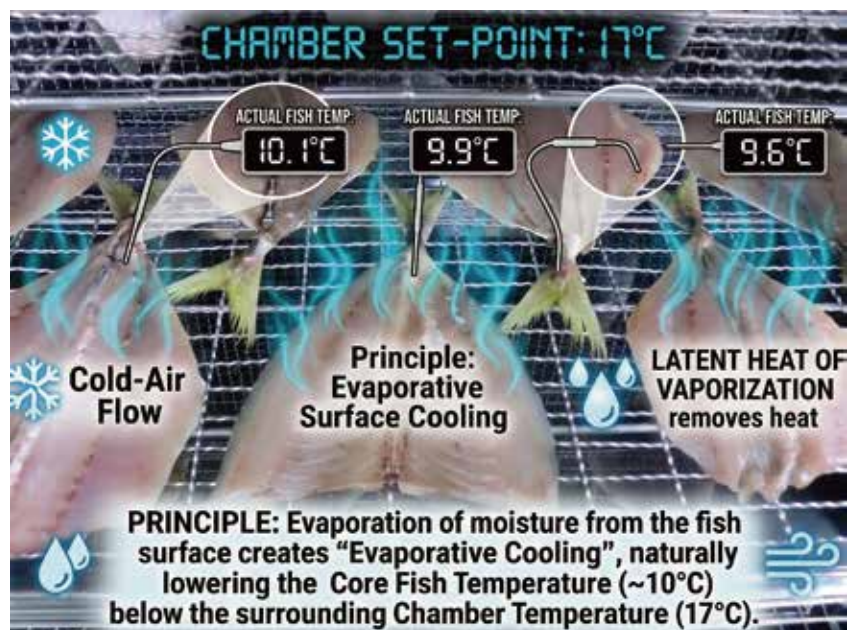
The key feature is leveraging the gap between the ambient environment and the food's internal temperature.

Set Temp : 17°C

Effective Temp: Around 10°C

Principle : Cold-air drying uses latent heat to drop food temp to ~10°C, staying below the 17°C ambient level.

The **Fresh-Aging Method** is a proprietary process developed by GSK that simultaneously achieves “controlling freshness to prevent deterioration (**Fresh**)” and “concentrating umami in a short time (**aging**).”



Taste Modifier®KF series

KF-1000

A model optimized for in-store sales

HACCP
compliant

Anti
bacterial

Wash
able

Quality
guaranteed



| Model | KF-1000 |
|-------------------------------|---------------------------------------|
| Rated Voltage | AC 200 V, 20 A, three-phase |
| Power Consumption | 1536W (876W in refrigeration mode) |
| Product Dimensions | W680mm D805mm H1630mm |
| Body Material | SUS304 |
| Weight | Approx. 206kgs |
| Refrigeration Unit | Air-cooled, 1 horsepower |
| Ozone | Built-in 6W UV lamp |
| Dimensions and No. of Shelves | W330mm D420mm 13 shelves |
| Capacity per Load | 65 pcs. (medium-sized horse mackerel) |
| Daily Production Capacity | 325 pcs. |

KF-2000

HACCP compliant—A standard model

HACCP
compliant

Anti
bacterial

Wash
able

Quality
guaranteed



| Model | KF-2000 |
|-------------------------------|--|
| Rated Voltage | AC 200 V, 20 A, three-phase |
| Power Consumption | 2168W (876W in refrigeration mode) |
| Product Dimensions | W1000mm D882mm H1880mm |
| Body Material | SUS304 |
| Weight | Approx. 290kgs |
| Refrigeration Unit | Air-cooled, 2 horsepower |
| Ozone | Built-in 6W UV lamp |
| Dimensions and No. of Shelves | W620mm D390mm 13 shelves |
| Capacity per Load | 130 pcs. (medium-sized horse mackerel) |
| Daily Production Capacity | 650 pcs. |

KFR-5000W

High-Capacity Model: 1,300 pieces per day (medium-sized)

HACCP
compliant

Anti
bacterial

Wash
able

Quality
guaranteed



| Model | KFR-5000W |
|-------------------------------|--|
| Rated Voltage | AC 200 V, 30 A, three-phase |
| Power Consumption | 3504W (2654W in refrigeration mode) |
| Product Dimensions | W1850mm D882mm H1980mm |
| Body Material | SUS304 |
| Weight | Approx. 497kgs |
| Refrigeration Unit | Air-cooled, 3 horsepower |
| Ozone | Built-in 6W UV lamp |
| Dimensions and No. of Shelves | W620mm D390mm 26 shelves (13×2) |
| Capacity per Load | 260 pcs. (medium-sized horse mackerel) |
| Daily Production Capacity | 1300 pcs. |