

Micronice Ultrasonic Nozzle Integration

Precise Humidification for Fresh Food Preservation with Tekceleo's Micronice Ultrasonic Nebulizers

Tekceleo on a North American Company Return on Experience for Micronice in their new food preservation humidification product.



Abstract

Maintaining optimal humidity is a decisive factor in the preservation and commercial value of fresh produce and other perishable goods. Conventional humidification methods—such as high-pressure misting, tank-based ultrasonic foggers, or blower-driven systems—are often inefficient, resource-intensive, or pose hygiene challenges. This white paper presents a detailed case study on the deployment of Tekceleo's **Micronice ultrasonic nebulization technology** in large-scale food preservation systems across North America.

The Micronice range delivers **precise humidification** through ultra-fine 5–8 µm droplets that hydrate without wetting, powered by a hygienic design operating on running water without reservoirs. Compared to conventional systems, Micronice achieves up to **95% lower energy consumption** and **86% water savings**, while ensuring compliance with strict health standards and reducing maintenance. Field results since 2023 confirm its ability to extend shelf life, reduce product shrinkage, and enhance the consumer experience.

Beyond supermarkets, the knowledge gained from this case has broader implications for **OEM humidification technology** in industries such as pharmaceuticals, biotech, agriculture, electronics, and cultural heritage preservation. By combining sustainability, hygiene, and performance, Micronice establishes a new benchmark in **energy-saving humidification technology** and positions Tekceleo as a platform provider of next-generation OEM solutions.

1. Introduction

Humidity is a silent but decisive factor in the quality and economic performance of fresh food distribution. Even minor deviations from optimal humidity levels accelerate **water loss, weight shrinkage, and deterioration** of fruits, vegetables, meat, and seafood. For retailers, this translates into millions in lost revenue every year, in addition to higher waste management costs and sustainability challenges.

Conventional humidification systems have been used for decades, but they are often **inefficient, difficult to maintain, or unhygienic**. In this context, Tekceleo’s **Micronice ultrasonic nebulization technology** provides a breakthrough: **precise humidification without wetting**, powered by hygienic design, low energy consumption, and ease of integration into OEM systems.

This white paper presents the deployment of Micronice nebulizers in large-scale food preservation systems across North America. It details the challenges faced, the technological differentiators, the results observed, and the lessons applicable to other industries.

By combining **scientific principles of humidity control** with **field results**, this case demonstrates how **OEM-ready, energy-saving humidification technology** can transform both business performance and sustainability outcomes.

2. The Challenge: Humidifying Fresh Food Displays Without Wetting

Fresh produce and meat are **living biological materials** even after harvest. They continue to respire, losing water through **transpiration**. If relative humidity in the storage or display environment is too low, the water loss accelerates, leading to:

- **Weight shrinkage:** products sold by mass lose economic value.
- **Visual deterioration:** wilting, browning, or drying out makes produce unattractive to consumers.
- **Shelf life reduction:** products spoil faster, increasing waste and costs.

Supermarkets must therefore maintain a delicate balance: **sufficient humidity to preserve freshness** without creating excessive wetness that can damage products or present safety hazards.

Traditional solutions and their consequences:

Key Challenge	Consequence for the Customer
Over-wetting from high-pressure misting	Slip hazards, soggy displays, lower product appeal
High water and energy consumption	Increased operating costs, sustainability concerns
Hygiene risks from reservoir-based systems	Risk of Legionella, biofilm, contamination
Noise and bulk of blower systems	Reduced customer experience, complex installation
Frequent maintenance requirements	Downtime, higher labor and service costs
Inconsistent humidity control	Uneven freshness, localized product spoilage

For retailers, the **financial implications are substantial**. Studies show fresh produce shrinkage can represent **2–5% of sales** in supermarkets. In high-volume operations, this can equal millions of dollars per year. At the same time, growing consumer and regulatory expectations on **sustainability and hygiene** make older humidification systems less viable.

3. The Solution: Tekceleo's Micronice Ultrasonic Nebulization Technology

Tekceleo's **Micronice range** brings a new paradigm to humidification: **precise droplet control, hygienic operation, and energy efficiency**.



3.1. How Micronice Works

Micronice nebulizers use piezoelectric ultrasonic vibration to create ultra-fine droplets directly from a running water stream. Unlike conventional ultrasonic humidifiers, there is **no water reservoir**, eliminating contamination risks. The droplet size can be tuned (05 μm or 08 μm), ensuring that the fog is **hydrating but non-wetting**.

In practice, the nebulizers are deployed in modular sections of display cases: **one nozzle per foot**, enabling consistent humidity across the entire line.

3.2. Comparison: Micronice vs. Other Humidification Technologies

Technology	Droplet Size	Hygiene Risk	Energy Consumption	Maintenance	Suitability for Fresh Food Displays
High-pressure misting	50–100 μm	Medium (pipes & nozzles clog, water stagnation)	High (compressed water pumps)	Frequent	Tends to over-wet, not ideal for delicate products
Tank-based ultrasonic humidifiers	5–10 μm	High (standing water reservoirs, Legionella risk)	High (~500 W per system)	High (cleaning tanks, replacing parts)	Limited, often fails hygiene compliance
Blower-based fog systems	5–10 μm	Medium	Very High (~600 W per section)	Moderate	Creates fog but energy-intensive and bulky
Tekceleo Micronice	5–8 μm	Low (running water only, no tank)	Very Low (25 W per 8 ft)	Minimal (no service contract)	Ideal: precise, non-wetting, hygienic

This comparison shows that Micronice uniquely combines **precision, hygiene, and efficiency**, making it the **first-choice OEM humidification technology** for modern preservation systems.

4. Implementation and Field Deployment

4.1. Design process

In collaboration with a North American leader in fresh product humidification, Tekceleo integrated Micronice into a patented **perishable preservation system**. The design includes:

- Modular lines of at least 8 feet, with one nozzle per foot.
- Choice of 05 μm or 08 μm droplet size depending on the product type (leafy greens, fruits, meat).
- Custom connectors and nozzle designs for compatibility with different display case manufacturers.
- Fluidic system co-designed for **optimal flow, minimal dead volume, and maximum reliability**.

Since its deployment in 2023, the system has been validated in multiple supermarket environments. It has shown **zero maintenance issues**, demonstrating both the robustness of the design and the reliability of Tekceleo’s support.

4.2. Constraints vs. Tekceleo’s Solutions

Constraint in Use Case	Tekceleo’s Solution
Need for non-wetting humidity	5–8 µm dry fog droplets prevent surface wetting
Strict hygiene requirements	Running water system, no standing water, exceeds health codes
Integration in compact display cases	Miniaturized nozzle with customized geometry/connectors
Energy consumption limits	25 W per 8-foot section
Maintenance cost reduction	No reservoir, minimal service, no FDA-mandated contract
Sustainability targets	-58% to -86% water savings, recyclable materials

This collaborative engineering ensured the system was **OEM-ready, compliant, and future-proof.**



4.3. Scalability

One of the strongest advantages of the Micronice range lies in its **scalable design**, which allows humidification performance to be easily adapted to different environments and case configurations. Each nozzle operates independently with minimal power consumption, enabling customers to scale from **a single 8-foot display case to entire supermarket aisles or warehouse-sized installations** without redesigning the core system.

This modularity ensures consistent humidity control across varied product types, while keeping integration straightforward and cost-effective. For our customer, this scalability has been decisive: the same Micronice core technology powers compact meat cases as well as larger fresh produce islands, guaranteeing uniform performance while simplifying procurement, maintenance, and training.

In practice, scalability reduces engineering complexity, accelerates deployment, and ensures that investments in OEM humidification technology remain **future-proof as store formats and needs evolve**. For example, starting from a 8-foot section, our customer easily developed :

- 4-foot islands for fresh food preservation
- Single nozzle humidifier for Humedor (cigars storage)
- Two nozzles humidifier for small Office humidification

5. Performance and Results of Micronice Integration

The integration of Tekceleo’s Micronice technology into our customer’s product range has delivered **measurable, field-proven improvements** since its deployment in 2023.

By replacing conventional misting and blower-based systems with Micronice, our customer achieved a solution that is not only more efficient and sustainable but also enhances product appeal and customer satisfaction. These results validate Micronice as a superior OEM humidification technology for food preservation and beyond.

Performance Indicator	Traditional Systems <i>(High-Pressure / Blower / Tank-Based Ultrasonic)</i>	With Micronice Integration	Observed Benefit
Droplet size & control	Large or inconsistent (10–100 µm) → risk of wetting or uneven fog	5–8 µm stable dry fog	Precise humidification, no wetting
Energy consumption	~500–600 W per 8 ft section	25 W per 8 ft section	-95% energy use
Water consumption	High, with wastage	-58% to -86% vs. competitors	>60,000 gallons saved per year per store
Hygiene & safety	Standing water reservoirs, Legionella risk	Running water, closed plumbing, no tank	Exceeds health standards, safer for food
Maintenance requirements	Frequent cleaning, clogged nozzles, service contracts	Virtually maintenance-free, no FDA-mandated contracts	Lower cost, higher uptime

Performance Indicator	Traditional Systems <i>(High-Pressure / Blower / Tank-Based Ultrasonic)</i>	With Micronice Integration	Observed Benefit
Product shelf life & shrinkage	Limited improvement, often uneven across display cases	Extended freshness, reduced shrink	Direct margin protection for retailers
Customer appeal	Wet displays, noisy fog/blowers	Clean, rolling fog, silent operation	Improved consumer perception & sales

The combination of **technical precision, energy and water efficiency, and robust hygienic performance** has positioned Micronice as a cornerstone of our customer’s humidification product line, enhancing both operational ROI and brand reputation in the market.



6. Beyond Fresh Produce: Extending the Use Case

While this case study focuses on food retail, the **knowledge created here is transferable**. Precise, hygienic, and energy-saving humidification is critical in many fields.

Knowledge Transfer to Other Applications

Knowledge from Fresh Food RETEX	Other Application Domains	Value Created
Non-wetting, micro-droplet fog	Electronics & semiconductor manufacturing	Prevents electrostatic discharge, maintains process stability
Running water, no stagnant reservoir	Pharmaceutical & biotech cleanrooms	Compliant with GMP hygiene standards
Compact OEM integration	Agricultural storage & transport	Lightweight, modular climate control
Energy-efficient humidification	Museums & archives	Stable humidity for preservation, low operating costs
Extended shelf life by reducing transpiration	Post-harvest handling of flowers and crops	Longer freshness during logistics and retail

This knowledge transfer positions Tekceleo as a **platform provider** of humidification technology with cross-industry relevance.

7. Key Takeaways

Key Lesson	Impact
Precise humidification extends product shelf life	Fresher displays, less shrinkage
OEM-ready integration enables new product lines	Case manufacturers gain competitive advantage
Energy and water efficiency lower operating costs	Immediate ROI for end-users
Hygienic design exceeds health standards	Lower risk, higher trust
Sustainability benefits extend beyond retail	Supports ESG strategies across industries

8. Conclusion

Tekceleo's Micronice ultrasonic nebulization technology has demonstrated its ability to **redefine humidification standards** in food retail: precise, hygienic, compact, and energy-saving. The case study shows measurable benefits in **product freshness, margin protection, and sustainability**, while providing an attractive consumer experience.

Beyond supermarkets, the **lessons learned here** apply to diverse fields, from high-tech manufacturing to heritage conservation. With Micronice, Tekceleo is not just solving a retail challenge — it is **shaping the future of OEM humidification technology** across industries.



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