airocide® SYSTEMS

AiroCide® Photocatalytic Air Purifying Technology in Del Monte Produce Distribution Facility

AiroCide photocatalytic air purifiers contain the same NASA-developed technology used in a variety of *AiroCide* air purifying product lines. In addition to serving the floral and perishable preservation and food safety industry, the technology is has been developed to kill/remove/eliminate airborne pathogenic and non-pathogenic microorganisms in vegetative and spore states (bacteria, mold & fungi, viruses and dust mites), allergens, odors and harmful volatile organic compounds (VOC's) in air in a variety of commercial, government, and residential applications including the medical healthcare industry (*AiroCide* air purifiers are FDA Class II listed medical devices).

Summary:

AiroCide photocatalytic air purifiers contain the same NASA-developed technology used in a variety of AiroCide air purifying product lines. In addition to serving the floral and perishable preservation and food safety industry, the technology is has been developed to kill/remove/eliminate airborne pathogenic and non-pathogenic microorganisms in vegetative and spore states (bacteria, mold & fungi, viruses and dust mites), allergens, odors and harmful volatile organic compounds (VOC's) in air in a variety of commercial,

Ethylene Gas

Del Monte personnel performed ethylene gas reduction Ethylene gas was reduced in the cooler by 99.8% in tests prior to the airborne mold/fungi tests summarized 66 hours. In this report. Ethylene gas was reported to have been reduced from a concentration of 250 parts per million The table below shows airborne mold/fungi PPM) to 0.5 PPM in 66 hours.

Mold/Fungi

The AiroCide PPT system reduced the amount of airborne mold in the cooler by an overall 44% after 72 hours of operation.

Protocol

The AiroCide PPT system used in the produce cooler consisted of one (1) ACS-100 unit. The test period consisted of four (4) days of air sampling. Baseline air samples were taken in the cooler on Monday, 10/02/06 without the AiroCide PPT system operating. Active On samples were taken after 24, 48 and 72 hours of AiroCide PPT use, on Tuesday 10/03/06, Wednesday, 10/04/06 and Thursday 10/05/06. Air samples were taken with an impingement air sampler (similar to the Anderson N6 sampler) on 15 x 100 mm plastic petri dishes in accordance with procedures established by the Indoor Air Quality Association (IAQA) and the American Industrial Hygienists Association (AIHA). This type of slit air sampler is considered the most accurate method of measuring viable (live) mold and is superior to air sampling that utilizes ambient or gravity spore capturing techniques.

Four locations were sampled for airborne yeast and mold and sent Siliker Inc. Food Science Center, South Holland, IL for analysis.

Results:

Ethylene gas was reduced in the cooler by 99.8% in 66 hours.
The table below shows airborne mold/fungi reduction inside the cooler of 44% in 72 hours.

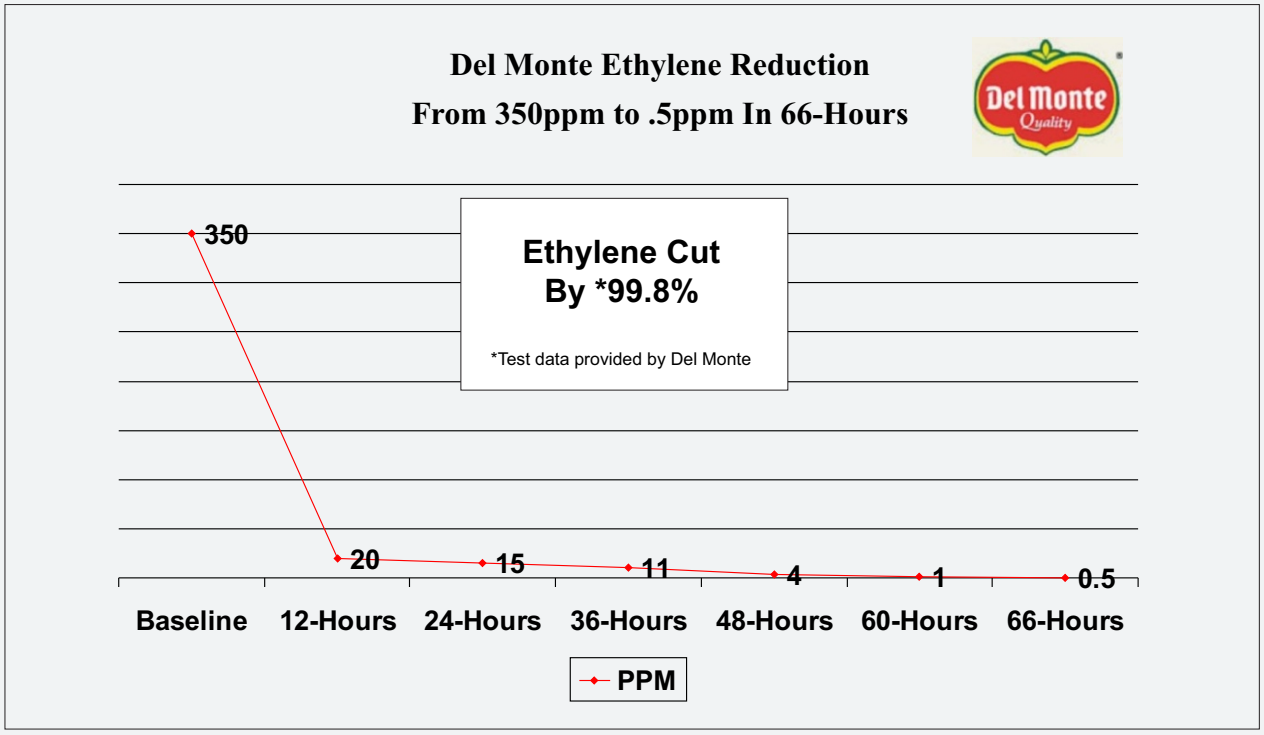
Location	Baseline	24 hrs	48 hrs	72 hrs
Cooler 1	31.5	6	12	17.5
Percent Change	N/A	-81%	-62%	-44%

In Perishable Cooler Applications:
One (1) AiroCide PPT air purifier model ACS-100 is designed to clean the air in enclosed areas up to 50,000 ft^3 in volume (1,415 m)

under standard operating conditions. *
One (1) AiroCide PPT air purifier model ACS-50 is designed to clean the air in enclosed areas up to 25,000 ft^3 in volume (707 m)

under standard operating conditions. *
One (1) AiroCide PPT air purifier model ACS-25 is designed to clean the air in enclosed areas up to 3,000 ft3 in volume under standard operating conditions. *

*AiroCide PPT air purifier specification requirements may vary according to the temperature and design of enclosure as well as the sensitivity of its contents to airborne mold, bacteria and ethylene gas.
In order to obtain a target airborne pathogen reduction of 90% or greater within 48 hours,



Cherry Storage Optimization: Airocide's Impact on Ethylene Suppression and Weight Loss Reduction

The Cherry Chamber study assessed the effects of Airocide on cherries, specifically focusing on weight loss and ethylene suppression over a 14-day period. In the Airocide chamber, ethylene levels decreased to 0.1 ppm, while the control chamber showed an increase to 2.0 ppm. Weight loss in the Airocide chamber was only 1.8% by day 14, compared to 4.0% in the control group.

Key Benefits:

Enhanced Freshness: With lowered ethylene levels, cherries experienced a slower ripening process, helping to retain their color, firmness, and quality.

Extended Marketability: By reducing weight loss, cherries had a longer shelf life, providing more flexibility in distribution and reducing waste.

Quick Return on Investment: Airocide demonstrated effective results within the first few days, making it an ideal solution for businesses seeking immediate improvements in product quality.

The Airocide unit proved highly beneficial for cherry preservation, with both reduced ethylene levels and minimized weight loss providing tangible ROI benefits for distributors and retailers handling delicate, perishable fruits.

OBJECTIVE

To evaluate the role of Airocide technology in maintaining the quality of cherries (Lapins and Regina varieties) by reducing weight loss, ethylene levels, and microbial load during cold storage.

METHODOLOGY

Cherries were divided into two groups: one placed in a chamber with an Airocide unit and the other without (control). Both chambers were kept at optimal storage conditions for cherries. Weight loss, ethylene levels, and visible quality indicators were monitored over a period of 7 and 14 days.

RESULTS

Weight Loss Reduction: The Airocide-treated cherries (both Lapins and Regina varieties) experienced significantly less weight loss compared to control, particularly noticeable by 7 and 14 days of storage.

Ethylene Suppression: Reduced ethylene levels in the Airocide chamber slowed the ripening process, preventing the premature softening of the cherries.

Quality Retention: Cherries stored with Airocide maintained a brighter, fresher appearance, with reduced signs of microbial spoilage and decay compared to control.losses.

ROI IMPACT

The Airocide unit quickly demonstrated value by extending cherry shelf life by several days. This decrease in spoilage means reduced waste and longer sales opportunities, providing a rapid return on investment for suppliers needing to manage sensitive, high-value produce.

EXECUTIVE SUMMARY

This report presents the results of case studies conducted in controlled Cherry Chambers to evaluate the effectiveness of Airocide technology in reducing ethylene levels and microbial load, thereby extending the shelf life and quality of stored produce.

Cherry Chamber Findings: In the Cherry Chamber, the Airocide unit effectively suppressed ethylene levels, delaying ripening and minimizing weight loss (1.8% vs. 4.0% in control). Cherries stored with Airocide retained better color and firmness, extending their shelf life and offering more flexibility in distribution, particularly for high-value, delicate produce.

CONCLUSION

Airocide technology demonstrated immediate and measurable benefits for cherries, showing its value in preserving freshness, reducing spoilage, and enhancing the marketability of perishable fruits. These findings support the use of Airocide as a viable solution for extending produce shelf life, especially for ethylene-sensitive fruits.

Optimizing Apple Storage: Impact of Airocide on Ethylene, Microbial Control, and Shelf Life

The Apple Chamber study evaluated the impact of Airocide technology on ethylene reduction and weight loss in stored apples. By using Airocide, ethylene levels were effectively reduced, as seen in the decrease from 1.0 to 0.2 ppm over 14 days, compared to the control chamber, where ethylene levels rose to 2.0 ppm. Weight loss was also significantly lower in the Airocide-treated apples, with only 1.5% weight loss versus 3.5% in the control group after 14 days.

Key Benefits:

Extended Shelf Life: The reduction in ethylene slowed the ripening process, allowing apples to maintain freshness for an additional 5-7 days.

Cost Savings: Reduced spoilage translates into fewer losses, enhancing ROI by allowing more product to reach the market in premium condition.

Immediate Impact: Observable reductions in both ethylene levels and weight loss were noted within the first 3-7 days, showcasing Airocide's quick and effective response.

The results illustrate the effectiveness of Airocide in preserving apple quality, leading to a rapid ROI for businesses focused on reducing waste and maximizing produce quality.

OBJECTIVE

To assess the effectiveness of Airocide technology in reducing ethylene gas and microbial load, thus extending the shelf life and reducing weight loss of apples stored in a controlled chamber environment. This study was designed to demonstrate rapid results that directly impact ROI through reduced spoilage and improved quality retention.

METHODOLOGY

In this study, apples were stored in two chambers: one with the Airocide unit and the other without (control). The chambers maintained consistent temperatures ideal for apple storage. The Airocide chamber aimed to reduce ethylene and microbial contamination, thus preserving the apples' freshness and firmness.

RESULTS

Ethylene Reduction: The Airocide unit effectively reduced ethylene levels, which helps delay the ripening process, thereby prolonging shelf life. Apples in the Airocide-treated chamber showed slower ripening compared to the control.

Weight Loss: The apples in the Airocide chamber exhibited less weight loss due to moisture retention and reduced microbial spoilage over the storage period.

Shelf Life Extension: Apples in the Airocide chamber retained their freshness up to 5-7 days longer than those in the control group, a critical factor for wholesalers aiming to reduce losses.

ROI IMPACT

Using Airocide resulted in a significant reduction in spoilage costs, with quick, measurable outcomes. By extending shelf life, businesses gain additional time to distribute and sell produce, reducing waste and enhancing profitability.

EXECUTIVE SUMMARY

This report presents the results of case studies conducted in controlled Apple Chambers to evaluate the effectiveness of Airocide technology in reducing ethylene levels and microbial load, thereby extending the shelf life and quality of stored produce.

Apple Chamber Findings: The Airocide unit significantly lowered ethylene levels, resulting in a slower ripening process. Apples in the Airocide-treated chamber showed reduced weight loss (1.5% vs. 3.5% in control) and maintained freshness for an additional 5-7 days. These benefits highlight the potential for reduced spoilage and increased profitability in apple storage.

CONCLUSION

Airocide technology demonstrated immediate and measurable benefits for apples, showing its value in preserving freshness, reducing spoilage, and enhancing the marketability of perishable fruits. These findings support the use of Airocide as a viable solution for extending produce shelf life, especially for ethylene-sensitive fruits.

Eliminating Bacteria and Odor in Fish Processing Facility with Airocide and with Airocide Mobile.

INTRODUCTION

Hassad, the largest fish market and processing conglomerate in the Middle East , established Aswaq as a subsidiary to manage its six integrated markets strategically located across Qatar in A'Sailiya, Umm Salal, Al Wakra, Abu Nakhla, Al Ruwais, and Al Khor, aiming for food security.

A'Sailiya Central Market, situated about 25 minutes from Doha, spans 78,000m^2 with retail, wholesale, traditional markets, an auction area, cold stores, fish, poultry and meat shops, a hypermarket, and service shops.

Hassad Food plans to invest in indoor air purification technology for the fish market area. They'll purchase and install Sterilumen's air purification devices, including Airocide TITAN-100 units and Airocide Mobile units. The placement was based on floor plans, dimensions, and available power supply.

Hassad Food is looking for a sustainable indoor air purification solution. SteriLumen provides FDA-approved air purification technology designed for NASA and offers seamless local implementation support in Qatar, effectively addressing indoor environmental quality (IEQ) challenges..

IMPLEMENTATION

- (3) Airocide TITAN-100 and (2) Airocide Mobile air purification devices were installed to mitigate odors resulting from fish market operations.
- Qualitative reduction of odor tests and quantitative testing (pre and post-installation) were carried out for common indoor environmental quality parameters.
- Post measurements for indoor environmental quality were taken after the air purifiers had been in operation for at least (1) week.

Airocide and Airocide Mobile units showed conclusive results:

Test Parameter	Results Obtained Pre-Installation	Results Obtained Post-Installation	Units	Reduction Percentage
Yeast & Molds	30	2	CFU/m³	93%
Total Bacterial Count	160	14	CFU/m³	91%
Particulate Matter 10 (PM 10)	330.25	16.85	µg/m³	95%
Particulate Matter 2.5	103.7	54.8	µg/m³	47%
Formaldehyde	<10.0	<10.0	ppb	
Ozone	0	0	µg/m³	
Total Organic Volatile Compounds (TVOCs)	545.4	410.70	ppb	25%

IMPACT

1. Bacteria

- Bacteria is the main factor when it comes to accumulating unwanted odor and smell. It also responsible for food spoilage by breaking down food, producing acids other waste products.
- Installing Airocide and Airocide Mobile to efficiently eliminate bacteria leads to the elimination of any odor and smell, avoid products from spoiling fast and provide a safer environment for your clients and staff alike.

2. Mold, Fungi, Yeast:

- Mold is infamous for spreading incredibly fast and infecting products all around the facility.
- Installing Airocide and Airocide Mobile to efficiently eliminate mold, fungi and yeast will preserve the quality of existing products for longer periods of time and safeguard new shipments.

3. VOCs, Formaldehyde, PMs, Ozone:

- All these elements are very harmful to an individual's health and are behind many illnesses (fatal and non-fatal). Some can cause fatigue, nausea, headaches, allergies and can decrease productivity.
- Ozone by nature is very harmful to the environment
- Installing Airocide and Airocide Mobile to eliminate these airborne threats will highly improve the shopping experience for your clients and encourage them to linger, purchase additional products and provide them with the safest environment by adding an extra value to your services.
- Installing Airocide to eliminate these airborne threats will increase your staff's productivity by providing clean air and decrease the risks of headaches, nausea, fatigue etc in the environment and adding an extra value to your services.

CONCLUSION

- The installation of the (3) units of Airocide TITAN-100 and (2) units of Airocide Mobile have managed to successfully reduce the qualitative odor issues in the Market. This is supported by the quantifiable reduction in quantitative IEQ parameters, including those parameters most responsible for unwanted odor and smell.

Airocide TITAN 100

Airocide Mobile

- The goals and objectives of providing practical and implementable Indoor Air Purification solution to reduce odors from fish market operations have been successfully achieved. Along with qualitative reduction of odor, the installation of the equipment has resulted in quantitative reduction for common indoor environmental quality parameters.

REDUCE SHRINK, EXTEND SHELF LIFE & IMPROVE FOOD QUALITY

Extending Avocado Shelf Life By Removing Ethylene Gas

Utilizing technology developed for NASA, Airocide is perfect for your facility

INTRODUCTION

In reality, the problems are always ethylene gas or microorganisms depending on the product. There can also be products that are not as high in ethylene production, such as asparagus, but if you combine it with an ethylene producer it affects them too much.

In Mexico, the avocado has several turns where we have opportunity:

Export packing, packing for national sale, packing for sale of product for process, process companies (Guacamole packing process). In all of these we have the opportunity to offer different benefits.

TECHNOLOGY

Originally designed for the NASA space station program, Airocide controls ethylene gas and destroys mold and bacteria without producing any harmful byproducts like ozone or VOCs. As an FDA cleared Medical Device (Class II) with a proven 99%+ kill rate for microbials, students and staff will benefit from improved food safety and are protected from hazardous cross-contamination. Airocide units also help institutions save on food-related costs by reducing shrink, slowing premature ripening, and preventing loss.

IMPLEMENTATION

Pre-cold, conservation chambers, quarantines or rest chambers, corridors sometimes have cold aisles and sometimes they have to store what effect it has on the fruit on the shelf.

Besides the good handling of the product of the customers, definitely the equipping with airocide has a positive effect in the shelf.

IMPACT

The implementation of the Airocide units was utilized to eliminate airborne threats that jeopardize the overall quality of the Avocados. Prior to installation of Airocide, the Avocados were having issues of advanced ripening and contamination issues. Since installing, the study confirmed that the Avocados last longer, and ripen more uniformly in a higher percentage.

CONCLUSION

The initiative to implement Airocide exemplifies its commitment to food safety and food quality. This strategic move not only highlights the company's dedication to maintaining the highest standards of air purification to eliminate unwanted airborne contaminants, but also positions it as a front runner in the adoption of advanced air purification technologies.

With Airocide

Without Airocide

Installed 24 Airocide GCS-100 units and 22 Airocide GCS-50 units and since installation, they have noticed that the Avocados last about a week or more longer in the whole process until they reach the customer.