

CASE STUDY

Ethylene Removal Capability

U.S. Cold Storage Distribution Facility

Introduction

A cold storage facility located in Bridgeport, CT imports bananas and plantains, which arrive at the beginning of the week. The fruit is stored at 57°F and 47°F, respectively. Then, depending upon demand, the fruit is shipped to customers via trucks by the end of the workweek. Occasionally in slow markets, the fruit is “carried over” from one week to the next.

Bananas, especially, are known to emit ethylene, a ripening agent, during cold room storage. Ethylene levels of greater than 1 part per million (ppm) in the cold room environment accelerate the banana ripening process. If ethylene accumulation can be controlled, the freshness and shelf-life of the fruit can be extended, especially during slower than normal turnover.

An arrangement was made for testing of Catalyx’s patented air purification system, the FRESH+™ to reduce the ethylene concentrations in the facility. The FRESH+™ system is a filter housing equipped with high-dose ultraviolet (UV) lamps and proprietary photocatalytic (PCO) filters. Volatile Organic Compounds (VOCs) such as ethylene are adsorbed onto the PCO filter. As shown in Figure 1, the UV light activates the PCO filter, generating an oxidation reaction on the surface of the filters, converting ethylene to minute amounts of carbon dioxide.

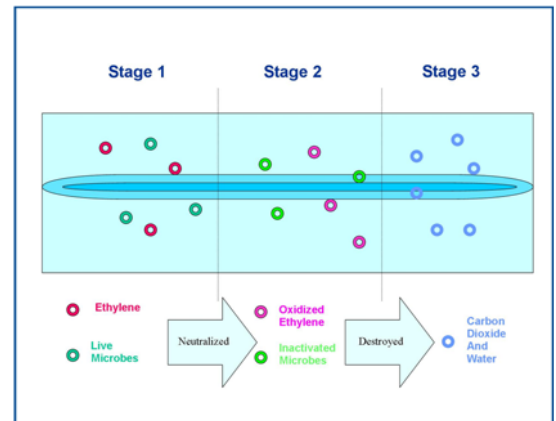


Figure 1 Action of Photocatalytic Oxidation & Disinfection

Figure 2

Summary of Ethylene Concentrations without FRESH+™

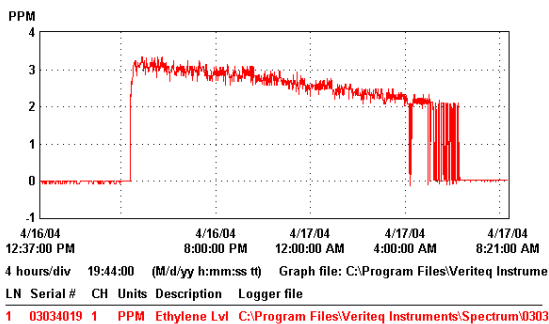
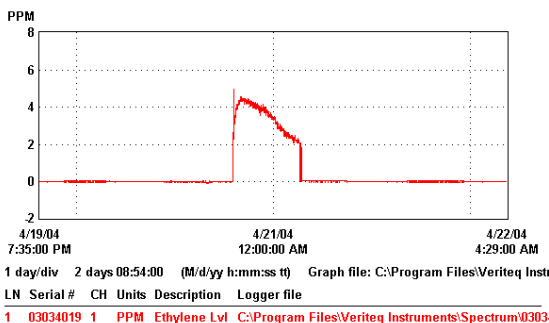


Figure 3

Summary of Ethylene Concentrations with FRESH+™



Trial Details

Figure 2 shows the ethylene data during a typical baseline week (without FRESH+™). On a typical day, the warehouse has about 300,000 kg of bananas and a free air volume of 1.1 million ft³. Theoretical calculations result in about 1.5 ppm of ethylene, after overnight storage. As seen from Figure 1, once the warehouse doors are closed, the ethylene from leftover fruit accumulates, and then is gradually depleted by the “leaky” ventilation system. Actual ethylene levels were much higher than anticipated, most likely from premature fruit ripening.

A week later, the FRESH+™ Ethylene Scrubber was placed in operation. In Figure 3, significant acceleration of ethylene degradation is evident compared to baseline conditions in the warehouse without ethylene removal. To assess performance of the FRESH+™, the slopes of the curves from the Figure 2 and Figure 3, which represents ethylene degradation rates, are compared. The results, shown in Table 1, demonstrate a significant increase in ethylene degradation (3.5 times) when FRESH+™ is in operation.

Table 1 Comparison of Ethylene Reduction Rates	
Sampling Period	Degradation Rate
Baseline – Natural	0.08 ppm/hour
FRESH+™	0.28 ppm/hour

Conclusions

The EC-800 used in this study was designed to provide 800 cfm of airflow. In a room size of up to 150,000 ft³, the system provides a minimum of 7.68 air changes per day (ACD). Due to test constraints, the test was conducted with the EC-800 in a 1,500,000 cu. ft. space providing a single air change per day, a fraction of the recommended air changes. Even with a single pass of air, FRESH+™ equipment demonstrated effective removal of ethylene and the strong oxidizing effect of the PCO reaction. This trial resulted in purchase of FRESH+™ by the company who participated in the trial.

In an actual commercial setting, we recommend a minimum of 6-8 air changes per day (ACD) on total room volume which provides a conservative estimate of ACD. This arrangement provides maximum ethylene reduction balanced with cost-effective performance. Catalyx technologies, LLC has developed an extensive knowledge base of UV and PCO technologies for ethylene control. From extensive university research, we have formulated a strong design basis for our equipment which includes taking into account the ethylene production and sensitivity of each commodity to provide a strong value proposition for our clients.

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