



Technology Readiness Level: **2**  
Technology Concept and/or Application Formulated

## Ethylene Removal Technology for Food Storage

**Effective, low cost, green solution to preserving food in storage and transit**

### Technology

**Innovation:** Proprietary catalyst removes ethylene, hydrogen cyanide; low temperature oxidation of numerous organic species

**Application:** fruit and vegetable preservation

### Benefits

- Low cost
- Five-year lifetime
- Low temperature removal activity
- Regenerability
- Green solution

Fresh fruit, vegetables, and flowers (FF&V) are transported and stored in refrigerated containers. As the produce ripens, ethylene gas is produced, which further ripens the product and can lead to premature spoilage. Most fruits and vegetables emit ethylene gas which promotes ripening; certain species, such as apples and bananas, produce more ethylene than others. Elevated ethylene levels can significantly reduce storage time; concentrations as high as only 1 ppm can destroy an entire container of produce in one day.

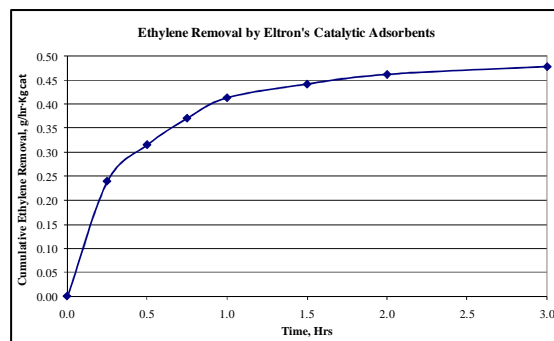


Figure 1. Data demonstrating ethylene removal activity for Eltron's catalytic adsorbent. Experiments were conducted at 2°C with 20 ppm ethylene and a space velocity of 18,000 hr<sup>-1</sup>.

The current ethylene removal industry employs *single-use* potassium permanganate adsorbent blankets or sachets, or a removal device that has a limited lifetime (3-8 months). Other devices that are on the market or currently being developed include biofilters, ozone generators, and photocatalytic and electrocatalytic devices. Disadvantages of these devices include very strict storage requirements, the potential of contamination by the ethylene destroying bacteria, the need to employ complex systems to produce ozone, and high manufacturing costs of the photocatalytic device and high costs of the nano-gold electrocatalyst.

### Eltron's Solution

Eltron Research & Development has developed proprietary catalytic materials for removing ethylene and other species containing a pi-bonding environment, such as hydrogen cyanide. **Results from an internally funded research and development program show that an *unoptimized* catalytic adsorbent has activity for ethylene removal (see Figure 1).** It is anticipated that Eltron's Catalytic Adsorbents will be effective for more than five years, a huge improvement over the three- to eight-month lifespan of permanganate materials. Eltron's Catalytic Ethylene Removal Technology is based on Eltron's proprietary catalytic adsorbents, which have shown high activity for the removal of ethylene, hydrogen cyanide, and the low temperature oxidation of numerous organic species. (The results from initial studies for the removal of ethylene are shown in **Figure 1**.) These materials have also been studied for the removal of hydrogen cyanide, HCN, from air at low temperatures (room temperature to 0° C).

Due to the similar bonding environment between HCN and ethylene (both contain pi-bonds); it is believed that these same catalytic adsorbent materials will be effective for ethylene removal. Results for HCN removal by Eltron's proprietary catalytic adsorbent materials can be seen in **Figure 2**. The figure shows the HCN removal expressed as *Ct*. *Ct* is the challenge concentration multiplied by the challenge time or breakthrough time. It is a method for expressing the protection of a filter in terms of the quantity of agent adsorbed.

As can be seen in **Figure 2**, Eltron's catalytic sorbents have been shown to be superior to the gas mask material that is currently in use by the military. Also, for two of the three catalytic sorbents, the *Ct* increased at lower temperatures (0°C) and demonstrated HCN removal capacities of greater than 14 wt.%.

### **Stage of Development**

A prototype reactor is operational, and samples are available for 3rd party testing. Eltron has issued and pending patents for this technology.

Eltron Research & Development's Tech Briefs, the technologies described, and all related inventions are owned by Eltron Research & Development Inc, and protected by copyrights, trademarks, issued and pending patents, trade secrets, or other applicable intellectual property rights.

### **Contact Us**

To discuss the possibility of entering into a business relationship with Eltron, contact the Business Development Group at [business@eltronresearch.com](mailto:business@eltronresearch.com).

To learn more about Eltron Research & Development's catalysts and the many other technologies that the company is commercializing, visit [www.eltronresearch.com](http://www.eltronresearch.com).

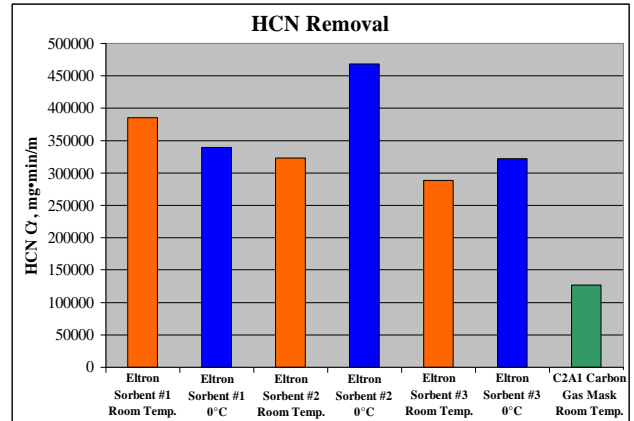


Figure 2. HCN removal by Eltron's proprietary catalytic sorbents at room temperature and 0°C and a state-of-the-art gas mask material, C2A1 Carbon.



### **Eltron Research & Development Inc.**

Eltron Research & Development Inc. commercializes novel technologies involving advanced materials, energy, water and environmental systems.