New Ethylene Inhibitor Could Extend Flower Life

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Ethylene gas can shorten the life of many floral crops, causing flower and bud drop, premature wilting, and flower discoloration. Silver thiosulfate (STS) is effective in preventing ethylene damage, but its use hasn't been widely adopted by U.S. growers. One reason is that the recommended treatment is a cumbersome two-step process, consisting of "pulsing" the flowers in STS solutions for a specific time, and then moving the flowers to standard fresh flower food. Also, poor mixing, old degraded solutions, and improper temperatures or treatment times may reduce success. Another problem with STS is the concern with disposal. Silver is a heavy metal that persists in soil and groundwater for long periods and may pollute drinking water. When absorbed by the body, heavy metals accumulate and at toxic levels will affect the nervous system. STS's impact on the environment has come under scrutiny by governmental agencies. In Holland, for example, its use on potted plants is prohibited.

In the U.S., STS can be used on cut flowers and potted plants, but disposal of leftover solutions is controlled. The legal maximum concentration of silver in waste water, set by the EPA, is 5 ppm, although local municipalities may often allow less. Since most effective STS treatments contain more than 100 ppm silver, it's necessary to remove the metal by passing it through a silver recovery system similar to that used by the commercial film processing industry.

Several fresh flower food manufacturers have developed alternative anti-ethylene products. However, these may not contain enough silver to be effective, or they may reduce internal ethylene that's naturally produced by plants and flowers but won't protect sensitive flowers exposed to external ethylene.

A new ethylene inhibitor was discovered by researchers at North Carolina State University. The compound, 1-methycyclopropene (MCP), acts as a binding site competitor and is very promising as a postharvest treatment for both potted plants and fresh cut flowers. MCP is a gas, like ethylene. When plants are pre-treated with MCP and then exposed to ethylene-polluted environments, MCP appears to give ethylene protection equal to that obtained from STS, but without silver.

What's ethylene?

Many floral crops are sensitive to the common atmosphere pollutant called ethylene. It is particularly insidious because it's a colorless gas that's difficult to detect and is active at minute concentrations. Ethylene-induced injuries include premature wilting in carnation and kalanchoe; flower discoloration in orchid; shattering and flower or bud drop in alstroemeria, lily, snapdragon, delphinium and rose. It accounts for an estimated 25 to 35% of all floral crop shrinkage.

Ethylene is actually produced in small quantities by naturally ripening fruit and by floral crops as they age. It's used commercially to force bromeliads into flower and to hasten the ripening of bananas and tomatoes. But ethylene is also an activator for the normal physiological processes of aging for many floriculture crops.

Exposure to external ethylene gas initiates the biochemical path that ultimately increases internal ethylene production in sensitive species. Besides being produced by ripening fruit and flowers, the gas is present in cigarette and wood smoke and exhaust from gas heaters and internal combustion engines.

Recent data from experiments at the University of California, Davis, and at California packing houses and supermarkets have shown a dramatic increase in display life for MCP treated plants and flowers that are exposed to ethylene-contaminated environments. Response varies with plant species. Potted plants such as miniature rose and begonia show as much as 300% increase in shelf life over control plants, while MCP-treated kalanchoes last more than 600% longer than untreated controls. For cut flowers such carnation, penstemon, snapdragon and stock, MCP treatments result in display life that is extended more than 200%. MCP treatments also improved vase life for alstromeria by 136%. See Tables 1 and 2.

Species	Treatment	Flower life (days)	% increase over control
Begonia			
Rosa	Control	2.3	—
	STS	7.5	326%
	MCP	7.3	317%
Rose Victory			
Parade	Control	3.3	—
	STS	9.3	282%
	MCP	9.0	273%
Kalanchoe			
Tropicana	Control	2.0	—
	STS	14.0	700%
	MCP	13.3	665%

Table 1. *Display life of potted plant species. After no treatment (control), or treatment with STS, or MCP, the plants were placed in environments containing 0.5 to 1.0 ppm ethylene at room temperature.*

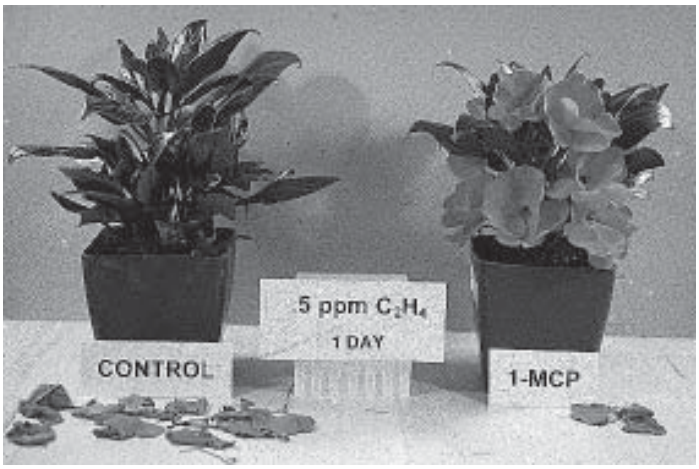

Figure 1. *The New Guinea impatiens on the right was treated with MCP, the plant on the left was untreated. Both were exposed to 0.5 ppm ethylene for two days.*

Species	Treatment	Flower life (days)	% increase over control
Alstroemeria	Control	5.0	—
	STS	6.8	136%
	MCP	6.8	136%
Stock	Control	2.3	—
	STS	5.0	217%
	MCP	5.0	217%
Carnation	Control	2.3	—
	STS	5.3	230%
	MCP	5.8	252%
Penstemon	Control	1.8	—
	STS	5.3	294%
	MCP	5.3	294%
Snapdragon	Control	3.0	—
	STS	6.3	210%
	MCP	6.5	217%

Table 2. *Display life of fresh cut flowers species. After no treatment (control), or treatment with STS or MCP, the flowers were placed in environments containing 0.5 to 1.0 ppm ethylene at room temperature.*

This research comparing MCP treatments with standard STS treatments shows that the effects of MCP were not significantly different. However, our data for MCP-treated gypsophila showed that MCP was less effective than STS treatments. It appears that in this species, MCP offers some protection for fully open flowers, but not for buds that will develope later.

MCP's ease of use and safety may promote wider use by the floriculture industry. Floral crops could be treated in closed greenhouses just before harvest, in storage or display coolers, truck trailers or shipping containers. MCP may also have applications for bedding plants and in fruit storage programs.

MCP will be commercially produced by Biotechnologies, Inc. (a subsidiary of Floralife) , which has acquired the licensing rights from NCSU. The company plans to sell the product in a powder form that will release MCP gas when mixed with water. The projected release, pending EPA approval, is early 1998. The often spectacular results in potted plants and cut flowers treated with MCP gas suggest that this compound may be the alternative to STS that the industry has been seeking.

Tips for avoiding ethylene damage

To maximize plant and flower life of ethylene-sensitive crops, avoid external ethylene sources. Don't operate internal combustion engines in or near refrigeration units and keep ripening fruit away from flowers. Discard flowers showing signs of aging and ventilate storage or display areas with ethylene-free air.

The use of ethylene scrubbers that force air across inert beads impregnated with the chemical absorbent, potassium permanganate, is also effective in storage areas.

Internal ethylene production and activity is reduced with cooler temperatures. Operate refrigerated storage at the lowest temperatures possible without causing chilling damage. For most crops this is at 0°C (32°F), but tropical crops such as anthuriums, bird-of-paradise, some orchids and ginger can be injured at temperatures below 10°C (50°F).

Postharvest anti-ethylene treatments are effective in reducing ethylene effects for sensitive species. However, growers may need to try them out on a small scale to determine appropriate temperature and treatment times if specific instructions are not provided by the manufacturer. Analysis of the silver concentration of STS products at an independent lab is also advised, since our research has found that some commercial products contain too little silver to be effective.

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