Inhibiting the Ethylene Pathway using a Receptor Antagonist

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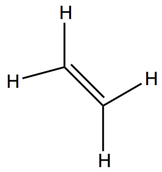
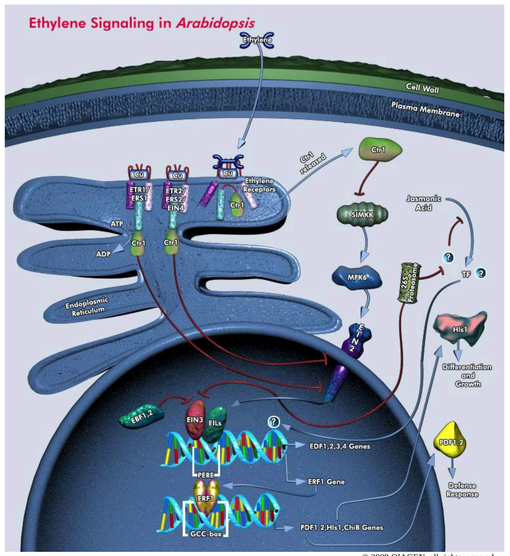
Molecular Structure of Ethylene gas

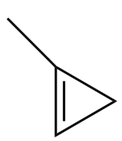


Ethylene is an important gaseous hormone that is produced by many plants and fruits. When interacting with fruits and flowers, ethylene can stimulate fruit ripening and flower opening. Due to this effect, ethylene is a serious problem for farmers and distributors.



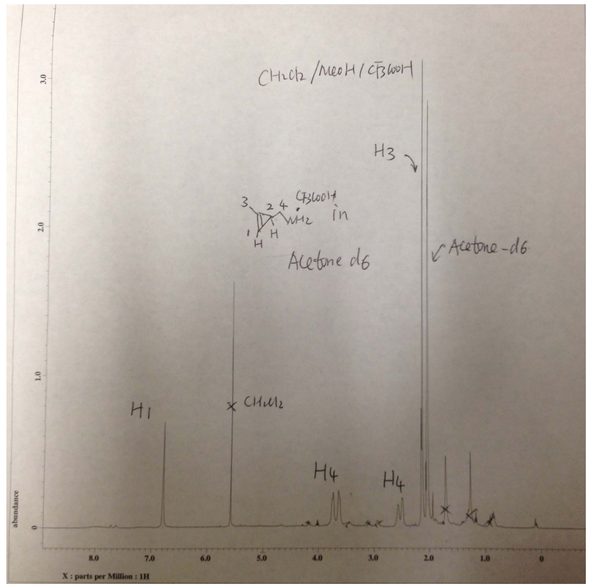
Ethylene receptor ETR inhibits protein kinases causing the release of transcription factors ERF1 and EILs. They then move to the nucleus causing the release of proteins that regulate development of tissue and cell maturation.

1-Methylcyclopropene Molecular Structure

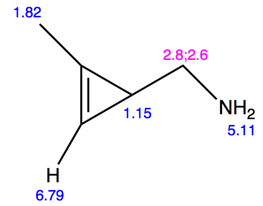


Currently, 1-MCP is the most used ethylene inhibitor for farmers and distributors, but it has many disadvantages. Since it is a gaseous molecule, it is very hard to store and move. Also, because of its molecular structure, 1-MCP can often polymerize with one another forming unwanted compounds.

Hydrogen-1 NMR – 500 mHz

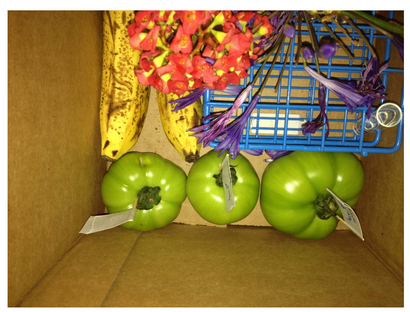


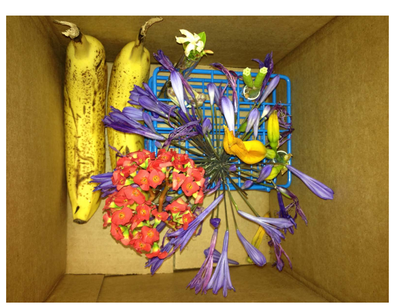
Chemical Shift of Methylcyclopropene amine

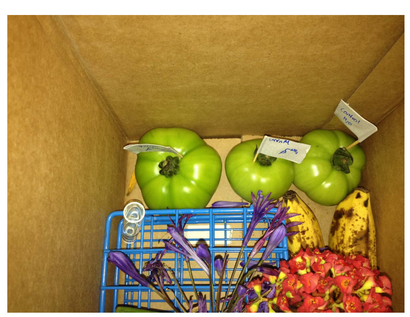


The H-NMR shows that it is mainly the Methylcyclopropene amine synthesized with very little impurities.

Flowers and Tomatoes Treated With Methylcyclopropene Amine







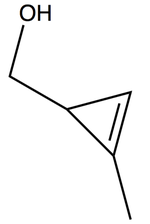
The flower experiment was done to see which flowers around campus had a higher effect to the exposure to ethylene. The flowers were first placed into separate test tubes filled with water. Then, one set of flowers were placed in a box with two bananas, and one set was placed in an empty box. They were then left overnight for the flowers to undergo abscission.

The tomato experiment was done to see the affects of Methylcyclopropene amine. Three tomatoes were used, one control with water, one with 1.48 nM Methylcyclopropene amine, and one with 7.4 nM Methylcyclopropene amine.

Effect of Methylcyclopropene Alcohol on Bananas

- The bananas were sprayed with 1 $\mu g*L^{-1}$ of methylcyclopropene alcohol for a period of 16 days.

Methylcyclopropene alcohol has the same effect on fruits and flowers as 1-MCP except that it is soluble in water, making it very stable compared to 1-MCP. As seen in last pictures, the banana with the methylcyclopropene alcohol treatment (Left) is less ripe than the control banana on the right.



Conclusions

- Methylcyclopropene alcohol may inhibit ethylene receptors in bananas.