

Effects of Ethylene on Quality of Fresh Vegetables

*Parul Mehra , ¹Shikha Jain

*Department of Horticulture (Vegetable Science), College of Agriculture, Jabalpur,
Jawaharlal Nehru Krishi Vishwavidayala, Jabalpur

¹Department of Horticulture (Fruit Science) College of Agriculture, Govind Ballabh Pant
University of Agriculture and Technology, Pantnagar, Uttrakhand

Corresponding Author- parulmehra1995@gmail.com

ARTICLE ID: 013

Introduction:-

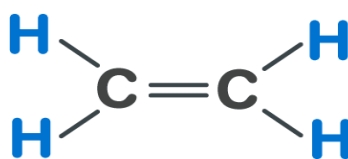
Ethylene was discovered by Dimitry. N Neljubow in 1901 and it is the only naturally occurring plant growth hormone which is gaseous in nature. Earlier, Ethylene was not recognized as an important plant growth hormone. But later on the importance of Ethylene was rediscovered, as a crucial plant hormone which is responsible for various physiological activities of plants like growth, differentiation, senescence and ripening.

The ethylene is a gaseous hydrocarbon which is lighter than air under physiological condition. The precursor of ethylene is Methionine.

Structure of Ethylene (C₂H₄)-

ETHYLENE STRUCTURE

BYJU'S
The Learning App



The production of ethylene can occur in almost all parts of higher plants but the rate of production differs. The meristematic regions and nodal regions are more active in biosynthesis of ethylene.

1. Effect of Ethylene on Fruit ripening-

Ethylene's most pronounced effect is the ripening of fruits for which it is known as the "fruit ripening hormone"

- ❖ In Climacteric vegetables such as tomatoes and melons, exposure of the mature fruits leads to the increase in respiration rate during initiation of ripening.
- ❖ Additional upsurge in ethylene results in hastening of ripening process. But no effect of ethylene is visible in non-climacteric vegetables like cucumber.
- ❖ In non-climacteric vegetables, ethylene treatment doesn't cause increase in rate of respiration.

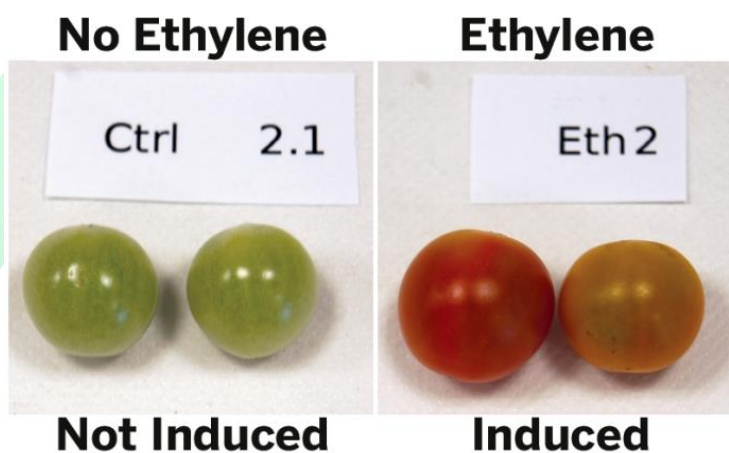


Fig 1. Showing green matured fruits don't have ethylene but for ripening ethylene is important

2. Ethylene effect on the appearance of vegetables

Ethylene enhances the appearance of many vegetables by stimulating their ripening.

- ❖ First commercial use of ethylene and 1-MCP was done for the whitening or blanching of Celery by accelerating the degradation of chlorophyll.

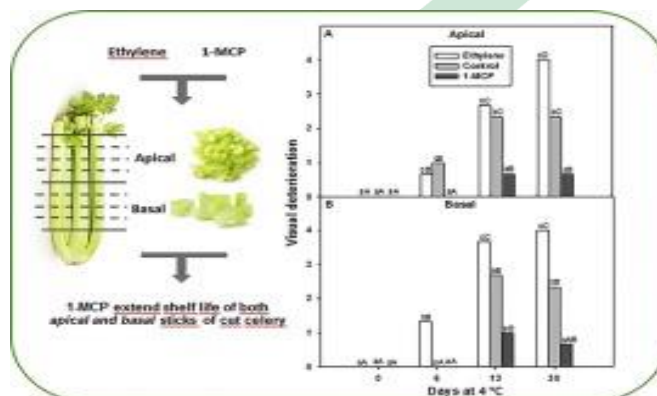


Fig 2. Showing use of ethylene and 1-MCP for blanching of Celery

- ❖ Pigment synthesis of Tomato is stimulated by ethylene which causes acceleration in chlorophyll loss.
- ❖ Treatment of peppers (*Capsicum annum*) with 2000ppm ethephon when two fruits on the plant were completely colored, increased the percentage of ripe fruit by 30% compared with control . (Grainfenberg and Giustiniani).



Fig 3- Development of Color in Peppers

3. Ethylene effect on texture of fresh vegetables

- ❖ In Asparagus, the ethylene exposure results in stimulation of phenylpropanoid stimulation and tissues lignifications (Lipton, 1990).
- ❖ Exposure of ethylene in Cucumber leads to unacceptable textural attribute (Poenicke et al., 1977).
- ❖ During curing when Sweet potatoes are exposed to ethylene leads to development of hard core which make it inedible when cooked (Timbie and Haard, 1977).

4. Detrimental effects of ethylene

- ❖ Exposure of lettuce to C_2H_4 , stimulates the destruction of chlorophyll. And also causes abortion of flowers, browning of leaves and appearance of russet spotting (small brown sunken lesions).
- ❖ In harvested Broccoli floret detrimental effect of ethylene is observed when exogenously exposure of ethylene takes place the floret become yellow (Tian et al. 1994).



Fig 4- Destruction of chlorophyll due to ethylene

5. Effect of ethylene on taste and flavour

C_2H_4 enhances the taste and flavor of the fruits and vegetables by stimulating fruit ripening. (Watada, 1986).

- ❖ For example, the picked matured green tomatoes which are ripened with ethylene will never attained the level of that volatilization which develops in fruits ripened on the plant (Stern et al., 1994).And also the aroma compound i.e. 3-hexanal of the matured green fruit ripened artificially with or without using ethylene was about 31% and 17% respectively.
- ❖ Treatment of honeydew melon with Ethylene stimulates flesh softening, enhancing external color and also imparts desirable aroma to the fruit. When the muskmelon is treated with ethephon, 3 days prior to harvest will result in reduced total soluble solids and sucrose content. (Yamaguchi et al., 1977)
- ❖ Fruits of treated plants are more aromatic than the fruits from the untreated plants. The fruits from treated plants have low shelf life because of rapid softening of tissues.
- ❖ In defense response, the diseased and injured tissues show the production of ethylene in copious amount. (Ecker and Davis, 1987). In carrot and parsnip roots, defense response results in the production of bitter tasting phenolic compounds during storage.
- ❖ The mechanically injured lettuce and sweet potatoes shows enhanced level of ethylene sensitivity. The cutting of lettuce stimulates the phenyl- propanoid

metabolism and turns the leaves from russet spot resistant cultivars into leaves sensitive to the inducing effect of ethylene. (Ke and Saltveit, 1989).

6. Effect of ethylene on nutritive value-

- ❖ Vitamin C content differs among the cultivars than among the ripeness stage during harvest.
- ❖ The average Vitamin C content in ripe tomatoes for harvested matured green fruit and red-ripened fruit don't differ. (Watada et al., 1976).
- ❖ But the average beta carotene content of matured green tomatoes and red ripened varies directly with the ripeness of the fruit at harvest. Ethylene doesn't affect Vitamin A activity but its content is more in ripened fruits than that of matured green.

Conclusion

It is concluded that, ethylene is one of the major plant growth hormone which involved in enhancing the quality of the fruits and vegetable. But it has both beneficial as well as detrimental effect, there is just a difference of degree and direction in the detrimental and beneficial effects of ethylene. Ethylene can have developmental, ripening and senescence effect on vegetables and fruits. Sometimes, these attributes can be desirable and sometimes undesirable, and it fully depends on requirement and acceptability.

References

- Ke, D., Saltveit, M.E., (1988). Plant hormone interaction and phenolic metabolism in the regulation of russet spotting in iceberg lettuce. *Plant Physiol.* 88, 1136-1140.
- Ke, D., Saltveit, M.E., (1989). Wound-induced ethylene production, phenolic metabolism and susceptibility to russet spotting in iceberg lettuce. *Physiologia Plantarum* 76, 412-418.
- Watada, A.E., (1986). Effects of ethylene on the quality of fruits and vegetables. *Food Technol.* 40, 82-85.
- Watada, A.E., Aulenbach, B.B., Worthington, J.T., (1976). Vitamins A and C in ripe tomatoes as affected by stage of ripeness at harvest and by supplementary ethylene. *J. Food Sci.* 41, 856-858.
- Yamaguchi, M., Hughes, D.L., Tyler, K.B., Johnson, H., May, D., (1977). Preharvest ethephon application reduces muskmelon quality. *HortScience* 12, 324-325.