

acceptability. However, untreated control fruits were hard textured and poor in color and quality. Generally, very low concentration of ethylene is sufficient to trigger the ripening process. However, in commercial practice 1000 ppm is commonly used to ensure uniform ripening. This is partly because many ripening rooms are not fully gas tight and concentrations may be reduced through leakage.

Concerns are being raised on the commercial exploitation of ethylene on the residual effects in the human health. Researchers have shown that the ethylene treated fruits were equivalent in quality and "healthfulness" to naturally ripened fruits. Another concern with ethylene is the issue of air pollution. The amount of ethylene released to atmosphere is very minimum. There are no national air quality standards for ethylene levels, but there are some from the American Industrial Hygiene Association. Ethylene is degraded in the atmosphere by UV light present in sunlight. It is also found out that ethylene in air reduces ozone pollution. This is not having any residual effect; hence use of Ethylene gas to promote ripening of fruits and vegetables is sanctioned under FDA Regulation 120.1016.

There is no health risk associated with fruits ripened with ethylene, because it is a

natural gaseous hormone, which triggers only the fruit ripening process and escapes into the atmosphere without leaving any harmful residue in the fruit tissues. Since ethylene ripening method retains the actual bright yellow colour, taste, flavour sweetness of the fruit and harmless to humans, it is a boon to the traders, indirectly benefit farmers and consumers.

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## ETHYLENE A SAFE RIPENING AGENT FOR BANANA



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## **ETHYLENE – A SAFE RIPENING AGENT FOR BANANA**

Ripening is the process by which the fruits attain desirable color, flavour and other textural properties and make them edible. Based on the ripening behaviour, the fruits can be classified into climacteric and non-climacteric fruits. Fruits such as mango, banana, papaya, guava, sapota, apple belong to climacteric group in which the fruits continue to ripen after harvest and emit ethylene along with increased respiration. The ethylene, thus released by the fruits is not sufficient enough to hasten ripening process. Hence, small dose of exogenous application of ethylene is essential to trigger ripening under controlled conditions of temperature and humidity.

### **What is ethylene?**

Ethylene (chemical formula:  $C_2H_4$ ) is an organic compound, a colorless, flammable gas with slightly sweet odour and soluble in water. It is a naturally occurring plant hormone responsible for triggering leaf and flower senescence and fruit ripening. In nature, ethylene is produced when fruits reach physiological maturity and under water stress condition. Besides when any other carbon materials are combusted the ethylene is released along with other gases like acetylene etc., as smoke.

## **Fruit Ripening Hormone - Ethylene**

Fruit ripening is a natural process. However, intentional exposure is primarily used to ripen harvested fruits. When the un-ripened fruit reaches physiological maturity in the plant, it starts ripening. The concentration of ethylene in the physiologically matured un-ripened fruit ranges from 0.1 to 1.0 ppm. The role of ethylene in fruit ripening is to trigger biochemical changes relating to ripening process. Ethylene breaks down the chlorophyll pigment to remove the masking effect on carotenoid and fruits appear yellow in colour.

Naturally ripening fruits are slow in ripening process which lacks uniform colour development, because of less ethylene production within the un-ripened matured fruit. But ethylene treated bananas ripens faster with uniformity and bright in colour. Since ethylene produced naturally within fruit is not sufficient to ripen quickly and uniformly, application of additional exogenous ethylene is recommended to merely accelerate the normal ripening process. Moreover, post-harvest applications of ethylene are predominantly in the gas phase, which are used primarily to promote fruit ripening. After triggering the ripening process, the ethylene escapes into atmosphere and doesn't leave any residue in the fruits. The synthesized

ethylene and naturally produced ethylene have same physical, chemical properties and biochemical reactions within the fruit. Many research reports have shown that there is no biochemical, chemical, physiological differences between fruit ripened with ethylene and naturally ripened fruit. The weight loss of ethylene treated ripened banana fruit is less because of quicker ripening process and loss of moisture from fruit. The un-ripened banana fruits treated with ethylene for ripening produce bright yellow colour, more sugars (total soluble solids), better starch conversion into sugars, better flavour, sweetness, same levels of acceptability and astringency and less off-odour than naturally ripening banana fruits. Besides inducing synchronous fruit ripening process, ethylene effects uniform ripening. Therefore, fruit ripening using ethylene is highly beneficial for consumers and traders for commercial varieties like Cavendish group of bananas. Being a harmless chemical to human health, it can even be recommended for organic farming of banana.

Exposure of green mature banana fruits (Grand Naine, an export variety) to ethylene gas at 100 ppm for 24 h, followed by storage at 18-20°C and 90-95% RH ensures faster and uniform ripening in 48 hrs with development of uniform color, flavour, desirable firmness and consumer