

VIEW POINT

ARTIFICIAL RIPENING: WHAT WE ARE EATING

ASHRAF-UR-RAHMAN¹, FAZLE RABBI CHOWDHURY², MD. BILLAL ALAM³

Abstract:

In recent times there is much concern about artificial ripening of fruits in many parts of the world including Bangladesh. Large amount of tropical fruits are produced in Bangladesh. Though fruits like mango naturally ripen in trees; some chemicals are used to ripen them artificially which hasten the ripening process. Ripe fruits are not suitable to carry & distribute as they get rotten. So fruit traders pick unripe fruits & use certain methods to increase the shelf life of them. For many years Ethylene had been used as a fruit ripening agent. But now-a-days Calcium carbide is getting popular in this regard as it has a faster ripening property. But inappropriate use of Carbide to ripen fruits is associated with many health hazards. In this topic we have tried to reveal the essentials of this burning issue & looked for solutions.

Ripening is a process in fruits that causes them to become more edible. In general, a fruit becomes sweeter, less green, and softer as it ripens. However the acidity as well as sweetness rises during ripening, but the fruit still tastes sweeter regardless. An organic compound involved with ripening is ethylene, a gas created by plants from the amino acid methionine. Ethylene increases the intracellular levels of certain enzymes in fruit and fresh-cut products, which include:

- Amylase, which hydrolyzes starch to produce simple sugars, and
- Pectinase, which hydrolyzes pectin, a substance that keeps fruit hard.

Other enzymes break down the green pigment chlorophyll, which is replaced by blue, yellow, or red pigment.¹

Mango fruits ripen unevenly on the tree and natural ripening can be very slow and unpredictable. Hence, to overcome these problems certain chemicals are used to ripen the fruits artificially. Fruits are briefly exposed to ethylene or similar gases like acetylene to initiate the ripening process. Ethylene is known to be a plant hormone that triggers fruit ripening. It has been reported that if ethylene is applied exogenously it helps fruit ripening.² Ethylene - treatment is usually given at the packing house or at the point of distribution. Ethephon is known as one of the most common ethylene-generating chemical and post harvest treatments. Ethephon accelerates ripening and improves the peel color of the mangoes.³ Though ethylene promotes the ripening process & improves colour development of the fruits, it has some disadvantages in post harvest shelf life & can be

harmful to product quality. Furthermore it is an explosive gas & is very expensive.

Use of ethylene for ripening of the fruit is a common practice in different countries but due to high cost and scarcity in terms of its availability, many developing countries like Bangladesh, India & Pakistan use low-cost calcium carbide to ripen fruit. Usually calcium carbide is imported from China, Taiwan and South Africa. Acetylene gas is generated from calcium carbide, which initiates the ripening process in a similar manner to ethylene. This practice is commercially used in Brazil and Senegal.⁴ Fruits ripened with calcium carbide are soft and have good peel color development but poor in flavor. A number of countries use calcium carbide to ripen a wide range of fruits as shown in Table-I.

Table I

The fruits and countries where acetylene liberated from calcium carbide.^{5,6}

Fruit species	Countries
<i>Banana</i>	Australia, Egypt, India, Philippines, South Africa, Sudan, Taiwan, U.S.A, Yemen
<i>Mango</i>	Brazil, Costa Rica, India, Malaysia, Philippines, Senegal, South Africa
<i>Citrus</i>	Australia, Philippines, South Africa
<i>Tomatoes</i>	Australia, Morocco, Philippines, U.S.A
<i>Plums</i>	South Africa
<i>Peaches</i>	South Africa

1. Post Graduate Trainee, Dept. of Medicine, Dhaka Medical College Hospital.
 2. Post Graduate Trainee, Dept. of Medicine, Dhaka Medical College Hospital.
 3. Associate Professor, Dept. of Medicine, Dhaka Medical College.

It has been reported that compared to ethylene, high concentrations of acetylene are required to initiate the ripening process.⁷ Calcium carbide not only changes the skin color of the fruits but it also initiates the enzymatic action that breaks down the glucose resulting in a quick ripening of the fruits. Use of calcium carbide sometimes gives ripening color to a raw fruit. It also increases the shelf life and maintains the ripened color.

Methods of Carbide Application:

The recommended way of application is to use a large vessel of water and added sufficient quantity of carbide and placing them in a well-ventilated chamber. Acetylene, which is then generated, is responsible for the fruit ripening as shown by the following equation.⁶



India is one of the major mango producing country and it also uses calcium carbide as a fruit ripening agent. Mann (1974)⁸ studied different doses of calcium carbide on mature hard green mango. The fruits were packed with calcium carbide and were moistened by a drop of water before being tightly covered with newspaper to prevent the leakage of acetylene. The fruits ripened within 8 days and the result showed that those fruits (4-5 kg), which were ripened with 2 g of calcium carbide, developed most desirable taste and flavor. Nagaraj et al., (1984)⁹ used ventilated wooden boxes with 2 g of calcium carbide kg⁻¹ of mango fruits, which were covered with straw and craft paper. The calcium carbide was removed after 96 hrs after which the fruit was kept in a well-ventilated room. The results showed that calcium carbide-treatments gave uniform yellow color and acceptable texture to the fruits. The treatment significantly reduced the number of days required for fruit ripening. In Senegal, calcium carbide is commercially used to ripen banana and mangoes and fruits are harvested green.

By now commercially two methods for calcium carbide application have been used. In one method fruits are placed in a basket made up of palm leaves and calcium carbide wrapped in a cloth or newspaper placed at the bottom of the basket. In order to increase the basket temperature and maintain the humidity level, the basket is covered with strong craft paper. The basket is placed in a closed room for 3-4 days and when the fruits developed a yellow skin color they are selected for sale. In another practice, a large heap of fruits (1

or 2 tons) is placed at the corner of a room with calcium carbide spread in several places and then the heap is covered with craft paper. The fruits ripened in both of these ways have good skin color with high acidity and low sugar content but poorly developed flavor.⁶

In Malaysia, mangoes are picked slightly unripe and then calcium carbide is applied for artificial color development. In this method soapboxes or basket lined with banana leaves are used on which calcium carbide is sprinkled and then this box is filled to the top with the fruits and then the fruits are covered with more leaves on which calcium carbide is scattered. The fruits develop uniform yellow color within 2 or 3 days with a poor flavor.¹⁰

In Tamil Nadu, India; now there is a solution to ripen mango in the right way that a mixture of water (5 litre), ethephon 39% (10 ml) and sodium hydroxide (2 gm), kept in a bucket close to mangoes heaped in an airtight chamber would release ethylene gas, which naturally facilitates the ripening of fruits without any harmful effect.¹¹

Health hazards associated with Carbide:

Though calcium carbide is used methodically in many countries including India, in our country it is being used openly, commonly & in an inappropriate way for ripening fruits. A very strong reactive chemical, calcium carbide has carcinogenic properties. Acetylene generated from carbide is flammable and explosive even in a low concentration as compared to ethylene.¹²

Acetylene gas is an analogue of ethylene and quickens the ripening process. Sometimes only the skin color is changed while the fruit remains unripe and raw. When a high dose of carbide is used on a raw fruit for ripening purposes it results in poor flavor of the fruit and possibly toxic. It is also considered as extremely hazardous as it may contain traces of arsenic and phosphorus Hydride.¹³ Early symptoms of arsenic and phosphorus poisoning include vomiting, diarrhea with or without blood, burning sensation of the chest and abdomen, thirst, weakness and difficulty in swallowing and speech. Other effects include numbness in the legs and hands, cold and damp skin and low blood pressure and in cases it can become fatal if not treated in time. Acetylene gas had an unpleasant odor and produced a noticeable flavor in the treated fruits.¹⁴ It is not only toxic to the fruits but it may be harmful to those who handle it. It affects the neurological system resulting in headache, dizziness, mood disturbances,

sleepiness, mental confusion and seizures on a short-term basis, while in the long-term it can cause memory loss and cerebral edema.

Use of ethylene and (methyl jasmonate) MJ for fruit ripening purposes is not harmful for human consumption but these compounds are quite expensive hence developing countries use low cost calcium carbide, which is harmful and has many disadvantages compared to ethylene. In developed countries fruits are ripened commercially in an artificial chamber having no health hazards. But in our country traders are using obsolete chemical, carbide being propelled by the quick-buck syndrome. Thus we are in risk of short-term as well as long-term health effects simply by eating fruits.

Recommendations :

1. Ethephon 39%, which is available in the market in the commercial name of ethrel, is being used as plant growth regulator in mango, pineapple, coffee, tomato, cucumber, groundnut and rubber. As this cost-effective method retains the actual colour and taste of the fruit and increases its shelf-life, this harmless method to ripen fruits could be a hit and a boon to the traders. It is essential to control the delivery system of acetylene from calcium carbide, which must be safe and applicable to the wide range of users.
2. Government, Concerned health authorities and law enforcing agencies should pay attention to this illegal practice of using carbide openly, which is occurring in many parts of Bangladesh.
3. It is important to develop new and better technique of application, which prevents direct contact of the substance with the fruits.
4. New compound, which are environmentally safe and not harmful for human health, must be discovered and tested.

Commercial ripening is an essential part of business as ripe fruits are not suitable to carry & distribute, as they get rotten. So fruit traders pick unripe fruits & use certain methods to increase the shelf life of them. Valid and acceptable methods of using chemical are desirable in this regard. Anything breach of that might be hazardous for our health.

References:

1. Ripening. In: Wikipedia, the free encyclopedia [online], available at: <http://en.wikipedia.org/wiki/ripening>
2. Medlicott, A.P., S.B. Reynolds; S.W. New; and A. K. Thompson. 1988. Harvest maturity effects on mango fruit ripening. *Tropical Agriculture*. 65: 153-157.
3. Lakshminarayana, S., M. Subbiah Shetty; and C. A. Krishnaprasad. 1975. Accelerated ripening of Alphonso mangoes by the application of ethrel. *Tropical Science*. 17: 95-101.
4. Medlicott, A.P. 1986a. Report on a visit to ITAC Brasil to investigate the effects of maturity, storage and gas treatment on mango fruit ripening. *Tropical Development and Research Institute, UK, Visit Report R 1319* (s).
5. Medlicott A. P., J. M. Sigrist; S. B Reynolds; and A. K. Thompson. 1987. Effects of ethylene and acetylene on mango fruit ripening. *Annals of Applied Biology*. 111: 439-444.
6. Sy. O. and H. Wainwright. 1990. Fruit ripening with calcium carbide. *Trop Science*. 30: 411-420.
7. Smith N. J. S and A. K. Thompson. 1987. The effects of temperature, concentration and exposure time to acetylene on initiation of banana ripening. *Journal of the Science of Food and Agriculture* 40, 43-50.
8. Mann S. S. 1974. Effect of ethylene and acetylene on the ripening of mango fruits. *Acta Horticulturae* 15: 409-412.
9. Nagaraj P., K.V.R. Ramana; B. A. Prasad; S. Mallikarjunaradhya; M. V. Pat Wardhan; S.M. Ananthakrishna; H. C. Rajpoot; and L. Subramanyan. 1984. Effect of Calcium Carbide on ripening and quality of Alphonso mangoes. *Journal of Food Science and Technology* 21: 278-281.
10. Berwick, E.J.H. 1940. Mangoes in Kriam. *Malayan Agriculturist*. 8: 517-524.
11. Now, a solution to ripen mango the right way, P.Sudhakar. The Hindu Tamil Nadu - Tirunelveli news, Thursday, May 18, 2006
12. Geesner, G. H. 1977. The condensed chemical dictionary. *VNR Company (London) Lit Educ. Publ. Inc*; pp149.
13. Delpierre M. 1974. *Manuel de laboratoire de analyses des denrees alimentaires. Rapport interne*. FAO-ITA. 74: 12-15.
14. Harvey, R. B. 1928. Artificial ripening of fruits and vegetables. *University of Minnesota Agricultural Experimental station Bulletin* 247, pp36.