

## FRUIT RIPENING

Ripening is the process by which fruits attain their desirable flavour, quality, colour, palatable nature and other textural properties. Ripening is associated with change in composition *i.e.* conversion of starch to sugar. On the basis of ripening behavior, fruits are classified as climacteric and non-climacteric fruits.

**Climacteric:** Climacteric fruits are defined as fruits that enter 'climacteric phase' after harvest *i.e.* they continue to ripen. During the ripening process the fruits emit ethylene along with increased rate of respiration. Ripe fruits are soft and delicate and generally cannot withstand rigours of transport and repeated handling. These fruits are harvested hard and green, but fully mature and are ripened near consumption areas. Small dose of ethylene is used to induce ripening process under controlled conditions of temperature and humidity.

### Climacteric fruits are:

*Mango	*Banana	*Papaya
*Guava	*Sapota	*Kiwi
*Fig	*Apple	*Passion fruit
*Apricot	*Plum	*Pear

These fruit in fully ripe state are too delicate to withstand transportation over long distances and should preferably be ripened near the consumption area.

**Non-Climacteric:** Non-climacteric fruits once harvested do not ripen further. Non-climacteric fruits produce very small amount of ethylene and do not respond to ethylene treatment. There is no characteristic increased rate of respiration or production of carbon dioxide.

### Non-climacteric fruits are:

*Orange	*Mousambi	*Kinnow
*Grapefruit	*Grapes	*Pomegranate
*Litchi	*Watermelon	*Cherry
*Raspberry	*Blackberry	*Strawberry

* Carambola	*Rambutan	* Cashew
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In order to improve external skin colour and market acceptance, citrus like orange, lemon, mousambi and kinnow can be treated with ethylene, as a **de-greening** agent. Ethylene treatment breaks down the green chlorophyll pigment in the exterior part of the peel and allows the yellow or orange carotenoid pigments to be expressed.

### **Technologies for ripening of fruits**

Lack of easier and rapid methods for uniform ripening poses a major problem in the fruit industry. Almost all methods of ripening, either conventional or the modern chemical methods, come with their own merits and demerits.

There are several simple technologies and methods available today for farmers for proper ripening. Normally, the number of days taken for edible ripening varies for different fruits and prevailing climatic conditions. For instance, it takes about 5 to 6 days for mangoes and 6 to 7 days for sapotas to ripen. Under natural conditions, ethylene, a ripening hormone produced by the plant plays a major physiological role in the ripening process.

- A simple technology practiced in households to trigger ripening is to keep un-ripened and ripened fruits together inside an air tight container. Since the already ripened fruits release ethylene, ripening will be faster.



Mango ripening in air tight rice bin

- Another method is to place the fruits intended for ripening inside an air tight room and induce ripening through smoking inside smoke chambers. Smoke emanates acetylene gas. Several fruit traders follow this technique to achieve uniform ripening especially in edible fruits like banana and mango. But the major drawback of this method is that the fruits do not attain uniform colour and

flavour. In addition, the persistence of smoke odour on the product impairs its quality

- Spreading unripe fruits as layers over paddy husk or wheat straw for a week to ripen is an another alternative.



Mango ripening using paddy straw

- Another practice is that some farmers dip unripe mature fruits in 0.1 per cent ethrel solution (1 ml of ethrel solution in 1 litre of water) and wipe it dry. The fruits are then spread over a newspaper without touching each other and a thin cotton cloth is covered over this. In this method, the fruits will ripen within two days.
- In one of the simple and harmless techniques, 10 ml of ethrel and 2 gm of sodium hydroxide pellets are mixed in five litres of water taken in a wide mouthed vessel. This vessel is placed inside the ripening chamber near the fruits and the room is sealed air tight. About a third of the room is filled with fruits leaving the remaining area for air circulation. Ripening of fruits takes place in about 12 to 24 hours. In order to reduce the cost of chemical, some ethylene releasing fruits such as papaya and banana can also kept in the same room.
- Ethylene gas filled in pressurized cans promote fruit ripening in 24-48 hours



Papaya fruits 3day after storage at room temperature



Papaya fruits exposed to ethylene gas (100 ppm) and 3 days after storage at room temperature

### Uniform ripening of papaya fruits using ethylene gas

#### Fruit ripening using calcium carbide

Most climacteric fruits in India are ripened with industrial grade calcium carbide. Industrial-grade calcium carbide usually contains traces of arsenic and phosphorus, and, thus, use of this chemical for this purpose is illegal in most countries. In India too, use of calcium carbide is strictly banned as per **PoFA (Prevention of Food Adultration) Act [Section 44AA]**. Calcium carbide, once dissolved in water, produces acetylene which acts as an artificial ripening agent. Acetylene is believed to affect the nervous system by reducing oxygen supply to brain. Arsenic and phophorus are toxic and exposure may cause severe health hazards.



Workers at a fruit market using calcium carbide to ripen raw mangoes

**The only safe and worldwide accepted method is using ethylene**, which is a natural hormone for ripening when done under controlled temperature and relative humidity conditions.