Ripening

Ripening of fruit is a natural process which makes the fruit less green, soft and sweeter . (or)

Ripening is the physiological process by which fruits attain their desirable Flavor, Quality, Color, Palatable nature and other textural properties.

Composition changes:

1. Acid content high in unripe fruit but reduced during ripening.
2. Starch are converted to sugars by Amylases.
3. Hard pectin converted to soft one by Pectinase.

ARTIFICIAL RIPENING

It is the process by which ripening is controlled and product may be achieved as per requirement by controlling the different parameters. *(Bhattarai et al.,2005)*

- It is done to achieve faster and more uniform ripening.
- Generally 80% fruits are ripened artificially through ripening agents. *(Dhembare, 2013).*
- The cosmetic quality of artificially ripened fruits will increase but organoleptic qualities, nutrition value and shelf life are depreciated when fruits are subjected to treatment without considering maturity status.

There are two types of fruits based on ripening:

1. Climacteric fruits.
2. Non- climacteric fruits.

Climacteric fruits:

Fruits that continue to ripen after harvest.

✓ These fruits emits ethylene during ripening along with increased respiration rate. So harvested hard and green.

✓ These fruits cannot withstand rigorous transport and handling.

Ex : Mango, Banana, Apple, Kiwi, Plum, Pear, Sapota, Guava.

Non - Climacteric fruit :

Fruits once harvested do not ripen further.

✓ These fruits produce very small amount of ethylene and do not respond to ethylene treatment.

✓ There is no characteristic increased rate of respiration.

✓ So, these fruits are harvested once they are fully ripened.

Ex : Orange, Grapes, Watermelon, Pomegranate, Strawberry, Litchi, Blackberry.,

Artificial ripeners

The chemicals or agents which are used to ripe fruits artificially.

- ✓ These are used during Pre-harvest, Post-harvest, Transportation, Storage by farmers, transporters and traders.
- ✓ These induce color changes and accelerate ripening.
- ✓ Ripped fruits are not suitable to carry and distribute. So, farmers pick unripe fruits which are hard and green and ripen it using chemicals.

Some of most commonly used artificial ripeners are,

- ✓ *Calcium carbide*
- ✓ *Acetylene gas*
- ✓ *Ethephon*
- ✓ *Ethylene*
- ✓ *Ethylene glycol.*

Ethylene (C_2H_4)

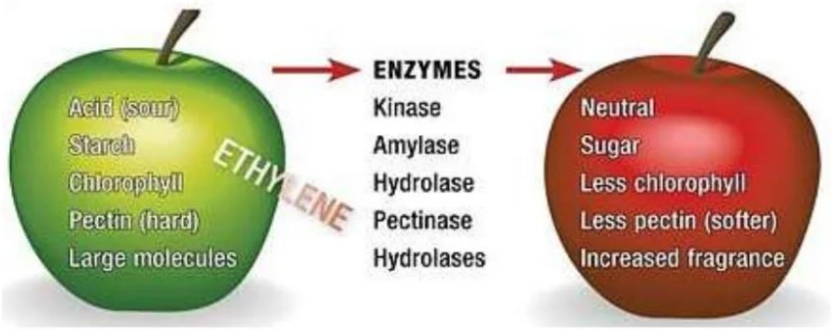
Ethylene is a daughter of ethyl (C_2H_5).

- ✓ It is a natural plant growth regulator.
- ✓ It acts as stimulating or regulating enzyme for the ripening of fruit.
- ✓ It is a gaseous hormone naturally produced in fruit.
- ✓ Commercially, it is very expensive . So traders use other chemicals.
- ✓ The concentration of ethylene required for the ripening initiation of commodities mostly in range of 0.1 to 1 ppm.

- ✓ The time of exposure to initiate ripening may vary but for climacteric fruits exposure for 24 hrs. is usually sufficient.
- ✓The only safe and worldwide accepted method is using ethylene.
- ✓ Ethylene being a natural hormone, does not pose any health hazard for consumers of fruits.
- ✓ It is generally recognized as safe (GRAS) by FDA.
- ✓ It is used as a de-greening agent in citrus, bananas.
- ✓ As fruits ripe they release more and more ethylene that fastens ripening process.

✓ Climacteric fruits produce large amounts of ethylene .

✓ For artificial ripening , ethylene is spread using catalytic generators in a closed room under controlled temperature and RH.



Calcium carbide (CaC_2)

It is a chemical compound used in the production of acetylene and calcium cyanamide and also in gas welding.

✓ It reacts with water or moisture to produce acetylene gas (Carbide gas) which act as ripening agent produce similar effect of ethylene.

$$CaC_2 + 2\ H_2O \longrightarrow Ca(OH)_2 + C_2H_2$$

✓ Acetylene is not effective as ethylene.

✓ Fruits develop good peel color with CaC_2 the intensity of color developed proportional to concentration of CaC_2 used .

- ✓ More raw/ immature the fruit, higher CaC_2 is required to ripen it.
- ✓ Carbide ripened fruit produce uniform skin color.
- ✓ Actually CaC_2 only changes the skin color and fruit remains raw inside.
- ✓ Carbide contains traces of Arsenic and Phosphorous hydride which are carcinogenic compounds. Because of cheap availability of CaC_2 in local markets illegally it is used for ripening process.

(1 kg - Rs.100 – ripen 200 kg of fruits)

In local it is popularly known as 'Masala'.

Ex: Mango, Banana, Apples, Papaya, Sapota are ripened using carbide.

Health effects :

- ❖ Early symptoms of Arsenic or Phosphorous poisoning include vomiting , diarrhoea with or without blood, burning sensation of chest and abdomen, thirst, weakness, difficulty in swallowing, irritation or burning in the eyes and skin, permanent eye damage, ulcers on skin, sore throat, cough and shortness of breath.
- ❖ Higher exposure may cause a build-up of fluid in the lungs.

❖ Carbide ripened fruit consumption erodes the mucosal tissues in the stomach and disrupts intestinal functions.

❖ It is carcinogenic and also may cause neurological problems.

Rules against Carbide use:

✓ In India, Artificial ripening is banned under PFA act ,1954.

✓The use of carbide gas for ripening is prohibited under Rules 44A of Prevention of Food Adulteration Rules, 1955.

Those convicted under this act could face for imprisonment for three years and a fine of Rs.1000.

✓ According to Food Safety and Standards Act, 2006 the selling of unsafe food is punishable.

✓ The food safety and standards regulation, 2011 explicitly prohibits the selling of fruits which are artificially ripened by carbide gas.

In India, Ethylene like compounds are quite expensive so traders are using low cost calcium carbide.

In developed countries , fruits are ripened commercially in ripening chambers having low health hazards.