International Journal of Food Science and Nutrition
ISSN: 2455-4898; Impact Factor: RJIF 5.14
Received: 21-03-2020; Accepted: 16-04-2020; Published: 25-04-2020
www.foodsciencejournal.com
Volume 5; Issue 2; 2020; Page No. 99-101

Awareness of artificial ripening of mangoes and recommendation for organic natural ripening

M Sujatha[1*], Yashas M[2], Yamuna M[3], Harshavardhana R[4], Harish B[5]
[1-5] Department of Chemistry, MES College of Arts, Commerce and Science, Bangalore, Karnataka, India

Abstract
Fruits are rich source of micronutrients. Ripening of fruits is the final stage of its maturation, when fruits attain their palatable nature, color, and other textural properties. Mangoes have to be harvested before they start to ripen on the tree. Usage of artificial ripeners have made the consumption of mangoes really questionable. Artificial ripeners like calcium carbide which contain traces of Arsenic and Phosphorus have harmful effects on health has to be eliminated. We aim to understand in brief, the process of Natural organic ripening.

Keywords: artificial ripener, calcium carbide, mango, natural ripening

Introduction
Mango, a nutrient rich fruit is often referred as the King of fruits. Mangoes belong to the genus *Mangifera*. Initial market price during the season is usually on the higher side, traders tend to sell majority of their produce during this period by artificial ripening the fruit irrespective of harmful health effects on the consumers [1]. Gaseous plant hormone ethylene plays a major role in ripening process of mango. The role of ethylene in ripening has been known for more than five decades [2]. The 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. The cost of ethylene is expensive therefore our farmers uses Calcium carbide which is economical. Usage of Calcium carbide to ripen the mango is associated with many health hazards and is banned under Prevention of Food Adulteration (PFA). Another widely acceptable method involves the usage of ethylene gas [3, 4]. The Government of India allows the vendors to use ethylene to ripen mangoes. Ethylene is used in liquid form to apply on mangoes. The ethylene liquid can be sprayed on mangoes which leads to ripening of mangoes in one or two days thus making them fit for consumption.

Composition of Mango
Mango has a high nutritional value and health benefits due to its important components. Its components can be grouped into macronutrients (carbohydrates, proteins, amino acids, lipids, fatty, and organic acids), micronutrients (vitamins and minerals), and phytochemicals (phenolic, polyphenol, pigments, and volatile constituents). Mango also contains structural carbohydrates such as cellulose and pectin. The major amino acids include lysine, leucine, cysteine, valine, arginine, phenylalanine, and methionine. The lipid composition increases during ripening, particularly the omega-3 and omega-6 fatty acids. The most important pigments of mango fruit include chlorophylls and carotenoids. The most important organic acids include malic acid, ascorbic acid and citric acids, and hence contribute for acidity of fruits. The volatile constituents are a heterogeneous group with different chemical functions that confer to the aromatic profile of the fruit.

During development and maturity stages, important biochemical, physiological, and structural changes takes place affecting mainly the nutritional and phytochemical composition, producing softening, and modifying aroma, flavor, and antioxidant capacity. In addition, post-harvest handling practices influence total content of carotenoids, phenolic compounds, vitamin C, antioxidant capacity, and organoleptic properties.

Difference between raw and ripen mangoes
Raw mangoes are green in color, but the ripened ones are not just yellow but also sport other colors, such as orange, purple, and red. The color is one of the main differences, along with the taste. Raw mangoes are sour, which can be attributed to the presence of various acids, including succinic, maleic, and citric, ascorbic acid. Both raw and ripe mangoes are high in Vitamin C, but raw ones are considered to have higher amounts of the vitamin. Another difference is that raw mangoes contain pectin, which is a polysaccharide which is also found in other fruits such as apples and berries. Pectin, a fiber used in manufacturing medicines, especially for people with high triglycerides and cholesterol levels. It is also used in prevention of colon cancer.
Ripened mangoes are healthy and favorite fruit in many parts of the world. The sweet, succulent taste is notable. They contain a great number of antioxidants, which can help to reduce the risk of acquiring cancer. They are also rich in beta-carotene and lycopene, which is a carotenoid that s suppresses growth of tumors and protect cells from damage.
Both ripened mangoes and raw mangoes have health benefits. Both are rich in fiber, along with vitamins and minerals. Consumption of Mangoes helps to fight against cancer (prostate, breast, and leukemia).

The ripening processes
Mango on ripening become sweeter and palatable in nature. Ripening brings out best flavor, texture and even an appetizing smell. As mango plants grow, the mango accumulates water and nutrients from the plant and they use these nutrients to create their pulp and seeds. At initial stages fruit is unattractive to the predators and when it

enhances the property of growth, it looks attractive due to change in color, fragrance etc. This ripening rate of fruit depend on how the fruit react to the Fruit-ripening hormone called Ethylene. During the process of ripening the cell wall of the fruit begins to breakdown by the proteins called enzymes. These enzyme activities are directly linked to the shelf life and texture of the fruits and hence softening of the mango on ripening.

During ripening process, there is an increase in the breakdown of starch inside the fruit and all the starch is converted into simple sugars which taste sweet such as fructose, glucose and sucrose and the acidity of the fruits decreases with ripening.

Artificial Ripening [10]

Unsaturated hydrocarbons such as acetylene, ethylene etc. can promote ripening and induce color changes effectively. Although the cosmetic quality of such artificially ripened fruits was found to improve, organoleptic quality was impaired especially when harvested fruits are subjected to treatment without considering their maturity status.

With the development of fruit trade, the fruits are sent to distant places, requiring several days in ordinary or refrigerated transportation and only firm and mature fruits are least damaged during transit from the farm. The fruits are ripened at the destination markets before retailing and hence artificial ripening has become essential. The most commonly used chemical for artificial ripening is Calcium Carbide and is popularly known as 'Masala" in India, though banned under PFA Rules, 1955 and also under Food Safety and Standards (Prohibition and Restrictions on Sales) Regulations, 2011. Calcium Carbide is colorless when pure, but greyish-white to black in color otherwise, with garlic like odor. When it reacts with water, it produces acetylene gas (popularly referred to as carbide gas) which is an analogue to ethylene and quickens the ripening process.

It is said to have the same effect as ethylene, the natural ripening hormone.

However, acetylene is not effective for ripening as ethylene and acetylene is not a natural hormone. Calcium Carbide contains traces of arsenic and phosphorous A strong reactive chemical, Calcium Carbide has carcinogenic properties and is used in gas welding. Being cheap and easily available in the local markets, CaC_2 is indiscriminately being used in preference to other recommended practices of inducing ripening in fruits.

Effects of Calcium Carbide on Fruit Quality

Fruits ripened with Calcium Carbide are overly soft, and inferior in taste and flavor. They also have a shorter shelf life. The fruit ripened with Calcium Carbide may develop uniform attractive surface color, but the tissue inside would not be ripened or may remain green or raw. When Calcium Carbide is used in very raw fruit, the amount of the chemical needed to ripen the fruit has to be increased. This results in the fruit becoming even more tasteless, unhealthy and possibly toxic.

Potential health effects associated with calcium carbide

Calcium Carbide is a dangerous and hazardous chemical. Carbide ripened fruits on consumption cause several harmful effects to human health. As discussed earlier, CaC_2 has cancer causing properties and contains traces of arsenic and phosphorous.

Consumption of fruits ripened with Calcium Carbide causes stomach upset because the alkaline substance is an irritant that erodes the mucosal tissues in the stomach and disrupts intestinal functions. As CaC_2 imitates acetylene gas, it may affect the neurological system. The fast-ripened fruits contain harmful properties because CaC_2 contains traces of arsenic and phosphorus and the production of acetylene gas has a hazardous effect on human. It may affect the neurological system. CaC_2 is banned in many countries because it has carcinogenic properties and hazardous effects.

Natural ripening of Mangoes

1. Place the mangoes in a paper bag or wrap it with a newspaper and leave it undisturbed for the night in order for it to release some ethylene, which is an odorless gas that speeds up the ripening process. Remove the mangoes from the bag once they start giving off a fruity smell and softened.

Fig 1: Natural ripening type 1 [6]

2. Place the mango fruits inside an air tight room and induce ripening through smoking inside smoke chambers. Smoke emanates acetylene gas, which speeds up the ripening process.

Fig 2: Natural ripening type 2 [7]

3. Spreading unripe fruits as layers over paddy husk or wheat straw for a week to ripen faster.

Fig 3: Natural ripening type 3 [7]

4. Put fruits that emits a high concentration of ethylene such as apples, pears, bananas, avocados and passion fruits in a paper bag with slower ripening fruit, then inside a plastic bag to contain more of the ethylene gas. Place in dark place like a cabinet overnight. Store them in a warm place along with hay.

Fig 4: Natural ripening type 4 [8]

5. Submerge the mango in raw rice or popcorn kernels as they help to trap ethylene gas around the mango, resulting in a much faster ripening process.

Fig 5: Natural ripening type 5 [9]

Conclusion

Ethylene exposure does not affect composition and ripening pattern of treated mangoes as compared to unexposed fruit. This paper illustrates the production of ethylene gas naturally which is a main source for ripening. Ripening naturally also induces a positive alteration on most of the physical characteristics and chemical constituents of the mango. The naturally ripened mangoes possess bright color, appearance and taste and good for health. The artificially ripened mangoes contain chemicals which contains traces of phosphorous and Arsenic which are harmful to health. This will also help the farmers and fruit vendors to follow the safe practice for ripening of mangoes.

More research has to be done to understand the natural process of ripening of mango and our country should be free from artificial ripener which is harmful to humans and our mother earth.

It is not always possible to wait for the fruit to ripen naturally. More often they need to be transported over long distance and if they had been harvested in a ripen stage they get spoiled before reaching their destination. For such situations farmers harvest them much before they get ripe and the traders ripen them artificially, they can make use of above methods of ripening naturally. In the present day, earth is becoming more polluted. In the next few decades, it can become much more so let us make use of natural method and avoid spraying chemicals on soil and fruits. Let us make use of natural method to save our earth.

References

1) Vishwas A Bapat, Bapat VA, Trivedi PK, Ghosh A, Sane VA, Ganapathi TR, *et al*. Ripening of fleshy fruit: molecular insight and the role of ethylene. Biotechnology advances. 2010; 28(1):94-107.
2) Pandarinathan S, Sivakumar S, Pandarinathan S, Shivkumar S. Studies on biochemical changes in mangoes due to artificial ripening. International Journal of Agricultural Sciences. 2010; 1:3347-3355.
3) Vishwas A Bapat Bapat VA, Trivedi PK, Ghosh A, Sane VA, Ganapathi TR, Nath P. Ripening of fleshy fruit: molecular insight and the role of ethylene. Biotechnology advances. 2010; 28(1):94-107.
4) Gill PPS, Jawandha SK, Kaur N, Singh N. Physio-chemical changes during progressive ripening of mango (Mangifera Indica L.) cv. Dashehari under different temperature regimes. Journal of food science and technology. 2017; 54(7):1964-1970.
5) Maria Elena Maldonado-Celis, Elhadi M Yahia, Ramiro Bedoya, Patricia Landázuri, Nelsy Loango, Johanny Aguillón, *et al*. Chemical Composition of Mango (*Mangifera indica* L.) Fruit: Nutritional and Phytochemical Compounds.
6) https://food.ndtv.com
7) www.vikaspedia.com
8) https://cooking.stackexchange.com
9) www.wikihow.com
10) Ramesh Babu D, Ram Deshmukh, Narasimha Rao KV, Rajya Laxmi M, Kafila, Sabita T. Awareness on Calcium Carbide Ripened Fruits and Recommendations for Toxic Free Artificial Ripening of Fruits, International Journal of Engineering and Advanced Technology (IJEAT), 2019, 9(2).