

# Fruits and vegetables preservation

Fresh is an important characteristic of fruit and vegetables, which means keeping the original quality, including color, texture and nutrient. However, many factors can induce quality losses in fresh fruits and vegetables, such as the spoilage organisms, aging and undesirable growth. Worldwide post harvest fruit and vegetables losses are as high as 30 to 40%. Therefore, it is necessary to make some efforts to maintain the freshness and flavor of the products.

## Temperature, Humidity and Atmosphere Control

### Cold storage

Fresh fruits need low temperature and high relative humidity to reduce the respiration and slow down the metabolic process. According to the optimal storage temperature, fruit and vegetables can be largely divided into 6 groups: 1) 0 to 2°C, 90-95% relative humidity. Many products in this group produce ethylene, such as apple and pear. 2) 0 to 2°C, 95-100% relative humidity. Many products in this group are sensitive to ethylene, such as kiwifruit and mushrooms. 3) 0 to 2°C, 65-75% relative humidity. Moisture will damage these products. The representative sample is Garlic and Onion. 4) 10°C, 85-90% relative humidity. Many of these products are sensitive to ethylene and chilling injury, such as bean and pepper. 5) 13-15°C, 85-90% relative humidity, such as avocados and pumpkin. 6) 18 to 21°C, 85-90% relative humidity. Sweet potatoes and watermelon are members of this group.

### Freezing

Freezing is one of the oldest and most widely used methods of food preservation. The freezing process is a combination of the beneficial effects of low temperatures at which microorganisms cannot grow, chemical reactions are reduced, and cellular metabolic reactions are delayed. During the freezing procedure, the core of the product will reach -18 °C within two to three minutes. Fruit and vegetables can be frozen whole, or in slices of different sizes.

### Atmosphere Control

Reducing the O<sub>2</sub>-level and increasing the CO<sub>2</sub>-level is the modification process generally used in Modified Atmosphere Packaging (MAP). By means of moving the O<sub>2</sub>-level from 20.9% to 0%, the growth of aerobic organisms and the speed of oxidation reactions would be inhibited. The removed oxygen can be replaced with nitrogen (N<sub>2</sub>) or carbon dioxide (CO<sub>2</sub>).

## Chemicals and Biological preservation

Preservatives (e.g., sulphur dioxide, benzoic acid and sorbic acid) are commonly used in preserving fruits and vegetables. In recent years, 1-methylcyclopropene (1-MCP) has resulted in an explosion of research on its effects on fruits and vegetables, including apple, avocado, banana, pear, peaches and nectarines, plums and tomato. 1-MCP is thought to interact with ethylene receptors and thereby prevent ethylene-dependent responses.

Edible coatings are an environmentally friendly technology that is applied on many products especially fresh-cut fruits and vegetables, in order to control moisture transfer, gas exchange or oxidation processes. Chitosan coating is widely researched and has been successfully used on *Myrica rubra*, grape, cucumber, pear etc.

Some biocontrol agents without negative environmental or toxicological impact have emerged as one of the most promising alternatives of chemical agents. Recently, *Metschnikowia*

pulcherrima has been reported as an effective biocontrol agent against postharvest decay of apple, table grape, grapefruit and cherry tomato. The strains of the yeast species mostly investigated generally act by consuming nutrients present on fruit and vegetable skins that allow rot-causing fungi to develop.

## **Radiation**

Radiation preservation is the use of gamma rays,  $\beta$ -rays, X-rays, ultraviolet (UV), visible and infra-red light, microwaves and other ionizing radiation or electron beams emitted by the radioisotope irradiation. It is possible to extend the shelf-life of fresh fruits and vegetables at room as well as at refrigeration. For example, 0.5kCy  $^{60}\text{Co}$   $\gamma$ -ray on strawberry, and kept in low-temperature, the decay coefficient is 70% lower than average during 15 days.

## **Processing**

Processing includes the production of concentrates, fruit juices, purees, dried fruits, preserves (jams, jelly, marmalade, conserves, sauces, pickles and chutneys) and fruit leathers (dried fruit pulp).