*Practical 5*

# PRIMARY PROCESSING & PRESERVATION OF FRUITS

## EXERCISE

5.1 : To know about primary processing and preservation of fruits

## OBJECTIVES

- To learn about different unit operations required for primary processing of fruits
- To learn about different methods of preservation of fruits

**Delivery schedule:** 03 periods

**Student expectations/learning objectives**

- Unit operations involved in primary processing of fruits
- Understanding different methods of preservation of fruits and their importance
- To start an agri-business on production of primary processed fruits

**Pre-learning required:** Primary knowledge about types of fruits, their availability and usefulness of primary processing and preservation.

**Handouts/material/equipment's & tools required:** Paper sheet and pen to note down the steps involved in primary processing and preservation of fruits.

## INTRODUCTION

With rapid urbanization, industrialization, there has been a sharp increase in middle class families. In addition, population of housewives is decreasing and that of working women is increasing. As a result, food

***For teachers***

- Perform some primary processing activities in your laboratory. You can start with simple and easily available fruits in the market. For example, fruits like papaya, pineapple and jackfruit can be used.
- Ask students to perform these activities in the lab.
- Ask students to teach primary processing of such fruits to their mothers, sisters and other members of their respective families

trends are also shifting towards convenience foods. Now, you can see fresh-cut fruits and vegetables in the market and you will find several purchasers for such products as well. Such fruits and vegetables are prepared by primary processing. After primary processing, fruits and vegetables can be processed further for the development of another value added products, called as secondary processing.

## Primary processing

The processing that occurs after harvesting to make food ready for consumption or use in other food products. Primary processing ensures that foods are:

- Easily transported
- Ready to be sold
- Ready to be eaten
- Ready to be processed into other products (e.g. after the primary processing of peeling and chopping, an apple can be stewed)

Some fresh-cut fruits

### *Secondary processing*

Secondary processing converts primary processed food into other food products. Secondary processing ensures that foods:

- Can be used for a number of purposes
- Do not spoil quickly
- Are available all the year (e.g. seasonal foods)

## Steps involved in primary processing

### *Cleaning/ Washing*

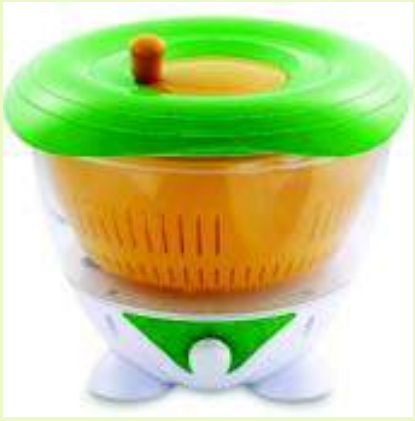
Harvested fruit is washed to remove soil, microorganisms and pesticide residues. Fruit washing is a mandatory processing step; it would be wise to eliminate spoiled fruit before washing in order to avoid the pollution of washing tools and/or equipment and the contamination of fruit during washing. Washing efficiency can be judged by the total number of microorganisms present on fruit surface

before and after washing. The best result are when there is a six fold reduction. The water from the final wash should be free from moulds and yeast; but a small quantity of bacteria is acceptable. Fruit washing can be carried out by immersion, by spray/ showers or by combination of these two processes, which is generally the best solution: pre-washing and washing.


Washing machine for fruits and vegetables

Some usual practices in fruit washing are:

- Addition of detergents or 1.5% HCl solution in washing water to remove traces of insecticides and fungicides;
- Use of warm water (about 50°C) in the pre-washing phase;
- Higher water pressure in spray/shower washers.


Ozone fruit and vegetable washing machine – a new introduction

Washing must be done before the fruit is cut in order to avoid losing high nutritive value soluble substances (vitamins, minerals, sugars, etc.).

## Sorting/Grading

Fruit sorting covers two main separate processing operations:

a. Removal of damaged fruit and any foreign bodies (which might have been left behind after washing);

b. Qualitative sorting based on organoleptic criteria and maturity stage.


Mechanical grading of fruits

Mechanical sorting for size is usually not done at the preliminary stage. The most important initial sorting is for variety and maturity. However, for some fruits and in special processing technologies, it is advisable to proceed to a manual dimensional sorting (grading).

### *Trimming and peeling (skin removal)*

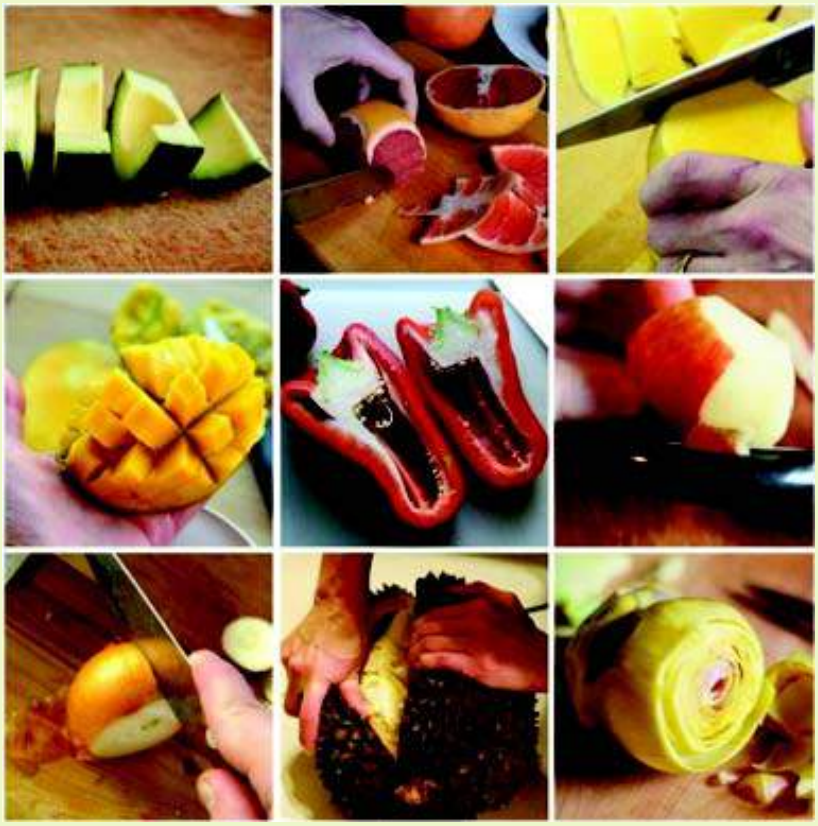
This processing step aims at removing the parts of the fruits, which are either not edible or difficult to digest, especially the skin.

Up to now the industrial peeling of fruit and vegetables was performed by three procedures:

a. Mechanically;

b. By using water steam;

c. Chemically; this method consists in treating fruit and vegetables by dipping them in a caustic soda solution at a temperature of 90 to 100° C; the concentration of this solution as well as the dipping or immersion time, vary according to each specific case.



Operations of peeling, trimming, cutting, coring in different fruits in primary processing

### *Cutting*

This step is performed according to the specific requirements of the fruit processing technology.

## Preservation of fruits

Preservation can be achieved by chemical means, by freezing, by drying or by pasteurization or by pickling. The choice of preservation process for each individual case is a function of the processed product type and the shelf life needed.

Potassium metabisulphite – a preservative

### *Drying*

Air drying following osmotic dipping is commonly used in tropical countries for the production of so-called "semi-candied" dried fruits. The sugar uptake, owing to the protective action of the saccharides, limits or avoids the use of $SO_2$ and increases the stability of pigments during processing and subsequent storage period. The organoleptic qualities of the end product could also be improved because some of the acids are removed from the fruit during the osmotic bath, so a blander and sweeter product than ordinary dried fruits is obtained. Owing to weight and volume reduction, loading of the dryer can be increased 2-3 times.

## Technical data for dehydration of fruits

| FRUITS | Drying Conditions | | | Finished Product | |
|---|---|---|---|---|---|
| | Load Kg/m² | Teperature°C | Time | Moisture (%) | Yield (%) |
| Plums | 15 | I. 40-50 | 6 H | 18-20 | 25-35 |
| Apples (Rings) | 10 | 75-55 | 5-6 H | 20 | 10-12 |
| Apricots (Halves) | 10 | 70-60 | 10-15 | 15-20 | 10-15 |
| Chenies (w. stones) | 10 | 55-70 | 6-8 | 12-15 | 25 |
| Pears (Halves and quarters) | 15 | 70-65 | 15-22 | 18-20 | 10-15 |
| | 15 | 70-60 | 10-15 | 15-20 | 10-15 |

The combination of osmosis with solar drying has been put forward, mainly for tropical fruits. A 24 hour cycle has been suggested combining osmodehydration, performed during the night, with solar drying during the day. Two-three-fold increase in the throughput of typical solar dryers is feasible, while enhancing the nutritional and organoleptic quality of the fruits.

Some dried fruits commercially available in the markets

A two-step drying process, OSMOVAC, for producing low moisture fruit products has also been used. The osmotic step is performed with sucrose syrup 65-75 °Brix until the weight reduction reaches 30-50%. The osmotic dehydration followed by vacuum drying usually produce puffy products

with a crisp, While a honeycomb-like texture can be obtained at a cost comparatively lower than freeze-drying.

**Moisture and shipping factors for some dried/dehydrated fruits**

| Products | Form | moisture (%) |
|---|---|---|
| Apples | 6 min rings | 20 |
| Apricots | Caps | 17-20 |
| Banana | Cut pieces | 15 |
| Chenies | Whole | 12-15 |
| Figs | Whole | 23 |
| Guava | Quarters | 6 |
| Mango | 15 min pulp sheets | 15 |
| Peaches | Caps | 15-30 |
| Pears | Halves | 23 |
| Prunes | Whole | 18-20 |
| Raisins | Whole | 17 |

***Addition of preservatives***

In many countries, in practice, preservation is carried out with sulphur dioxide, sodium benzoate, formic acid and, on a small scale, with sorbic acid and sorbates.

*Preservation with sulphur dioxide* is a widespread process because of its advantages: universal antiseptic action and very economic application. The drawbacks of $SO_2$ are: $SO_2$ turn firms the texture of some fruit species (pomaces), desulphiting is not always complete and recolouring of red fruits is not always complete after desulphitation. Practical preservation dosage levels with $SO_2$ for about 12 months range between 0.18 - 0.20% $SO_2$ (with respect to the product to be preserved). This level could be reduced to 0.09% $SO_2$ for 3 months and to 0.12% $SO_2$ for 6 months preservation. The preservation with sulphur dioxide is in use mainly for "pulps" and for "purees-marks".

*Preservation with sodium benzoate* has the following advantages: it does not firm up the texture and does not modify fruit colour. The disadvantages are: it is not a universal antiseptic, its action needs an acid medium and the removal is partial. Sodium benzoate is in use for 'pulps' and for 'purees-marks' but less for fruit juices.

Practical dosage level for 12 months preservation is 0.18-0.20 % sodium benzoate, depending on the product to be preserved. Sodium benzoate is used as a solution in warm water; the dissolution water level has to be at maximum 10% reported to semi-processed product weight.

*Formic acid* preservation is performed mainly for semi-processed fruit juices at a dosage level of 0.2 % pure formic acid (100%). Formic acid is an antiseptic effective against yeasts, and it does not influence colour of products and is easily removed by boiling.

Formic acid can be diluted with water in order to ensure a homogeneous distribution in the product to be preserved; water has to be at maximum 5 % of the product weight. Because of a potential effect of pectic substance degradation, formic acid is less in use for "pulps" and "purées-marks" preservation.

*Sorbic acid* used as potassium sorbate (easily water soluble) can be used for preservation of fruit of semi-processed products of at a dosage level of 0. 1%. Advantages of sorbates are: they are completely harmless and without any influence on the organoleptic properties of semi-processed fruit products.

## STUDENT'S ACTIVITIES/EXERCISES

1. Identify the fruits suitable for primary and secondary processing.
2. Perform primary processing of some fruits in your laboratory and teach your respective mothers, sisters or other members of family.
3. Purchase some processed products from the market and note the preservatives used in them from their labels.
4. Prepare a list of pickles available in your house. Make a flow diagramme for making those pickles. Follow the steps with the help of you mother or sister and make pickles from the fruit of your choice.

## RESOURCE MATERIAL


- Sharma, S.K. and Nautiyal, M.C. (2009). Postharvest technology of horticultural crops. New India Publishing Agency, New Delhi.
- Siddappa, G. and Tandon, D.K. (1998). Preservation of fruits and vegetables. ICAR, New Delhi.
- Srivastava, R.P. and Kumar, S. ( 2001). Fruit and vegetable preservation: Principles and practices. International Book Distributing Co., Lucknow, India.
- Verma, L.R. and Joshi, V.K. (2000). Post harvest technology of fruits and vegetables. Volume 1 and 2. Indus Publishing House, New Delhi.