

*Technology of  
Minimally Processed  
Fruits and Vegetables*



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➤ Production of Fruits	: 74.50 m MT
Vegetables	: 162.20 m MT
Total	: 236.70

- India is the **II<sup>nd</sup>** largest producer of Fruits and Vegetables in the world.
- India produces **12.90%** of world's Fruits and **14%** of Vegetables.

(NHB Data Base, 2013)

# Share of India in worlds Market

<b>Name of Fruit</b>	<b>Share (%)</b>	<b>Rank</b>
<b>1. Mango</b>	<b>51.00</b>	<b>Ist</b>
<b>2. Papaya</b>	<b>38.00</b>	<b>Ist</b>
<b>3. Banana</b>	<b>23.00</b>	<b>IIInd</b>
<b>4. Guava</b>	<b>3.00</b>	<b>Ivth</b>
<b>5. Oranges</b>	<b>5.00</b>	<b>VIth</b>
<b>6. Pine apple</b>	<b>7.00</b>	<b>VIth</b>
<b>7. Grapes</b>	<b>2.40</b>	<b>XIth</b>

# Share of India in worlds Market

Name of vegetable	Share (%)	Rank
1. Cauliflower	37.72.00	Ist
2. Onion	11.38	IIInd
3. Cabbage	7.07	IIIrd
4. Potato	6.80	Vth
4. Tomato	5.70	vth
5. Green peas	5.20	IIInd

# Estimated losses in Fruits

Name of Fruit	Losses (%)
1. Apples	14
2. Banana	20-80
3. Grapes	27-37
4. Citrus fruits	20-85
5. Papaya	40-100

# Estimated losses in Vegetables

Name of Vegetables	Losses (%)
1. Onions	16-35
2. Potato	5- 40
3. Tomato	5-50
4. Okra	12 -20
5. Sweet potato	35- 45

In developed countries these losses are ranged between **5 to 10%** only



## Handling of Fruits and Vegetables in India



➤ **About 25 to 30% losses of the fruits and vegetables**

➤ **In terms of money Rs. 55 to 60 thousand cr. Annually**

**Efforts are needed to save 10% only**



- Gov. of India created Separate Ministry i.e. *Ministry of FPI* has been during **July, 1990**.
- Food Processing Industry is known as **'SUN RISING INDUSTRY'**
- Presently **6235** processing units (**FSSAI, 2006**)
- The maximum units are in MS **1186**
- Maximum units are in **small scale** category
- They are using their **50%** installed capacity

## Level of processing (Fruits & Vegetables)

USA	65%
France	70 %
Brazil	70%
Malaysia	83 %
Philippines	78%
Thailand	30 %
India	2.1%

**Source: Indian Food Processing Sector, 2013**

## Definition of Minimal Processing :

*Fresh-cut fruits & vegetables that have been trimmed, peeled and cut into a fully usable form, which are subsequently packed to offer consumers convenience while maintaining the freshness.*

# **Terms used to refer to minimally processed products**

- **Lightly Processed**
- **Partially Processed**
- **Fresh Cut Fruits and Veg.**
- **Pre-prepared Fruits & Veg.**
- **Ready – to – Eat/cook Fruits & Veg.**

It involves following operations such as :

**Cleaning**

**Washing**

**Trimming**

**Coring**

**Slicing**

**Shredding**

**and so on**

## **Importance of Minimally Processed F. and V.**

- **Consumers are becoming more conscious about their food but have less time to prepare**
- **F and V are to be prepared at the production site, pre-packed products helps in reducing the garbage problems in the cities**
- **Increase in number of working women , they like to prepare the food at home but they don't have time**
- **Minimally processed products available in the supermarkets, hotels, airlines catering etc. services**
- **India it self is a big market**
- **As the product is very perishable**

- **Most of the processing techniques enhances their storage shelf life while**
- **Minimal processing increases their perishability**

**Because of this:**

**Need for increased sanitation, preparation and handling of these products require knowledge of Food science & Technology, Microbiology and Postharvest Physiology**

**A small vendor's cart with fresh-cut produce in developing countries**





**Fresh cut Jack fruit in local market in common place**



## **Fruits suited for Minimal processing**

- **Slices of Mango, Papaya, Guava,**
- **Water melons, Musk melons**
- **Peeled and cored pineapple**
- **Peeled citrus fruits**
- **Jack fruit bulbs**
- **Pomegranate arils**

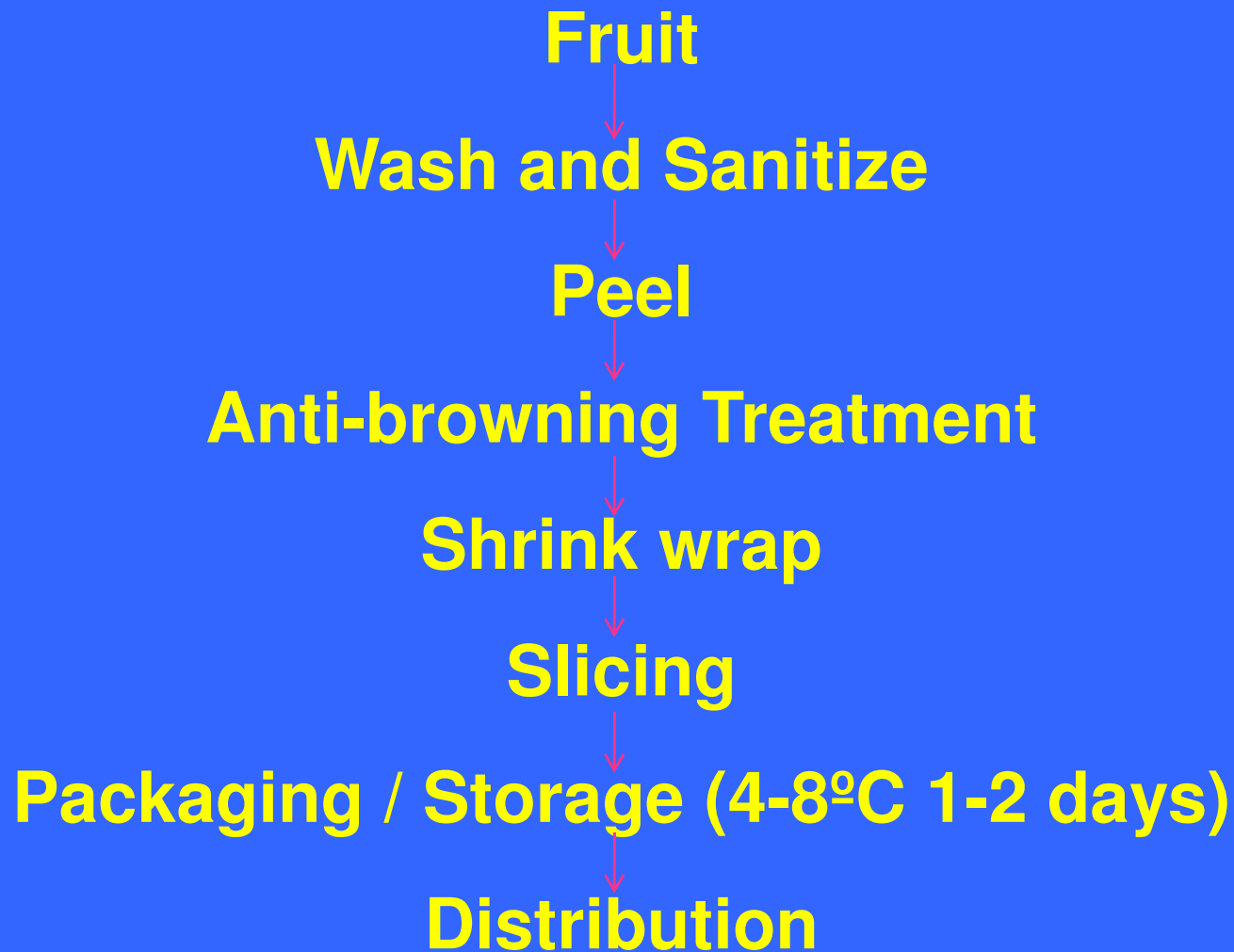
# Vegetables suited for Minimal Processing

- Peeled and sliced Potatoes
- Shredded lettuce and cabbage
- Washed and trimmed Spinach
- Vegetable snacks : Carrot and Celery sticks

- **Cauliflower & Broccoli florets**
- **Cleaned & diced onions**
- **Shelled Green peas**
- **Scrapped Drum Stick**

## Flow sheet for minimal processing





**Steps in the production of fresh-cut fruits ( Small processor )**

# 1. Physiological Response

1. The physical damage or wounding caused by preparation increases respiration and ethylene production within minutes

2. Rates of metabolic processes

3. Change in color flavor, texture and nutritional quality

4. *Change in texture of the product*

## **The impact of wounding can be reduced by**

- 1. Cooling the product before processing**
- 2. Temperature control after processing**
- 3. Use of sharp knives and equipments**
- 4. Maintenance of good sanitation**
- 5. Removal of surface moisture of the cut product.**



## 2. Microbiological Concerns

- Fruits and vegetables are safe to eat because the surface peel is an effective physical and chemical barrier to micro-organisms.
- In addition, if the peel is damaged, the acidity of the pulp prevents the growth of organisms.
- The normal spoilage organisms are :

***Erwinia* and *Pseudomonas* - Harmful to humans**

- **Changes in the environmental conditions surrounding a product can result in significant changes in the m. o.**
- **The risk of pathogenic bacteria may increase with film packaging with packaging of products of low salt content and high temperatures (>5°C ).**
- **Food pathogens such as *Clostridium* and *Listeria* can potentially develop on minimally processed fruits and vegetables.**

**Microbial growth on minimally processed products can be controlled by**

- **Good hygiene and Sanitation during the process**
- **Use of chlorinated water – Sanitation of all equip.**
- **Temperature management:**  
**i.e. Low temp. during and after processing**

# Post-cutting treatments to extend the shelf-life of fresh-cut products

## ***A. Chemical post-cutting treatments***

### ➤ ***Acidification:***

➤ ***PPO (around pH 7.0)***

➤ **Browning can be slowed by dipping products in mild**

**Acetic, ascorbic, citric, tartaric, fumaric or phosphoric acid alone or**

➤ **In combinations of ascorbic and citric acid better than individual use**

**However, these acids may impart off-flavours or promote tissue softening and must be used with care**

## ***B. Application of edible coatings:***

- ***Sodium caseinate and Stearic acid reduce white blush in carrots***

## ***C. Natural antimicrobials:***

***Plant extracts such as :***

- ***Ginger***
- ***Cinnamon @ at 500 ppm***

## ***D. Firming agents:***

***Calcium chloride solutions  
@ 0.5 to 1.0 percent.***

***E. Packaging : MAP/ CA (O<sub>2</sub> @ 2 to 8% CO<sub>2</sub> @ 5 to 15 %)***

***F. Low temp.:***

# Fresh cut fruits in containers





## Packaging of fresh cut Fruits and Vegetables



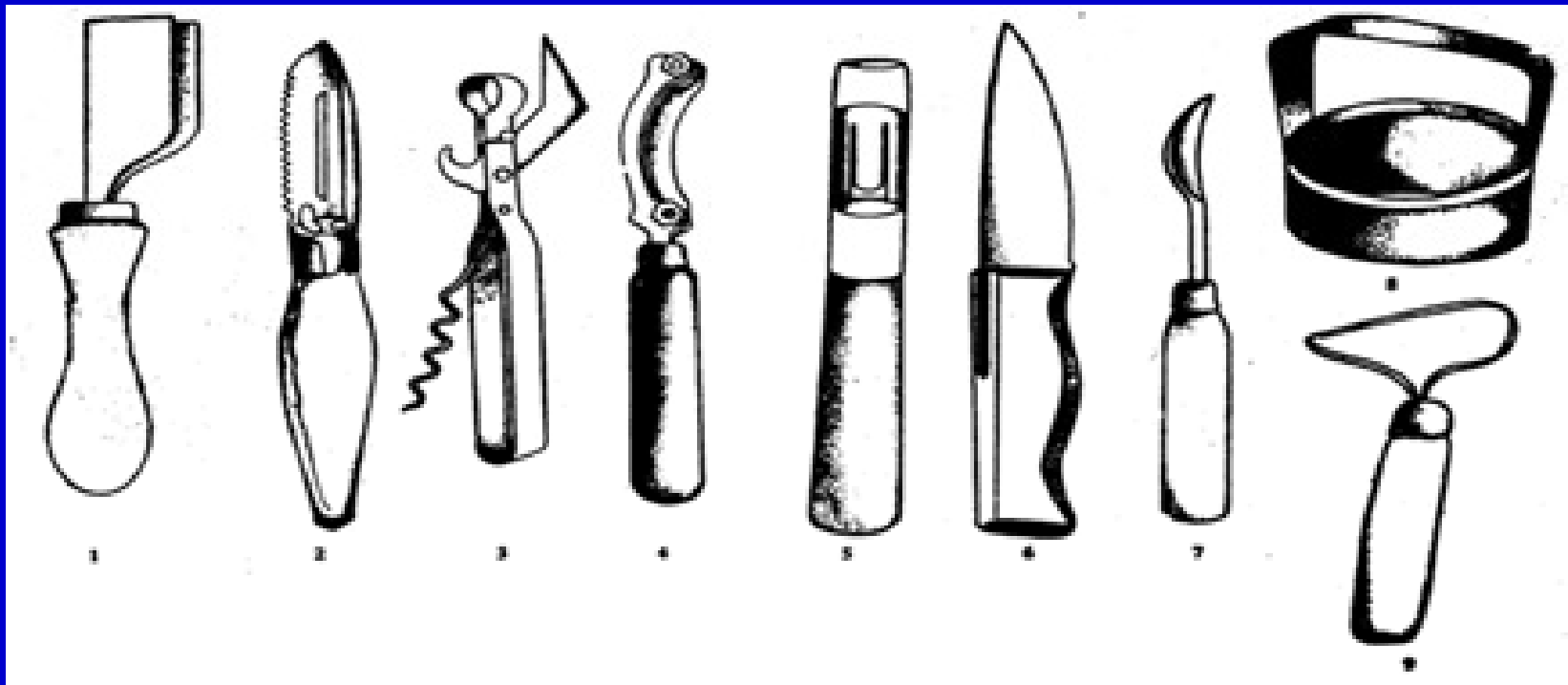
## List of equipment used

- Product bin dumpers
- Elevator belt conveyors
- Automatic sorting machines
- Abrasive peelers or high pressure water peelers
- Slicers or other cutting machines
- Continuous washing conveyors
- Spin driers, air driers, shakers
- Form-fill-seal packaging machines
- Weighing, labeling, coding machines
- Boxing and palletizing machines
- Metal detectors

J. B. James and T. Ngarmsak (2010)  
Processing of fresh-cut tropical fruits and vegetables:  
A TECHNICAL GUIDE



# List of equipments used during processing



1. Pine apple eye remover  
5. Core Remover  
8. Pine apple Puncher

2 and 4. Peeling Knife  
6. Cutting Knife  
9. Seed Remover

3. Can Opener  
7. Pitting Knife.



**Leafy Vegetables packaged in breathable bags**



**Tray with hinge interlock**



**PET tray with an overwrap film**



**Zip lock bags used in small-scale**

## Washing and transporting fruit in a large packing house



## Washing of pre-cut lettuce



# Cutting and Slicing machine



# Centrifugal driers



# Auto scale with form-fill-seal packaging unit



## Sorting of cut fruit





## Fresh-cut products sold in the fresh market





*Thank You!*