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# Participant Handbook

Sector
**Food Processing**

Sub - Sector
**Fruits and Vegetables**

Occupation
**Processing**

Reference ID: **FIC/Q0101, Version 3.0**
**NSQF Level 3**

## Squash and Juice Processing Technician

**Published By**

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> Skilling is building a better India. If we have to move India towards development then Skill Development should be our mission.

**Shri Narendra Modi**
Prime Minister of India

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# Certificate

## COMPLIANCE TO QUALIFICATION PACK – NATIONAL OCCUPATIONAL STANDARDS

is hereby issued by the

**FOOD INDUSTRY CAPACITY AND SKILL INITIATIVE SECTOR SKILL COUNCIL**

for Food Processing

**SKILLING CONTENT - PARTICIPANT HANDBOOK**

Complying to National Occupational Standards of
Job Role/Qualification Pack: **Squash and Juice Processing Technician** QP Nos **FIC/Q0101 Level 3**

Date of Issuance: 30/09/2021

Valid up to : 29/09/2024

**Valid up to the next review date of the Qualification Pack or the *Valid up to' date mentioned above (whichever is earlier)*

Authorised Signatory
(Food Industry Capacity and Skill Initiative)

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The preparation of this participant handbook would not have been possible without the support of the Food Processing Industries. The Industry feedback has been extremely encouraging from inception to conclusion & it is with their inputs that we have tried to bridge the skill gaps existing today in the Industry.

This participant handbook is dedicated to all the aspiring youth who desire to achieve special skills which would be a lifelong asset for their future endeavors and help them make a bright career in the Food Processing Sector.

## About this book

This Participant Handbook is designed to enable training for the specific Qualification Pack (QP). Each National Occupational (NOS) is covered across Unit/s. This book is designed to enable a candidate to acquire skills that are required for employment. The content of this book is completely aligned to the National Occupation Standards QP/NOS and conform to the National Skills Qualification Framework (NSQF). The Qualification pack of Squash and Juice Processing Technician Tech Processed Food Entrepreneur, Level 3 includes the following NOS's which have all been covered across the units

1. FIC/N0101: Evaluate and develop entrepreneur skills Prepare and Maintain Work Area and Process Machineries for Squash and Juice Processing
2. FIC/N0102: Prepare for Production of Squash and Juice
3. FIC/N0103: Produce Squash and Juice
4. FIC/N9001: Food and Safety, Hygiene and Sanitation
5. FIC/N0104: Complete Documentation and Record Keeping Related to Production of Squash and Juice

Key Learning Objectives for the specific NOS mark the beginning of the Unit/s for that NOS. The symbols used in this book are described below.

## Symbols Used


Key Learning Outcomes


Steps


Exercise


Tips


Notes


Unit Objectives


Summary

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# 1. Introduction

Unit 1.1 – Introduction to the Training Programme

Unit 1.2 – Introduction to the Food Processing Industry

Unit 1.3 – Introduction to Fruit and Vegetable Processing

Unit 1.4 – Introduction to Squash and Juice

Unit 1.5 – Attributes of a Squash and Juice Processing Technician

FIC/N0101

## Key Learning Outcomes

**By the end of this module, participants will be able to:**

1. Explain the purpose of training.
2. Discuss the National Occupational Standards and Qualification Pack.
3. Define food processing.
4. List the various sectors of the food processing industry.
5. Describe the various stages of food processing for converting raw materials to food products.
6. State the need for fruit and vegetable processing.
7. State the common methods of fruit and vegetable processing.
8. List the various sub-sectors of beverage industry.
9. List the various fruit drinks.
10. Define fruit juice and its types.
11. Define squash.
12. List the various fruits used for making squash and juice.
13. State the roles and responsibilities of a squash and juice processing technician.

# UNIT 1.1: Introduction to the Training Programme

## Unit Objectives

**By the end of this unit, participants will be able to:**

1. Explain the purpose of training
2. Discuss the National Occupational Standards and Qualification Pack

## 1.1.1 Purpose and Benefits of the Training Programme

This training programme is developed to impart specific skills to individuals who wish to be a Squash and Juice Processing Technician. The training programme is based upon the National Occupational Standards for the food processing sector. The National Occupational Standards have been described in the following subsection of this chapter.

The training programme will enable an individual to:

- Maintain work area and process machineries for squash and juice processing;
- Prepare for production of squash and juice;
- Produce squash and juice;
- Complete documentation and record keeping related to production of squash and juice;
- Ensure food safety, hygiene and sanitation for processing food products.

After successful completion of training and passing the assessment, you will be issued a certificate.


*Fig. 1.1.1. Skill cards*

## 1.1.2 Introduction to QP and NOS

This training programme is intended for imparting basic skill and knowledge relevant to the job role, required to perform at a food processing industry. This programme is based on qualification pack called Squash and Juice Processing Technician. The Qualification Pack Code for Squash and Juice Processing Technician is FIC/Q0101. This is also called a QP.

A QP consists of a set of National Occupational Standards (NOS). NOS specify the standard competency a worker must achieve when carrying out a function at the workplace.

Under Squash and Juice Processing Technician QP, there are five NOSs which detail the functions to be performed at work site as a Squash and Juice Processing Technician.

| NOS Code | MajorFunction/Task |
|---|---|
| FIC/N0101 | Prepare and maintain work area and process machineries for squash and juice processing |
| FIC/N0102 | Prepare for production of squash and juice |
| FIC/N0103 | Produce squash and juice |
| FIC/N0104 | Complete documentation and record keeping related to production of squash and juice packaging food products |
| FIC/N9001 | Food safety, hygiene and sanitation for processing food products |

# UNIT 1.2: Introduction to the Food Processing Industry

## Unit Objectives

**By the end of this unit, participants will be able to:**

1. Define food processing
2. List the various sectors of the food processing industry
3. Describe the various stages of food processing for converting raw materials to food products

## 1.2.1 Food Processing

Agriculture is the backbone of the Indian economy. The produce from various agriculture-based occupations is primarily used for consumption within the country. It is exported to different parts of the world as well. Agricultural produce is also used as raw material in the food processing industry.

Food processing is the method used to convert raw materials into food products. They could be processed foods, ready-to-eat foods, food additives or foods used to prepare other food products. Besides food processing, the food industry also relies on food preservation as an important method to store food products for longer periods of time.

The food processing industry in India is divided into several sub-sectors. They are:

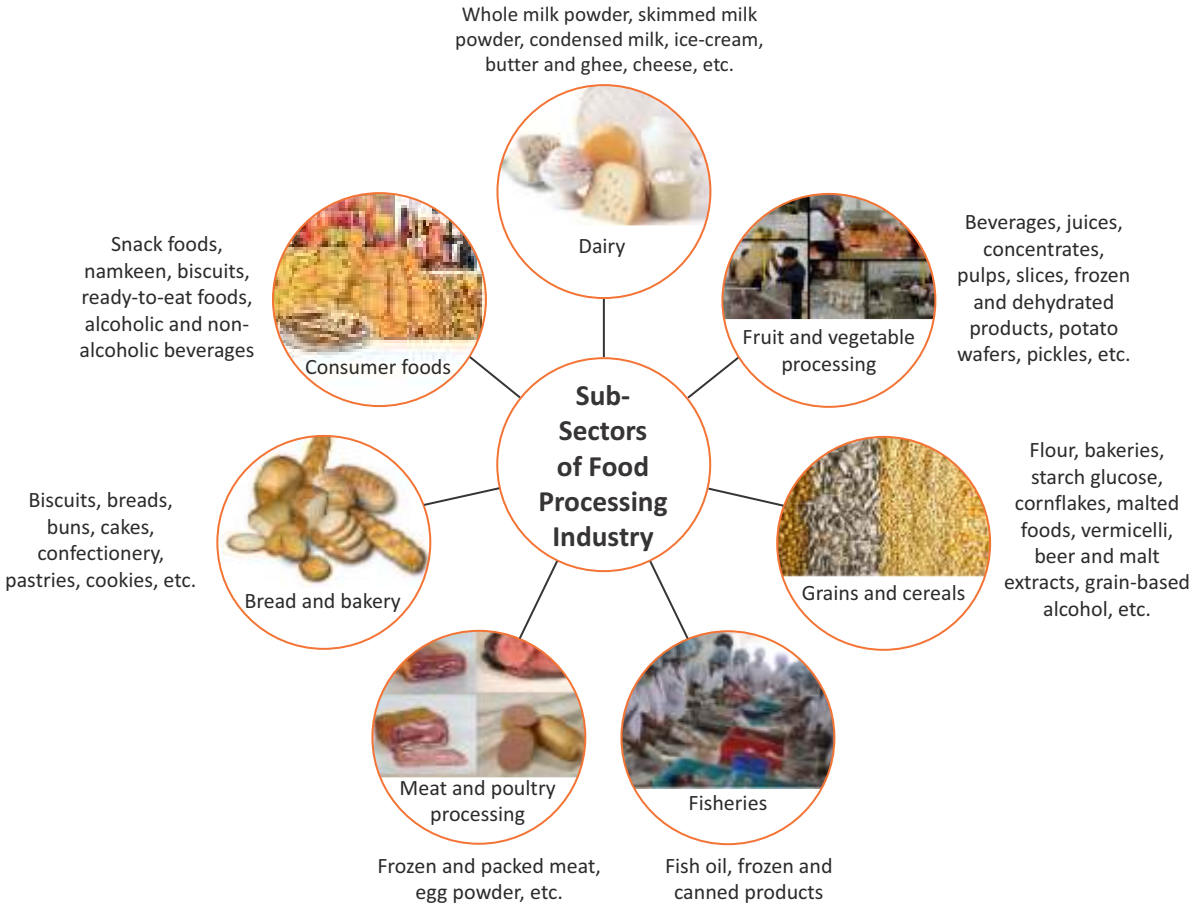


*Fig. 1.2.1. Sub-sectors of food processing industry*

The Indian food industry is a star sector in India with a bright prospect for growth and development. Indian food and grocery market is the sixth-largest in the world. Food industry, particularly the food processing sector in India, has shown immense potential due to its quick-paced growth. Food processing ranks fifth in the country in terms of its production, growth, export, and consumption. One of the recent trend that is seen in this sector is ordering food online. Even though this segment is still in its early stages of development, it is growing at an increasingly fast pace.

Food industry is implementing stringent food safety and quality measures in order to attract more investors and ensure the safety of its existing consumers. All these factors will have a positive impact on the way the sector functions and also on the job market in the country.

Women have always been associated with preparing food for the family or the household, but in modern times women are breaking this stereotype and turning entrepreneurs in this sector. Women are also becoming professional chefs and bakers, and contributing to the economy and towards the sector.

## 1.2.2 Journey of Food from Harvest to Consumer

The following chart shows the journey food material goes through to become a final, consumable product to various customers.

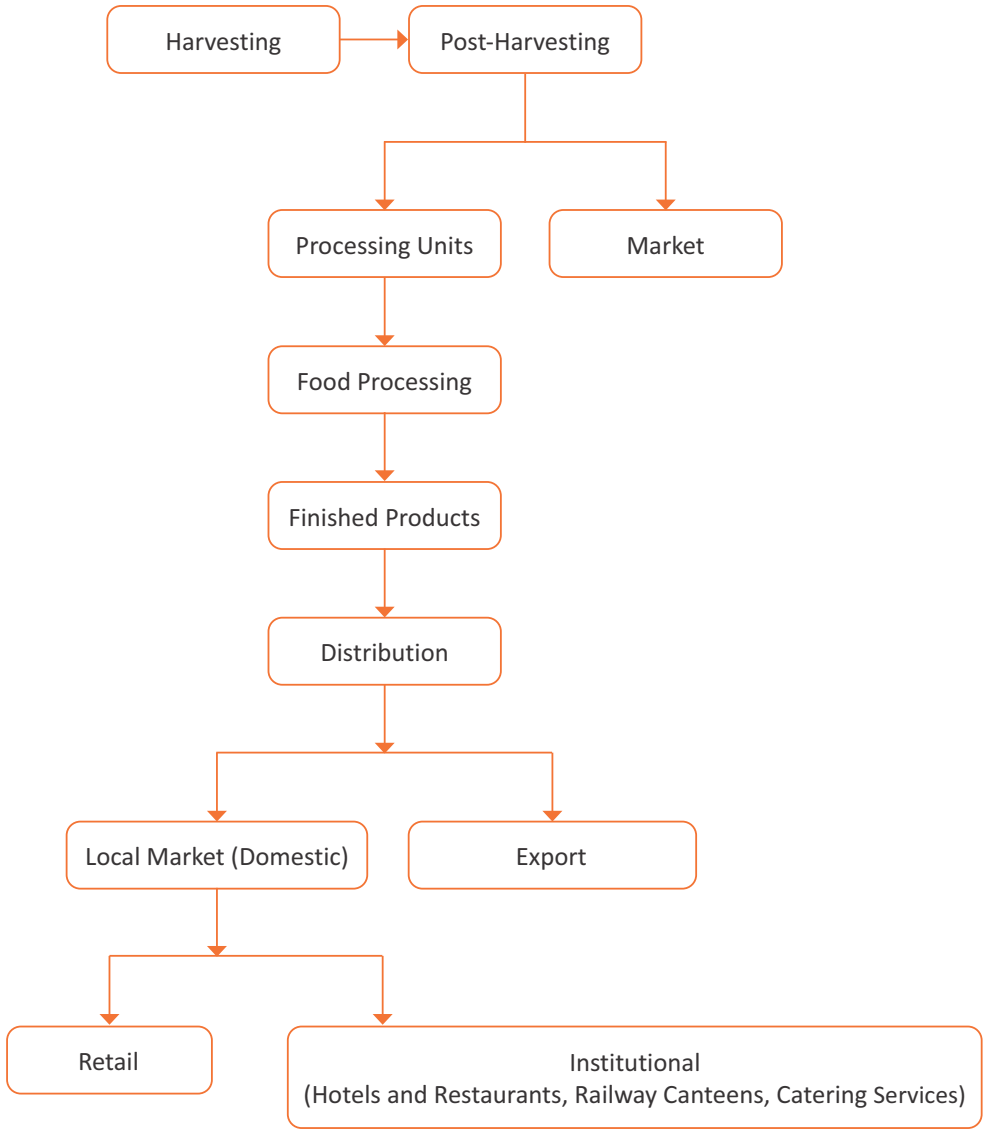


*Fig. 1.2.2. Journey of harvested food*

**Scan the QR code to watch the related videos**

https://youtu.be/wMu0EpUgCd4

Introduction to the Food Processing Industry

# UNIT 1.3: Introduction to Fruit and Vegetable Processing

## Unit Objectives

**By the end of this unit, participants will be able to:**

1. State the different sub-sectors of fruits and vegetable industry
2. State the common methods of fruit and vegetable processing

## 1.3.1 Overview of the Fruit and Vegetable Sub-Sector

The fruit and vegetable processing sub-sector deals with processed foods, semi-processed foods, and packaged foods that are made from fruits and vegetables. This includes:

*Fig. 1.3.1. Juices*

*Fig. 1.3.2. Jellies*

*Fig. 1.3.3. Pulps*

*Fig. 1.3.4. Jams*

*Fig. 1.3.5. Frozen foods*

*Fig. 1.3.6. Wafers*

*Fig. 1.3.7. Pickles*

There are certain parameters that are important to consider when selecting a fruit/vegetable for processing. They are:

- Demand for processed food made from that vegetable/fruit;
- High quality produce;
- Continuous supply;
- Huge supply in case of seasonal fruits/vegetables.

These parameters are important to ensure that raw materials withstand the processing and preservation process.

## 1.3.2 Methods of Processing Fruits and Vegetables

Some common methods of processing fruits and vegetables are:

*Fig. 1.3.8. Drying*

*Fig. 1.3.9. Concentration*

*Fig. 1.3.10. Heating*

*Fig. 1.3.11. Fermentation*

*Fig. 1.3.12. Sterilisation*

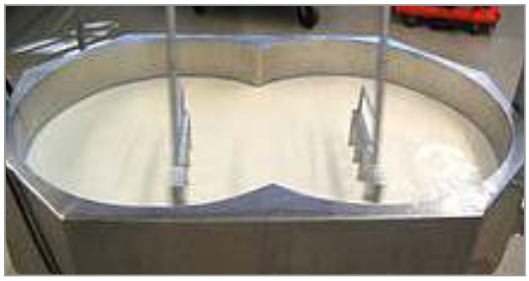

*Fig. 1.3.13. Pasteurisation*

*Fig. 1.3.14. Blanching*

*Fig. 1.3.15. Canning*

**Scan the QR code to watch the related videos**

https://youtu.be/iacTHJtrXIE

Overview of the Fruit and Vegetable Sub-Sector

## Notes

# UNIT 1.4: Introduction to Squash and Juice

## Unit Objectives

**By the end of this unit, participants will be able to:**

1. List the various sub-sectors of beverage industry
2. List the various fruit drinks
3. Define fruit juice and its types
4. Define squash
5. List the various fruits used for making squash and juice

## 1.4.1 Beverage Industry

It is an industry that produces drinks and is a rapidly growing industry. The leading beverage companies in India are exporting various products around the world. The industry is fragmented and its sub-sectors are:

| BeverageType | Product |
|---|---|
| Soft drinks | Fruit drinks, carbonated drinks, Ready To Serve (RTS) drinks, mineral water, energy drinks |
| Alcoholic beverages/fermented drinks | Beer, wine, barley water, hard drinks, country liquor |
| Dairy drinks | Various milk drinks like chocolate milk, cocoa milk, etc. |
| Tea and coffee drinks (daily beverage) | Herbal teas, lemon tea, cold coffee, coffee flavoured liquors |

**Table 1.4.1 Sub-sectors and its products**

**FruitDrinks**

A beverage made from fruit is a fruit drink. Fruit drinks are of following types:

- Juice
- Concentrates and pulps
- Ready To Serve (RTS)
- Nectars
- Squashes
- Cordials
- Syrups
- Crush

**Juices**

It is an unfermented beverage made from crushing/squeezing fruit. The resultant liquid is juice. It is of two types:

| Natural Juice | Sweetened Juice |
|---|---|
| • Pure in form; extracted from ripe fruits<br>• Contains natural sugars<br>• Example: Apple juice, orange juice, etc. | • 85 % is pure juice mixed with soluble solids<br>• Sugar added to sweeten it as per processing requirement<br>• Example: Strawberry squash and lemon squash |

**Table 1.4.2 Difference between natural and sweetened juice**

**Squashes**

It is an unfermented beverage made from combining juice/pulp and total soluble solids of fruits in proportions.

**Types of Products Made from Various Fruits**

The table below provides the various products made from fruit juice:

| Name of Fruit | JuiceType |
|---|---|
| Mango | • Juice<br>• Blended juice<br>• Ready to serve<br>• Squash<br>• Nectar |
| Guava | • Blended juice<br>• Ready to serve<br>• Nectar<br>• Squash |
| Papaya | • Ready to serve<br>• Nectar<br>• Squash |
| Pomegranate | • Juice<br>• Blended juice<br>• Syrup<br>• Cordial<br>• Nectar |
| Pineapple | • Juice<br>• Squash<br>• Cordial<br>• Juice concentrate |
| Orange | • Juice<br>• Blended juice<br>• Squash<br>• Syrup<br>• Juice concentrate |

| Name of Fruit | JuiceType |
|---|---|
| Apple | • Pure juice<br>• Blended juice<br>• Juice concentrate |
| Grape | • Juice<br>• Bended juice<br>• Syrup<br>• Juice concentrate |
| Strawberry | • Crush<br>• Squash<br>• Jelly<br>• Ice-cream<br>• Pulp powder |
| Lemon/lime | • Pure juice<br>• Blended juice<br>• Citrus juice<br>• Ready to serve<br>• Nectar<br>• Squash<br>• Cordial<br>• Syrup |
| Jamun | • Syrup<br>• Squash<br>• Nectar<br>• Ready to serve |
| | |

**Table 1.4.3 Types of juice made from fruits**

# UNIT 1.5: Attributes of a Squash and Juice Processing Technician

## Unit Objectives

**By the end of this unit, participants will be able to:**

1. State the roles and responsibilities of a squash and juice processing technician

## 1.5.1 Roles and Responsibilities

The roles and responsibilities of a squash and juice processing technician are:

| Roles | Responsibilities |
|---|---|
| Handle raw material from post-harvest storage to the process line | • Check raw material for quality<br>• Ensure fruits are free from dirt, debris, foreign matter, glass, and insects<br>• Ensure minimum loss of raw material |
| Record-keeping and documentation | • Document and maintain records of raw materials<br>• Document and maintain records of production schedule and process<br>• Document and maintain records of finished products |
| Hygiene and sanitation maintenance | • Adopt safety and sanitation-related measures<br>• Follow food safety norms and practices |
| Inspect machines and troubleshoot issues | • Ensure smooth operation of machinery to complete production line<br>• Optimise the use of machinery<br>• Attend to minor repairs of tools and machinery when required<br>• Ensure safety rules and regulations are observed<br>• Prevent accidents<br>• Inform issues to the supervisor when required |
| Plan and execute pulping process | • Examine products at different stages of fruit pulping<br>• Adhere to Good Manufacturing Practice (GMP)<br>• Ensure the products meet the quality standards set by the organisation |
| Inspect intermediate as well as finished products | • Check fruits' ripening quality along with intermittent and finished products for quantity, quality, and salt equilibrium<br>• Ensure conformance of quality as per organisational standards |
| Follow storage and packaging norms | • Ensure safe and proper storage of raw material, packing material, and finished goods |

**Table 1.5.1 Roles and responsibilities**

## Exercise

**1. Fill in the blanks with the correctoption**

a. Food _____ is the method used to convert raw materials into food products.

i. proofing
ii. dispersing
iii. processing
iv. picking

b. Food _____ is an important method to store food products for longer periods of time.

i. preparation
ii. preservation
iii. consumption
iv. allocation

c. Journey of food from harvest ultimately reaches the _____ .

i. consumers
ii. bankers
iii. builders
iv. packers

d. Fruit selected for processing should be of _____ quality.

i. high
ii. rotten
iii. sun scorched
iv. damaged

e. A beverage made from _____ is a fruit drink.

i. milk
ii. jam
iii. squash
iv. fruit

f. _____ is the backbone of the Indian economy.

i. Agriculture
ii. Fishing
iii. Mining
iv. Meat and Poultry

g. _____ sub-sector produces juices, jellies, pulps, pickles, jams etc.

i. Dairy
ii. Grains and cereals
iii. Fisheries
iv. Fruit and vegetable processing

h. Squash and Juice Processing Technician should not compromise on the _____ of the product at any cost.

i. quantity
ii. quality
iii. quality and quantity
iv. characteristics

j. Handling raw material from post-harvest storage to the process line is one of the _____ of squash and juice processing technician.

i. description
ii. job role
iii. responsibility
iv. function

**2. Arrange the steps for pulp extraction**

| Procedure/Steps | Orderthesteps (as 1, 2, 3, 4, 5, 6 and 7) |
|---|---|
| a. Carry post production cleaning and regular maintenance | |
| b. Extract fruit juice | |
| c. Clarify juice | |
| d. Prepare squash | |
| e. Fill, package, and store juice and squash | |
| f. Pasteurise fruit juice | |
| g. Receive, wash, sort, and slice fruits | |

**Scan the QR code to watch the related videos**

https://youtu.be/_bs_--89szA

Orientation Video - Squash and Juice Processing Technician

## Notes

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# 2. Prepare and Maintain Work Area and Process Machineries for Squash and Juice Processing

Unit 2.1 – Equipment Used for Fruit Pulping

Unit 2.2 – Sanitisation of Work Area

Unit 2.3 – Cleaning Processes

FIC/N0101

## Key Learning Outcomes

**By the end of this module, participants will be able to:**

1. Identify the different equipment, tools, and machineries used for food processing
2. State the materials and equipment used in cleaning and maintenance of the work area and machineries
3. List the various cleaning chemicals required
4. State the cleaning processes used to clean the work area and process machineries

# UNIT 2.1: Equipment Used for Fruit Pulping

## Unit Objectives

**By the end of this unit, participants will be able to:**

1. Identify the different equipment, tools, and machineries used for food processing

## 2.1.1 Pulp-Processing Equipment

The equipment used in a pulp-processing unit are:

| Name of Equipment | Usage |
|---|---|
| Ripening chamber with ethylene doser | Used for ripening fruit/vegetables by passing ethylene gas |
| Fruit washing machine | Used for fruit washing |
| Sorting and grading machine | Used for fruit segregation as per size and firmness |
| Conveyor belt | Used for mango tip cutting and visual inspection for sorting |
| Peeler | Used for removing fruit skin |
| De-seeder/de-stoner | Used for removing fruit seeds and stones in mangoes |
| Core cutter | Used for cutting fruit core especially in pineapple |
| Crusher/chopper/shredder | Used for crushing/chopping/shredding of fruit |
| Blancher/hot break system | Used to heat the fruit/vegetable to facilitate pulping process |
| Juice extractor/hydraulic press/ continuous press/filter press | Used to extract juice and separate fruit fibre, skin, seed, and grits from juice |
| Steam jacketed kettles/blending tanks | Used for cooking juice by blending all ingredients like sugar, ascorbic acid, colour, flavourings, etc. |
| Decanter | Used to remove fibre, grits, black and brown specks, extraneous matter, dust, and other impurities from juice |
| Enzyme treatment tank/ collection tank | Used to hold juice when enzyme is added for enzyme activity |
| Evaporator/concentrator | Used for evaporating water from juice |
| Pasteuriser | Used for pasteurising juice by passing steam through it |
| Clarifier/ultra-filtration unit | Used to clarify juice. A clarifier is used to remove solid particulates or suspended solids from liquid for clarification and/or thickening |
| Aseptic filler | Used for aseptic filling of processed pulp in aseptic bags |
| Holding tank/reservoir tank | Used for storing fruit juice |
| Bottle filling machines | Filling of juices/squashes into bottles |
| Crown crimping machine | Metal lid capping machine |
| pilfer proof sealing machine | Plastic lid sealing machine |

| Name of Equipment | Usage |
|---|---|
| Bottle washing machine | Used for bottle washing. They are of two types: brush washer and chemical washer |
| Batch coder | Used for coding |
| Tetra packaging machine | Packing machine for tetra packages |
| Labelling machine | Used for labelling packaged packets |
| Strapping machine | Equipment used in Squash and juice industry |

*Fig. 2.1.1. Ripening chamber with ethylene doser*

*Fig. 2.1.2. Fruit washing machine*

*Fig. 2.1.3. Sorting and grading machine*

*Fig. 2.1.4. Conveyor belt*

*Fig. 2.1.5. Peeler*


*Fig. 2.1.6. De-seeder/de-stoner*

*Fig. 2.1.7. Blancher/hot break system*

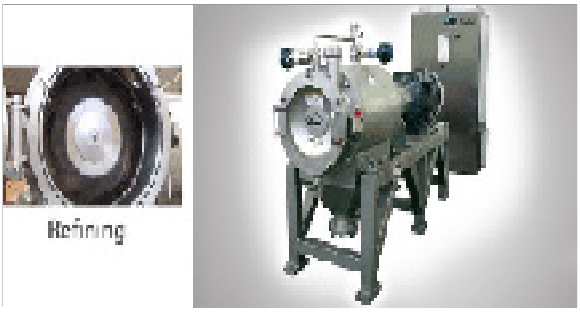

*Fig. 2.1.8. Juice extractor/hydraulic press/continuous press/filter press*

*Fig. 2.1.9. Evaporator/concentrator*

*Fig. 2.1.10. Pasteuriser*

*Fig. 2.1.11. Clarifier/ultra-filtration unit*


*Fig. 2.1.12. Aseptic filler*

*Fig. 2.1.13. Holding tank/reservoir tank*

*Fig. 2.1.14. Bottle filling machines*

*Fig. 2.1.15. Batch coder*

*Fig. 2.1.16. Tetra packaging machine*

**Precautions and safety measures to follow while handling equipment**

- Avoid direct spillage of water on electrical components
- Clean the tools and equipment before and after each operation
- Ensure regular maintenance of tools and machinery
- Do not open machines with sharp knives during operation. It is safe to open a machine when it is unplugged from an electrical source.
- Check machines like the steam-jacketed kettles regularly for efficiency of valves
- Ensure the build-up of pressure for machines is always under control
- Ensure the controls of all the machines are set to prescribed limits

# UNIT 2.2: Sanitisation of the Work Area

## Unit Objectives

**By the end of this unit, participants will be able to:**

1. State the materials and equipment used in cleaning and maintenance of the work area and machineries
2. List the various cleaning chemicals required
3. List the appropriate cleaning agents and sanitizers to clean the work area, machinery, tools, and equipment after squash production

## 2.2.1 Cleaning & Sanitizing Work Area, Machinery, Tools, and Equipment

The cleaning and sanitizing process are one of the most essential programs in the food processing industry. It has always been a critical element for ensuring food safety and quality. Food processing industries need to be kept spotlessly clean to ensure compliance with standard regulations and prevent contamination. Everything from random debris to flakes of rust and paint needs to be kept clear from foodstuff to make sure the product is entirely safe for consumption, so frequent cleaning is vital to food processing operations.

Though the entire process is quite tricky because of the complexity of the machinery and equipment used in the industry, it can also introduce additional difficulty by creating a wet environment. Equipment must be designed and built to withstand these environments, like using only food-grade stainless steel, but the complexity doesn't end there. High-pressure washers used to clean equipment can also strip the coatings on machines and cause injuries to employees, and the wet environment itself often poses a slip-and-fall hazard as well as food contamination.

Cleaning and sanitizing (disinfecting) are usually two separate processes. Effective cleaning must be carried out before sanitizing the work area and machinery, as sanitizers may not work as well if the work area or machinery has not had all visible contamination removed. Cleaning is often done using correct proportion of detergent and water. Detergents are chemicals that eliminate dirt and grease. However, it does not kill bacteria and other microorganisms. Microorganisms may be removed during the cleaning process but it can't be destroyed properly. Hence, sanitizing is required for this purpose.

The primary reasons for cleaning and sanitizing the work area and machinery are:

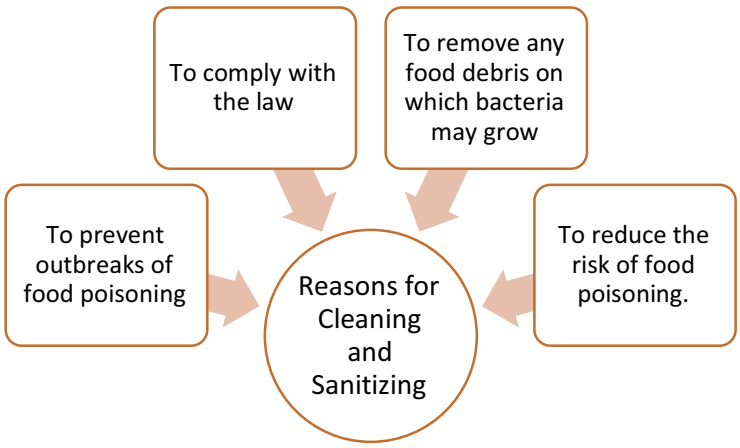


*Fig. 2.2.1 Reasons for Cleaning and Sanitizing*

The food processing industry follows standard procedures for cleaning the work area to ensure no bacterial growth due to the presence of leftover food particles. For cleaning purposes, the work area is divided into two categories:

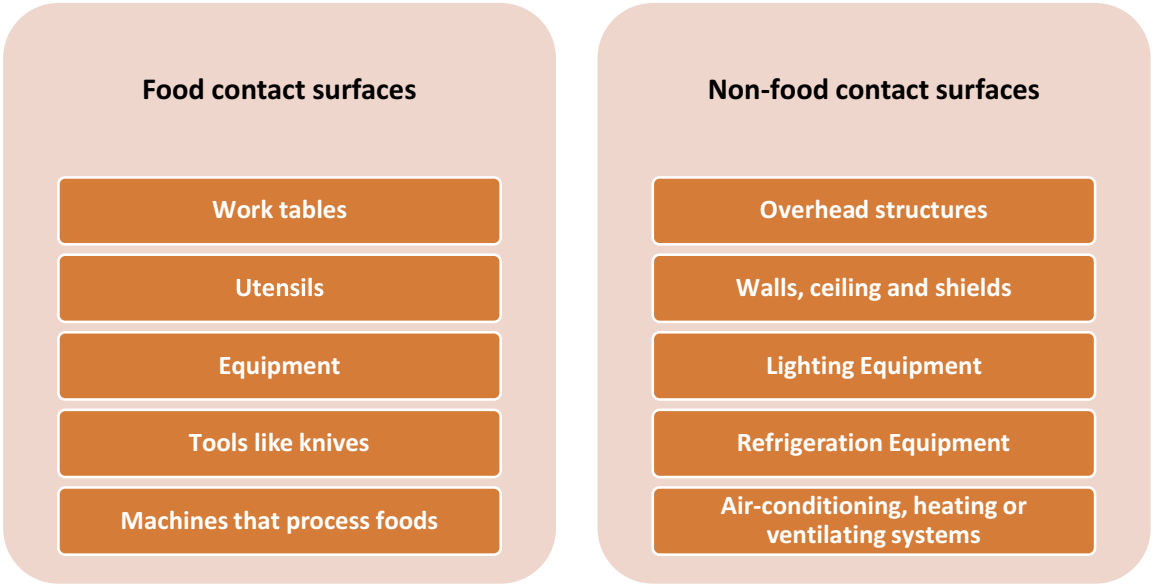


*Fig. 2.2.2 Cleaning Work Area Categories*

Proper and regular cleaning of the work areas protects food from any contamination. The cleanliness of the ambient air should also be controlled in the workplace, where contamination of any infectious material will be dangerous. The surfaces used for producing and storing foods with low moisture content should always be dry and hygienic during use. When wet cleaning is required, these surfaces must be sanitized and thoroughly dried to use. The entire work area in wet applications must be cleaned and sanitized absolutely before use or at the risk of contamination. Equipment and tools when not in usage should be stored properly to avoid any contamination risk.

## 2.2.2 Cleaning Agents and Sanitizers Used for Cleaning

There are several common cleaning and sanitizing agents that can be used to clean the food-contact and non-food contact surfaces. The nature and complexity of the detergent employed depend on the variation of soils, water hardness, and temperature of the method, plant surfaces, and safety. Detergent suppliers normally have a range of detergents to be employed in varying and specific circumstances. The range of products will include:

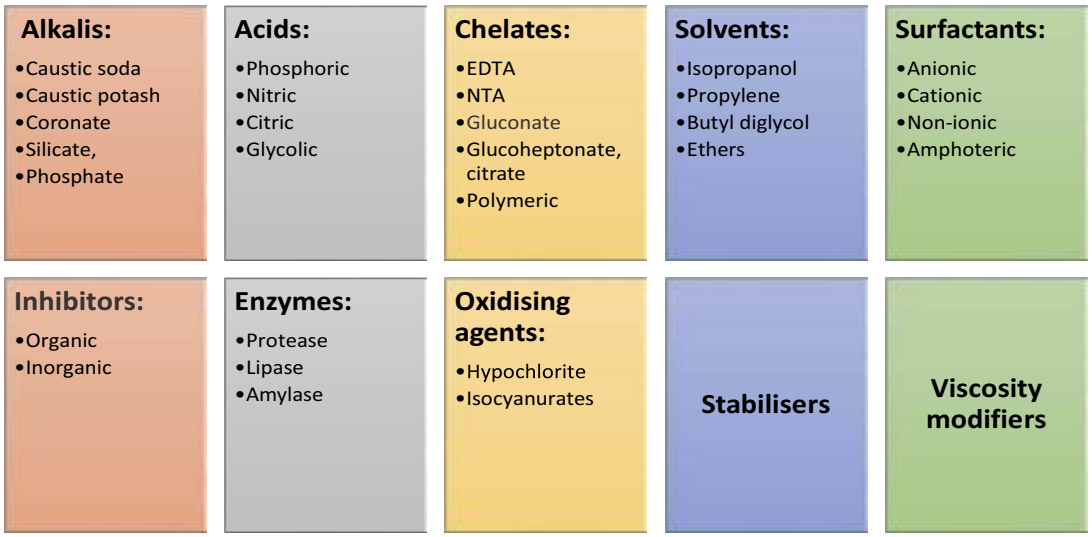


*Fig. 2.2.3 Various Ranges of Detergents*

The industry must use approved cleaning and sanitation chemical agents and the same must be prepared before use as per the instructions described on the product label. It is essential to identify the correct detergent for cleaning operation correctly. This will save money in the long term as cleaning will be more effective. The failure of a product to work is usually not due to a poor quality product but rather choosing the wrong one. Application and use are also important factors, and a good supplier will usually provide training in the correct use of the product. A 'detergent' is designed to remove soils. Another term used is 'sanitizer' and is often used to describe similar products. A 'disinfectant' is a product that kills microbes without employing a soil removal action.

The table below lists the typical cleaning agents and their appropriate usage, risks, and safety measures that should be taken while using these agents.

| Cleaning agents | Used for | Risk | Safety measures |
|---|---|---|---|
| Hypochlorite like<br>• Potassium hypochlorite,<br>• Sodium hypochlorite, and<br>• Calcium hypochlorite | Cleaning stainless steel food Contact surfaces | Leads to corrosion | Ensure pH and concentration levels are maintained |
| Liquid chlorine | Internal cleaning of stainless steel Equipment and vessels | Leads to corrosion | Ensure concentration levels are maintained |
| Hydrogen peroxide | Killing bacterial spores, Pathogens, spoilage Organisms, and other Microorganisms | Has a strong odor | Use in well-ventilated and open spaces |
| Ozone | Cleaning food-contact and on-food-contact surfaces like Equipment, walls, doors, Drains, conveyors, tanks, and Other containers; Killing Microbes | No risk involved since it leaves no residue | Safe to use |

**Table 2.2.1 Different types of cleaning agents, related risk factors, and safety measures**

Cleaning and sanitization take time and cost money. However, well-designed and organized food processing businesses can reduce the time needed for thorough cleaning with proper planning.

**Scan the QR code to watch the related videos**

https://youtu.be/QWpU7DAfNcs

Hygiene and sanitation Practices

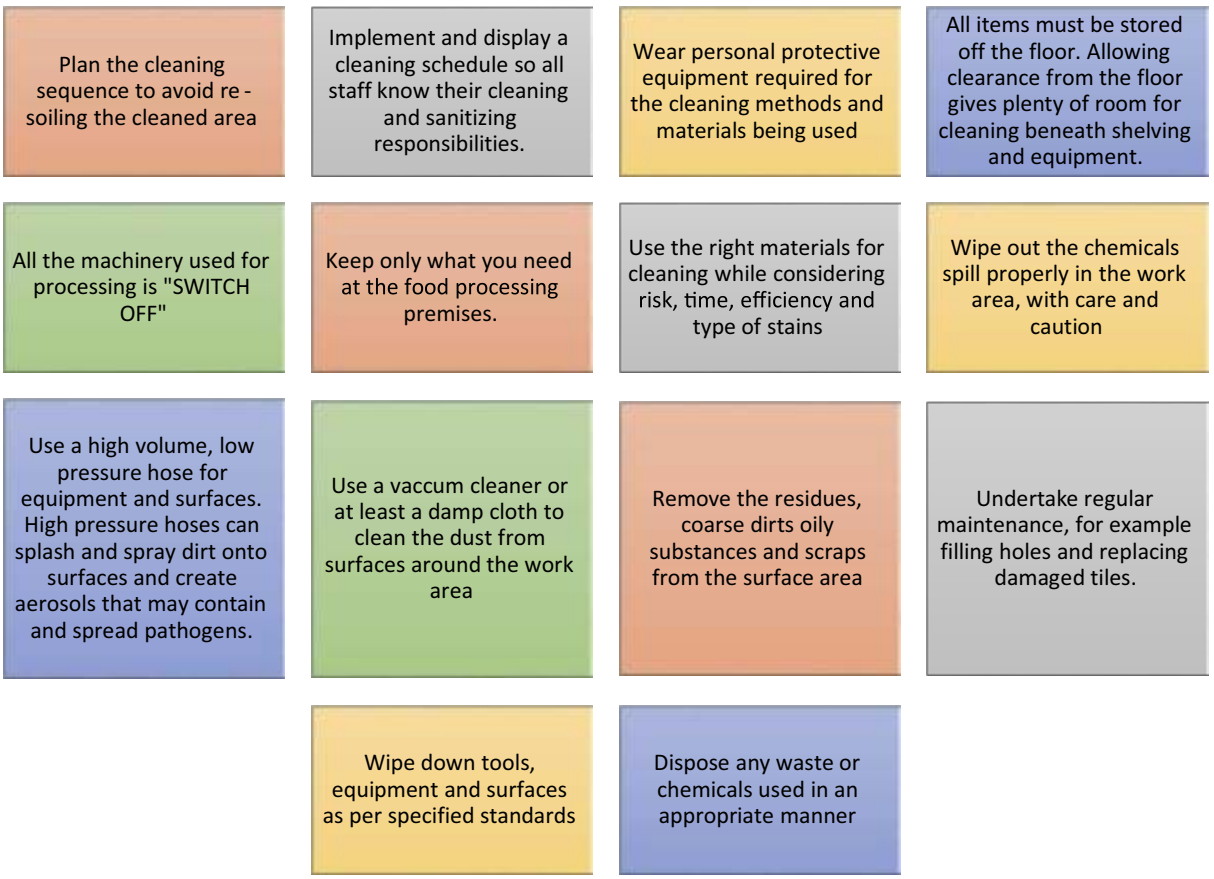


*Fig. 2.2.4 Standard Practices for Cleaning the work area and equipment*

The term sanitary refers to the state of a food contact surface or machinery where it does not contain microorganisms at a level that would permit the transmission of infectious disease or compromise food safety. Sanitizers are substances capable of destroying microorganisms, including those bacteria that cause food poisoning and other diseases. With appropriate use, they can reduce surface contamination by bacteria to a safe level. Therefore, it is essential to read and follow the directions on sanitizers carefully. Sanitizing is usually done using heat and water, or chemicals, or a combination of both methods.

**Effective Practices for Sanitization**

For effective and safe use of a sanitizer, follow the manufacturer's instructions provided on the label.

- Some sanitizers are toxic to people, and the residue must be rinsed off, while other sanitizers are food-safe and do not require rinsing. So, the manufacturer's instructions shall always be followed for the sanitizer to ensure safe use.
- Sanitizers work best at the correct dilution. If they are too weak, they do not work effectively, and money is being wasted if they are too strong.
- Sanitizers need time to work. The contact time varies and may be seconds to minutes depending on the job.
- Check the dilution, contact time, safety precautions, shelf life, and storage of all chemicals before use.

In some cases, cleaning and disinfection may be combined into one operation using a sanitizer which has the action of both a detergent and a disinfectant. However, it is believed that the two-stage approach is more consistent and effective than the single-stage sanitizer approach. It is important that non-scented chemicals are used in food operations due to the risk of taint.

## Notes

# UNIT 2.3: Cleaning Processes

## Unit Objectives

**By the end of this unit, participants will be able to:**

1. State the cleaning processes used to clean the work area and process machineries

## 2.3.1 Clean-In-Place (CIP)

CIP is a method used for internal cleaning of machineries. It is done without dismantling pipes, vessels, process equipment, filters or fittings. In this process, a sanitising agent is circulated through the entire processing unit with the help of a spray ball. The turbulence created removes soil, ensuring removal of bacteria and chemical residues.

**Tips to conduct an effective CIP process:**

- Use the right vessels for the right process
- Use the right cleaning and sanitising solutions
- Ensure correct flow rate
- Ensure all connections are clean
- Monitor and verify the entire process

## 2.3.2 Clean-Out-Of-Place (COP)

COP is conducted at a cleaning station. This method involves dismantling of the equipment. In this process, equipment and units are scrubbed with soap in COP tanks. After this, the tanks are rinsed again to remove residual detergent or chemicals. Equipment and units are reassembled and sanitised once more with heat treatment or sanitising agent.

**Tips to conduct an effective COP process:**

- Follow the order of tasks
- Use cleaning tanks as much as possible
- Ensure tools used in COP do not lead to contamination

Food processing equipment and units that undergo the COP process are:

- Fittings
- Gaskets
- Valves
- Tank vents
- Grinders
- Pumps
- Knives
- Nozzles

## 2.3.3 Sterilising-In-Place (SIP)

SIP is the process by which food processing equipment is sanitised after the CIP process. It helps to eliminate any residual microbiological contamination.

SIP is a combination of three processes viz. sterilisation, disinfestation, and sanitisation.

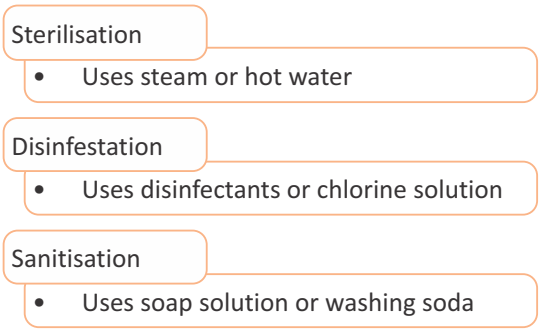


*Fig. 2.3.1. Sterilising-In-Place (SIP)*

## 2.3.4 Air-Pressure Cleaning

The food processing industry follows the air-pressure cleaning method to ensure cleanliness of regularly used equipment. The following chart explains the process in detail:


*Fig. 2.3.2. Air-pressure cleaning*

## 2.3.5 Process of Cleaning the Work Area

The following chart explains the process of cleaning the work area before production. The dotted boxes explain pest-control measures and methods used for waste material disposal in detail.

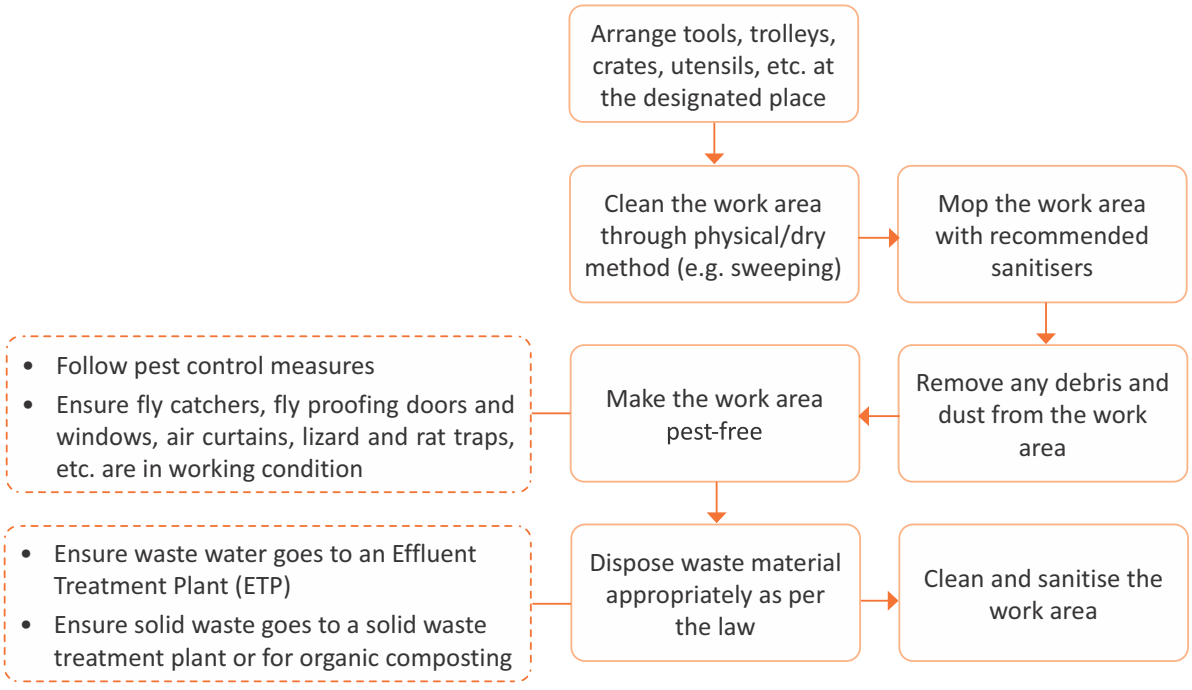


*Fig. 2.3.3. Process of cleaning the work area*

## 2.3.6 Process of Cleaning Machineries, Tools and Equipment

The chart explains cleaning of machineries, tools, and equipment used in the fod processing industry. The dotted chart states the techniques used for mechanical cleaning of equipment.

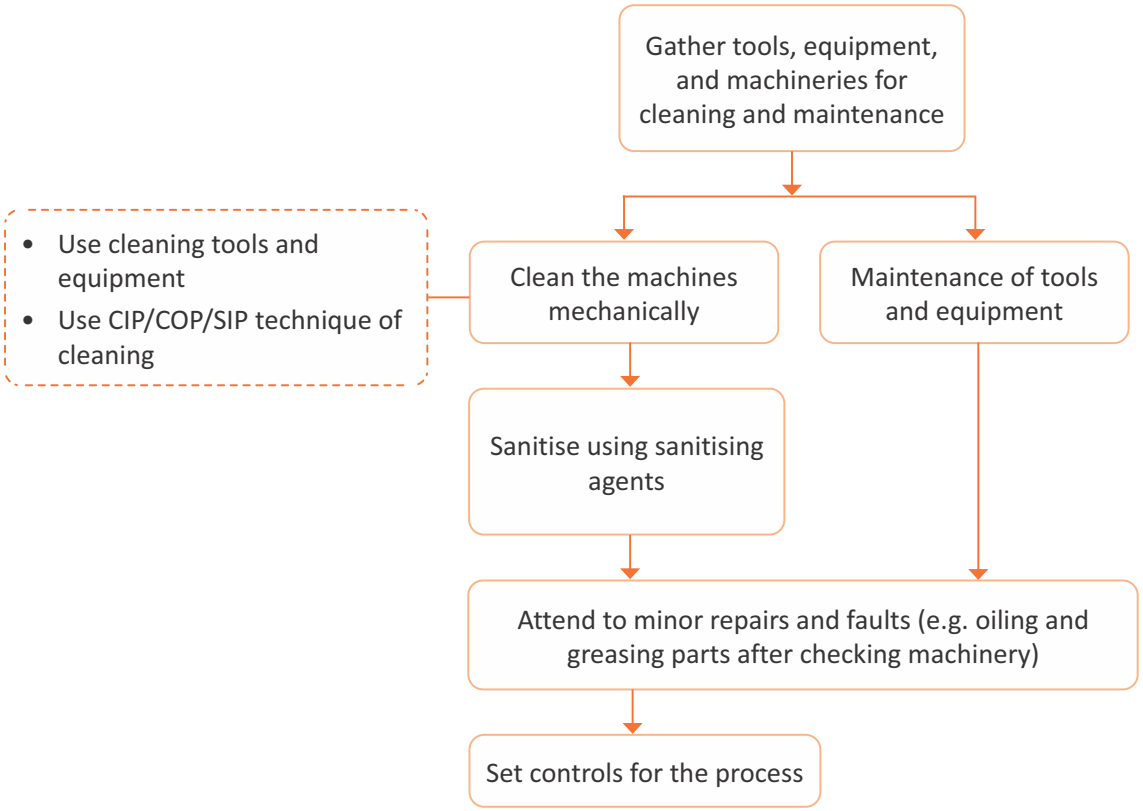


*Fig. 2.3.4. Process of cleaning machineries, tools and equipment*

## Exercise

**1. Match the columns**

| Name of cleaning process | Method of cleaning |
|---|---|
| a. Air-pressure cleaning | i. Internal cleaning of machineries |
| b. COP | ii. Process of sterilisation, disinfection, and sanitation |
| c. SIP | iii. High pressure air is blown |
| d. CIP | iv. Dismantling of equipment and cleaning |

**2. Fill in the blanks with the correct option**

a. The cleaning agent used to clean stainless steel food contact surfaces that can lead to corrosion if pH concentrations are not maintained is _____ .

i. water
ii. ozone
iii. hypochlorite
iv. brine solution

b. Sanitisation leads to _____ of all pathogenic and almost all non-pathogenic organisms.

i. addition
ii. destruction
iii. deposition
iv. concentration

c. The full form of SIP is _____ .

i. Sterilising-In-Place
ii. Sanitisation-Inward-Place
iii. Sanitisation-In-Pipes
iv. Side-In-Place

d. The cleaning process used for internal cleaning of machineries without dismantling pipes is _____.

i. CIP
ii. COP
iii. SIP
iv. APC

e. The two types of microorganisms are _____ and _____.

i. good, harmful
ii. biological, physical
iii. healthy, sick
iv. biological, harmful

**3. Match the columns**

| Machine | Usage |
|---|---|
| a. Conveyor belt | i. Used for removing fruit skin |
| b. De-stoner | ii. Used for cooking juice by blending all ingredients like sugar, ascorbic acid, colour, flavourings, etc. |
| c. Core cutter | iii. Used to remove fibre, grits, black and brown specks, extraneous matter, dust, and other impurities from juice |
| d. Peeler | iv. Used to heat the fruit/vegetable to facilitate pulping process |
| e. Decanter | v. Used for cutting fruit core especially in pineapple |
| f. Blancher | vi. Used for removing fruit seeds and stones in mangoes |
| g. Steam jacketed kettles | vii. Filling of pulp into aseptic bags/packs |
| h. Aseptic filler | viii. Used for mango tip cutting and visual inspection for sorting |

## Notes

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# 3. Prepare for Production of Squash and Juice

Unit 3.1 – Basic Calculations

Unit 3.2 – Raw Material: Selection and Handling

Unit 3.3 – Production Planning Process and Sequence

FIC/N0102

## Key Learning Outcomes

**By the end of this module, participants will be able to:**

1. Use basic mathematics for various calculations in day-to-day processes
2. Identify the raw materials required for production as per production schedule and formation
3. Organise quality raw material as per production process and company standards
4. State the methods for storing raw material for later use
5. Check the raw material for quality and grade
6. Prepare the raw material for production
7. Plan the production schedule as per organisational standards and instructions
8. Organise for raw material, packaging materials, manpower, equipment, and machineries for the scheduled production
9. Plan the production sequence to maximise capacity utilisation of resources, manpower, and machineries
10. Calculate the batch size based on the production schedule and machine capacity
11. Prioritise urgent orders based on the production schedule
12. Check the conformance of raw material quality to company standards

# UNIT 3.1: Basic Calculations

## Unit Objectives

**By the end of this unit, participants will be able to:**

1. Use basic mathematics for various calculations in day-to-day processes

## 3.1.1 Raw Material and Manpower Estimation

The **raw material** is something that is used to produce a product. The availability of raw materials affects the production process which in turn affects the revenue of an organization. Raw material's availability assists manufacturing units in conducting production processes following the requests and wishes of the consumer. Raw material inventories are fundamental in squash and juice making processing because the uncertain demand and availability of raw materials due to seasonal reasons can cause complications over costs incurred. Moreover, raw materials is an investment that affects the financial stability and listed as a current asset on a company's balance sheet. So, it is important to apply best practices for managing raw material inventory. There are two subdivisions of raw materials:

**Direct Materials** are those resources that are part of or incorporated into the finished product. Forexample in squash and juice industry vegetables, oil, spices etc

**Indirect Materials** are those resources consumed during the manufacturing process but are not part of the finished product. For example disposable tools, protective equipment, cleaning supplies, fuel, light bulbs etc.

It is important to determine the value of opening and ending inventory for estimating raw materials for squash and juice making as per production requirements. It is calculated as follows:

**Raw Materials Inventory = Beginning Inventory + Raw Materials Purchased - Cost Of Goods Sold**

1. **Beginning/opening inventory value -** The value is obtained from the previous accounting period balance sheet as the closing inventory.

**Opening Inventory = (Cost Of Goods Sold + Ending Raw Materials Inventory) - Raw Materials Purchased**

2. **Closing/ ending inventory value –** It is the inventory on hand at the close of an accounting period. The value is revealed on the balance sheet.

**Ending Inventory = (Raw Materials Purchased + Beginning Raw Materials Inventory) - Cost Of Goods Sold**

3. **Raw material Purchased –** it is calculated as:

**Raw Materials Purchased = (Ending Inventory – Beginning Inventory) + Cost Of Goods Sold**

4. **Cost of goods sold (COGS) –** It appears as an item in the income statement during the accounting period.

**Cost of goods sold = Begining inventory + Purchases – ending inventory**

**Note:-**

- **Beginning Inventory -** Value of a company's inventory at the start of an accounting period.
- **Ending Inventory -** Value of goods still available for sale and held by a company at the end of an accounting period.
- **Raw Materials -** Vegetable, fruits, ingredients, spices, oil etc.
- **Good Sold -** Accumulated total of all costs used to create a product which has been sold.

To calculate **manpower** requirements for pick and paste production, divide the value of goods and services produced by the total hours worked by employees over a specified period. Here are the steps to estimate manpower for production.

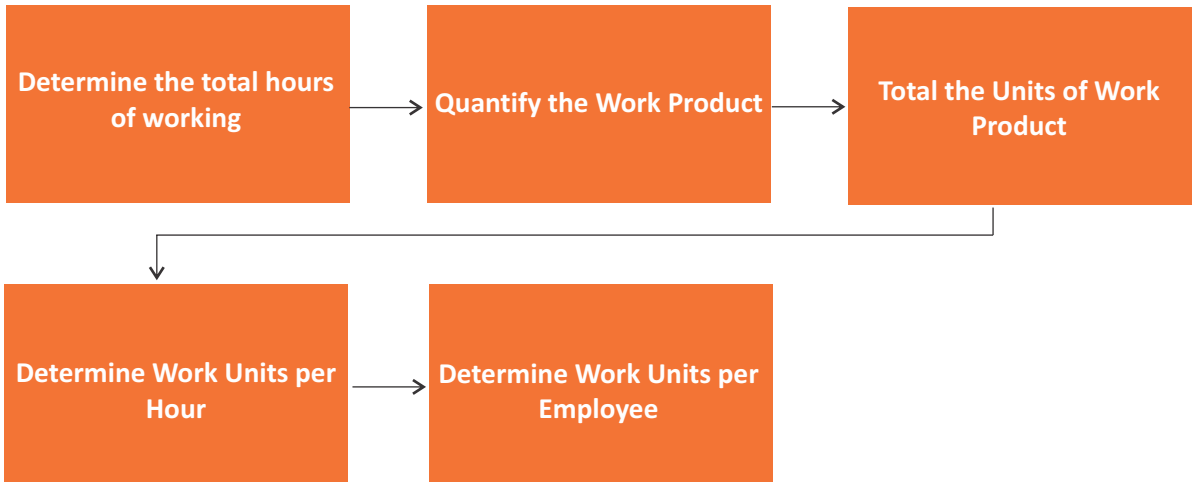


*Fig. 3.1.2 Steps to Calculate Manpower Estimation for Production*

# UNIT 3.2: Raw Material: Selection and Handling

## Unit Objectives

**By the end of this unit, participants will be able to:**

1. Identify the raw materials required for production as per production schedule and formation
2. Organise quality raw material as per production process and company standards
3. State the methods for storing raw material for later use
4. Check the raw material for quality and grade
5. Prepare the raw material for production

## 3.2.1 Selection of Raw Material

**Raw Material Procurement and Storage**

It is important to choose only those fruits/vegetables that are in the best condition during procurement.

The fruit processing industry for pulp manufacturing in India uses a wide range of fruits/vegetables. Some of the commonly used are mango (totapari, alphonso), guava, papaya, banana, etc. Vegetables used for commercial pulp manufacturing are tomato, carrot, etc.

Fruit selection depends on following factors:

- Tree or crop type
- Growing practices
- Degrees of maturity and ripeness
- Region where the crop has grown as per weather
- Location of the crop
- Method of pulping/harvesting

The procured fruits are carried to the manufacturing areas in plastic cases, which take approximately 20 kg of products. These cases not only protect the product from physical damage, but also protect the fruit quality by maintaining a high level of air circulation. The fruit reaches the manufacturing unit in about 2 to 10 hours. Ripened fruits have to be processed quickly. Hence, the manufacturing unit and the processing area are located close. This is because:

- There is continuous demand for raw materials
- Delay in production may lead to losses

In case of other fruits/vegetables, excess raw material and raw material that maybe processed later is stored in clean, airy, well ventilated, cold storage areas within the food processing unit.

Shown below is a chart of crop season, raw materials, and their time of availability:

| Crop Season | Raw Material | Availability times |
|---|---|---|
| One | Mango | January to May |
| | Apple | July to September |
| | Lime | November to February |
| | Orange | December to March |
| | Pear, peach, and apricot | April to July |
| | Strawberry | February to April |
| | Eggplant/aubergine (brinjal) | October to March, July to September |
| | Tomato | October to April |
| | Carrot | October to March |
| Two | Pineapple | November to January and June to July |
| | Guava | November to January and June to July |
| | Papaya | November to January and June to July |
| No season | Banana | Throughout the year |
| | Lemon | Throughout the year |

**Table 3.2.1 Raw material and their availability times**

## 3.2.2 Handling of Raw Materials

**How to Handle Raw Materials**

Before starting with the actual process, it is important to understand how to handle raw materials that are procured from the farmer/supplier. Given below is a simple chart that shows the process the raw materials undergo before the pulping process:

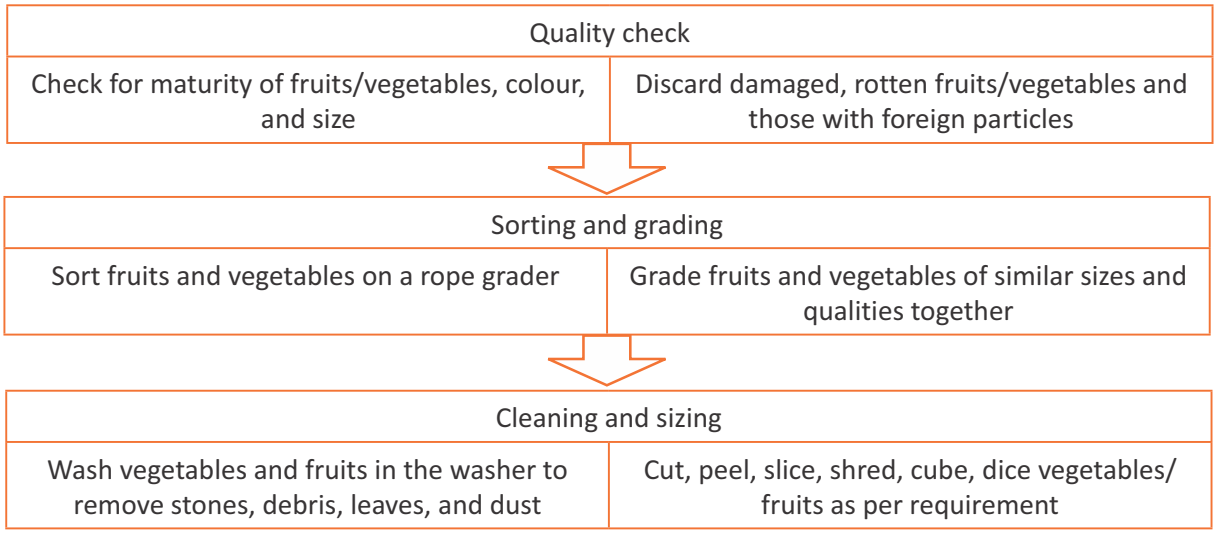


*Fig. 3.2.1. Handling of raw materials*

# UNIT 3.3: Production Planning Process and Sequence

## Unit Objectives

**By the end of this unit, participants will be able to:**

1. Plan the production schedule as per organisational standards and instructions
2. Organise for raw material, packaging materials, manpower, equipment, and machineries for the scheduled production
3. Plan the production sequence to maximise capacity utilisation of resources, manpower, and machineries
4. Calculate the batch size based on the production schedule and machine capacity
5. Prioritise urgent orders based on the production schedule
6. Check the conformance of raw material quality to company standards

## 3.3.1 Production Plan

The following chart provides an overview of the production planning process:

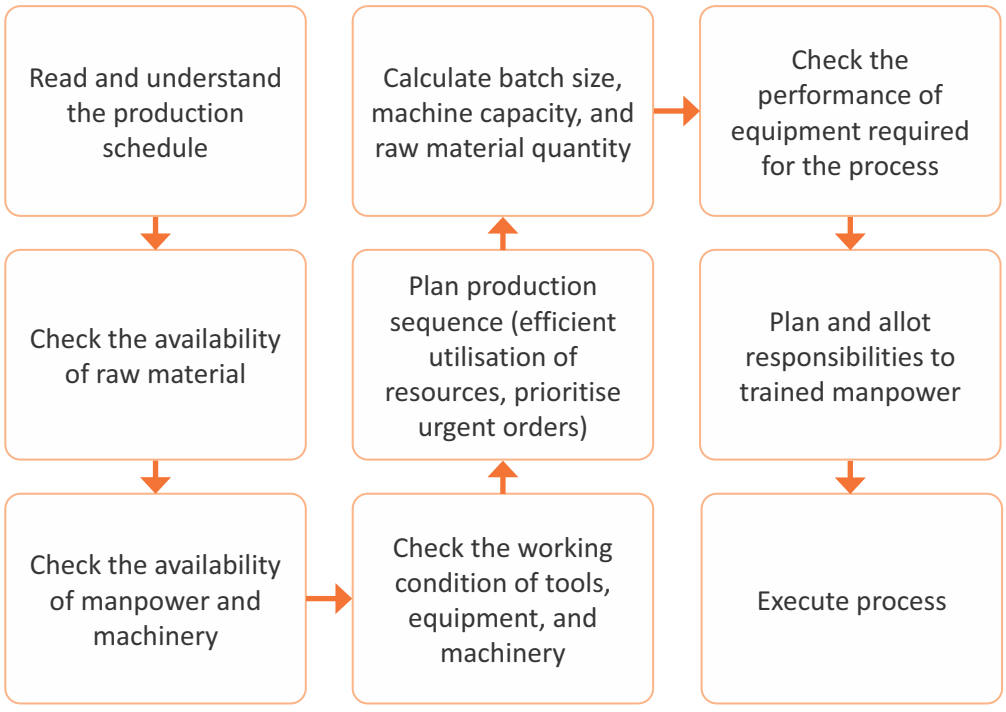


*Fig. 3.3.1. Production plan*

## 3.3.2 Planning the Production Sequence

The following chart provides an overview of the production planning process:

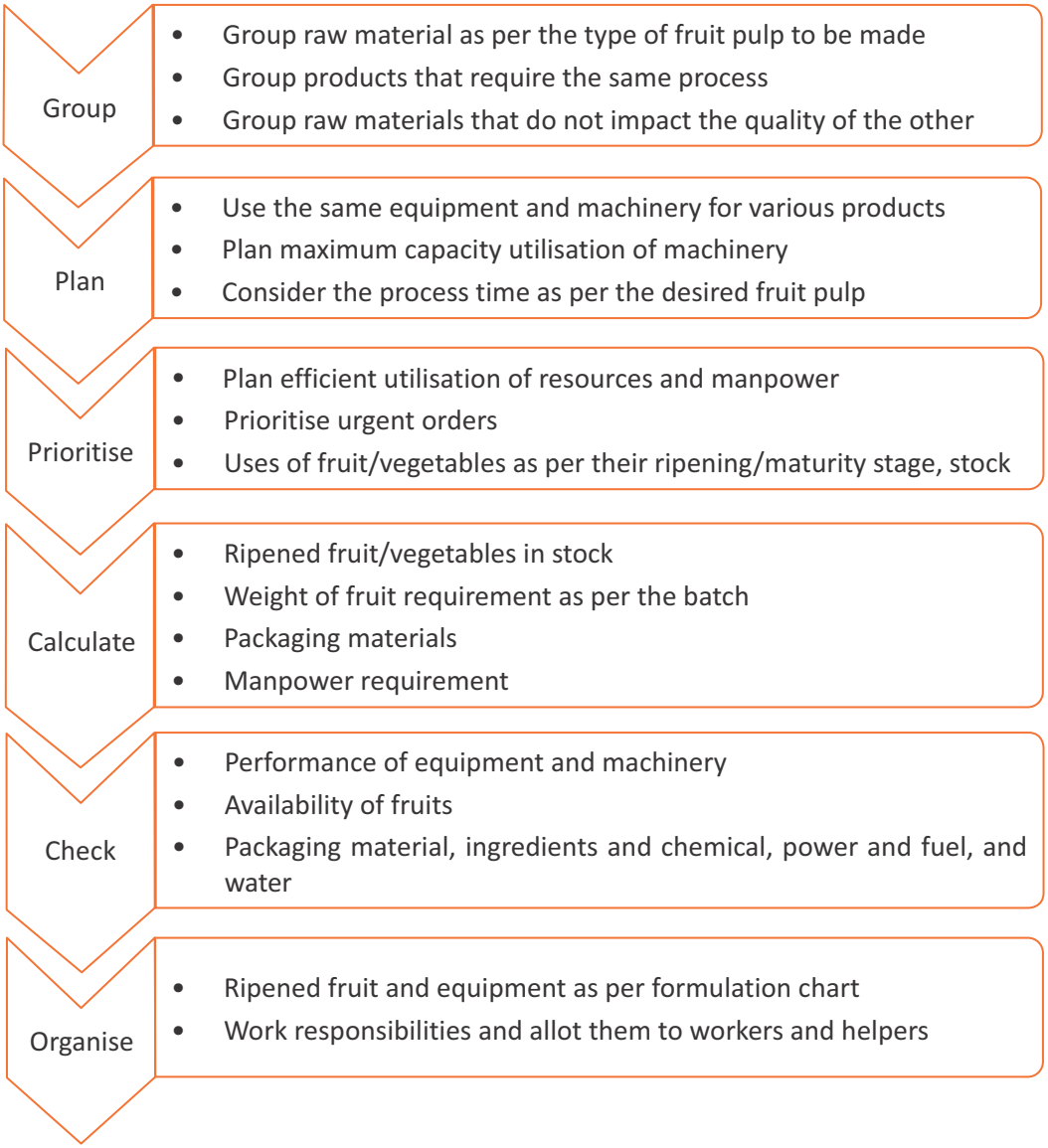


*Fig. 3.3.2. Planning the production sequence*

## Exercise

**1. Match the columns**

| Name of fruit | Time of availability |
|---|---|
| a. Strawberry | i. December to March |
| b. Lime | ii. February to April |
| c. Papaya | iii. Throughout the year |
| d. Mango | iv. January to May |
| e. Orange | v. November to January and June to July |

**2. Arrange the production sequence in the right order**

| Production sequence | Order the steps (as 1,2,3,4,5 and 6) |
|---|---|
| a. Prioritise | |
| b. Group | |
| c. Plan | |
| d. Organise | |
| e. Check | |
| f. Calculate | |

**3. Fill in the blanks with the correctoption**

a. Unit used to describe the total soluble solids content in a fruit pulp/juice is _____ ratio.

i. TSS
ii. brix to acid
iii. SST
iv. TIS

b. _____ of raw materials is very important, after it is procured from the farmer or supplier.

i. Preservation
ii. Processing
iii. Storage
iv. Handling

c. The _____ of the raw material determines the quality of the product.

i. quantity
ii. quality
iii. quality and quantity
iv. cost

d. Excess raw material is stored in clean, airy, well _____ and _____ areas within the food processing unit.

i. dry and warm
ii. ventilated and warm
iii. ventilated and cold storage
iv. dry and cold

e. Calculate batch size as per _____ capacity.

i. production
ii. machine
iii. stock
iv. storage

## Notes

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# 4. Produce Squash and Juice

Unit 4.1 – Perform Fruit Juice Extraction Process

Unit 4.2 – Pasteurize and Clarify the Extracted Juice

Unit 4.3 – Production Process of Squash

Unit 4.4 – Filling, Packing and Storage of Juice and Squash

Unit 4.5 – Post Production Cleaning and Maintenace

FIC/N0103

## Key Learning Outcomes

**By the end of this module, participants will be able to:**

1. Perform the tasks to extract the fruit juice for producing the squash and juices
2. Discuss the procedures followed to extract fruit juice for making squash
3. Perform the tasks to pasteurize and clarify the extracted juice
4. Discuss the process of pasteurization and clarification of extracted juice
5. Perform the tasks to produce the squash
6. Describe the methods required to prepare squash
7. Perform the tasks to fill, pack and store the juice and squash
8. Describe the reporting procedure regarding the discrepancy
9. State the basic categories of packing
10. State the various types of packaging materials used for packing fruit pulp
11. State the factors for selecting packaging materials
12. State the storage procedures for finished goods
13. Explain the rules for stock rotation of finished goods
14. Explain aseptic packaging in fruit processing industry
15. Demonstrate the process of cleaning and maintenance of work area after production
16. State the kind of waste produced and its disposal

# UNIT 4.1: Perform Fruit Juice Extraction Process

## Unit Objectives

**By the end of this unit, participants will be able to:**

1. State the significance and procedure of interpreting and analysing the process chart, product flow chart, and formulation chart for the production process
2. Discuss the fruit juice extraction process
3. Explain the standard procedure to dispose of the waste produced while extracting the juice
4. Describe the physical parameters (such appearance, colour, consistency, flavour, taste, etc.) for checking the quality of extracted juice
5. Discuss the standard procedure to take and send the samples of the extracted fruit juice to quality lab for analysis

## 4.1.1 Significance of Enzyme Activity

The enzymes are types of proteins that regulate the chemical reaction in food products. It has contributed to increasing the yield and production of various kinds of juices. Enzymes enhance transformation, such as flavour, colour, turbidity, and viscosity. Hence it is crucial to know the types of enzymes naturally present in a particular fruit. Enzymes can also remove the bitterness of citrus juice, extract pigments, among other applications, and have also had a great interest in juice production.


*Fig. 4.1.1. Benefits of Enzyme Activity of Fruit Juices*

Fruit juices extracted from ripe fruit contain a significant amount of pectin. Pectin imparts a cloudy appearance to the liquid and results in a presence and mouthfeel that many customers do not find appealing. Pectinases are naturally occurring enzymes that act on pectin yielding a crystal clear juice with the appearance, stability, mouth-feel, taste, and texture characteristics customers prefer.

Treating the juice with a pectin enzyme is the safest method to achieve pectin elimination without affecting color or flavor. The variable quality and quantity of the natural pectin in the liquid does not interfere when it is treated with the pectinase enzyme.

Pectinases, celluloses, and hemicelluloses are used to clarify fruit juices, which helps improve cloud stability, liquefaction, and maceration. These enzymes degrade structural polysaccharides that interfere with juice extraction, filtration, clarification, and concentration. These enzymes are termed "macerating or mash enzymes" that find application in the extraction of juice from citrus fruits and tropical fruits such as mango, banana and papaya, and pineapple. For Apple and Pears, pectin enzymes are used to facilitate pressing or juice extraction, to aid in separating the flocculent precipitate by sedimentation, filtration, or centrifugation. A combination of pectinolytic enzymes, is added to fruit and pressed fruit juice to reduce juice viscosity. Such viscosity reduction makes juice filtration, clarification, and concentration more efficient. In concentrated fruit systems, it improves the efficiency of spray drying.

## 4.1.2 Fruit Juice Extraction Process

There are various beverages available in the market. Still, fruit beverages are the most popular across the world. Being a tropical country, India has a vast market of various fruit beverages or drinks for consumers. These fruit beverages are produced using extracted fruit juice or fruit pulp as the base material. Almost all fruits can be used to make different fruit juices. The most popular ones are pineapple, orange, mango, grapefruit, and passion fruit. Many fruit beverages are consumed as pure juices without adding any other ingredients, whereas some are diluted with sugar syrup, acid, stabilizers, and preservatives. Commonly, sodium benzoate is used as a preservative to extend the shelf life of fruit juices and beverages. Below are the different types of fruit beverages or drinks as follows:

**Juices**

- In which one or more fruit juice(s) from the fruits used in the product which may be strained or filtered are the liquid packing medium.

**Thermally Processed Fruit Nectar (TPFC)**

- Unfermented but fermentable pulpy or non-pulpy, turbid or clear product intended for direct consumption made from fruit singly or in combination, obtained by blending the fruit juice / pulp/fruit juice concentrate and/ or edible part of sound, ripe fruit(s), concentrated or unconcentrated with water, nutritive sweeteners and any other ingredient appropriate to the product and processed by heat, in an appropriate manner, before or after being sealed in a container, so as to prevent spoilage.

**Fruit syrup/Squashes**

- The product prepared from unfermented but fermentable fruit juice/puree (min 25% puree in the final product) or concentrate clear or cloudy, obtained from any suitable fruit or several fruits by blending it with nutritive sweeteners, water and with or without salt, aromatic herbs, peel oil and any other ingredients suitable to the products.

**Cordials**

- A clear product free from any cellular matter, obtained by blending unfermented but fermentable clarified fruit juice with nutritive sweeteners & water with or without salt and peel oil and any other ingredients suitable to the products.

*Fig. 4.1.2. Classification of Fruit Beverages*

Each fruit beverage is preserved by amalgamating natural acidity, pasteurization, and packaging in sealed containers. Fruit squashes and syrup also contain a high concentration of sugar, which helps to preserve them for more extended periods. The first stage of all the fruit-based beverages production is the extraction of juice or pulp from the fruit. Any fruit can be used to prepare fruit juice. For this, the fruit is prepared before the extraction process, later followed by clarification and pasteurization. Consequently, the finished beverage or drink is packed and preserved. Fruit Juice extraction is the process of eliminating fibrous and solid particles from the juice. The following are the key manufacturing stages in the fruit extraction process.

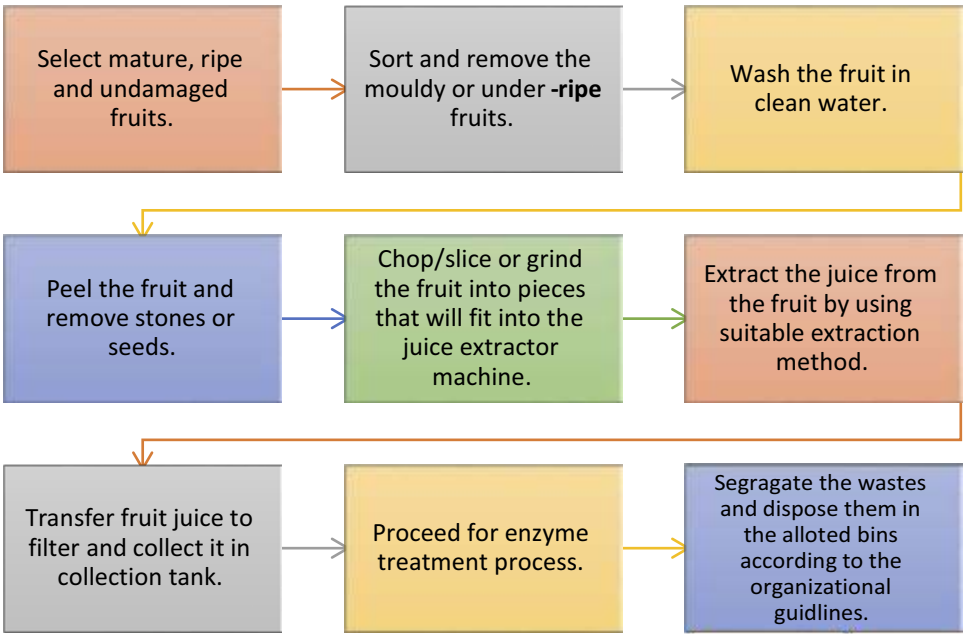



*Fig. 4.1.3. Fruit-Juice Extraction Process*

After the extraction of the juices, it is vital to check the quality of the juices as per appearance, colour, consistency, flavour, aroma, taste, etc. These are the critical factors for consumer acceptance of the final product.

A fruit juice extractor machine is used to extract juice from various kinds of fruits. In the food processing industry, fruit juice extractor machine is used to extract juice in bulk quantity, which is convenient and nutritional. All the fruits, such as apple, pineapple, pear, orange, grape, strawberry, watermelon, lemons, tomatoes, can be extracted by fruit juice extractor machine. The raw materials must be continuous; the non-rigid foreign matter must be fed into the hopper to avoid screen damage.

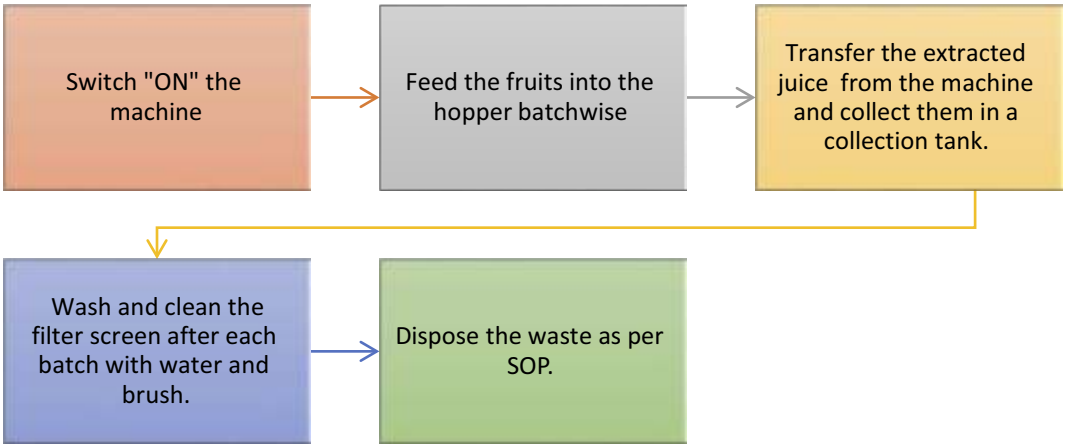



*Fig. 4.1.4. Workflow Process of Fruit-Juice Extractor Machine*

## 4.1.3 Methods of Fruit Juice Extraction

There are numerous ways to extract juice, depending on the fruit you use. Pressing or reaming are the best and suitable methods for citrus fruits. At the same time, some fruits such as melon and papaya are steamed to release the juice. Fruits such as mango, guava, pineapple, and strawberry are pulped to extract the fruit juice.

**Pressing**

- Fruit is cut in half and the individual halves reamed to extract both the juice and the inner fruit solids. Example -Citrus fruits like lemon, orange and grapes etc.

**Solvent Extraction**

- Solvent extraction is the process of ransferring uice from fruits and vegetables to hot water. It applies to fruits that contain less water, such as wild jujube, dark plums, and red dates.

**Pulping**

- Pulping is the process in which we eliminate the seed and peel of fruits to obtain their juices. Example - Mango, strawberry, peach etc.

**Centrifugation**

- Through horizontal spiral filter centrifuge, fruit juice are separated by centrifugal force. Slurries are transmitted to rotary drum filter through feed tube. Under high speed centrifugal force, the pomace is thrown to the drum wall and transmitted to the end of drum by conveying screws, while fruit juice drains out of screw gaps. Example - Apple, guava, Pineapple etc.

**Rough Filtration**

- Rough filtration is the process of removing larger particles or suspended particles dispersed in the juice. , The extracted juice or pulp is filtered through a muslin cloth or a stainless steel filter of the machine.

Fig.4.1.5 Pulper

Used for extraction of pulp/juices from fruits

Fig.4.1.6 Citrus juicer

Used for extraction juices from citrus fruits

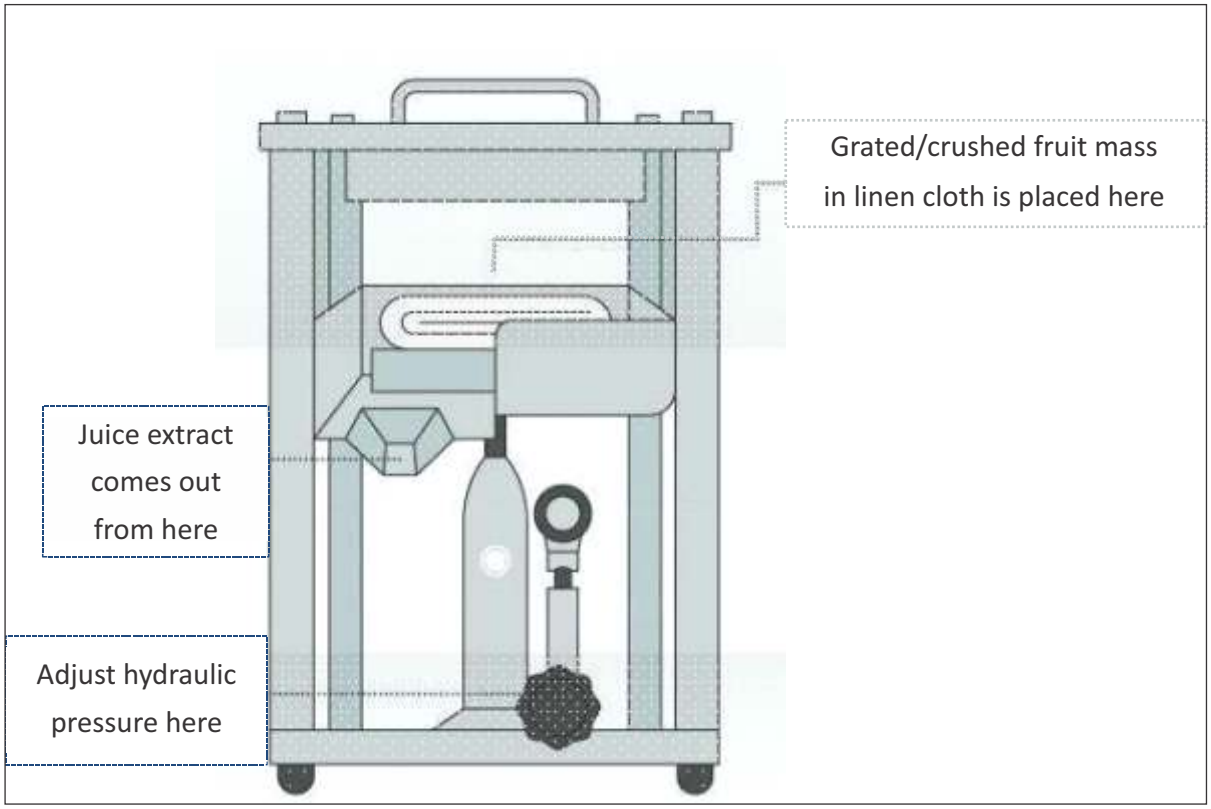



Fig.4.1.7 Manual hydraulic press juicer

Uses pressure to extract the juice out of raw produce.


Fig.4.1.8 Juice extractor/hydraulic press/continuous press/filter press

Used to extract juice and separate fruit fibre, skin, seed, and grits from juice

## 4.1.4 Standard Procedure for Lab Analysis

It is important to examine the sample after each process to maintain the quality of fruit juice. After extraction process, sample of juice is sent to laboratory for quality analysis. Following are the physical parameters for quality check:


*Fig. 4.1.9. Quality Parameters of Fruit Juices*

## Exercise

**Answer the following questions:**

1. Write a short note on:

   a. Enzyme activity

   _____
   _____
   _____

   b. Rough filtration

   _____
   _____
   _____

   c. Classification of fruit beverages

   _____
   _____
   _____

2. Explain the fruit extraction process.

   _____
   _____
   _____

3. Explain the workflow process of fruit extractor machines.

   _____
   _____
   _____

# UNIT 4.2: Pasteurize and Clarify the Extracted Juice

## Unit Objectives

**By the end of this unit, participants will be able to:**

1. State the significance of ensuring pasteurization of the cloudy juice immediately after pressing
2. Discuss the pasteurization process of the extracted juice
3. State the importance of ensuring the uniform mixing of enzymes during the clarification process
4. State the significance of pasteurizing and clarifying the juice
5. Elaborate on basic food microbiology and quality assessment based on physical parameters

## 4.2.1 Pasteurization Process of the Extracted Juice

Pasteurization is a process in which the products are treated with mild heat, usually to less than 100 °C (212 °F), to eliminate pathogens and extend shelf life. The process is intended to destroy or deactivate organisms and enzymes that contribute to spoilage or risk of disease, including vegetative bacteria, but not bacterial spores. It eradicates microorganisms that can grow during storage and inactivates enzymes that cause unwanted clarification or cloudy juice. Hence, it is important to pasteurize the fruit juice immediately after the pressing to make them safer for consumption and prolong shelf life.

Pasteurization was initially developed to resolve the sourness of wine. This technology is named after French microbiologist Louis Pasteur, who discovered that microbes or pathogens(germs) that grow during the fermentation process could be eliminated by the heating treatment that ruins wines. He heated up the wines to 63.5 for half an hour to kill the lactobacillus (bacteria) without damaging the wines. This technique saved the French wine industry. In the beginning, it was referred to as heating at a low temperature (60-70 ) for 30 min. Nowadays, it refers to various heat treatments for killing bacteria, including heating at high temperatures for a shorter time. The pasteurization process is widely used for fruit juice, pulp, milk, and wine production.

All the fruit juices go through the pasteurization process at 80-95°C for 1-10 minutes (depending on the fruit) before hot-filling into bottles. It eliminates the cloudiness in the juice by deactivating pectin methyl esterase (PME), the enzyme that causes cloud loss or gelation and destroys the bacteria which may contaminate the juice. Also, the primary reason for pasteurizing fruit juices is to preserve the properties that make them attractive and enjoyable to customers, such as taste, appearance, and “mouthfeel”. The clarification of juice is usually referred to as cloud loss, which is the breakdown of pectin by enzymes. Practically, the tangible results of cloud loss are reductions in opaqueness and viscosity. This process prevents this undesirable process by deactivating PME.

Special attention is required during the production of the fruit juices due to heat resistant enzyme present in the liquid. These enzymes may harm the skin after prolonged contact, and hence all the employees dealing with this process must wear gloves to protect their hands. The juice must be heated to a higher temperature for a longer time to terminate the enzyme (e.g., boiling for 20 minutes). Fruit juices (low pH foods) are often pasteurized in their container due to the risk of cross-contamination. The main parameters that influence the pasteurization process of a fruit juice are as follows:

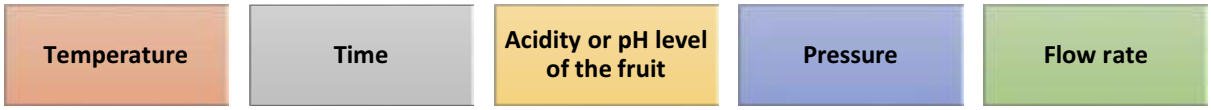



*Fig. 4.2.1. Parameters of Pasteurization Process*

*Fig: 4.2.2 Pasteuriser*

Used for pasteurising juice by passing steam through it

## 4.2.2 Types of Pasteurization Process

The pasteurization process can be performed either by heating at a **low temperature for a long time** (LTLT) or **heating at a high temperature for a short time (HTST).**

**LTLT (low temperature long time) pasteurization process:**

- In this process, juices are heated at 62.5℃ for 20 - 30 minutes and cool down suddenly to 4-5℃, which cause the bacteria to die. It can achieve sterilization effects in short time and at low temperature, preserving the color, flavor, and taste of the fruit juice. This technique is known as Batch Pasteurization.

**HTST (high temperature short time) pasteurization**

- In this process, juices are heated up at high temperature of 72.0°C for short time (15 sec - 30 sec), eliminating all the bacterias without causing nutrition loss. It has more thorough sterilization effect and the pasteurized drinks can preserve longer. This technique is also known as Flash Pasteurization.

*Fig. 4.2.3. Types of Pasteurization Process*

Following figure explains different methods of pasteurization used in food processing industries.

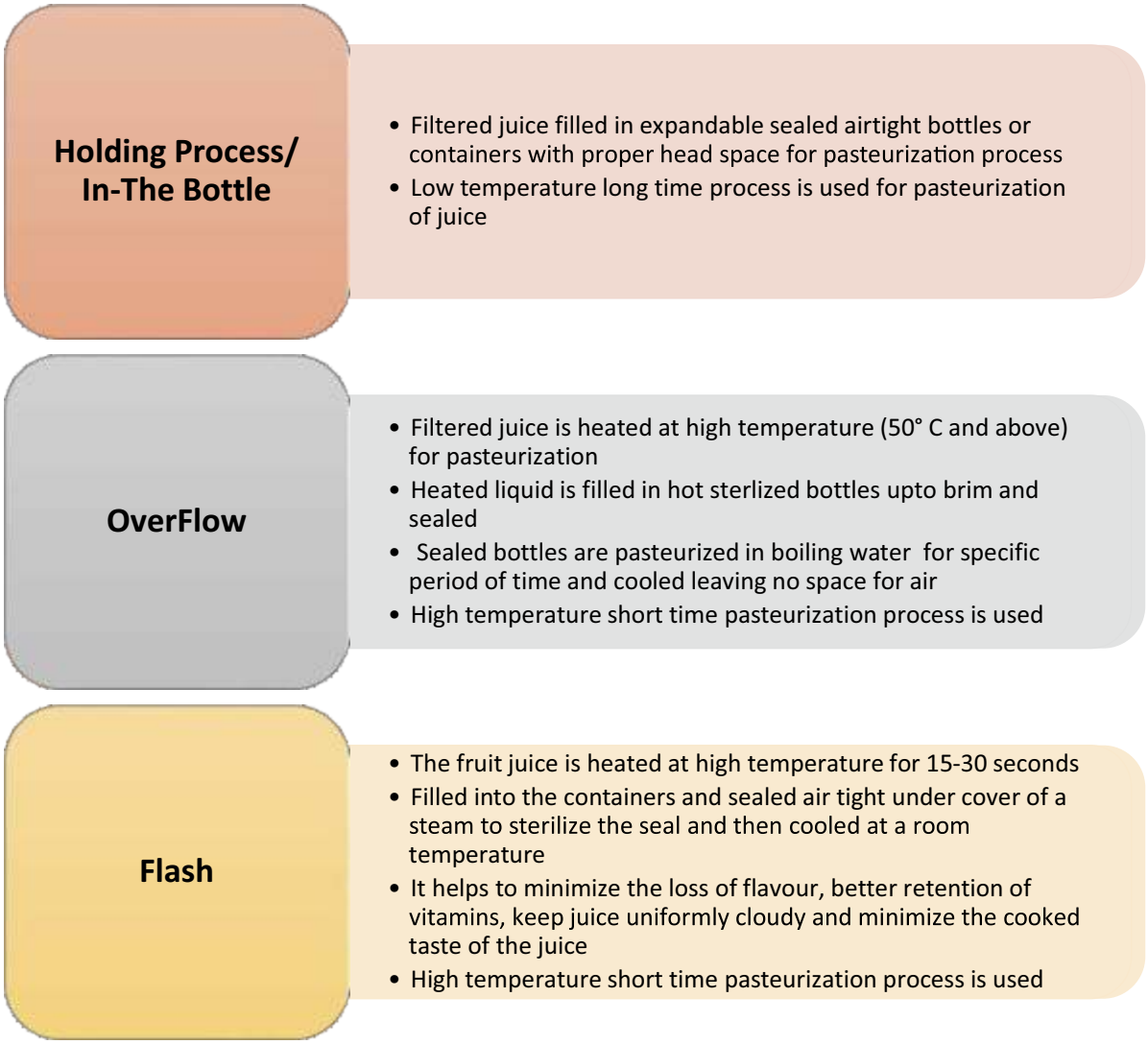



*Fig. 4.2.4. Various Methods of Pasteurization*

## 4.2.3 Workflow Operation of Pasteurization Machine

Currently, manufacturers usually adopt HTLT technology to heat up the juices to high temperature and keep them for a very short time. The Fruit Juice pasteurization machine is used to sterilize the fruit juice with high heat. It is carried out before juice filling and packing and after juice extraction, filtration, and concentrate processing.

Generally, there are three types of pasteurizer machines, plate pasteurizer, tubular pasteurizer, and steam pasteurizer. Plate pasteurizer is the most prevalently used in fruit juice processing production. It incorporates the function of preheating, sterilization, heat preservation, and cooling, which is suitable for fruit juices.

UHT (Ultra Heat Treated) technology.

Can operate under the temperature of 135° C - 140° C for 3-5 seconds

Short time protects the drinks from nutrition or flavor loss

Sterilization capacity is 1 -10t/h.

High heat-recovery efficiency, and automatic temperature control

Highly suited for thermal sensetive products due to short heating time

Compact structure and pretty appearance

*Fig. 4.2.5. Features of Plate Pasteurizer*

Plate pasteurizers consist of serial plates and gaskets (placed between the plates) that resist high temperature and prevent the mixing of the fluids which flow on the plates. These plates are made of stainless steel with 95-125 mm thickness. Patterns on the plates create turbulence, increase the heat transfer area and stretch out the time of heat transfer.

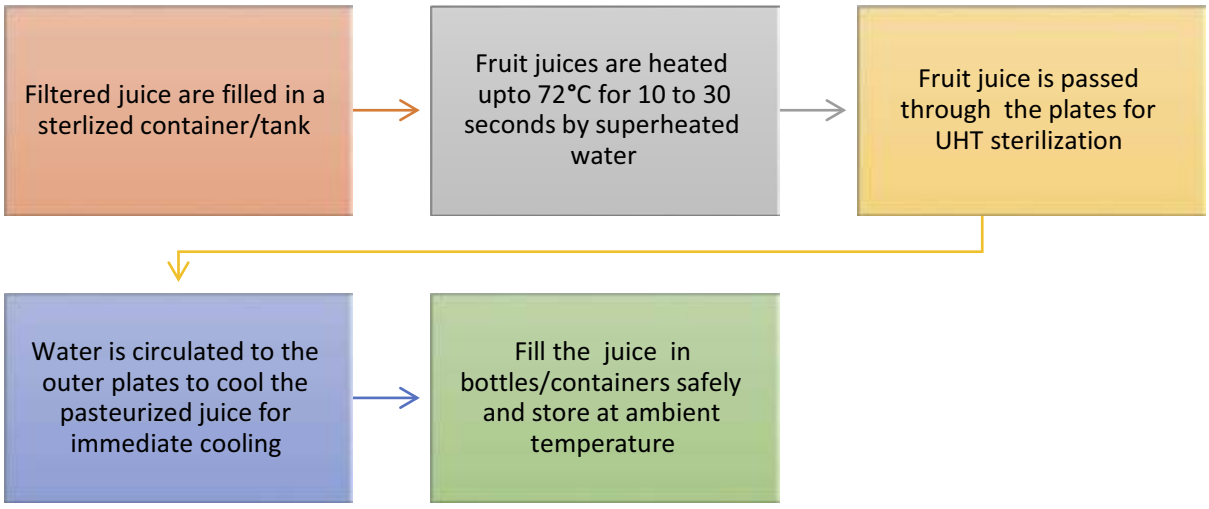



*Fig. 4.2.6. Workflow Operation of Plate Pasteurizer Machine*

## 4.2.4 Clarification Process of Fruit Juice

The clarification process of fruit juices can be done using different methods like straining or screening, settling or sedimentation, and filtration. Below are the common methods used in the clarification process of the fruit juices.

### Straining or screening

- A process by which fruit juices are allowed to pass through a mesh/membrane either manually or by automatic process, which ensures to remove the coarse particles from the juice and thus leaving a clear juice without any bigger visible particles.

### Finishing

- It is a process to separates the pulpy matter, rag, seeds etc. from the juice. The finisher separates the pulpy matter from the juice using a rotating auger inside a cylinder screen. The diameter of the screen holes varies depending on the condition and softness of the fruit. The pulp content of the fruit juice is used to determine completion.

### Decantation

- Decantation is the process of separation of liquid from solid and other immiscible (non-mixing) liquids, by removing the liquid layer at the top from the layer of solid or liquid below. Decantation is the simplest method of clarification, in which the juice containing solids is allowed to settle down and then clear juice is decanted or siphoned out. The juice kept at low temperature for long period, helps in setting of solid to allow clarification.

### Centrifugation

- Centrifugation is the process that uses centrifugal force for the separation of two liquids in a mixture. The clouding particles are separated by centrifugal action. The juice containing solids is fed into a basket or disc type centrifuge, where the centrifugal force separates the light and dense components in each layer. The clear juice is collected and unwanted solids are separated.

### Enzymes

- Enzymes are proteins that help speed up chemical reactions in fruits. The pectinol enzyme is used for clarification of fruit juices as it breaks pectin into soluble form thereby freeing the suspended particles which settle down and leaves the juice clear. Similarly, proteolytic and starch liquefying enzymes i.e. amylases are used to remove protein and starch from fruit juices. Pectinol is more effective in the case of acidic juices. Fruit juices can be clarified in about 1-2 hours at 40-50°C but requires 20 hrs at 20°C.

**Physical finings**

- Physical fining agents, also known as filter aids like kaolin, diatomaceous earth, spanish clay, bentonite or china clay are mixed(0.5 to 0.1 percent earth) with fruit juice and then passed through the filter press. Physical finings are used in ultra filtration process that separates particles based on molecular weight and has better retention of the nutrients in the juice. It is necessary to degrade the pectin enzymatically before ultra-filtration, to reduce viscosity and allow a satisfactory juice.

**Chemical finings**

- Finings are substances that are usually added at or near the completion of the processing of brewing wine, beer, and various nonalcoholic juice beverages. They are used to remove organic compounds, either to improve clarity or adjust flavor or aroma. Depending on the tannin content of the fruit juice, gelatin or caesin solution is mixed in the juice and allowed to stand for 18 to 24 hrs to ensure that the precipitated matter clots together and settles down. The clarified juice is then siphoned off. Albumin (egg white) can also be used in clarification of juices.

**Clarification by freezing**

- Freezing is the process in which a liquid changes to a solid. Cream of tartar or potassium hydrogen tartarate is mixed in the juice and refregerated and later by thawing process, the clarified juice is seperated from unwanted solids.

**Clarification byheating**

- The juice is heated to 80-85°C for few minutes and cooled immediately followed by filtration by passing the juice through a filter press.

*Fig. 4.2.7. Various Methods of Clarification Process of Fruit Juice*

Fig. 4.2.8 Clarifier/Ultra-filteration unit

Used to remove solid particulates or suspended solids from liquid for clarification and /or thickening

## 4.2.5 Quality Assessment and Sample Analysis

It is important to assess the quality of pasteurized and clarified fruit juice before it is sent for further processing. Sample analysis is necessary for maintaining the quality of a product as per the company standard norms and specific guidelines mentioned by the government. If the quality standards are not maintained, it could lead to fatal consequences. On the other hand, contamination free processed food will not cause any harm to the customers.

Every step involved in the process requires monitoring, including food safety and personal hygiene. For example, in fruit juice processing, a quality lab check is done based on technical specification and organoleptic, which differ from fruit to fruit. After clarification of the fruit juice, the sample of clarified juice is sent to the lab for quality analysis. Following are the parameters for quality check:

**Taste/flavour, colour, and texture –**Fruit Juice is checked by testing the taste and flavour, whereas the colour and texture of the clarified fruit juice go through visual inspection.

**pH –** A numeric scale to check acid levels in fruit pulp. Each fruit has its acidity level. The processingcompany maintains it as per their requirement.

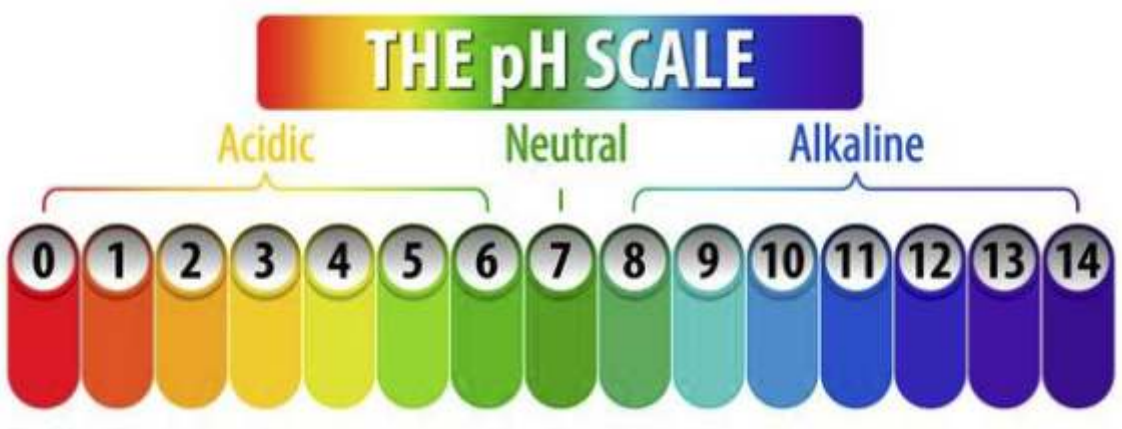



*Fig. 4.2.9. pH Scale*

**TSS (Total Soluble Solids) -** It is the extracted mass of fruit, which contains fibers and fruit sugar. Each fruit has its own Brix ratio. It is maintained as per the company's requirement.

**Brix -** It is a measure of the amount of dissolved solids in a liquid via its specific gravity, and is used specially to measure dissolved sugar. One-degree Brix is 1 gram of sucrose in 100 grams of solution. Brix measurement is commonly used in the food industry for measuring the approximate amount of sugars in fruits, vegetables, juices, wine, and soft drinks.

**Titratable Acidity -** It measures the total acid concentration in fruit juice and is determined by exhaustive titration of intrinsic acids with a standard base. Titratable fruit acidity is expressed as g/100 mL of the predominant acid.

**Viscosity -** Viscosity is a measure of a fluid's resistance to flow. It is measured by Viscometer as per the need.

*Fig. 4.2.10. Viscometer*

| Microbiological Standards for Fruit Products | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Product Description** | **Aerobic Plate Count** | | | | **Yeast and Mold Count** | | | | **Enterobacteriaceae** | | | | **Staphylococcus aureus (Coagulase +ve)** | | | |
| | Sampling Plan | | Limit (cfu) | | Sampling Plan | | Limit (cfu) | | Sampling Plan | | Limit (cfu) | | Sampling Plan | | Limit (cfu) | |
| Minimally Processed or Packed Fruit Juices | 5 | 2 | $1x10^6/g$ | $1x10^7/g$ | 5 | 1 | $1x10^2/g$ | $1x10^4/g$ | 5 | 2 | $1x10^2/g$ | $1x10^4/g$ | 5 | 1 | $1x10^2/g$ | $1x10^3/g$ |
| Pasteurized Juices | 5 | 2 | | | | | | | | | | | | | | |
| Carbonated Fruit beverages | 5 | 1 | 50/ml | $5x10^2/ml$ | 5 | 0 | <10/ml | | 5 | 0 | Not detectable as per prescribed method | | 5 | 0 | Absent/25g | |
| Thermally processed (other than pasteurization at less than 100°C) | 5 | 1 | $1x10^2/g$ | $1x10^3/g$ | 5 | 1 | 50/g | $1x10^2/g$ | 5 | 0 | | | 5 | 0 | Absent/25g | |

**Table. 4.2.1 Microbiological Standards for Fruits and their Products**

*Source: Table 4B, https://www.fssai.gov.in/upload/uploadfiles/files/Compendium_Food_Additives_Regulations_08_09_2020-compressed.pdf)*

## Exercise

**Answer the following questions:**

1. What do you understand by pasteurization of fruit juice? Why it is important?

_____

_____

2. Explain the pasteurization process of fruit juices.

_____

_____

3. Describe the workflow operation of pasteurizer.

_____

_____

4. Explain any two method of clarification of fruit juices.

_____

_____

5. How do you measure titrability acidity in fruit juice?

_____

_____

**Fill in the Blanks:**

1. _____ is used for clarification of fruit juices as it breaks pectin into soluble form thereby freeing the suspended particles which settle down and leaves the juice clear.
2. The clarification process of fruit juices can be done using different methods like _____, _____, and filtration.
3. The different methods of pasteurization used in food processing industries are _____, _____ and _____.
4. The main parameters that influence the pasteurization process of a fruit juice are _____.
5. Pasteurization technology is invented by French microbiologist _____.

# UNIT 4.3: Produce and Prepare Squash

## Unit Objectives

**By the end of this unit, participants will be able to:**

1. Discuss the usage of refractometer in the squash preparing process
2. Describe the procedure to measure the quantity of acids, preservatives, color, flavor, etc. to be mixed in a blending tank
3. State the importance of observing the mixing process and collecting a sample, and check physical parameters to ensure uniform mixing of the fruit juice
4. Describe the control parameters of pasteurizer or heat exchanger
5. Discuss the procedure to prepare and clarify fruit juice squash

## 4.3.1 Fruit Squash

Squash is a type of fruit beverage made by mixing of the calculated quantity of fruit juice with sugar, acid, and other ingredients. According to Indian food laws, squash must contain at least 25% fruit juice or pulp, and the total soluble solids content should not be less than 40% of brix in the finished product. The acidity of the squash should not exceed 3.5% as anhydrous citric acid. A variety of fruits, like mango, orange, lemon, pineapples, grape, and litchi, are used to commercially make squash. Squash are also prepared using the juice or pulp from fruits like bael, guava, pear, apricot, muskmelon, papaya, passion fruit, peach, plum, mulberry, raspberry, strawberry, grapefruit, etc. The maximum permissible limit of preservatives in squash is 350 ppm of sulphur dioxide or 600 ppm of benzoic acid. Potassium metabisulphite is not added in dark-coloured fruits as it may bleach the anthocyanin pigments. In such beverages, sodium benzoate is used. Commercially available squash contains 40 to 50 percent sugar and around 1.0 percent acid. They are diluted in the ratio of 1:4 before consumption.

| List of ingredients used for the preparation of squash | |
|---|---|
| Fruit Components | · It is in the form of fruit juice or pulp, the required amount should be more than 25% in the finished product. |
| Sugar Syrup | · Carbohydrate syrup is added in various forms like sucrose, glucose, or modified syrup.<br>· Sugar syrup provides body and imparts sweetness to the squash.<br>· Syrup also assists in the development of flavour, mild preservative effect, and is always added after the filtration and sterilization process. |
| Acid | · Citric acid is the most preferred acidulant, other than malic, lactic, and tartaric acid.<br>· Balanced acid to sugar ratio helps impart flavour to the finished product. |
| Preservatives | · It is added to prevent the growth of fungi, yeast, and lactic acid bacteria in the finished product.<br>· Permitted preservatives in squash are sulphur dioxide, benzoic acid, and sorbic acid. |
| Flavourings | · It is a highly concentrated flavor extracted from a combination of fruits.<br>· Mostly natural or natural identical flavouring is used to prepare squash that improves the taste/flavour without affecting other properties. |
| Colourings | · A permitted food colour is used to enhance the aesthetic appeal of the squash.<br>· It may include natural, natural identical, or synthetic dyes with a maximum permissible limit as specified in IFC 14.1.4.3 of FSSAI (Food Additives Regulations. |
| Other Additives | · Additives include stabilizers to keep the fruit solids in suspension and improve the mouthfeel of the beverage.<br>· Acidity regulators, emulsifiers, anti-oxidants, and clouding agents are used to enhance the acceptability of beverages. |

**Table. 4.3.1 List of ingredients used for the preparation of squash**

**Preparation of Sugar Syrup -** Sugar Syrup is usually prepared by mixing 1 part (volume) sugar to 3-6 parts (volume) water in stainless steel tanks fitted with top-driven agitators. Sugar syrup is passed through a plate heat exchanger to decrease the microbial load. The syrup is pre-prepared, tested and diverted to proportioned for mixing with water and carbonation. The refractometer is used for checking the specifications of the sugar syrup Brix. For squash making, it requires sugar syrup of 67º Brix strength. The syrup is dosed through a mass flow meter, and the water dosing is done volumetrically by using a magnetic induction flow meter.

## 4.3.2 Equipment used in Squash Making

To prepare squash at a commercial level, several equipment and processing machines are used. Some of the equipment and tools required for squash production are:

**Basic equipment/ accessories**

1. Cutting Knife (SS), coring knife, pitting knife, peeling knife
2. Working table
3. Buckets, Tubs, Jugs
4. Volumetric flask
5. Conical flask
6. pH meter
7. Heat production system
8. Blending Tank
9. Storage tank

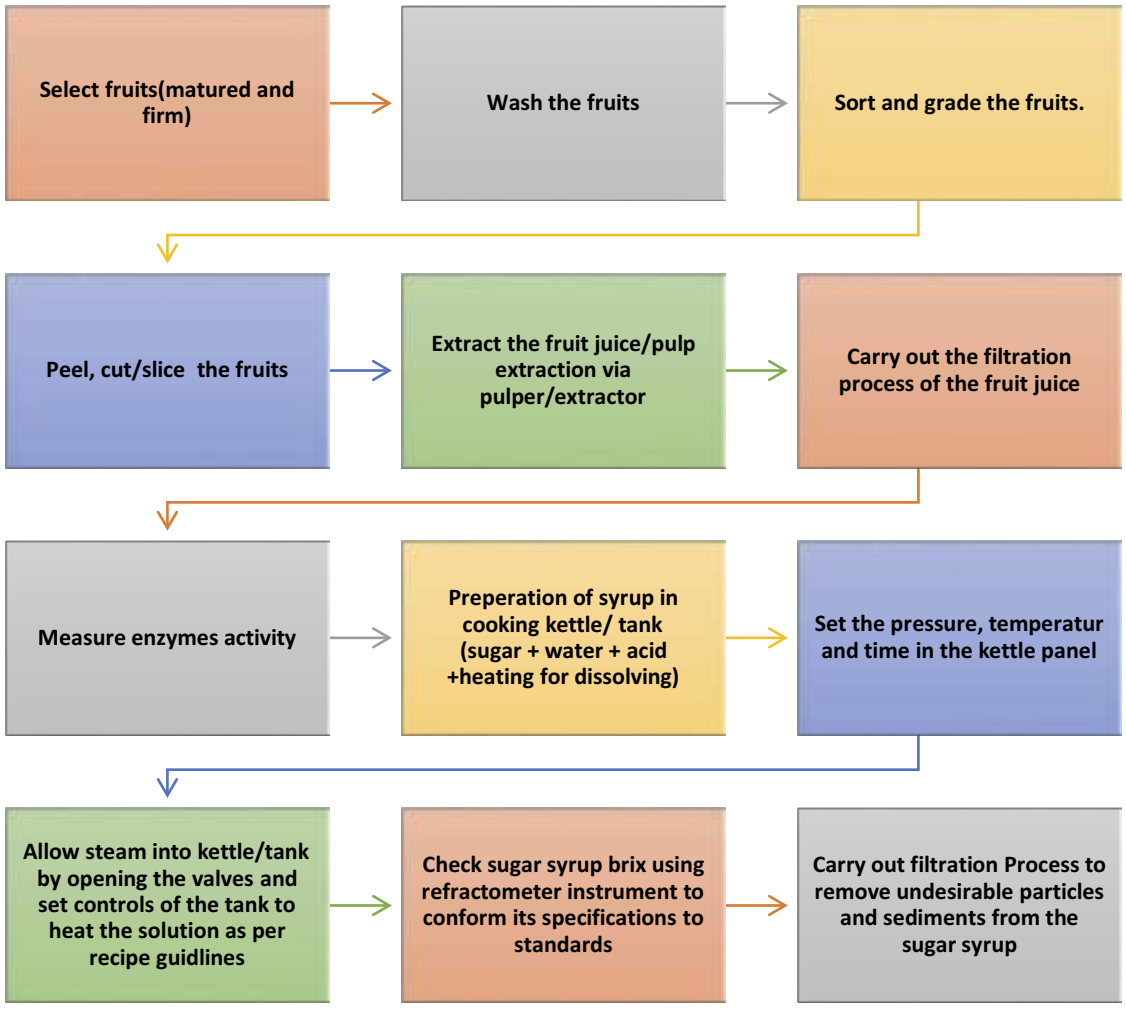
| Types of Equipment and Tools | Description |
|---|---|
|  <br>*Cooking Kettle* | A cooking kettle is an all-purpose machine for making high-quality products such as squash, jam, marmalade, and jellies. Various stirring and mixing processes can be carried out with a cooking kettle.<br><br>**Operation of Cooking Kettle**<br><br>After filling the water jacket with water, the kettle is ready to operate. The electric heater heats the water bath to the set temperature and keeps it constant. With the integrated mixer, the product is evenly heated and mixed. After the cooking process, the kettle can be easily emptied with the disc valve on the bottom. Cooking kettles mainly consists of: -<br><br>• Aspherical tank<br>• Vapor-liquid separator<br>• Condenser<br>• Receiving tank, etc.<br><br>Cooking kettles have the advantages of a large heating area, high thermal efficiency, quick heating of materials, uniform heating, and easy control of heating temperature. |
|  <br>*Peeler* | Peeler is used to peeling various ball-shaped fruits and vegetables, equipped with rotating soft and hard brushes that thoroughly clean and peel the vegetables. |
|  <br>*Pulper machine* | Pulper is used for extracting pulp of most fruits & vegetables like mango, apple, tamarind, custard apple, plum, apricot, peach, kiwi, tomato, etc. The fruits and vegetables are fed in the pulping chamber where due to blades and brushes the fruit is pressed against the sieve. The extracted pulp passes through the perforations in the sieve, and stone and skin are pushed forward and discharged from the other end. |

| | |
|---|---|
|  <br>*Filter cloth/sieve* | A sieve is an equipment used to separate the passage of granular materials according to particle size. |
|  <br>Mixer/Agitattor | An Agitator is a machine used in a tank for mixing various process media together. It consists of an impeller that rotates to impart energy to the media, which interact and mix the ingredients in the tank. |
|  <br>*Sterilizer/Pasteurizer* | A pasteurization machine sterilizes the squash to destroy pathogenic microorganisms by heating the product to a moderately high temperature for a brief period. The main parameters that influence the pasteurization process of a fruit squash are as follows:<br>1. Temperature<br>2. Time<br>3. Acidity or pH level of the fruit<br>4. Pressure<br>5. Flow rate |
|  <br>*Refractometer* | Refractometer measures total soluble solids (TSS) as °Brix, which corresponds to % sugar.<br><br>Usage: A refractometer is used for monitoring and controlling the quality of fruit juices, jams, ketchup, fruit extracts, syrups, chocolate, milk, and other products by measuring the total solids during processing. It is a well-known instrument for determining the water content of liquids. It measures the liquid's refractive index, which varies with moisture content.<br><br>Process:<br>1. Place the deionized or distilled water (100 uL) on the sample well for full coverage of the prism.<br>2. Press the Zero button.<br>3. Remove the sample from the prism.<br>4. Place your squash sample on the sample well. |

| | |
|---|---|
| | 5. Take the refractometer reading.<br>6. Clean the prism and repeat for any other measurements |
|  <br>*Crown corking/capping machine* | The crown corking/capping machine is used for sealing the caps/corks of the jars/bottles |

**Table. 4.3.2 List of Equipment and Tools for Squash Making**

The following workflow process chart explains the preparation of fruit squash:



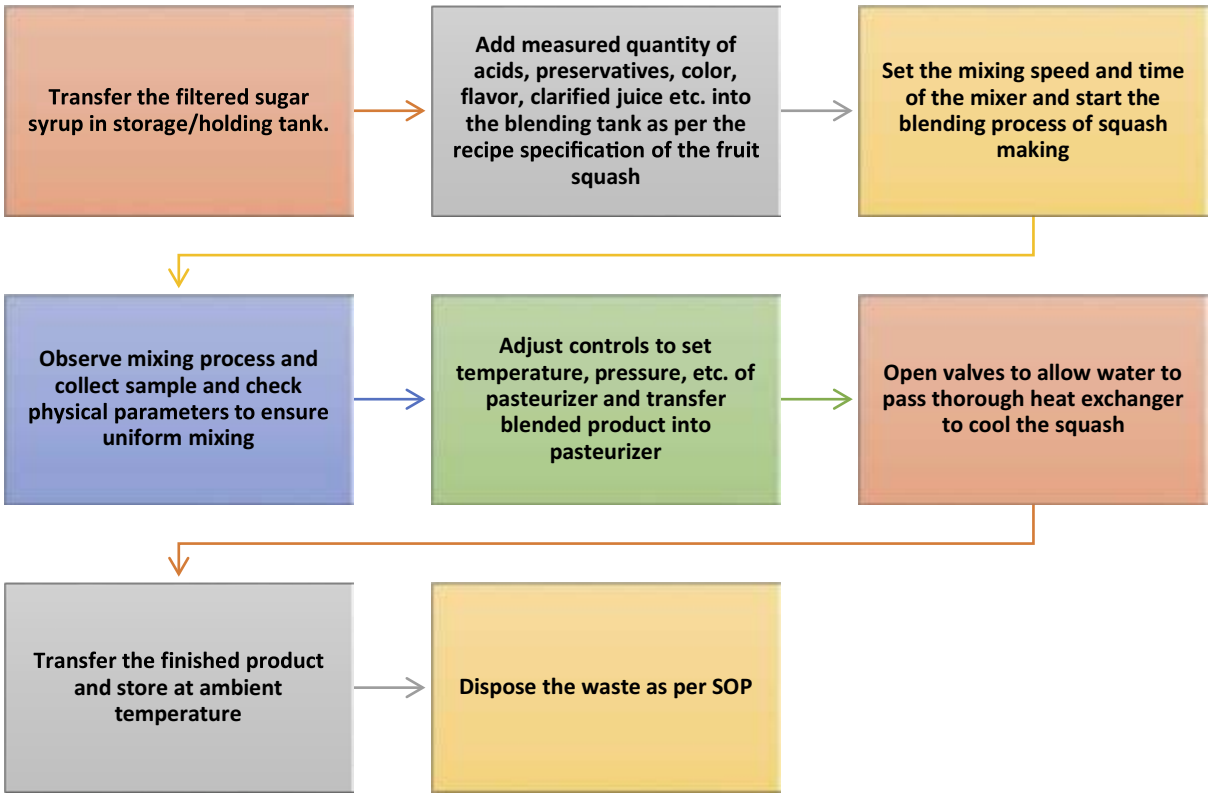



*Fig. 4.3.1. Workflow Process of Squash Making*

## Exercise

**Answer the following questions:**

1. List any two ingredients used for the preparation of squash making.

_____
_____
_____

2. Explain the workflow process of squash making.

_____
_____
_____

3. What is the operating procedure of the cooking kettle?

_____
_____
_____

4. What is the purpose of the refractometer in squash making process?

_____

_____

_____

**Fill in the blanks:**

1. A _____ is used to sterilize the squash to destroy pathogenic microorganisms by _____ the product to a moderately high temperature for a brief period.
2. _____ is usually prepared by mixing 1 part of sugar to 3-6 parts of water in stainless steel tanks fitted with top driven agitators.
3. Permitted preservatives in squash are _____, and _____.

# UNIT 4.4: Filling, Packing and Storage of Juice and Squash

## Unit Objectives

**By the end of this unit, participants will be able to:**

1. Discuss the procedure to transfer the finished product into the filling tank
2. Elaborate the SOP to wash bottle/plastic containers to fill measured quantity of finished products
3. List the control parameters of the packaging machine, like filling volume, batch code details, date of manufacture, best before date, etc.

## 4.4.1 Introduction to Packaging

Food packaging is the most reliable process for preventing food contamination. This is the best way to safely control and protect the food against physical, chemical, biological, and environmental factors. Packaging provides many advantages such as protecting the contents in its containment from spoilage and leakage, more accessible transportation and storage, and better communications between the manufacturer and consumer. The most critical functions of packaging include:


*Fig. 4.4.1. Functions of packaging*

The principal factors which affect the efficiency and utilization of a packaging line are as follows:

1. The suitability of the machine for the purpose
2. The output speed
3. The likelihood and frequency of stoppages and the time taken to overcome them

The following chart explains the benefits of packaging of squash and juices:

| | |
|---|---|
| **Shelf life** | •To maintain the organoleptic properties over a long period |
| **Preservation** | •Prevent temperature fluctuations, bacterial ingress, dust, etc. |
| **Barrier Protection** | •Prevent migration of oxygen, water vapor, UV light, etc. |
| **Physical Protection** | •Protection from shock, vibration, compression, etc. |
| **Security** | •Prevent pilferage and/or tampering. Also, assures authenticity |
| **Portion control** | •A single serving pack has a precise amount of contents to control usage. |

*Fig. 4.4.2. Benefits of Packaging of Squash & Juices*

**Scan the QR code to watch the related videos**

https://youtu.be/osA74cAqMLc

4.4.1 Introduction to Packaging

## 4.4.2 Packaging Machinery

- Some of the packaging machinery used in food processing industries are:
- Filling machines are often but not exclusively used in the food packaging industry. Filling machines are used to fill liquids, grains, and other products into a container. The accuracy of the filling machine helps to maintain a consistent product for consumers efficiently.
- Form Fill Seal is used in multiple forms of flexible packaging applications. Many industrial, retail, pharmaceutical, and food packaging products are sealed using a heat sealer. Sealers come in multiple sizes and specifications.
- Cartoning systems are used in most packaging applications utilizing corrugated boxes. Tape guns are used in smaller operations, but higher volumes require case sealers for efficient packaging. Manual and automatic case sealers are used in retail, food, industrial, and pharmaceutical bulk packaging.

- A bottling system is a collection of automatic machines connected by a conveyor belt or a group of highly specialized, fully automatic units that are completely integrated by a synchronized drive arrangement.
- Coding machines apply a code (including bar codes), dates, and other variable or unique information to a package or transit container. These machines are usually attached to a larger packaging machine such as a cartoner, filler, or wrapper.
- Labelling Machines apply labels and decoration onto all types of packaging containers, display, point-of-sale, and transit packs. Labels are used on every kind of product to brand, decorate or provide information for the consumer.
- Conveyors are machines and equipment which carry ingredients, products, containers, packs, or packaging components from one place to another.

## 4.4.3 Filling and Bottling Operation of Squash

After the preparation and pasteurization process of squash, the products should be hot-filled into clean, sterilized bottles. A stainless steel bucket, drilled to accept a small outlet tap, is very effective bottle filler. After filling hot squash or juices from the tap/nozzle, the bottles are capped and laid in inverted position to cool before labelling. Hot filling offers a simpler means of ensuring microbial integrity of the nectars. The bulk product is heated to a pre-determined temperature, then filled hot (70°-85°C) in packs and sealed immediately. In case of glass bottle, it should be pre-heated to minimize thermal shock. The packs are inverted for proper mixing of the nectar and held at the desired temperature for a required time. Finally, they are cooled in a hydro-cooler to 25°C, the surface is then air-dried and labeled.

**The filling station consist of:**

| Functions of Filling Machine | |
|---|---|
| Air jet Cleaner (Cleaning machine) | for empty containers with water and steam treatment |
| Bottle Unscrambler | for Container/bottle feeding |
| Linear piston filler | for filling dense and semi-dense products |
| Filling Area | where jars/bottles are placed |
| Cooling Conveyer | to cool the containers before moving to the capping machine |
| Automatic linear capping/corking machine with cap/cork feeder | for capping the containers |
| Drying unit with air knives | to seal the caps of the container |
| Electronic Vacuum detector with the rejecting system | to reject the uncapped or cross capped containers |

**Table. 4.3.4 Various Functions of Filling Machine**

The following chart explains the workflow process of filling station for filling juices/ squash into the bottle and simultaneously capping them.

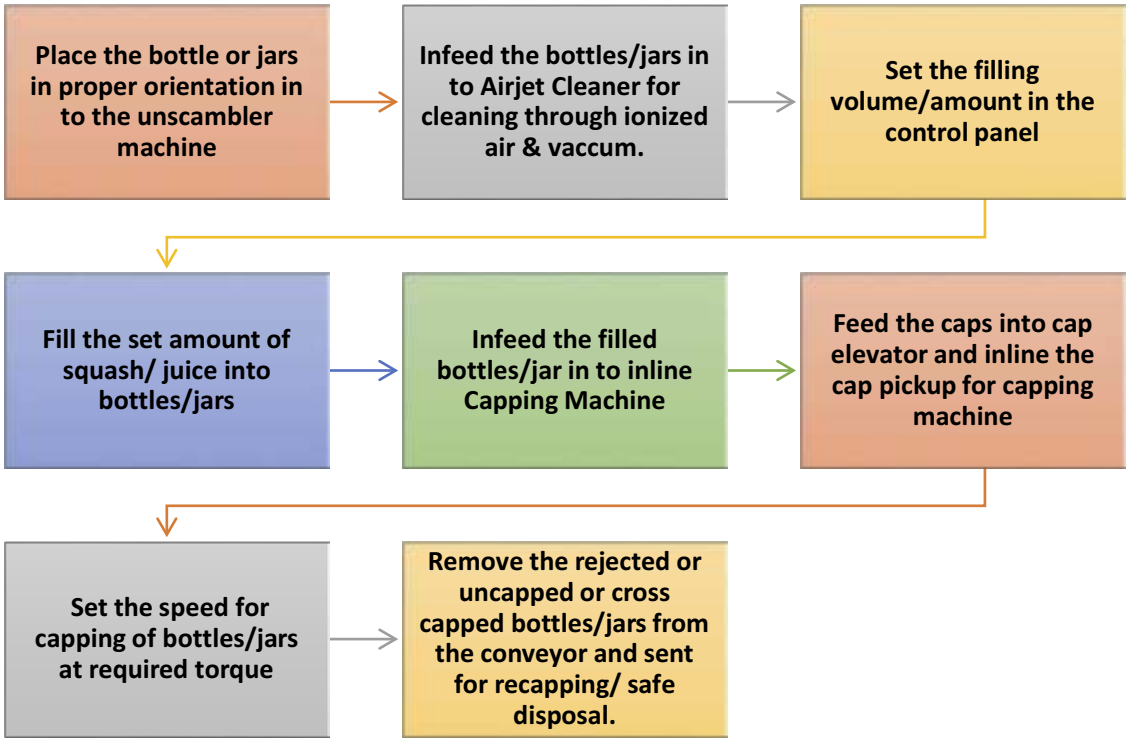



*Fig. 4.4.3. Workflow Process of Filling Station*

**Below are the filling and packaging criteria for the squash and juices:**

- Rinsing machines for jars or other containers should be used to remove dust and debris from the containers before filling, removing the possibility of producing contaminated products or reducing the shelf life of a batch.
- Squash or juice should be filled hot at 70°-85°C to prevent browning and loss of vitamins during subsequent storage and distribution.
- The liquid must be kept at a constant temperature throughout the process to ensure the product flow evenly, and the fill can be consistently and reliably repeated.
- Packaging material should be heat-resistant, i.e., should have resistance towards high filling temperature.
- It should be sturdy to prevent handling and storage hazards.
- The package should not react with and change the product's properties over a given period of storage and preservation.
- Containers/bottles should be cooled before applying the label to avoid wrinkles or peeling off of the label. It also helps the juice or squash to set in the container.
- Packaged products should be stored under ambient temperature in a dry place.

*Fig. 4.4.4. Bottle filling machines used for filling of juices squashes into bottles*

*Fig. 4.4.5. Packaging of fruit juice*/squash

## 4.4.4 Standard Procedure to Load Labels in Labeling Machine

The following chart explains the standard process for loading batch code details, date of manufacture, best before date, etc.) in a labelling machine:

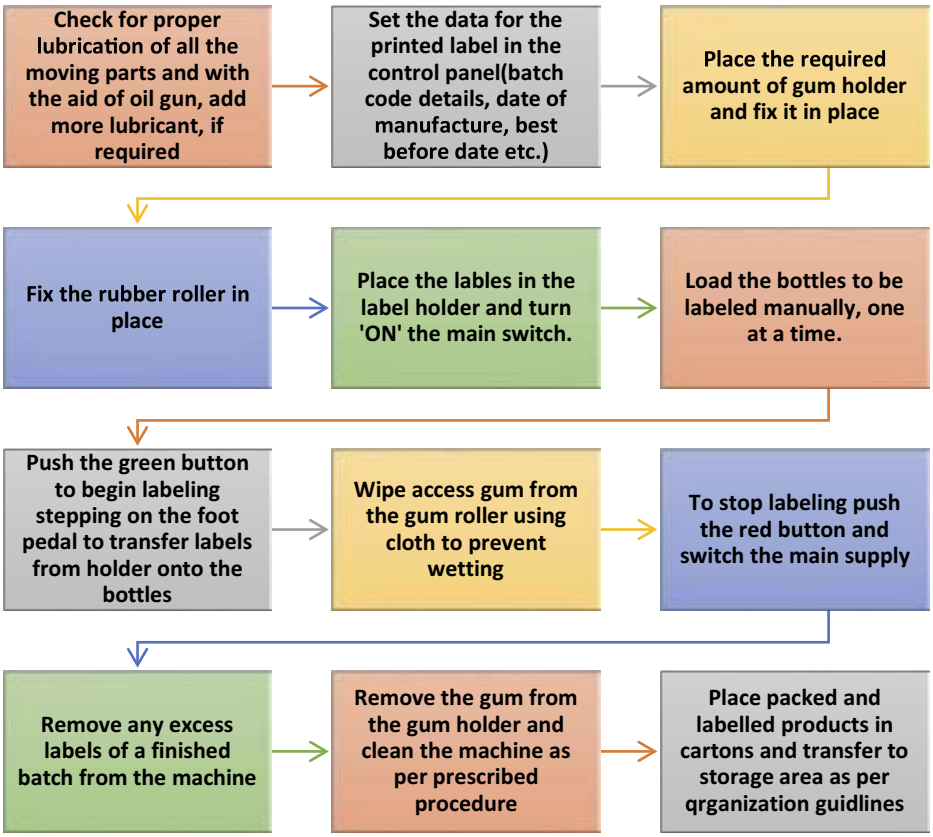



*Fig. 4.4.6. Workflow Process of Labeling Fruit juice/Squash Bottles*


*Fig. 4.4.7. Labelling Machine*

## Exercise

**Answer the following questions:**

1. Explain the operation of the filling station.

_____
_____
_____

2. List any five types of packaging machines

_____
_____
_____

3. What are the benefits of packaging?

_____
_____
_____

4. Explain the workflow process of labeling fruit juice/squash bottles.

_____
_____
_____

**Fill in the blanks:**

1. _____ should be filled hot at _____ to prevent browning and loss of vitamins during subsequent storage and distribution.
2. _____ should be heat-resistant i.e., should have resistance towards high filling temperature.
3. _____performs varied tasks such as protecting the contents in its containment from _____and leakage, easier transportation and _____, and better communications between the manufacturer and consumer.

# UNIT 4.5: Post Production Cleaning and Maintenance

## Unit Objectives

**By the end of this unit, participants will be able to:**

1. Demonstrate the process of cleaning and maintenance of work area after production
2. State the kind of waste produced and its disposal

## 4.5.1 Post Production Cleaning of Work Area and Machinery

After the production cycle is complete, cleaning the area, machines, and equipment becomes imperative before starting the following process. Otherwise, the residuals from the previous cycle may cause contamination and other related quality problems in the upcoming production cycle. There are various methods of cleaning the work area and machinery that can be applied as per the requirement.

### Manual Cleaning:

- This method of cleaning uses cloths, mops, brushes,pads, etc. It isusually used in small areasornon -waterproof equipment or machinery that requires dismantling or areas that are difficult to clean by othermethods . It is a labor-intensive method and may limit the use of certain chemicals for safety reasons. The method must be clearly defined and staff trained to anappropriate level to ensure cleaningis effective.

### Foam Cleaning:

- It is the commonmethodfor cleaning most foodoperations .A foamblanket that is created using a wide range of available equipment is projectedfrom a nozzleand is allowed timeto act on the soil. Then, it is rinsed off with the released deposits. Foam cleaning is idealfor cleaninglarge areas such asfloors, walls, conveyors,tables, and well-designed production equipment. Foam is a carrier fordetergent . The foam isappliedin an evenlayer . Coverage rates are quick, and chemical usage iseconomical . The equipment for foam cleaning may be mobile, or centralized.

### Spray:

- Spray cleaning uses a lance on a pressure washerwithchemical induction byventuri . This should ideally be used wherefoaming propertiesare not essential for the cleaningaction as this method can be wasteful of chemicals and can be slow to produce foam.

### Fogging:

- This method uses compressed air or other equipment to generate a fine mist of disinfectant solution,which hangs in the airlong enough to disinfect airborne organisms. It also settles on surfaces to produce a bactericidal effect. The system is availablein both small portable devices and built-in automatic central systems. Fogging should never be used as a primary sanitizing method. This shall be used inconjunction withothermethods . It is alsovital to ensure that coverage andsaturation are sufficient and the mist isacceptable to allow proper action.

**Machine Washing:**

- Machine washing is an automatic or semi-automatic washing process conducted within a purpose-builtmachine .Many machine designs are available depending on the application, e.g., crate washing or utensilwashing . They represent a significantcapital investment and need to have a clear business case before purchasing. In addition, theytend to consume a large number of chemicals and water. Failure to maintain them correctly can lead to a contamination risk to the product. Chemicals used in these machines should be low foaming.An effective system for controlling the dose of chemicals shouldbe employed, and temperature control systems shouldbe used where critical.

*Fig. 4.5.1. Various Methods of Cleaning the Work Area and Machinery*

Cleaning and sanitization is a complex process. A defined and systematic approach should be followed to ensure it is conducted appropriately that considers several factors. This approach takes the form of a procedure, which is usually a legal and a fundamental requirement of global food standards. A collection of these cleaning procedures forms a Cleaning Plan or Program, which is plant-specific. The correct sequence of a general cleaning procedure for surfaces in a food plant is:

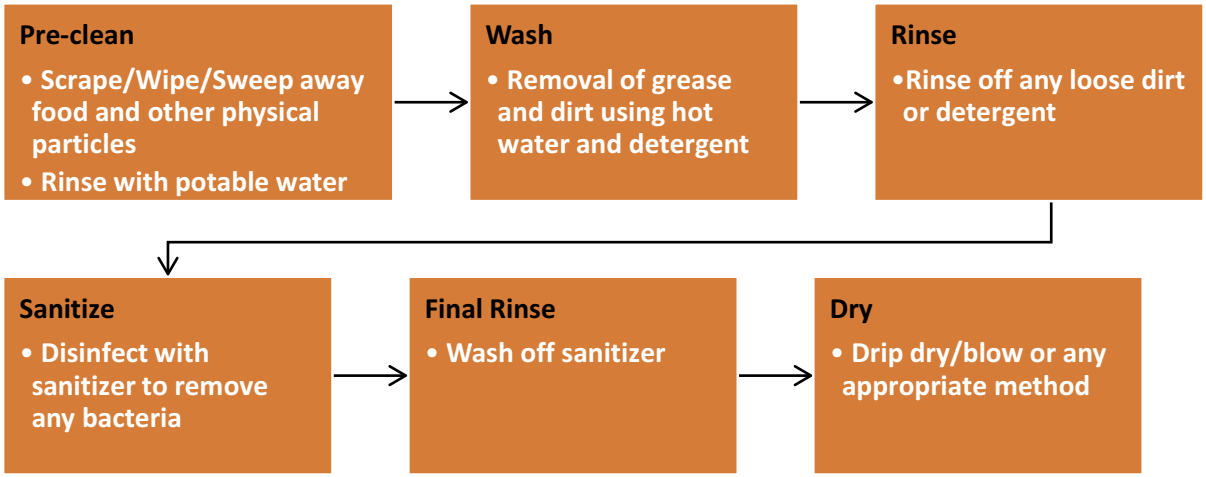



*Fig. 4.5.2. Steps for Cleaning Work Area*

The following chart explains workflow process of cleaning and maintenance of fruit squash and juice processing machinery and equipment.

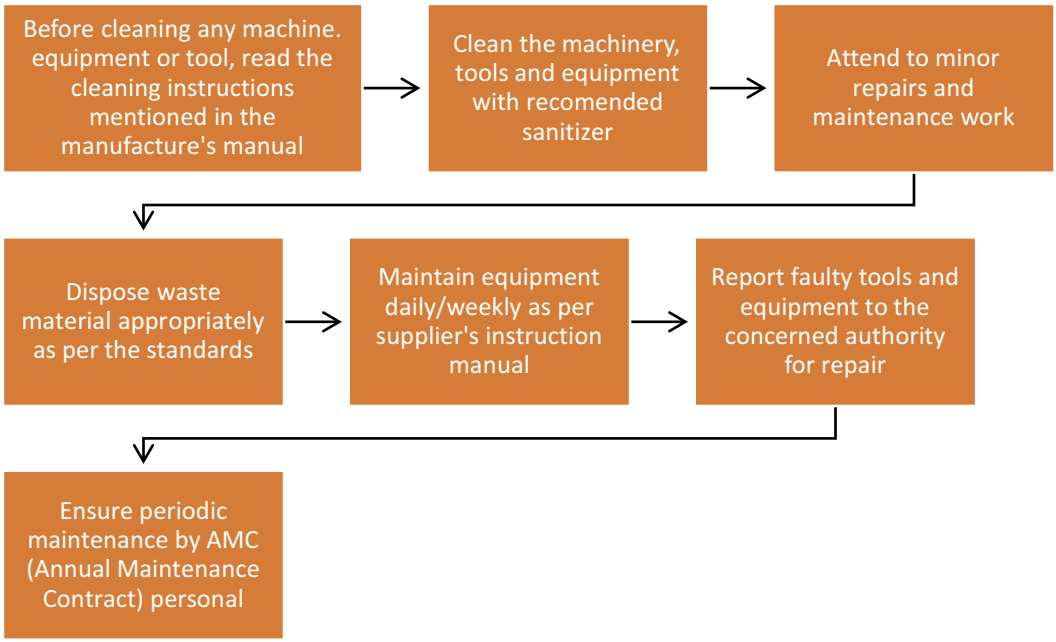



*Fig. 4.5.3. Cleaning and Maintenance Process for Squash and juice Machinery and Equipment*

It is important to report faulty tools and equipment to the concerned authority, as it minimizes the possible risks and hazards related to equipment and prevents major failures and serious injuries or mishaps. The following figure explains the significance of reporting to the concerned authority:


*Fig. 4.5.4. Importance of Reporting Faulty Tools and Equipment*

**Scan the QR code to watch the related videos**

https://youtu.be/CD0XLUutibk

Cleaning Facilities

## 4.5.2 Maintenance and Check

In food manufacturing, maintenance supports various key objectives, many of which are unique to food production. Maintenance plays the following roles in food manufacturing:

1. It keeps the production running smoothly.
2. It helps to prevent any contamination and ensure food safety.
3. It reduces product losses.
4. It maintains regulatory compliance.

An effective maintenance routine ensures that operations are continued, repair costs are minimized, and downtime is reduced.

**Following are the types of maintenance that are carried out in a food processing unit:**

1. Reactive Maintenance is a method where machines run until they fail. It's a hands-off approach, and the significant benefit is that it keeps routine maintenance costs low.
2. Predictive Maintenance uses advanced technology such as infrared and ultrasound equipment during the routine inspection of machines. This process can stop unpredicted breakdowns, and using advanced technology and the industrial unit can reduce the amount of time needed to inspect equipment piece by piece. This type of maintenance is expensive, but this method accurately stays a step in front of faults.
3. Proactive Maintenance is a systemic issue-focused maintenance program. Rather than examining equipment, this approach considers how to control the problems that lead to machine wear and tear instead of the deterioration itself.
4. Preventative Maintenance is the checking of machines and equipment on a planned, regular basis. The purpose is to prevent costly downtime and minimize the probability of faults. It requires more planning and effort than other techniques. However, it has long and short-term benefits in cost-reduction and efficiency of machine performance. Preventative checks are done before a machine breakdowns and while it is still in running condition. Generally, the strategy leads to good food hygiene and prevents foreign materials from entering food produce.

It is essential to have a schedule for preventative maintenance of each piece of machinery and equipment used in the production. This consists of:

- Time schedule stating when and how frequently maintenance should be done
- Maintenance activities list for each item

These schedules provide simple guidelines for all types of equipment, covering the duties to be undertaken in the following areas:

**MAINTENANCE SCHEDULE GUIDELINES**

- Care and cleaning
- Safety checks
- Functional and performance checks
- Maintenance tasks(changing parts, lubricating moving parts, etc.)

*Fig. 4.5.5. Maintenance Schedule Guidelines*

### Checklist for Planning Maintenance

- Identify the assets that require preventative maintenance.
- Distinguish what kind of safety checks the machine will need.
- Assess whether parts need replacing or cleaning.
- Decide how regularly assets need checking.
- Create a formal risk assessment process to help the person responsible for checks.
- Talk to employees who work closely with equipment to discover more about how the machines are operating at the time of the check.
- Find out if parts need cleaning, lubricating, or changing.

*Fig. 4.5.6. Maintenance Checklist*

After completing any maintenance, the technician must keep a log for maintenance. This log entry should include a description of the work carried out, who carried it out, and the date and time it happened

**Document Maintenance Procedures:** Every piece of equipment and machinery should have detailed descriptions, drawings, and photographs of how and when each machinery should be maintained or serviced. It includes:

- Maintenance procedures
- Lubrication procedures
- Tool reconciliation procedures
- Procedures for temporary repairs
- Procedures for emergency repairs
- Spare parts inventory program
- Training procedures
- Handover procedures Audit Procedures

## 4.5.3 Waste Management

It is a method of treating/handling the unwanted materials that are a threat to the environment. Ensuring that the waste generated is disposed properly, one of the important features of Good Manufacturing Practices (GMP) is waste management.

A lot of waste is generated in fruit and vegetable processing industry. A valuable by-product can be made from waste to solve the problem of waste disposal. Given below is the table in which as per fruit, the name of waste and its by-products are listed:

| Fruit | Name of waste | By-products |
|---|---|---|
| Apple | Pomace, cores | Pectin, cider, vinegar, chutneys, etc. |
| Apricot, peach | Kernel | Kernel oil can be used in pharmaceutical oil cake as cattle feed |
| Citrus fruits | Rags, peels, seeds | Peel can be used for oil, pectin, marmalades, and extraction candy manufacturing. Sludge can be used for citric acid manufacturing. Seed can be used for oil extraction |
| Grapes | Stem and pomace | Pomace can be used for making jelly, chutney, cream of tarter, and cattle feed. |
| Guava | Cores, seeds, peels | Guava cheese and cattle feed |
| Mango | Peel and stone | Mango stones after removal of coat is dried, powdered, and is used as edible starch. Peel can be fermented to prepare vinegar |
| Pear | Skin and seed | Cattle feed |
| Pineapple | Skin, rind, crown | From crown, edible wax can be extracted. Rind can be used for pineapple candy and skin may be crushed for juice extraction |
| Tomatoes | Seeds | Can be used for extraction of oil |
| Other fruits | | Banana skin may be used for paper pulp. Green papaya latex can be used for papain extraction |
| Vegetable waste | Skin leaves | Can be used for cattle feed |

**Table 4.5.1 kinds of waste generated by different fruits**

Other unutilised portion of waste is dried and used as fuel for boiler and composted as agricultural compost. Wastewater generated is sent to ETP for further treatment.

**Scan the QR code to watch the related videos**

https://www.youtube.com/watch?v=nrEOtxjwKsQ

Waste Management

## Notes

## Exercise

**1. Fill in the blanks with the correct option**

a. _____ refers to the process of cooking fruit pulp in order to remove the water content from the product.

i. Decanting
ii. Aeration
iii. Pulping
iv. Concentration

b. Two methods of sterilising in fruit processing industry are _____ and _____.

i. boiling and retort
ii. retort and tube-in-tube
iii. tube-in-tube and boiling
iv. boiling and concentration

c. The functions of a package are to _____ the quality and freshness of food, to add appeal to the food to attract consumers, and to facilitate its storage and distribution.

i. preserve
ii. enhance
iii. maintain
iv. restore

d. Packaging undertaken in a germ-free environment is called _____ packaging.

i. homogenised
ii. germ-free
iii. sterilised
iv. aseptic

e. De-canting is a _____ process in which all rotten fruit particles are removed.

i. filtering
ii. aeration
iii. sterilisation
iv. aseptic

f. Clarification refers to the process of _____ from the extracted juice.

i. adding water
ii. adding syrup
iii. removing specks
iv. removing salt

g. Full form for HTST is _____.

i. High Terminal Short Time
ii. High Temperature Short Temperature
iii. High Tempo Short Time
iv. High Temperature Small Time

h. Enzymes are _____ that regulate chemical reactions within food products.

i. filtering
ii. aeration
iii. proteins
iv. aseptic

i. Pasteurisation is a _____ method used in food industry for milk and juices.

i. filtering
ii. preservation
iii. heating
iv. aseptic

j. _____ is made from fruit juice and fruit pulp with additives, sugar, acid and preservatives.

i. Squash
ii. Cordial
iii. Juice
iv. Soft drink

**2. Arrange the following in the correct sequence**

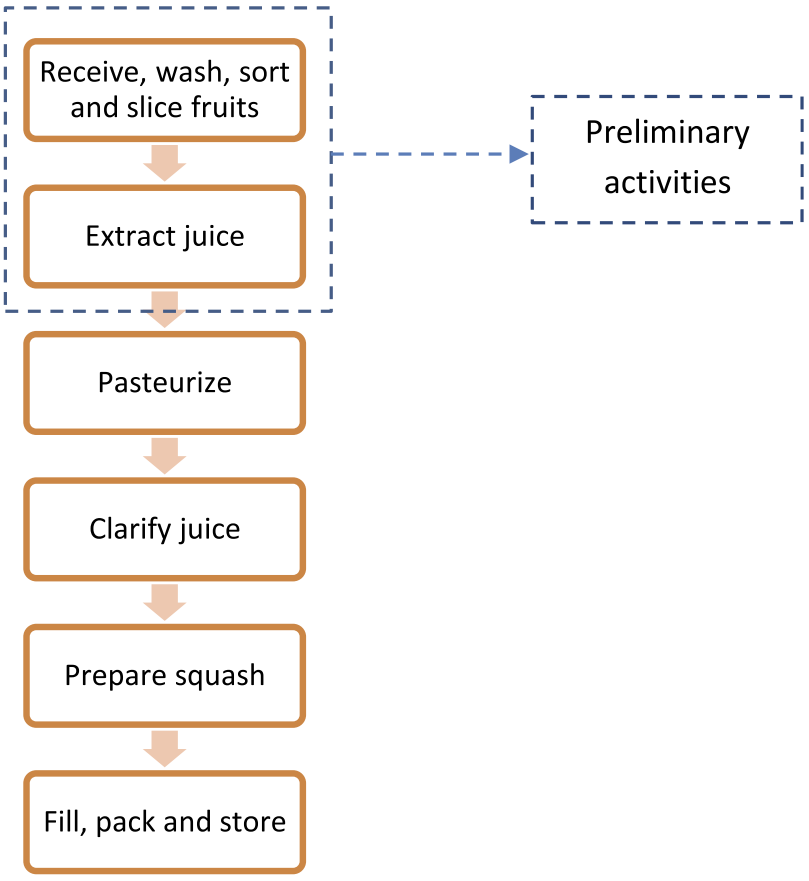
| Production sequence | Order the steps (as 1, 2, 3, 4, 5, 6, 7 and 8) |
|---|---|
| a. Fruit selection | |
| b. Blanching | |
| c. Washing | |
| d. Aseptic packaging | |
| e. Clarification | |
| f. Decanting | |
| g. Concentration | |
| h. Pasteurisation | |

## Practical-1

**Pre-requisite knowledge:**

- Produce Squash and Juice.

**Method:**




*Squash and juice making process*

1. Pasteurize the extracted juice at 80-95°C for 10 – 20 minutes using a pasteuriser.
2. Next do hot-filling into bottles.

**Precautions:**

- Ensure pasteurisation is done at the recommended temperature and time.

**Observation:**

| Sr no | Name of fruit and pulp | Pasteurization temperature | Pasteurization time |
|---|---|---|---|
| 1 | | | |
| 2 | | | |
| 3 | | | |
| 4 | | | |
| 5 | | | |

**Conclusion:**

Write your conclusion of the practical.

| Sr no | |
|---|---|
| 1 | |
| 2 | |
| 3 | |
| 4 | |
| 5 | |

Skill India
कौशल भारत-कुशल भारत

सत्यमेव जयते
GOVERNMENT OF INDIA
MINISTRY OF SKILL DEVELOPMENT
& ENTREPRENEURSHIP

N·S·D·C
National
Skill Development
Corporation
Transforming the skill landscape

FICSI
Food Industry Capacity and Skill Initiative

# 5. Food and Safety, Hygiene and Sanitation

Unit 5.1 – Sanitation and Hygiene

Unit 5.2 – Safety Practices

Unit 5.3 – Good Manufacturing Practices (GMP)

Unit 5.4 – Hazard Analysis and Critical Control Point (HACCP)

FIC/N9001

## Key Learning Outcomes

**By the end of this module, participants will be able to:**

1. State the personal hygiene and sanitation guidelines
2. State the food safety and hygiene standards to follow in a work environment
3. List the different sanitisers used in the process area and equipment
4. Follow health and safety practices in the work area
5. State the importance of safety, hygiene, and sanitation in the food processing industry
6. Follow the industry standards to maintain a safe and hygiene workplace
7. State the storage and stock rotation norms
8. Follow HACCP principles to eliminate food safety hazards in the process and products

# UNIT 5.1: Sanitation and Hygiene

## Unit Objectives

**By the end of this unit, participants will be able to:**

1. State the personal hygiene and sanitation guidelines to follow in a work environment
2. State the food safety and hygiene standards to follow in a work environment
3. List the different sanitisers used in the process area and equipment

## 5.1.1 Personal Sanitation

Sanitation and hygiene are the most important aspects to take care of when working in a food processing area. Some important sanitation and hygiene practices that must be followed are:

Maintain a high standard of personal cleanliness viz. have a bath every day and wear clean clothes to work.

Wear Personal Protective Equipment (PPE) such as aprons, mouth mask, head cover, face mask, hand gloves, gum boots, and beard cover mask at all times during work hours.

Always keep your finger nails trimmed.

Always keep your hair trimmed and wear a hair net while working.

*Fig. 5.1.1. Personal sanitation*

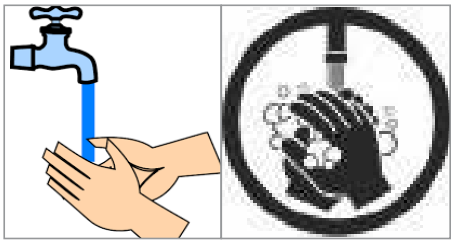


*Fig. 5.1.2. Washing hands with soap and water*

Wash your hands and feet at the designated area or wash stations provided.

Wash your hands with soap and water each time before you enter the production area.

Refrain from smoking, spitting, chewing paan, sneezing or coughing over any food when in the production area.

Do not handle food when suffering from a disease, illness, burns, injury or infection.

*Fig. 5.1.3. Do not smoke, spit, cough*

*Fig. 5.1.4. Timely medical treatment*

Take proper and timely medical treatment when you are ill or if you have met with an accident.

Visit a registered medical practitioner at regular intervals to keep a check on your health.

**Scan the QR code to watch the related videos**

https://youtu.be/gNEx8P9UqPA

Personnel Hygiene & Personal Behaviour

## Notes

# UNIT 5.2: Safety Practices

## Unit Objectives

**By the end of this unit, participants will be able to:**

1. Follow health and safety practices in the work area

## 5.2.1 Symbols

There are some symbols that you must know and understand to ensure safety in case of an emergency or fire. They are:

Caution

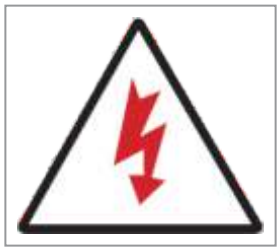
Danger Fragile Roof

Dangerous Chemicals

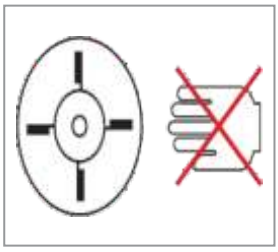
Do Not Enter

Danger Scaffolding Incomplete

Beware of Electric Shock



Electric Hazard

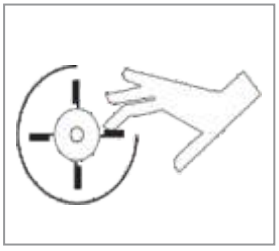


Never put your Hand Inside During the Operation

Highly Flammable

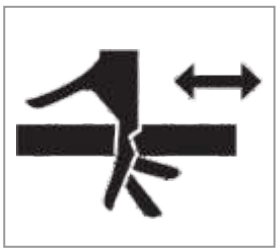
Hot Surface Do Not Touch

Mind Your Head



Never Open the Cover During the Operation

Use the Dustbin



Never Touch Moving Part

Wear Eye Protection

Wear Protective Clothing

Warning Slippery Floor

This is a Tobbacco Free Workplace

Assembly Point


Fire Exit

*Fig. 5.2.1. Safety symbols*

## 5.2.2 Emergency Measures

During an emergency, you must follow certain measures to tackle the situation in an organised manner. These measures are:

- Do not panic
- Respond to your senior immediately or inform the matter to the concerned person
- Prepare against the emergency situation by keeping a fire bucket and a water source handy
- Evacuate the work area

After the emergency, you must:

- Report the situation to a senior or the concerned authority
- Undertake recovery measures

**Fire Safety Measures**

Just like emergency measures, some common fire safety measures must be followed in case of a fire. They are:

- Press the closest fire alarm button (if available)
- Call the fire brigade
- Assemble at the assembly point or designated area for safety
- Evacuate the building from the closest fire exit

## Types of Fire and Fire Extinguishers

| Choosingtherightextinguishercanpreventproperty damageandsavelives | | | | |
|---|---|---|---|---|
| TypesofFireExtinguishers → / Types of Fire ↴ | Water | Foam | $CO_2$ | Dry Chemical |
| Class A: Paper, Wood, Plastic Fabric, Rubber, Trash | ✓ | ✓ | ✗ | ✓ |
| Class B: Oil, Petrol, Some Paints and Solvents | ✗ | ✓ | ✓ | ✓ |
| Class C: Electrical Equipment, Appliances, Computers | ✗ | ✗ | ✓ | ✓ |

*Fig. 5.2.2. Types of fire and fire extinguishers*

## How to use the Fire Extinguisher?

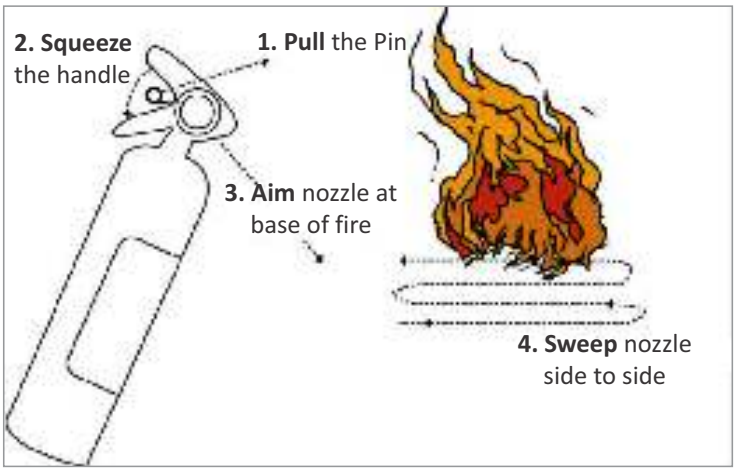



*Fig. 5.2.3. Fire extinguisher*

## How to use the Fire Buckets?

Use the fire bucket filled with sand/water → Dump the sand/ water on the fire → Refill the fire buckets


*Fig. 5.2.4 fire Buckets*

# UNIT 5.3: Good Manufacturing Practices (GMP)

## Unit Objectives

**By the end of this unit, participants will be able to:**

1. State the importance of safety, hygiene, and sanitation in the food processing industry
2. Follow the industry standards to maintain a safe and hygiene workplace
3. State the storage and stock rotation norms

## 5.3.1 Good Manufacturing Practices (GMP)

GMP is a set of guidelines proposed by the Food Safety Standards Authority of India (FSSAI) to ensure the production of high quality and safe processed foods. It requires a qualitative approach towards manufacturing to reduce chances of microbial contamination, spoilage, and errors.

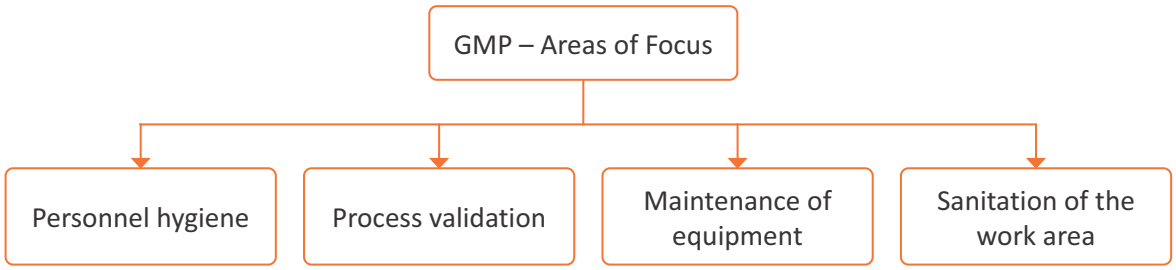



*Fig. 5.3.1. Good manufacturing practices (GMP)*

| Area of focus | GMP |
|---|---|
| **Personnel hygiene**<br>  <br>*Fig. 5.3.2. Personnel hygiene*<br>  <br>*Fig. 5.3.3. Facilities for toilets* | • Your organisation follows strict hygiene and sanitation guidelines<br>• You are provided training on Good Manufacturing Practices (GMP)<br>• You are in a sound health condition during working hours<br>• You follow high standards of cleanliness<br>• Your processing unit has enough facilities for toilets and wash stations |
| **Sanitation of the work area**<br>  <br>*Fig. 5.3.4. Designated area for keeping utensils*<br>  <br>*Fig. 5.3.5. Sanitation of the work area* | • The processing unit where you work is located in a clean, pollution-free area<br>• The entire processing unit is well ventilated and has adequate lighting<br>• The entire work area follows high standards of cleaning and sanitisation<br>• There is a designated area for keeping utensils and equipment. It is kept clean and pest-free at all times |

**Equipment maintenance**

*Fig. 5.3.6. Equipment maintenance*


*Fig. 5.3.7. Monthly schedule*

- The equipment used for processing foods is protected against contamination from lubricants, metal fragments, fuel, and contaminated water
- The cleaning and maintenance of tools, materials, and equipment is an easy process
- The organisation follows a cleaning and sanitising drill as per daily, weekly, and monthly schedules

**Process validation**

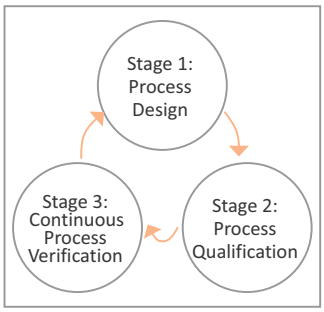



*Fig. 5.3.8. Process validation*

*Fig. 5.3.9. Quality checks*

- All processes of production, like raw material procurement, execution, storage, packaging, and logistics follow strict organisational parameters
- Quality checks are conducted at each step of production. This helps to ensure that food quality is maintained as per prescribed norms and standards
- The stock rotation of finished product follows the FEFO and FIFO methods. This is to ensure that there is a minimum chance of food spoilage. It will also help to retain the taste of processed foods

**Scan the QR code to watch the related videos**

https://youtu.be/RS4A-uczS6E

Good Manufacturing, Hygiene Practices and Food Safety Management Systems.

# UNIT 5.4: Hazard Analysis and Critical Control Point (HACCP)

## Unit Objectives

**By the end of this unit, participants will be able to:**

1. Follow HACCP principles to eliminate food safety hazards in the process and products

## 5.4.1 What is HACCP?

Hazard Analysis and Critical Control Point (HACCP) is an international food safety regulation that is followed to reduce the risk of hazards in a food processing unit. It is a system that identifies possible hazards and controls them at various points of the production process. The HACCP is based on seven principles. They are:

**Conduct a hazard analysis**

- Evaluate the production process and identify the points where hazards (physical, chemical, and biological) may be introduced

**Identify critical control points**

- Identify the critical points in the process plan where a hazard may occur
- Plan preventive measures at that critical point to control the risk

**Establish critical limits**

- State the boundary line between safe and unsafe processes
- State the limit until which a critical point maybe controlled

**Establish a monitoring system**

- State the process of monitoring critical points and critical limits

**Establish corrective measures**

- Specify the corrective actions that should be followed when critical limits are crossed

**State verification procedures**

- State the verification process to check whether HACCP principles are applied and followed
- Test the HACCP plan and ensure compliance on a regular basis
- Check whether the HACCP plan helps to prevent hazards effectively

**Follow record-keeping procedures**

- Keep records of all the critical points
- Maintain a log of situations when critical limits were exceeded
- State the corrective measures that were applied
- Include records of the development and maintenance of the system

*Fig. 5.4.1. What is HACCP*

**Example of an HACCP Plan**

| Operationalstep | Hazard | Control measure | Criticallimit | Monitoring method | Corrective action | Responsibility | Record |
|---|---|---|---|---|---|---|---|
| Procurement of raw material | Physical (dirt, stone particles) | Supplier guarantee specifications established by quality assurance department | As per company internal specifications | Supplier guarantee certificate is visually confirmed | Reject materials if not accompanied by supplier guarantee | Store manager | Supplier guarantee |
| | Chemical (toxins, pesticides from raw material) | Relative humidity of the store to be maintained | | | | | |
| | Microbiological (high microbiological load of raw materials, presence of pathogenic bacteria) | FIFO system should be established | | Monitor temperature and humidity of storage | | | Store temperature logs |

## Notes

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# 6. Complete Documentation and Record Keeping Related to Production of Squash and Juice

FICSI
Food Industry Capacity and Skill Initiative

Unit 6.1 – Documentation and Record Keeping

FIC/N0104

## Key Learning Outcomes

**By the end of this module, participants will be able to:**

1. State the need for documenting and maintaining records of raw materials, process, and finished products
2. State the method of documenting and recording the details of raw material to final finished product
3. Observe the various facilities, machineries in the food processing industry

# UNIT 6.1: Documentation and Record Keeping

## Unit Objectives

**By the end of this unit, participants will be able to:**

1. State the need for documenting and maintaining records of raw materials, process, and finished products
2. State the method of documenting and recording the details of raw material to final finished product

## 6.1.1 Need for Documentation

Every organisation has to maintain records of raw material procurement, production processes, and sales. This is to ensure that the business runs effectively and is profitable. Listed below are some reasons why there is a need for documentation:

- It gives detailed knowledge about running of the business.
- It helps to control product quality.
- It helps to keep track of the money invested in the business.
- It helps to identify the separate costs of raw material or product ingredients.
- It helps to identify the production cost of a particular process.
- It helps to ensure that quality assurance procedures are followed.
- It helps to ensure that the production unit is running smoothly/effectively.
- It works as an evidence for legal procedures.
- It helps to set an appropriate product price.
- It helps to take corrective measures at the right time.

## 6.1.2 How to Keep Records?

Every food processing organisation follows a more or less similar way of keeping records. Production records keep a log of:

- The quantity and type of raw materials
- The quantity and type of ingredients used
- The processing conditions in which production took place (e.g. the temperature set or the air pressure applied)
- The product quality

Product quality can be maintained only when:

- The same quantity and quality of ingredients and raw materials are mixed in every batch
- A standard formulation is used for every batch
- Standard process parameters are applied for every batch

Every batch of food is given a batch number. This number is recorded in:

- Stock control books (where raw material procurement is noted)
- Processing log books (where production process is noted)
- Product sales records (where sales and distribution is noted)

The batch number must correlate with the product code number, which is printed on labels. This helps the processor to trace any fault found in a batch back to the raw material used or the production process.

Example of a stock control book:

| • Product Name | | | • Batch Number | |
|---|---|---|---|---|
| • Raw material | • Supplier | • Results of inspection for: | | |
| | | A | B | C |
| | | | | |
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**Scan the QR code to watch the related videos**

https://youtu.be/kcpGlHBpphA

Audit, Documentation & Record Keeping

## Exercise

**1. Tick the correct options**

a. What is the need for documentation?

- i. It gives detailed knowledge about the running of a business. ☐
- ii. It helps to control product quality. ☐
- iii. It helps to keep track of the money invested in the business. ☐
- iv. It helps to identify the separate costs of raw material or product ingredients. ☐
- v. It helps to identify the production cost of a particular process. ☐
- vi. It helps in raw material storage. ☐
- vii. It helps to ensure that quality assurance procedures are followed. ☐
- viii. It helps to ensure that the production unit is running smoothly/effectively. ☐
- ix. It works as an evidence for legal procedures. ☐
- x. It helps to clean the food handling equipment and machineries. ☐
- xi. It helps in sending the produce to the market. ☐
- xii. It helps to set an appropriate product price. ☐
- xiii. It helps to take corrective measures at the right time. ☐

b. Production records keep a log of _____ .

- i. the quantity and type of raw materials. ☐
- ii. the amount of finished products stored. ☐
- iii. the quantity and type of ingredients used. ☐
- iv. the processing conditions in which production took place (e.g. the temperature set or the air pressure applied). ☐
- v. the product quality. ☐

**2. Match the columns**

| Column A | Column B |
|---|---|
| a. Every production process completed is given a number | i. Stock control books |
| b. The details of raw material procurement is noted | ii. Batch number |
| c. The details of production process is noted | iii. Quality procedures are followed |
| d. The details of product sales is recorded | iv. Legal evidence |
| e. Records serve as | v. Processing log books |
| f. Properly maintained records help to identify whether | vi. Sales and distribution log |

**3. Complete the process of documentation and maintaining records of production and finished products. Fill in the blanks with the correct options given below.**

a. Document and maintain the records of _____.

b. Document the finished products details _____.

c. Maintain the record of _____ related to finished products.

d. Verify the documents and _____ in case of quality concerns and for quality management system audit.

e. Document process details such as type of raw material used, process parameters (temperature, time, etc. as applicable) for entire process handled _____ for all products produced.

**Options:**

1. In process chart or production log
2. As per company standards
3. Finished products
4. Track from finished product to raw materials
5. Observations or deviations (if any)

# 7. Employability Skills

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# 8. Annexure

## Annexure

| Chapter Name | Unit Name | Topic Name | URL | Pg. No. | QR Code |
|---|---|---|---|---|---|
| Chapter 1: Introduction | Unit 1.2: Introduction to the Food Processing Industry | 1.2.1 Food Processing<br>1.2.2 Journey of Food from Harvest to Consumer | https://youtu.be/wMu0EpUgCd4 | 07 | Introduction to the Food Processing Industry |
| | Unit 1.3: Introduction to Fruit and Vegetable Processing | 1.3.1 Overview of the Fruit and Vegetable Sub-Sector | https://youtu.be/iacTHJtrXIE | 10 | Overview of the Fruit and Vegetable Sub-Sector |
| | Unit 1.4: Orientation Video of Squash and Juice Processing Technician | 1.4.1 Beverage Industry | https://youtu.be/_bs_--89szA | 16 | Orientation Video - Squash and Juice Processing Technician |
| Chapter 2: Prepare and Maintain Work Area and Process Machineries for Squash and Juice Processing | Unit 2.2: Sanitisation of the Work Area | 2.2.1 Cleaning & Sanitizing Work Area, Machinery, Tools, and Equipment | https://youtu.be/QWpU7DAfNcs | 25 | Hygiene and sanitation Practices |

## Annexure

| | | | | | |
|---|---|---|---|---|---|
| Chapter 4: Produce Squash and Juice | Unit 4.4 Filling, Packing and Storage of Juice and Squash | Food Packaging | https://youtu.be/osA74cAqMLc | 73 | Introduction to Packaging |
| | Unit 4.5: Post Production Cleaning and Maintenance | 4.5.1 Post Production Cleaning of Work Area and Machinery | https://youtu.be/CD0XLUutibk | 81 | Cleaning Facilities |
| | | 4.5.3 Waste Management | https://www.youtube.com/watch?v=nrEOtxjwKsQ | 85 | Waste Management |
| Chapter 5: Food and Safety, Hygiene and Sanitation | Unit 5.1: Sanitation and Hygiene | 5.1.1 Personal Sanita | https://youtu.be/gNEx8P9UqPA | 92 | Personnel Hygiene & Personal Behaviour |
| | Unit 5.3: Good Manufacturing Practices (GMP) | 5.3.1 Good Manufacturing Pracitices | https://youtu.be/RS4A-uczS6E | 97 | Good Manufacturing Practices, Good Hygiene Practices and Food Safety Management Systems. |

## Annexure

| | | | | | |
|---|---|---|---|---|---|
| Chapter 6: Complete Documentation and Record Keeping Related to production of Squash and Juice | Unit 6.1 – Documentation and Record Keeping | 6.1.1 Need for Documentation | https://youtu.be/kcpGlHBpphA | 104 | Audit, Documentation & Record Keeping |
| | | 6.1.2 How to Keep Records? | https://youtu.be/kcpGlHBpphA | | |

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