



Participant Handbook

Sector
Food Processing

Sub-Sector
Fruits and Vegetables

Occupation
Processing

Reference ID: FIC/Q0103, Version 1.0
NSQF Level-4



**Jam, Jelly and Ketchup
Processing Technician**

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Shri Narendra Modi
Prime Minister of India

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



Certificate

CURRICULUM COMPLIANCE TO QUALIFICATION PACK – NATIONAL OCCUPATIONAL STANDARDS

is hereby issued by the

FOOD INDUSTRY CAPACITY AND SKILL INITIATIVE (FICSI)

for the

MODEL CURRICULUM

Complying to National Occupational Standards of
Job Role/Qualification Pack: '**Jam, Jelly and Ketchup Processing Technician**'
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About this book

In India, the food sector has emerged as a high growth and high profit sector. Food and grocery account for about 31% of India's consumption basket. The Indian food and grocery market is the world's sixth largest. A jam, jelly and ketchup processing technician has huge employment opportunities.

This Participant Handbook is designed to enable theoretical and practical training to become a jam, jelly and ketchup processing technician. The qualification pack of a jam, jelly and ketchup processing technician includes the following National Occupation Standards which have been all covered in this Participant Handbook

1. Prepare and maintain work area and process machineries for jam, jelly and ketchup processing
2. Prepare for production of jam, jelly and ketchup
3. Produce jam, jelly and ketchup
4. Complete documentation and record keeping related to production of jam, jelly and ketchup.
5. Food safety, hygiene and sanitation for processing food products

This Participant Handbook is designed considering the minimum education qualification of a Jam Jelly and Ketchup processing technician is preferably 8th standard. The Key Learning Objectives and the skills gained by the participant are defined in their respective units. The participant will be able to produce Jam Jelly and Ketchup in fruit processing units. He will also be able to follow food safety practices, hygiene and sanitation for processing food products. We hope that this Participant Handbook will be able to provide a sound learning support to our young friends to aspire to build their career in the food processing sector

Symbols Used



Key Learning
Outcomes



Steps



Time



Tips



Notes



Unit
Objectives

UNIT 1.4: Jam, Jelly, and Ketchup Processing Processes

Unit Objectives

At the end of the session, you will be able to:

- Describe the processing of Jam
- Describe the processing of Jelly
- Describe the processing of Ketchup

Unit 1.4.1: Terminology Used in Process

- TSS (Total Soluble Solids): It is the extracted mass of fruit, which contains fibres and fruit sugar.
- Refractometer: It is a tool used for measuring TSS.
- pH indicator: A numeric scale to check acid levels in pulp/juice. It is between 2.5 to 4.

Unit 1.4.2: Jam

Jam is a product made by boiling fruit pulp with sufficient sugar to a reasonably thick consistency, firm enough to hold the fruit tissues in position, Apple, pear, sapota (chiku), apricot, loquat, peach, papaya, karonda, carrot, plum, straw- berry, raspberry, mango, tomato, grapes and muskmelon are used for preparation of jams. It can be prepared from one kind of fruit or from two or more kinds. Commercial jams such as tutti-frutti can be prepared from pieces of fruit, fruit scraping and pulp adhering to cores of fruits which are available in plenty in canning factories. Jam contains 0.5-0.6 per cent acid and invert sugar should not be more than 40 per cent.

Fig 1.14

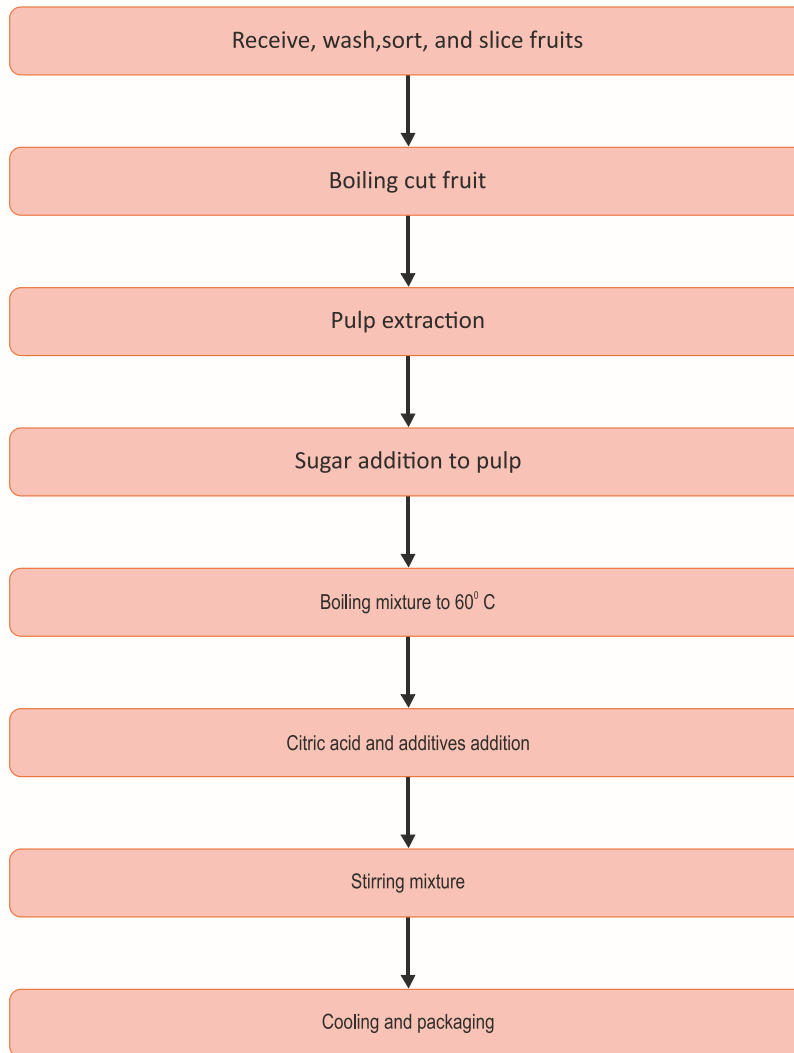


Unit 1.4.2: Jam

Overview of Processing Process

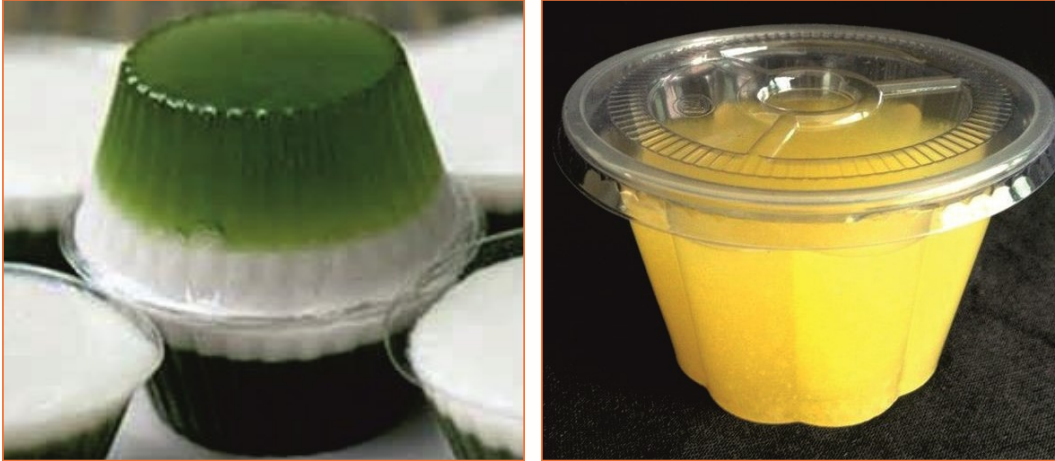
1. Jam processing process is as follows:

Fig 1.15



Unit 1.4.3: Jelly

Fig 1.16



A jelly is a semi-solid product prepared by boiling a clear, strained solution of pectin containing fruit extract, free from pulp, after the addition of sugar and acid. A perfect jelly should be transparent, well-set, but not too stiff, and should have the original flavour of the fruit. It should be of attractive colour and keep its shape when removed from the mould. It should be firm enough 'to retain a sharp edge but tender enough to quiver when pressed. It should not be gummy, sticky or syrupy or have crystallized sugar. The product should be free from dullness, with little or no syneresis (weeping), and neither tough nor rubbery.

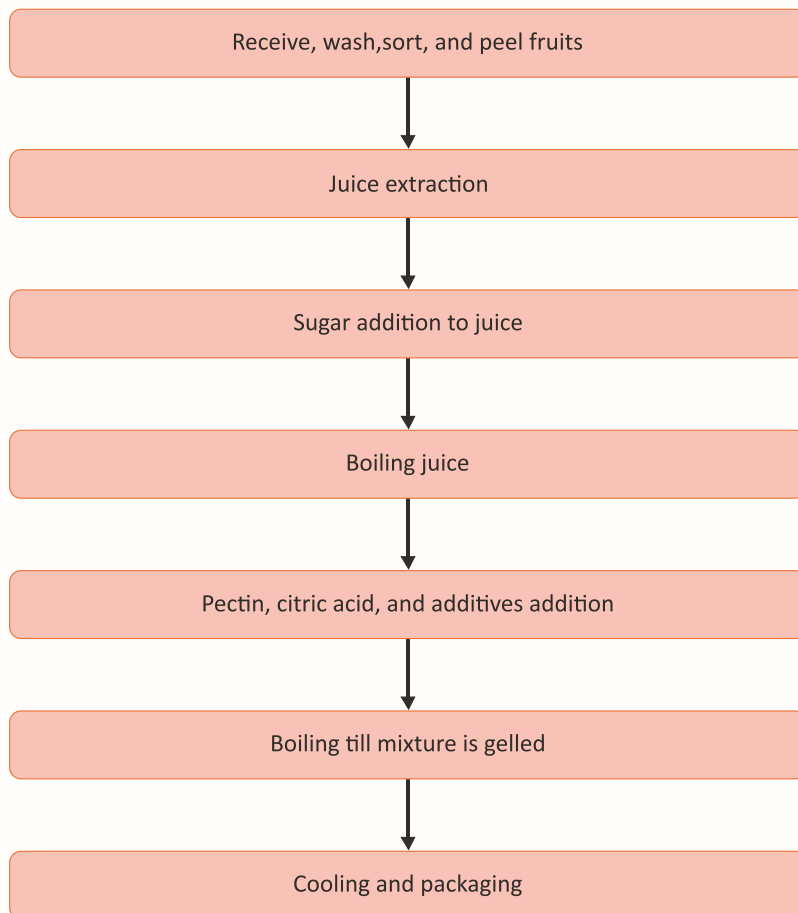
According to their pectin and acid contents:

1. Rich in pectin and acid: Sour and crab apple, grape, sour guavas, lemon, oranges (sour), plum (sour), jamun.
2. Rich in pectin but low in acid: Apple (low acid varieties), unripe banana, sour cherry, fig (unripe), pear, ripe guava, peel of orange and grapefruit.
3. Low in pectin but rich in acid: Apricot (sour), sweet cherry, sour peach, pineapple and strawberry.
4. Low in pectin and acid: Ripe apricot, peach (ripe), pomegranate, rasp berry, strawberry and any other over-ripe fruit.

Unit 1.4.3: JELLY

Jelly processing process is as follows:

Fig 1.17



Unit 1.4.4: Ketchup

It is made from strained tomato juice or pulp and spices, salt, sugar and vinegar, with or without onion and garlic, and contains not less than 12 per cent tomato solids and 25 per cent total solids

Ketchup processing process is as follows:

Fig 1.18

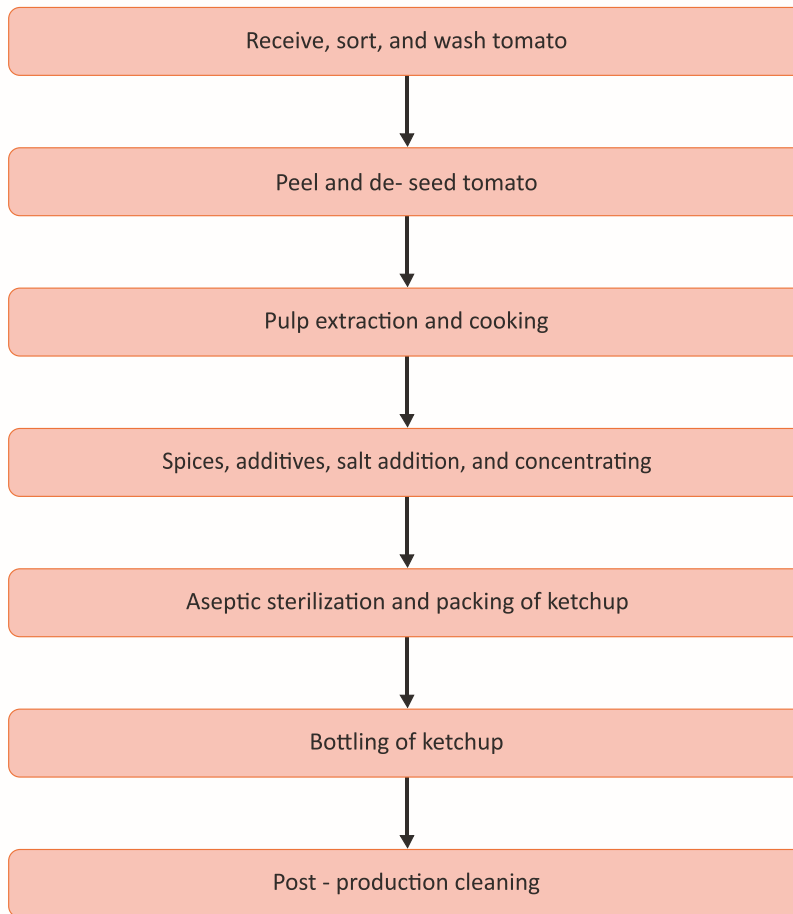


Fig 1.19



UNIT 4.6: Production Processes

Unit Objectives

At the end of the session, you will be able to:

- Explain the processing of jam ;
- Explain the processing of jelly;
- Explain the processing of ketchup.

Unit 4.6.1: Processing of Jam

Following are the steps for jam processing:

1. Selection of fruit
2. Washing of fruit
3. Peeling and washing
4. Deseeding/mango tip cutting and destining/core cutting
5. Separation of segments
6. Cutting/slicing
7. Blanching/heating
8. Fruit pulp extraction by crushing
9. Decanting
10. De-aeration of pulp
11. Cooking
12. Mixing sugar
13. Boiling to 60°C
14. Addition of citric acid and additives (pectin if required)
15. Cooking and stirring till setting consistency
16. Cooling
17. Aseptic packaging
18. Labelling
19. Storage

Unit 4.6.2: Processing of Jelly

Following are the steps for jelly processing:

1. Selection of fruit
2. Washing of fruit
3. Peeling and washing
4. Deseeding/mango tip cutting and destining/core cutting
5. Separation of segments
6. Cutting/slicing
7. Blanching/heating
8. Fruit juice extraction by crushing/squeezing
9. Decanting
10. Clarification of juice
11. Boiling juice
12. Mixing sugar syrup
13. Cooking the mixture
14. Addition of citric acid, pectin, and additives
15. Stirring and heating till setting consistency
16. Cooling
17. Aseptic packaging
18. Labelling
19. Storage

Unit 4.6.3: Processing of Ketchup

Following are the steps for Ketchup processing:

1. Selection of tomato
2. Washing of tomato
3. Blanching/heating
4. Crushing/squeezing
5. Extraction of raw tomato puree/pulp
6. Deseeding and separation of segments
7. Decanting
8. De-aeration
9. Cooking of pure tomato puree/pulp
10. Addition of spices, seasonings, acetic acid, and additives
11. Boiling of mixture
12. Addition of salt
13. Cooking till done
14. Cooling
15. Aseptic packaging
16. Labelling
17. Storage

UNIT 4.7: Enzyme Activity

Unit Objectives

At the end of the session, you will be able to:

- Describe enzyme activity in fruit processing;
- Describe pectin's role.

Unit 4.7.1: Enzyme

Enzymes are a type of proteins that regulate chemical reactions within food products. Enzymes enhance in transformation of food flavour, colouring, and shelf life. Hence, it is necessary to know the types of enzymes naturally occurring in a particular fruit.

Unit 4.7.2: Enzyme activity

The chemical substance called substrate on which enzymes act and the conditions governing its activity are important. The enzymes used are break down cells walls and release the liquids and sugars, which make up the fruit.

Unit 4.7.3: Enzymes used

Pectinases, amylases and celluloses are commonly used enzymes that break down different structures of the fruit cells and affect the extraction process in different ways.

Pectin is the commonly used substance for setting of jam and jelly. It is naturally present in fruits, which is extracted by dilution method. To the fruit minimum quantity of water is added and boiled and pectin is extracted.

UNIT 4.8: Procedures Involved in Juice/ Pulp Extraction

Unit Objectives

At the end of the session, you will be able to:

- state the procedures used to extract the fruit and vegetable juice/pulp.

Unit 4.8.1: Decanting:

It is a filtering/removal process. All the rotten fruit particles (black and brown skin and extraneous matter), larva, eggs, sand from the fruit extract, etc. is separated out. The extracted fruit pulp is raw, pure fruit pulp. It is done by centrifugation process. The raw extracted pulp is rotated at high speed to remove the layer of black specks and unwanted particles.

Unit 4.8.2: De-aeration

It is a process of expelling air from the product before sterilization and filling.

In crushing, pressing, separation, and decanting, the raw fruit pulp extract is subjected to considerable aeration. The inclusion of oxygen can promote enzymatic browning, destroy nutrients, modify flavour, and otherwise damage quality. Hence, ensure caution and care to protect the material.

Unit 4.8.3: De-aeration methods

1. **Rapid heating and heated pulp transferred into a vacuum chamber:** Rapid heating at high temperature removes some undesirable volatile aroma and air. The heated pulp is passed into vacuum chamber for storing/further processes.
2. **Inert gas bubbling:** In the extracted, raw, pre-cooked pulp, nitrogen or carbon dioxide gas is bubbled prior to storing it under an inert atmosphere. After the removal of air, pulp needs protection from the atmosphere in all subsequent processing steps. It is done in vacuum conditions with the aid of a pump.

Unit 4.8.4: Concentration

It is a process to cook fruit pulp in order to remove water content from the product. The fruit pulp is boiled, and it becomes thick after water evaporates from it. The processed fruit pulp is called concentrate. It is done in an evaporator under controlled conditions of pulp flow, temperature, and boiling time. Low temperature evaporators operate at a maximum temperature of 50°C.

Unit 4.8.5: Clarification

It is a process of ultrafiltration in which quantities of tartar cream is used. Certain specks that are not removed during decanting are removed. The process is carried out in two ways:

Freezing	Heating
<ul style="list-style-type: none">• Precipitation of juice• The bottle of juice is refrigerated so as to complete precipitation• The tartar crystals settle down leaving clear liquid on top• Example: Apple juice	<ul style="list-style-type: none">• Rapid heating to about 180°C followed by sudden cooling• It is one in flash heaters to avoid oxidation• After rapid heating and cooling the liquid is passed through a filtering material• Example: Pomegranate juice

UNIT 4.9: Pasteurization of Fruit and Vegetable Juice/Pulp

Unit Objectives

At the end of the session, you will be able to:

- Describe pasteurization process for fruit processing industry.

Unit 4.9.1: Pasteurization

It is a process in which foods heated at specific temperature and time to kill (or deactivate) some number of potentially harmful bacteria. Pasteurization is a preservation method used in food industry for milk and juices.

Unit 4.9.2: Methods of Pasteurization

Optimum temperature and time used for pasteurization of juices and squashes is 185°C. It is done in two ways:

- High Temperature Short Time (HTST): Juice is heated at high temperatures for short time
- Low temperature Long Time (LTLT): Juice is heated at low temperature for a long time

Given below are three methods of pasteurization:

1. In-The-Bottle/Holding

- Filtered juice filled in expandable bottles with proper heads, sealed airtight, and pasteurized
- LTLT way of pasteurization is used

2. Overflow

- Juice is heated 50°C above pasteurization temperature
- This heated liquid is filled in hot sterilized bottles up to brim and after sealed
- Sealed bottles pasteurized at 50°C lower temperature filling
- On cooling the bottles contract leaving no air space in between
- HTST way of pasteurization is used

3. Flash

- The juice is heated 10°C above pasteurization temperature for a minute
- The liquid filled in air tight container and sealed in steam cover for sterilized sealing
- It is cooled at room temperature
- HTST way of pasteurization is used

UNIT 4.10: Sterilization of Fruit and Vegetable Juice/Pulp

Unit Objectives

At the end of the session, you will be able to:

- Describe sterilization process for fruit processing industry;
- State the methods of sterilizing fruit juice.

Unit 4.10.1: Sterilization Process

It is a process to kill all harmful microorganisms present in the product. It is done to increase the product life.

Methods of sterilizing the fruit juice

Given below are two methods used for sterilization in fruit processing industry:

Table 4.4

Retort	Tube-in-tube
Batch process	Continuous process
Filled cans are put on a rack and loaded into a retort	Passed through a series of tubes placed within a tube
Steam is trapped in the retort	Steam is passed through the outer tube
Sterilization technique is done on basis of cooking in a cooker	High Temperature Short Time (HTST) technique used for sterilization
Cooling is done separately	Cooling is done by extension of tube at filling temperature

UNIT 4.11: Quality Analysis

Unit Objectives

At the end of the session, you will be able to:

- State the quality control of a product;
- List the quality parameters of fruit pulp, juice, jam, jelly, and ketchup;
- List the various faults in jellies;
- List the corrective measures for the faults in jellies.

Unit 4.11.1: Quality Control

It is an optimum standard maintained continuously as per the company standard norms to produce a quality product along with specific guidelines from the as per government. If the quality standards are not maintained, then it could lead to fatal consequences. be harmful for health

Unit 4.11.2: Quality parameters

1. Fruit juice

Every step involved in the process requires monitoring inclusive of food safety and personal hygiene. In fruit juice, quality check is done on the basis of technical specification and organoleptic, which differ from fruit to fruit. The most important parameter to control is pH level as the juice is natural and without any additives.

1. **pH:** Each fruit has its own acidity level. The processing company maintains it as per their requirement.
2. **TSS:** Each fruit product has its own Brix ratio. The processing company maintains it as per their requirement.
3. **Consistency:** It is measured by refractometer as per the need
4. **Taste/flavour, colour, and texture:** It is checked by tasting the juice

2. Fruit pulp

1. **pH:** Each fruit has its own acidity level. The processing company maintains it as per their requirement.
2. **TSS:** Each fruit product has its own Brix ratio. The processing company maintains it as per their requirement.
3. **Viscosity:** It is measured by refractometer as per the need
4. **Taste/flavour, colour, and texture:** It is checked by tasting