

## Principle of Jelly Formation

Jelly is a clear, semi-solid fruit product prepared by cooking fruit juice with sugar and acid under controlled conditions. The formation of jelly mainly depends on the proper balance of pectin, sugar, and acid, which together create the gel structure. When these three components are present in the right proportion and the mixture is heated and cooled properly, a stable gel is formed.

### 1. Pectin

Pectin is a natural complex carbohydrate (polysaccharide) present in the cell walls of many fruits. It plays the most important role in the formation of jelly. When dissolved in water and combined with sugar and acid under suitable conditions, pectin molecules form a three-dimensional network that traps the liquid and produces the characteristic jelly texture.

Fruits such as apple, guava, citrus fruits, and grapes are naturally rich in pectin and are highly suitable for jelly making. However, fruits like mango, papaya, strawberry, and pineapple contain low amounts of pectin, and therefore additional commercial pectin may need to be added during preparation. The pectin content is usually higher in slightly unripe fruits and decreases as the fruit becomes fully ripe.

### 2. Sugar

Sugar performs several important functions in jelly preparation. It helps in gel formation, improves taste, and acts as a preservative. Sugar reduces the solubility of pectin in the juice and promotes the formation of a gel network. It also binds with water molecules, thereby lowering water activity and preventing the growth of microorganisms.

Generally, the proportion of sugar used in jelly preparation is about 60–65% of the final product. This concentration provides the proper consistency, sweetness, and shelf stability. Too little sugar may prevent proper gel formation, while excessive sugar may lead to crystallization or an overly stiff jelly.

### 3. Acid

Acid is another essential component required for proper jelly formation. It helps to reduce the pH of the mixture to around 3.0–3.5, which is the optimum range for pectin to form a stable gel. Acid neutralizes the negative charges present on pectin molecules, allowing them to come closer and form a network structure.

Common acids used in jelly preparation include citric acid, tartaric acid, or lemon juice. In addition to aiding gel formation, acid also enhances the flavor, color, and preservation of the jelly.

### Mechanism of Gel Formation

When fruit juice containing pectin is boiled with sugar and acid, the heat causes pectin molecules to disperse uniformly in the solution. As the concentration of sugar increases and the mixture cools, the pectin molecules begin to associate with each other and form a network structure. This network traps the sugar solution within it, resulting in a semi-solid gel-like structure known as jelly.

If the balance between pectin, sugar, and acid is not correct, the jelly may fail to set properly. For example:

- Low pectin results in a soft or runny jelly.
- Low sugar prevents proper gel formation.
- Insufficient acid leads to weak gel structure.

Therefore, maintaining the correct proportions of these three components is essential for producing a clear, firm, and well-set jelly.

### Raw Materials Required for Jelly Preparation

The quality of jelly depends greatly on the quality and composition of the raw materials used. The following ingredients are generally required for jelly preparation:

#### 1. Fresh Fruit Juice

Fruit juice is the primary raw material used in jelly making. The juice should be extracted from fresh, healthy, and preferably slightly under-ripe fruits, as they contain higher levels of pectin. Fruits commonly used for jelly preparation include apple, guava, grape, citrus fruits, plum, and pineapple. The juice should be clear and free from pulp particles, as the presence of pulp can make the jelly cloudy instead of transparent.

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## INTRODUCTION

Jelly is a clear, transparent, and semi-solid fruit product prepared by cooking fruit juice with sugar and pectin until it forms a firm gel-like consistency. It is one of the most popular preserved fruit products due to its bright appearance, pleasant flavor, smooth texture, and relatively long shelf life. Jelly is widely consumed as a spread on bread, toast, biscuits, and other bakery products, and it is also used as a topping or filling in various confectionery and dessert items.

Unlike jam and marmalade, jelly is prepared only from clarified fruit juice, which means that the juice is filtered to remove pulp, seeds, and fruit pieces. As a result, the final product is clear, sparkling, and transparent, giving jelly its distinctive and attractive appearance. In contrast, jam contains crushed fruit pulp, and marmalade generally includes pieces of fruit peel, particularly from citrus fruits.

Fruits that are naturally rich in pectin, such as apple, guava, grapes, and plum, are commonly used for jelly preparation because they readily form a gel when cooked with sugar and acid. Some other fruits like strawberry, mango, pineapple, and peach contain lower amounts of pectin, and therefore additional pectin may need to be added during processing to ensure proper gel formation.

Jelly preparation is an important method of fruit preservation that helps extend the usability of seasonal fruits and reduces post-harvest losses. This technique is widely practiced both at the household level and in commercial food processing industries. By converting fresh fruit juice into jelly, the product can be stored for several months without significant deterioration in quality.

The quality of jelly mainly depends on the proper balance of three essential components: pectin, sugar, and acid. Pectin forms the structural framework of the gel, sugar contributes to sweetness and preservation, and acid provides the suitable pH required for gel formation. When these components are present in appropriate proportions and the mixture is cooked to the correct concentration, a firm, clear, and well-set jelly is obtained.

Thus, jelly making not only enhances the value and shelf life of fruits but also provides a convenient and nutritious food product that can be enjoyed throughout the year.



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# एग्रीकल्चर फ़ोरम फॉर टेक्निकल एजुकेशन ऑफ़ फार्मिंग सोसायटी

कोटा, राजस्थान



## Jelly preparation

संकलन

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## 2. Sugar

Sugar is an essential ingredient used in large quantities in jelly preparation. It provides sweetness, texture, and preservation. Sugar also helps in the formation of the gel by interacting with pectin and acid.

The commonly used sugar is refined cane sugar (sucrose). The usual ratio of fruit juice to sugar is 1:1, although it may vary depending on the natural sugar and pectin content of the fruit.

## 3. Citric Acid or Lemon Juice

Citric acid or lemon juice is added to adjust the acidity (pH) of the mixture to the optimum level required for gel formation. It also enhances the flavor and stability of the jelly. In fruits that already have sufficient natural acidity, only a small amount of additional acid may be required.

## 4. Water

Water may be added during the extraction of juice from certain fruits, especially those that are very pulpy or fibrous, such as guava or apple. The amount of water should be controlled carefully so that the concentration of pectin in the juice is not diluted excessively.

## 5. Pectin (Optional)

If the natural pectin content of the fruit is low, commercial pectin may be added to ensure proper gel formation. Commercial pectin is usually derived from citrus peels or apple pomace and is available in powder or liquid form.

The addition of pectin helps to improve the setting quality, texture, and consistency of the jelly, especially when using fruits that naturally contain low levels of pectin.

### Steps in Jelly Preparation

Jelly preparation involves a series of systematic steps to ensure the formation of a clear, well-set, and high-quality product. Each step is important for achieving the desired texture, flavor, and shelf life.

#### 1. Selection of Fruits

The first and most important step in jelly preparation is the selection of suitable fruits. Fruits should be fresh, healthy, and slightly under-ripe, as they contain higher amounts of natural pectin required for gel formation. Overripe fruits generally have low pectin content and may produce a soft or poorly set jelly. Fruits such as apple, guava, grape, and plum are commonly preferred for making jelly due to their naturally high pectin levels.

#### 2. Washing and Cutting

Selected fruits are thoroughly washed with clean water to remove dust, dirt, pesticides, and other contaminants. After washing, the fruits are cut into small pieces using clean knives or cutters. Cutting increases the surface area and helps in the efficient extraction of juice and pectin during boiling.

#### 3. Extraction of Juice

The cut fruit pieces are placed in a vessel and boiled with a small quantity of water until they become soft and pulpy. This process helps release the juice and pectin from the fruit tissues. After boiling, the mixture is strained through a muslin cloth or a jelly bag to obtain a clear juice. The juice should not be squeezed excessively because this may make the jelly cloudy instead of clear.

#### 4. Testing for Pectin

Before adding sugar, the extracted juice is tested for its pectin content to determine whether it is sufficient for jelly formation. Two commonly used methods are:

- **Alcohol Test:** A small amount of fruit juice is mixed with alcohol. If a large clot of pectin forms, the juice contains sufficient pectin.
- **Jell Meter Test:** This instrument measures the amount of pectin present and helps determine the exact quantity of sugar required.

If the juice contains insufficient pectin, commercial pectin may be added to ensure proper gel formation.

#### 5. Addition of Sugar and Acid

After determining the pectin content, sugar is added to the clarified juice, usually in an equal proportion (1:1 ratio). Sugar not only provides sweetness but also helps in gel formation and preservation. If the fruit juice lacks sufficient acidity, citric acid or lemon juice is added to adjust the pH to around 3.0–3.5, which is the ideal range for pectin gel formation.

## 6. Cooking

The mixture of fruit juice, sugar, and acid is boiled rapidly with continuous stirring. During cooking, the mixture thickens as water evaporates and the concentration of sugar increases. Any foam or scum formed on the surface is removed with a spoon to maintain the clarity and quality of the jelly. Proper cooking is essential for achieving the correct gel consistency.

## 7. End Point Determination

Determining the correct end point is critical in jelly making. If cooking stops too early, the jelly may remain soft or runny, while overcooking may produce a hard or sticky jelly. The endpoint can be determined using the following methods:

**vSheet or Flake Test:** When the jelly is allowed to drop from a spoon, it falls together in sheets or flakes instead of separate drops.

**vTemperature Test:** The jelly stage is usually reached at about 105°C.

**vTotal Soluble Solids (TSS):** Using a refractometer, the TSS should be around 65–68° Brix.

## 8. Filling and Sealing

Once the jelly reaches the desired stage, it is immediately poured into clean, sterilized glass jars while still hot. A small headspace is left at the top of the jar to allow for expansion. The jars are then sealed tightly with lids to prevent contamination by microorganisms.

## 9. Cooling and Storage

The filled jars are allowed to cool undisturbed at room temperature so that the gel structure can properly develop. After cooling, the jelly becomes firm and ready for use. The jars should be stored in a cool, dry place away from direct sunlight to maintain quality and extend shelf life.

### Characteristics of Good Jelly

A good quality jelly should possess the following desirable characteristics:

- Clear and transparent appearance without cloudiness
- Bright, attractive color typical of the fruit used
- Firm yet tender gel consistency that holds its shape
- Pleasant flavor and natural fruit aroma
- Smooth texture without sugar crystals
- Easily spreadable on bread or toast without being sticky, tough, or rubbery

Table-1: Common Defects in Jelly

Defect	Cause
Jelly fails to set	Low pectin, insufficient sugar, or improper acidity
Cloudy jelly	Poor filtration or use of overripe fruits
Crystallization	Excess sugar
Syneresis (weeping)	Excess acid or low sugar
Defect	Cause

## Nutritional and Economic Importance

Jelly plays an important role in both nutrition and the economic utilization of fruits. It is an effective method of preserving fruits, especially during seasons when there is excess production. By converting fresh fruit juice into jelly, seasonal fruits can be stored and consumed for a longer period, thereby reducing post-harvest losses and improving food availability.

From a nutritional point of view, jelly serves as a good source of quick energy because of its high sugar content. Although some nutrients may be reduced during processing, jelly still retains natural fruit flavors, small amounts of vitamins, and certain beneficial compounds present in the fruit juice. It is widely consumed as a spread on bread, toast, and bakery products, making it a convenient and tasty food item.

Economically, jelly preparation has great potential as a value-added fruit product. Small-scale production of jelly can be easily carried out at the household level, cottage industries, and small food processing units. Farmers can utilize surplus or slightly damaged fruits that are not suitable for the fresh market to produce jelly and other processed products. This helps in increasing the value of fruits and generating additional income.

Furthermore, jelly production can create employment opportunities for rural youth, self-help groups, and small entrepreneurs, particularly in fruit-growing regions. With proper training, packaging, and marketing, jelly can become a profitable small-scale agro-processing enterprise.

## CONCLUSION

Jelly preparation is a simple, effective, and widely practiced fruit preservation technique that combines scientific principles with culinary skill. The process mainly depends on the correct balance of pectin, sugar, and acid, which together form the gel structure responsible for the characteristic texture of jelly.

To obtain a high-quality product, it is essential to select suitable fruits, extract clear juice, add the correct proportion of ingredients, and cook the mixture carefully until the proper jelly stage is reached. When prepared correctly, jelly should be clear, bright in color, pleasantly flavored, and firm yet easily spreadable.

With the increasing demand for processed and value-added fruit products, jelly production offers promising opportunities for both household consumption and commercial processing industries. It not only enhances the shelf life and utility of fruits but also contributes to reducing post-harvest losses and promoting rural entrepreneurship. Thus, jelly making remains an important and beneficial technique in the field of food preservation and fruit processing.