



**FACULTY OF AGRICULTURE SCIENCES AND ALLIED  
INDUSTRIES**

**Unit I**

**For**

**B.Sc. Ag (Third Year)**



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## **Lecture 15 . PREPARATION OF JAMS, JELLIES, MARMALADES, CANDIES, CRYSTALLIZED AND GLAZED FRUITS, PRESERVES, CHUTNEYS, PICKLES, KETCHUP, SAUCE, PUREE, SYRUPS, JUICES, SQUASHES AND CORDIALS**

### **PREPARATION OF JAMS**

Jam is a product made by boiling fruit pulp with sufficient quantity of sugar to a reasonably thick consistency, firm enough to hold the fruit tissues in position. Apply, sapota, papaya, plums, mango, grapes, jack, pineapple, banana, guava and pears are used for preparation of jam. It can be prepared from one kind of fruit or from two or more kinds. In its preparation about 45% of fruit pulp should be used for every 55% of sugar. The FPO specification of jam is 68.5% TSS, 45% of fruit pulp and 0.5-0.6% of acid (citric acid) per 100 gm of the prepared product.

#### **a) Selection and preparation of fruit**

Select good quality ripe fruits. Wash the fruits well in cold water. Peel the fruits and remove the stones and corers present. Cut the peeled fruit into small pieces with a stainless steel knife. If the fruit is hard, it should be cut into very small pieces. Pulp the fruits by using pulper.

#### **b) Addition of sugar and acid**

#### **c) Cooking**

Cook the mixture slowly with occasional stirring. The fruit pulp should be crushed with a laddle during cooking. Continue cooking till the temperature of the mass reaches 105.5°C. **Sheet (or) Flake Test**

A small portion of jam is taken out during boiling in a spoon or wooden laddle and cooled slightly. It is then allowed to drop. If the product falls off in the form of a sheet (or) flakes instead of flowing in a continuous stream (or) syrup, it means that the end point has been reached and the product is ready. Otherwise boiling is continued till the sheet test is positive.

#### **d) Packaging**

Fill the hot jam into clean dry sterilized jars. Allow the jam to cool and fix the sterilized lid to the jar. Store in a cool place.

#### **Process**

Ripe firm fruits → Washing → Peeling → Pulping (Remove seed and core) → Addition of sugar and acid → Boiling (with continuous stirring) → Judging of end point by further cooking upto 105°C (or) 68% TSS (or) by sheet test → Filling hot into sterilized bottles → cooling → Sterilized bottles → cooling → Waxing → Capping → Storage (at ambient temperature).

### **PREPARATION OF JELLY**

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 when it is 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. The FPO specification for jelly is the final product should have 65% solids, 45% fruit extract and 0.5-0.75% acid.

Guava, sour apple, plum, karonda, wood apple, papaya and jack fruit are rich in pectin and generally used for preparation of jelly. Pineapple, strawberry grapes etc. can be used but only after addition of pectin powder, because these fruits have low pectin content. Preparation of jelly is similar to that of jam.

### **Process**

Fruit (Firm, not over ripe) → Washing → Cutting into thin slices → Boiling with water (1 ½ times the weight of fruits for about 20-30 min) → Addition of citric acid during boiling (2 g per kg of fruit) → Straining of extract → Pectin test (for addition of sugar) → Addition of sugar → Boiling → Judging of end point (sheet / drop / temp test) → Removal of scum (or) foam (one teaspoonful of edible oil added for 45 kg sugar) → Addition of colour and remaining citric acid → Filling hot into clean sterilized bottles → Waxing (paraffin wax) → Capping → Storage at ambient temperature.

### **Important considerations in jelly making**

Pectin, acid, sugar (65%) and water are the four essential ingredients. Pectin test and determination of end point of jelly formation are very important for the quality of jelly.

### **PREPARATION OF MARMALADE**

This is a fruit jelly in which slices of the fruit (or) its peel are suspended. The term is generally used for products made from citrus fruits like oranges and lemons in which shredded peel is used as the suspended material. Citrus marmalades are classified into (1) jelly marmalade (2) jam marmalade. The FPO specifications for marmalade are TSS- 65% and fruit juice - 45% of the prepared product.

### **Ingredients**

Pectin extract	-	1 litre
Sugar	-	750 gm
Shredded peel	-	62 gm

### **Jelly marmalade**

It prepared from the clarified pectin extract.

### **Process**

Ripe fruits → Washing → Peeling outer yellow portion (Flavedo) thinly → Cutting yellow portion into fine shreds (1.9 - 2.5 cm long and 0.8 – 0.12 cm thick) → Cutting of 0.3 thick slices of peeled fruit (or) crushing into pulp in a greater → Boiling (in 2-3 times its weight of H<sub>2</sub>O for 40-60 min.) Straining the extract → Addition for pectin content

of sugar (as required)      Cooking to 103-105°C (Continuous stirring)  
shreds (shredded peel boiled for 10 to 15 min. in several changes of water for softening and  
removing bitterness and added @ about 62 g per kg of extract)  
(continuous stirring)  
with continuous stirring)  
Storage at ambient temperature.

- Addition of
- Boiling till
- Testing for end p
- Flavouring

### **Jam Marmalade**

The method of preparation is practically the same as that for jelly marmalade. In this case the pectin extract of fruit is not clarified and the whole pulp is used. Sugar is added according to the weight of fruit, generally in the proportion of 1:1. The pulp – sugar mixture is cooked till the TSS content reaches 65%.

### **PREPARATION OF CANDIED FRUITS / VEGETABLES**

A fruit /vegetable impregnated with cane sugar (or) glucose syrup and subsequently drained free of syrup and dried is known as candied fruit / vegetable. The most suitable fruits for candying are amla, kranda, pineapple, cherry, papaya, apple, peels of orange, lemon, grape fruit and ginger etc. The FPO specifications for candied fruits are TSS -75%, total sugar-70% and reducing sugar-25%.

The process for making candied fruit is practically similar to that for preserves. The only difference is that the fruit impregnated with syrup having a higher percentage of sugar – 75% brix. The syrup left over from the candying process can be used for candying another batch of the same kind of fruit after suitable dilution, for sweetening chutneys, sauces and pickles and vinegar making.

### **PREPARATION OF CRYSTALLIZED FRUITS /VEGETABLES**

Candied fruits /vegetables coated with crystals of sugar, either by rolling in finely powdered sugar or by allowing sugar crystals from dense syrup to deposit on them are called crystallized fruit / vegetable.

The candied fruits are placed on a wire mesh tray which is placed in a deep vessel. Cooled syrup (70% TSS) is gently poured over the fruit so as to cover it entirely. The whole mass is left undisturbed for 12-18 hrs during which a thin coating of crystallized sugar is formed. The tray is then taken out carefully from the vessel and the surplus syrup dried off. The fruits are then placed in a single layer on wire mesh trays and drained at room temperature or at about 49°C in driers.

### **PREPARATION OF GLAZED FRUITS /VEGETABLES**

Covering of candied fruits / vegetables with a thin transparent coating of sugar, which imparts them a glossy appearance is known as glazing.

Cane sugar and water (2:1 by weight) are boiled in a steam pan at 113-114°C and the scum is removed as it comes up. Thereafter the syrup is cooled to 93°C and rubbed with a wooden laddle on the side of the pan when granulated sugar is obtained. Dried candied fruits are passed through this granulated portion of the sugar solution, one by one, by means of fork and then placed on trays in a warm dry room. They may also be dried in a drier at 49°C for 2-3 hrs when they become crisp, they are packed in

airtight containers for storage.

### **Preparation of Preserves**

A mature fruit / vegetable (or) its pieces impregnated with heavy sugar syrup till it becomes tender and transparent is known as preserve. Aonla, apple, pear, mango, cherry, karonda, strawberry, pineapple, papaya, carrot etc. can be used for making preserves. FPO specifications for preserve is TSS 68°Bx and fruit pulp - 55%.

### **General considerations**

Cooking of fruit directly in syrup causes shrinking of fruit and reduces absorption of sugar. Therefore, the fruit should be blanched first to make it soft enough to absorb water, before steeping in syrup. However, highly juicy fruits may be cooked directly.

Fruits may be cooked in syrup by three processes as given below

#### **i. Rapid process**

Fruits are cooked in low sugar syrup. Boiling is continued with gentle heating until the syrup becomes sufficiently thick. Soft fruits such as strawberries, grapes which require very little boiling for softening. Unlike hard fruits like apples, pears and peaches, which require prolonged heating. Rapid boiling should, however be avoided as it makes the fruit tough, especially when heating is done in a large shallow pan with only a small quantity of syrup. The final concentration of sugar should not be less than 68% which corresponds to a boiling point of 106°C. This is a simple and cheap process but the flavour and colour of the product are lost considerably during boiling.

#### **ii. Slow process**

The fruit is blanched until it becomes soft. Sugar, equal to the weight of fruit, is then added to the fruit in alternate layers and the mixture allowed to stand for 24 hrs. During this period, the fruit gives out water and the sugar goes into solution, resulting in a syrup containing 37-38% TSS. Next day, the syrup is boiled after removal of fruits to raise its strength to about 60% TSS. A small quantity of citric acid (1 to 1.5 g/kg sugar) is also added to invert a portion of the cane sugar and thus prevent crystallization. The whole mass is then boiled for 4-5 min. and kept for 24 hrs. On the third day, the strength of syrup is raised to about 65% TSS by boiling. The fruit is then left in the syrup for a day. Finally, the strength of the syrup is raised to 70% TSS and the fruits are left in it for a week. The preserve is now ready and is packed in containers. This method is usually practiced.

### **3. Vacuum process**

The fruit is first softened by boiling and then placed in the syrup which should have 30- 35% TSS. The fruit-syrup blend is then transferred to a vacuum pan and concentrate under reduced pressure to 70% TSS. Preserves made by this process retain the flavour and colour of the fruit better than by the other two methods.

In all these processes, the fruit is kept covered with syrup during cooking as well as afterwards

otherwise it will dry up and the quality of the product would be affected.

The product should be cooled quickly after the final boiling to prevent discolouration during storage.

The fruits are drained free of syrup and filled in dry containers or glass jars. Freshly prepared boiling syrup containing 68% TSS is then poured into the jars / containers which are then sealed airtight. In the commercial scale production, however, it is better to sterilize the cans to eliminate any possibility of spoilage of product during storage.

### **Process**

Mature fruits → Washing → Preparation of fruit for sugar treatment → Keeping fruit and sugar in alternate layers (1.0 kg Fruit: 1 kg Sugar) (or) steeping fruit in syrup of 40% TSS for a day → Removal of fruit → Increasing consistency of syrup to 60% TSS by boiling □ Steeping o  
fruit for a day → Repeating the process and raising strength of syrup by 5% TSS to 70% on alternate days –  
Steeping in 70% TSS for a week → Preserve – Draining – Filling in jar (or)  
container → Covering fruit with freshly prepared sugar syrup of 68% TSS □ Sealing (airtight) –  
Storage.

### **PREPARATION OF CHUTNEYS**

A good quality chutney should be palatable and appetizing. Mango chutney is an important food product exported from India to many countries. Apple and apricot chutneys are also very popular in the country.

The method of preparation of chutney is similar to that for jam except that spices, vinegar and salt are added. The fruits / vegetables are peeled, sliced or grated or cut into small pieces and cooked in water until they become sufficiently soft. The quality of chutney depends to a large extent on its cooking which should be done for a long time at a temperature below the boiling point. To ensure proper thickening, cooking is done without a lid even though this results in some loss of volatile oils from the spices. Chopped onion and garlic are added at the start to mellow their strong flavours. Spices are coarsely powdered before adding. Vinegar extract of spices may be used instead of whole spices. Spices and vinegar are added just before the final stage of cooking, because prolonged boiling causes loss of some of the essential oils of spices and of vinegar by volatilization. In mango and apricot sweet chutneys, where vinegar is used in large quantity, the amount of sugar added may be reduced, because vinegar itself acts as a preservative. These chutneys are cooked to the consistency of jam to avoid fermentation.

### **Sweet mango chutney**

#### **Recipe**

Mango slices (or) shreds – 1.0 kg, sugar (or) gur – 1.0 kg, salt – 45 g, onions (chopped) – 50 g, garlic (chopped) – 15 g, ginger (chopped) – 15 g, red chilli powder – 10 g, black pepper, cardamom, cinnamon, cumin – 10 g each, cloves – 5 nos. and vinegar – 170 ml.

## **Process**

Mature mangoes → washing → Peeling → Grating (or) slicing → cooking with a little water to make highly soft → Mixing with sugar and salt and leaving for an hour → Keeping all ingredients (except vinegar) in cloth bag, tied loosely, putting in mixture and cooking on low flame → During cooking, spice bag pressed occasionally □ Cooking to consistency of jam (upto 105°C) with stirring occasionally → Removal of spice bag after squeezing → Addition of vinegar → Cooking for 2-5 min. → Filling hot into bottles → Sealing (airtight) → Storage at ambient temperature.

## **PREPARATION OF PICKLES**

The preservation of food in common salt (or) in vinegar is known as pickling. It is one of the most ancient methods of preserving fruits and vegetables. Pickles are good appetizers and add to the palatability of a meal. They stimulate the flow of gastric juice and thus helps in digestion. Preservation by salt ( $\text{NaCl}_2$ )

Sodium chloride is an indispensable component of food. At lower concentrations it contributes significantly to the flavour. At higher concentrations it exhibits an important bacteriostatic action. Salt is easily available and not expensive.

### **Pickling process**

Pickling is done in two stages (1) By curing (or) fermentation with dry salting (or) fermentation in brine (or) salting without fermentation (2) By finishing and packing.

Pickling is the result of fermentation by lactic acid forming bacterial which are generally present in large numbers on the surface of fresh vegetables and fruits. These bacteria can grow in acid medium and in the presence of 8-10% salt solution whereas the growth of a majority of undesirable organisms is inhibited. Lactic acid bacteria are most active at 30°C, so this temperature must be maintained as far as possible in the early stage of pickle making. When vegetables are placed in brine, it penetrates into the tissues of the vegetables and soluble material present in them diffuses into the brine by osmosis. The soluble material includes fermentable sugars and minerals. The sugars serve as food for lactic acid bacteria which convert them into lactic acid and other acids. The acid brine thus formed acts upon vegetables tissues to produce the characteristic taste and aroma of pickle. There are two methods for pickling

### **1. Dry salting method**

Alternate layers of vegetables and salt (20-30 gm of dry salt/kg vegetables) are kept in a vessel which is covered with a cloth and a wooden board and allowed to stand for about 24 hrs. During this period, due to osmosis, sufficient juice comes out from the vegetables to form brine.

The amount of brine required is usually equal to half the volume of vegetables. Brining is the most important step in pickling. The growth of a majority of spoilage organisms is inhibited by brine containing 15% salt. Lactic acid bacteria, which are salt tolerant can thrive in brine of 8- 10% strength though



fermentation takes place fairly well even in 5% brine. In a brine containing 10% salt, fermentation proceeds somewhat slowly. Fermentation takes place to some extent upto 15% but stops at 20% strength. It is therefore, advisable to place the vegetables in 10% salt solution for vigorous lactic acid fermentation.

As soon as the brine is formed, the fermentation process starts and  $\text{CO}_2$  begins to evolve. The salt content is now increased gradually, so that by the time the pickle is ready, salt concentration reaches 15%. When fermentation is over, gas formation ceases.

Under favourable conditions fermentation is completed in 7-10 days. When sufficient lactic acid has been formed, lactic acid bacteria cease to grow and no further change takes place in the vegetables. However, precautions should be taken against spoilage by aerobic microorganisms, because in the presence of air, pickle sum is formed which brings about putrefaction and destroys the lactic acid. Properly brined vegetables keep well in vinegar for a long time.

## **II. Fermentation in brine**

Steeping of the vegetable in a salt solution of pre-determined concentration for a certain length of time is called brining. This type of treatment is adopted in the case of cucumbers and similar vegetables which do not contain sufficient juice to form brine with dry salt. Brine can be prepared by dissolving in common salt in water and filtering it through the cloth to remove insoluble impurities. The remaining process is similar to that of dry salting method.

### **Raw materials used in pickling**

- 1. Salt:** Free from impurities, and salts such as lime ( $\text{CaO}$ ), iron (blackening), magnesium (results bitter taste) and carbonates (makes the pickle soft in texture).
- 2. Vinegar:** Vinegar of good quality should contain atleast 4% acetic acid. Synthetic vinegar (or) low quality vinegar are not suitable for pickle preparations. Usually malt (or) cider vinegar is used. In order to ensure good keeping quality pickle, the final concentration of acetic acid in the pickle should not be less than 2%. Acetic acid (commercial) is also used because it is highly concentrated.
- 3. Sugar:** Used in the preparation of sweet pickles should be of high quality.
- 4. Spices:** Spices are added practically to all pickles, the quantity added depending upon the kind of fruit (or) vegetable taken and the kind of flavour desired. The spices generally used are bay leaves, cardamom, chillies, cinnamon, clove, coriander, dill herb, ginger, mace, mustard, black pepper, cumin, turmeric, garlic, mint, fenugreek, asafoetida etc.
- 5. Water:** Only potable water should be used for the preparation of brine. Hard water contains salts of Ca, Na, Mg etc., which interfere with the normal salt curing of the vegetable. If hard water is to be used, a small quantity of vinegar should also be added to the brine to neutralize its alkalinity. Iron should not be present in the water in any appreciable quantity as it causes the blackening of the pickle.
- 6. Cooking utensils:** Metallic vessels should be non-corrodiable. Vessels made of iron (or) copper are not suitable. Glass-lined vessels, and stainless steel vessels are preferred. The laddles, spoons

and measuring vessels should also be made on non-corrodible materials. At present, pickles are prepared with salt, vinegar, oil (or) with a mixture of salt, oil, spices and vinegar. These methods are discussed below

### **I. Preservation with salt**

Salt improves the taste and flavour and hardens the tissues of vegetables and controls fermentation. Vegetables do not ferment when they are packed with a large quantity of salt. Spoilage is prevented by adding sufficient common salt, bringing its final concentration in the material from 15-20%. At this high salt concentration, mould and even lactic acid forming bacteria do not grow. This method of preservation is applicable only to vegetables which contain very little sugar because sufficient lactic acid cannot be formed by fermentation to act as preservative. Some fruits like lime, mango, etc. are also preserved with salt.

#### **Example**

**1. Lime pickle:** Lime – 1 kg, salt – 200 g red chilli powder – 15 g, cinnamon, cumin, cardamom and black pepper (powdered) each – 10 g cloves – 5 Nos.

#### **Process**

Limes → Washing → Cutting into 4 pieces → Squeezing out juice from ¼ amount of fruit → Mixing spices and salt with juice → Mixing with lime pieces → Filling in jars → Covering with lid → Keeping in sun for 4-6 days (shaking jar at least twice a day) → Storage at ambient temperature.

### **II. Preservation with vinegar**

In vinegar pickles, vinegar acts as a preservative. The final concentration of acid as acetic acid in the finished pickle should not be less than 2%. To avoid dilution of vinegar below this strength by the H<sub>2</sub>O liberated from the tissues, the vegetables (or) fruits are generally placed in strong vinegar of about 10% acidity for several days before final packing. This treatment helps to expel the gases present in the intercellular spaces of vegetable tissues. Papaya, pears, onion, garlic, chillies, mango and cucumber pickles are prepared in this method. **Example**

#### **Cucumber pickle**

Cucumber – 1.0 kg, salt – 200 g red chilli powder – 15 g, cardamom (large), cumin, black pepper (powdered) each – 10 g, cloves – 6 Nos., vinegar – 750 ml.

#### **Process**

Cucumbers → Washing → Peeling → Cutting into 5 cm round pieces → Mixing with salt → Filling in jar → Standing for 6-8 hrs → Draining off H<sub>2</sub>O → Adding spices and vinegar → Keeping in sun for a week → Storage.

### **III. Preservation with oil**

The fruit (or) vegetable should be completely immersed in the edible oil. Cauliflower, lime, mango, amla, karonda, bittergourd, brinjal, turnip pickles are prepared from this method.

#### **Example**

**Green chilli pickle:** Green chillies – 1 kg, salt – 150 gm, mustard (ground) – 100 gm lime juice – 200 ml (or) amchur – 200 gm, fenugreek cardamom (large), turmeric, cumin (powdered) each – 15 gm, mustard oil – 400ml.

#### **Process**

Green chillies → Washing → Drying → Making incision → Mixing all spices in a little lime juice → Mixing with chillies → Filling into jar → Adding lime juice and oil → Keeping in sun for a week – Storage.

#### **IV. Preparation with mixture of salt, oil, spices and vinegar**

##### **Example**

**Tomato pickle:** Tomatoes – 1 kg, salt 75 g, garlic (chopped) – 10 g, ginger (chopped)- 50 g, red chilli powder, cumin, cardamom (large), cinnamom, turmeric, fenugreek – each – 10 g, cloves – 50 nos, asafoetida (powdered) – 2g, vinegar – 250 ml, oil – 300 ml.

#### **Process**

Tomatoes (ripe, firm and pulpy) → Washing → Blanching for 5 min → Cooling immediately in water → Peeling → Cutting into 4-6 pieces (or) mashing → Frying all ingredients in a little oil except vinegar → Mixing with pieces → Heating for 2 min → Cooling → Addition of vinegar and remaining oil → Filling in jar → Storage.

#### **PREPARATION OF SAUCES / KETCHUPS**

There is no essential difference between sauce and ketchup. However, sauces are generally thinner and contain more total solids than ketchups. Tomato, apple, papaya, walnut, soybean etc. are used for making sauces. The FPO specifications of sauces are TSS – 25% and acidity – 1%.

Sauces are of two kinds (i) thin sauces of low viscosity consistency mainly of vinegar extract of flavouring materials like herbs and spices and (ii) thick sauces that are highly viscous. Sauces / ketchups are prepared from more or less the same ingredients and in the same manner as chutney, except that the fruit or vegetable pulp or juice used is sieved after cooking to remove the skin, seeds and stalks of fruits. Vegetables and spices are added to give a smooth consistency to the final product. However, cooking takes longer because fine pulp (or) juice is used.

Some sauces develop a characteristic flavour and aroma on storing in wooden barrels. Freshly prepared products often have a raw and harsh taste and have, therefore, to be matured by storage. High quality sauces, are prepared by maceration of spices herbs, fruits and vegetables in cold vinegar or by boiling them in vinegar. Thickening agents are also added to the sauce to prevent sedimentation of solid particles. Apple pulp is commonly used for this purpose in India but starch from potato, maize, arrow root (cassava) and sago are also used.

A fruit sauce should be cooked to such a consistency that it can be freely poured without the

fruit tissues separating out in the bottle. The colour of the sauce should be bright. Sauces usually thicken slightly on cooling. By using a funnel hot ketchup is filled in bottles leaving a 2 cm head space at the top and the bottles are sealed or corked at once. The necks of the bottles when cold, are dipped in paraffin wax for airtight sealing.

### **Apple sauce**

**Recipe :** Apple – 1.0 kg, sugar – 250 g, salt – 10 g, onion (chopped) – 200 g, ginger (chopped) – 100 g, garlic (chopped) - 50 g, red chillipowder – 10 g, cloves – 5 Nos. cinnamon, cardamom – 15 g (each), vinegar – 50 ml, sodium benzoate – 0.7 g/kg of finished product.

### **Process**

Apples → Washing → Peeling → Removal of core and seeds → Making into fine pulp → Straining of pulp → Cooking pulp with one third quantity of sugar → Putting spice bag in pulp and processing occasionally → Cooking to one - third of original volume of pulp → Removal of spice bag (after squeezing in pulp) → Adding remaining sugar and salt → Cooking to one – third its original volume → Addition of vinegar and preservative → Filling hot into bottles → Crown corking → Pasteurization at 85-90°C for 30 min. → Cooling → Storage at ambient temperature.

### **PREPARATION OF PUREE AND PASTE**

Tomato pulp without skin or seeds, with or without added salt, and containing not less than 9.0% of salt free tomato solids, is known as medium tomato puree'. It can be concentrated further to heavy tomato puree which contains not less than 12.0% solids. If this is further concentrated so that it contains not less than 25% tomato solids, it is known as tomato paste, on further concentration to 33% or more of solids it is called concentrated tomato paste.

Tomato pulp is prepared from ripe tomatoes in the same manner as tomato juice. Cooking for concentration of the pulp can be done either in an open cooker or a vacuum pan. In the former most of the vitamins are destroyed and the product become brown. On the other hand, use of vacuum pans, which are extensive, help to preserve the nutrients, and also reduce the browning to a great extent. In vacuum pans the juice is boiled at about 71°C only. While cooking in an open cooker, a little butter or edible oil is added to prevent foaming, burning and sticking.

After cooking, the total solids content of the juice is higher than required, more juice is added to lower it, if it is lower, cooking is continued till the desired concentration is reached. The endpoint of cooking puree and paste can be determined either with a hand refractometer or by measuring the volume.

### **Process**

Tomato juice (strained) → Cooking to desired consistency (open cooker / vacuum pan) → Judging of endpoint for puree (or) paste → Filling hot into bottles or cans (82-88°C) →

Sterilization in boiling water for 20 min. →Cooling → Storage at ambient temperature.

## **PREPARATION OF SYRUP**

This type of fruit beverage contains 25% fruit juice (or) pulp, 65% TSS, 1.3 to 1.5% acidity and 350 ppm of  $\text{SO}_2$  or 600 ppm of KMS. It is diluted before serving, Fruits like aonla, jamun, pomegranate, grape, lemon, orange and sometimes ginger can be used for the preparation of syrup. It is also prepared from extracts of rose, sandal almond etc.

### **Synthetic syrups**

Heavy sugar syrup of 70-75 per cent strength is used as the base of all synthetic syrups and they are flavoured and coloured with artificial essence/flavours and colours. They never contain fruit pulp/juice. A large proportion of these syrups can, however, be replaced by real fruit juices, squashes and syrups which are more nutritious.

Large quantities of synthetic syrups (orange, lemon, pineapple, strawberry) are manufactured and sold in various countries. These can be prepared by using 1.5 kg of sugar, 500 ml of  $\text{H}_2\text{O}$  and 15 g of citric acid. Different colours and flavours are added as required. Among colours, orange red, lemon yellow, green, raspberry red etc. are mostly used, while artificial essence/flavours of rose, orange, pineapple, strawberry, lemon etc. are added as flavouring substances.

## **PREPARATION OF FRUIT JUICES**

### **i. Selection of fruit:**

All fruits are not suitable because of difficulties in extracting the juice or because the juice is of poor quality. The variety and maturity of the fruit and locality of cultivation influence the flavour and keeping quality of its juice. Only fully ripe fruits are selected. Over ripe and green fruits, if used, adversely affect the quality of the juice.

### **ii. Sorting and washing**

Diseased, damaged (or) decayed fruits are rejected or trimmed. Dirt and spray residues of arsenic, lead etc., are removed by washing with water or dilute hydrochloric acid (1 part acid 20 parts water).

### **iii. Juice extraction**

Generally juice is extracted from fresh fruit by crushing and pressing them. Screw type juice extractors, basket presses or fruit pulpers are mostly used.

The method of extraction differs from fruit to fruit because of differences in their structure and composition. Before pressing, most fruits are crushed to facilitate the extraction. Some require heat processing for breaking up the juice – containing tissues. In case of citrus fruits, the fruit is cut into halves, and the juice extracted by light pressure in a juice extractor or by pressing the halves in a small wooden juice extraction. Care should be taken to remove the rind of citrus fruits completely

otherwise it makes the juice bitter. Finally, the juice is strained through a thick cloth or a sieve to remove seeds. All equipments used in the preparation of fruit juices and squashes should be rust and acid proof. Copper and iron vessels should be strictly avoided as these metals react with fruit acids and cause blackening of the product. Machines and equipments made of aluminium, stainless steel etc. can be used. Extracted juices should not be unnecessarily exposed to air as it will spoil the colour, taste and aroma and also reduce the vitamin content.

#### **IV. Deaeration**

Fruit juices contain some air, most of which is present on the surface of the juice and some is dissolved in it. Most of the air as well as other gases are removed by subjecting the fresh juice to a high vacuum. This process is called deaeration and the equipment used for the purpose is called a deaerator. Being a very expensive method, it is not used in India at present.

#### **V. Straining (or) Filtration**

Fruit juices always contain varying amounts of suspended matter consisting of broken fruit tissue, seed, skin, gums, pectic substances and protein in colloidal suspension. Seeds and pieces of pulp and skin which adversely affect the quality of juice, are removed by straining through a thick cloth or sieve. Removal of all suspended matter improves the appearance but often results in disappearance of fruity character and flavour. The present practice is to let fruit juices and beverages retain a cloudy or pulpy appearance to some extent. In case of grape juice, apple juice and lime juice cordial however, a brilliantly clear appearance is preferred.

#### **VI. Clarification**

Complete removal of all suspended material from juice, as in lime juice cordial, is known as clarification which is closely related to the quality, appearance and flavour of the juice. The following methods of clarification are used (a) Settling (b) filtration (c) freezing (D) cold storage (e) high temperature (f) chemicals such as gelatin, albumen, casein, mixture of tannin and gelatin (g) enzymes such as pectinol and filtragol.

#### **VII. Addition of sugar**

All juices are sweetened by adding sugar, except those of grape and apple. Sugar also acts as preservative for the flavour and colour and prolongs the keeping quality. Sugar based products can be divided into 3 groups on the basis of sugar content.

- a. Low sugar – 30 per cent sugar or below
- b. Medium sugar – sugar above 30 and below 50%
- c. High sugar – 50% sugar and above

Sugar can be added directly to the juice or as a syrup made by dissolving it in hot water, clarifying by addition of a small quantity of citric acid or a few drops of lime juice and filtering.

#### **VIII. Fortification**

Juices, squashes, syrups etc. are sometimes fortified with vitamins to enhance their nutritive value, to improve taste, texture or colour and to replace nutrients lost in processing. Usually ascorbic acid and Beta-carotene (water – soluble form) are added at the rate of 250-500 mg and 7-10 mg per litre, respectively. Ascorbic acid acts as an antioxidant and beta-carotene imparts an attractive orange colour. For a balanced taste some acids are added. Citric acid is often used for all types of beverages and phosphoric acid for cola type of drinks.

### **IX. Preservation**

Fruit juices, RTS and nectars are preserved by pasteurization but sometimes chemical preservatives are used. Squashes, crushes and cordials are preserved only by adding chemicals. In the case of syrup, the sugar concentration is sufficient to prevent spoilage. Fruit juice concentrates are preserved by heating, freezing or adding chemicals.

### **X. Preservation by Bottling**

Bottles are thoroughly washed with hot water and filled leaving 1.5-2.5 cm headspace. They are then sealed either with crown corks (by crown corking machine) or with caps (by capping machine).

### **Individual Beverages**

#### **1. Juices**

Juices are of two types

**a. Natural juice (pure juice):** It is the juice, as extracted from ripe fruits, and contains only natural sugars.

**b. Sweetened juice:** It is a liquid product which contains at least 85% juice and 10% TSS.

Pure fruit juices such as apple juice and orange juice are commercially manufactured. Apple juice is generally bottled while other juices are canned.

#### **Example Apple juice**

**Apples** → **Washing with 1.5% HCl – Grating (apple grater)** → **Crushing for juice extraction** → Straining → Clarification (By enzyme (or) gelatin) → Filtration → Heating at 82-85°C → Filling hot into cans → Sealing → Processing at 100°C for 15 min. → Cooling → Storage.

#### **Citrus juice**

Mandarin and sweet oranges → Washing → Peeling (By hand) → Separation and cleaning of segments → Juice extraction (Screw type extractor) → Straining → Heating at 80°C – Bottling (or) canning (Baby food cans) → Crown corking (or) can sealing → Pasteurization → Cooling → Storage.

#### **Example for sweetened**

#### **juice Mango juice**

Mangoes (ripe) → washing → peeling → stone removal → straining of pulp – addition of

water (1 lit pulp 0.5 lit H<sub>2</sub>O) → mixing with syrup → Homogenization → Heating at 85°C → Filling hot into cans → sealing → Processing at 100°C for 20 min → cooling → storage.

## **2. Ready-to-serve (RTS)**

This is a type of fruit beverage which contains atleast 10% fruit juice and 10% total soluble solids besides about 0.3 per cent acid. It is not diluted before serving hence it is known as ready to serve.

Commercially RTS beverages (with 13% TSS and 0.3 % acid) can be prepared by using SO<sub>2</sub> -70 ppm or benzoic acid 120 ppm.

### **For example: Papaya RTS**

Ripe fruits → Washing → Peeling → Cutting into halves → Seed removal → Passing through pulper → Pulp → Mixing with strained syrup solution (Sugar + Water acid, heated just to dissolve) Homogenisation → Bottling → crown corking → Crown corking → Pasteurization (about 90°C for 25 min) – Cooling → Storage.

## **PREPARATION OF SQUASH**

This is a type of fruit beverage containing atleast 25 per cent fruit juice (or) pulp, 45% TSS, 1.0% acidity and 350 ppm of So<sub>2</sub> (or) 600 ppm of sodium benzoate. It is diluted before serving (13). Lime, mango, orange and pineapple are used for making squash commercially using KMS as preservative or fruits viz. jamun, passion fruit, raspberry, strawberry, grape fruit etc. with sodium benzoate as preservative.

## **PREPARATION OF CORDIAL**

It is a sparkling, clear, sweetened fruit juice from which pulp and other insoluble substances have been completely removed. It contains atleast 25% juice, 30% TSS, 1.5% acid and 350 ppm of So<sub>2</sub>. This is very suitable for blending with wines. Lime and lemon are suitable for making cordial.

### **Process**

Fruits → Washing → Cutting into halves → Juice extraction → Straining → Addition of preservative (kms/gm/litre juice) → Storing in glass container for 10-15 days for clarification (suspended material settles down) → Syphoning off the supernatant clear juice → Straining and measuring → Preparation of Syrup → Straining → Mixing of juice with syrup → Addition of preservative → (KMS 0.6 g / lit product) → Bottling → Capping → Storing in cool and dry place.