

## **Beverages**

Production of fruit beverages on a commercial scale was practically unknown till about 1930, but since then it has gradually become an important industry. In tropical countries like India, fruit beverages provide delicious cold drinks during the hot summer. Due to their nutritive value they are becoming more popular than synthetic drinks which at present have a very large market in our country.

Synthetic drinks contain only water (about 88%) and total carbohydrates (about 12%) and provide about 48 K-cal, whereas fruit based drinks contain vitamins (A, B and C:) and minerals (iron, calcium, etc.) and provide more calories. Thus, fruit-based drinks are far superior to many synthetic drinks. If synthetic preparations are replaced by fruit beverages, it would be a boon to the consumers as well as to the fruit growers.

### **Fruit beverages**

Fruit beverages are easily digestible, highly refreshing, thirst-quenching, appetizing and nutritionally far superior to many synthetic and aerated drinks. They can be classified into two groups:

- (A) Unfermented beverages:** Fruit juices which do not undergo alcoholic fermentation are termed as unfermented beverages. They include natural and sweetened juices, RTS (ready-to-serve), nectar, cordial, squash, crush. syrup, fruit juice concentrate and fruit juice powder. Barley waters and carbonated beverages are also included in this group.
- (8) Fermented beverages:** Fruit juices which have undergone alcoholic fermentation by yeasts include wine, champagne, port, sherry, tokay, muscat, perry, orange wine, berry wine, nira, and cider.

## **Preparation and preservation of unfermented fruit beverages:**

The general process for the preparation and preservation of unfermented fruit beverages is as under:

- (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 extractor. 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 equipment 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. During extraction 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:** The juice is stored in a carboy or barrel, after adding a chemical preservative to ensure that it does not undergo fermentation, e.g., lime juice is stored for 3 to 6 months for settling with the addition of 700 ppm sulphur dioxide. Colloidal pectins, gums, proteins, mucilaginous solids settle down and the juice is syphoned off for further treatment. However, the process is very slow.

**(8) Filtration:** Filtration is necessary to remove completely all fine and colloidal suspensions. In this process, the juice, after straining, is forced through a filtering medium which may be cotton pulp, wood pulp, woven fibre cloth, etc. The colloidal suspension tends to clog the filter, hence a filter aid is used to reduce clogging. The most important filter aids are supercel, kieselguhr, spanish clay and bentonite, which are added to the extent of 0.1-0.2 per cent. However, a filter aid may impart an unpleasant taste to the juice, therefore, these should be used with caution. Recently, china clay has been demonstrated to be a good filter aid.

**(C) Freezing :** The pasteurized juice kept in a carboy is frozen at  $-18^{\circ}\text{C}$  and thereafter stored for 4 to 7 days at room temperature. This is a costly method and is used to some extent only for clarification of grape juice.

**(D) Cold storage :** This is generally used for grape juice. The juice is stored at  $-2$  to  $-3^{\circ}\text{C}$  for one month during which the suspended matter settles down and clear juice can then be taken out.

**(E) High temperature :** The juice is heated at  $82^{\circ}\text{C}$  for about a minute when the colloidal material coagulates and settles down. After cooling rapidly, the juice is mixed with a filter aid and passed through a filter press. Pomegranate juice is prepared by this method.

**(F) Chemicals:** Fining agents such as gelatin, albumen, casein, and a mixture of tannin and gelatin, are also used for clarification.

7. **(a) Gelatin:** It is used for apple and cashew apple juices. On addition of gelatin solution, the colloids present in the juice coagulate and form a flocculent precipitate which settles down. The precipitation is due to electrostatic action between the positively charged gelatin particles and Negatively charged colloids in the juice.

**(b) Albumen:** Solid albumen available in the market is dissolved in warm water to make a 2 per cent solution. A solution of egg-white may also be used. The albumen solution is mixed with the juice, which is heated to about  $91^{\circ}\text{C}$  to ensure complete coagulation of albumen.

**(e) Casein:** Addition of hydrochloric acid to skimmed milk precipitates casein which is thoroughly washed with water to remove traces of acid, dried and powdered. It is then dissolved in a little liquor ammonia and the solution diluted 10 to 20 times with water and then boiled to re- move all traces of ammonia. It is again diluted with water to give a 2 per cent solution which is mixed with the juice. In 24 hours the acids in the juice

precipitate the casein which settles down along with other colloidal particles.

**(d) Mixture of tannin and gelatin:** The tannin-gelatin method is very widely used for clarifying fruit juices. The quality of gelatin to be added is determined by carrying out a preliminary laboratory test. Sufficient tannin is added to minimize the bleaching action of gelatin. About 42 g of tannin and 85 g of gelatin are generally required for every 455 litres of juice. The juice is well stirred, the tannin solution is added to it with stirring and the gelatin solution is then added. The treated juice is allowed to stand undisturbed for 18 to 24 hours to let the suspended matter coagulate and settle down. The clear juice is then syphoned off carefully without disturbing the sediment. In case of lime juice addition of 213 g of tannin and 283 g of gelatin per 2500 litres of juice, preserved by the addition of about 350 ppm of sulphur dioxide, immediately after extraction, gives a sparkling clear product. The colloidal matter settles down completely in 4 to 6 days and the clear supernatant juice can be syphoned off and used for preparation of cordial.

**(G) Enzymes:** Soluble pectins in the juice are responsible for keeping in suspension other materials such as hemicellulose. When the pectin is destroyed by adding pectic enzyme preparations, e.g., Pectinol and Filtragol, it settles down and during this process also carries down other materials. After filtering, the clear juice is heated to about 77°C for 30 minutes to stop the enzymatic action otherwise the juice becomes cloudy again.

**(vii) Addition of sugar :** All juices are sweetened by adding sugar, except those of grape and apple. Sugar also acts as preservative for the flavor and colour and prolongs the keeping quality. Sugar-based products can be divided into three 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 per cent,
- (c) High Sugar - 50 per cent 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 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 to 500 mg and 7 to 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. The details regarding methods or preservation are given

in the chapter on 'Principles and Methods of Preservation'.

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

### Unfermented Beverages

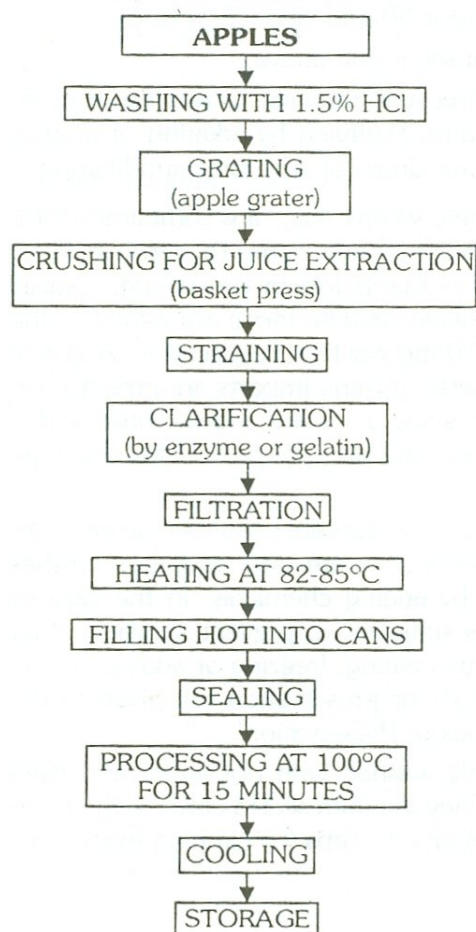
**(1) Juices:** Juices are of two types -

**(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 per cent juice and 10 per cent total soluble solids. Pure fruit juices, such as apple juice and orange juice are commercially manufactured in several countries. Apple juice is generally bottled while other juices are canned. The techniques for preparation of various fruit juices are given as follows:

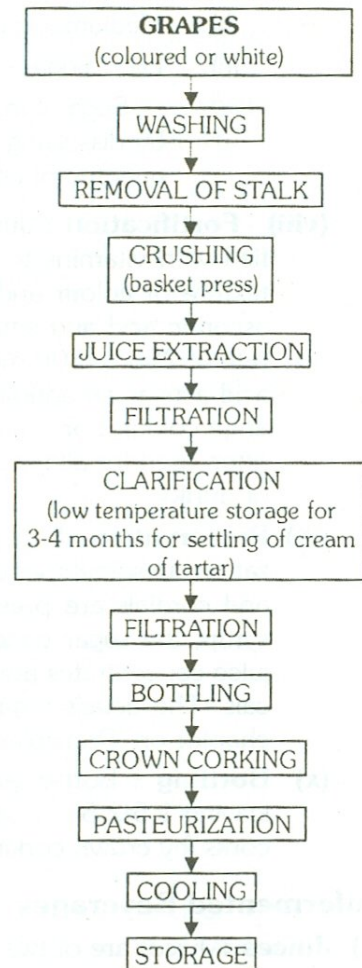
#### (i) Apple juice

##### FLOW-SHEET FOR PROCESSING OF APPLE JUICE



#### (ii) Grape juice

##### FLOW-SHEET FOR PROCESSING OF GRAPE JUICE



## (ii) Blended juices

Sometimes two or more juices are mixed to yield a well-balanced, rightly flavoured, highly palatable and refreshing drink. Juices are blended so as to utilize a too sweet fruit (grape), a bitter fruit (grapefruit), too acidic or tart fruits (sour lime, sour plum, galgal, sour cherry, etc.), bland and insipid tasting fruits like pear or apple, and strongly flavoured fruits (guava and banana). Some of the common commercial blends of juice are:

- (1) Grape (97%) and lime (3%)
- (2) Grape (50%) and orange (50%)
- (3) Orange (50-75%) and grapefruit (25-50%)
- (4) Apple (97%) and lime (3%)
- (5) Apple (74%) and grapefruit (25%) + 1% sugar
- (6) Apple (50-75%) and pineapple (25-50%) + 1% sugar
- (7) Apple (37%) and plum (62%) + 1% sugar

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

This is a type of fruit beverage which contains at least 10 per cent fruit juice and 10 per cent total soluble solids besides about 0.3 per cent acid. It is not diluted before serving, hence it is known as ready-to-serve (RTS).

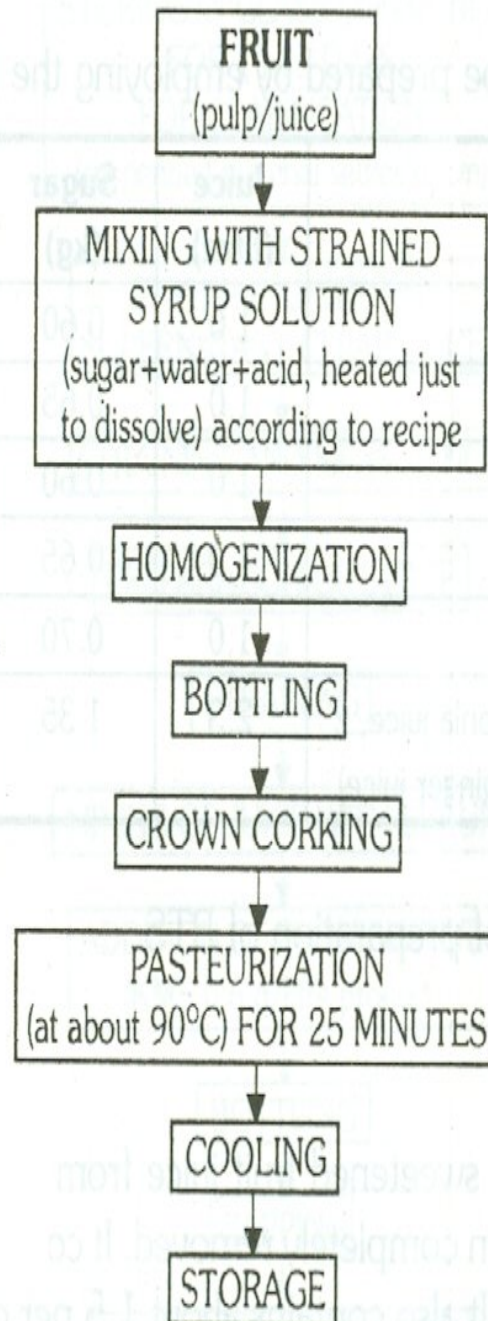
Before undertaking the preparation of beverages, it is necessary to know the techniques of extraction of pulp/juice from various fruits used for RTS, nectar, squash, syrup, etc. The extraction techniques for some fruits have been described earlier and for some other fruits are as under.

For preparing the beverages the total soluble solids in the pulp/juice and its acidity are first determined and then requisite amounts of sugar and citric acid dissolved in water are added for adjustment of TSS and acidity.

In homes, RTS can be prepared by using the following recipes:

S. No.	Fruit	Juice (litre)	Suga (kg)	Citric acid (g)	Water (litre)
1	Bael	1.0	1.20	28	7.7
2	Lemon/Lime	0.5	1.30		8.2
3.	Guava	1.0	1.25	28	7.7
4.	Aonla blend (10 part aonla juice : 2	1.3	1.60	22	10.0
5	Mango	1.0	1.,25	28	7,7
6	Ginger	0.25	1.30	30	8.4

## FLOW-SHEET FOR PROCESSING OF RTS BEVERAGES



### (3) Nectar

This type of fruit beverage contains at least 20 per cent fruit juice/pulp and 15 per cent total soluble solids and also about 0.3 per cent acid. It is not diluted before serving.

Commercially, nectar (with 13% TSS and 0.3% acid) can be prepared by using the following recipes standardized by Department of Horticulture, N.D. University of Agriculture and Technology, Faizabad.

s. No.	Fruit	Juice/pulp (%)	Quantity of water (litre)
1	Mango	20	Quantity of finished product (litre)--Quantity of juice (litre) + sugar (kg) + acid (kg)J used
2	Papaya	20	
3	Guava	20	
4	Bael	20	
5	Jamun	20	
6	Aonla (blend)	Aonla pulp 20 Ume juice 2 Ginger juice 1	

For preparing the above beverages the total soluble solids and total acid present in the pulp/juice are first determined and then the requisite amounts of sugar and citric acid dissolved in water are added for adjustment of TSS and acidity.

In homes, nectar can be prepared by employing the following recipes:

s. No.	Fruit	Juice (litre)	Sugar (kg)	Citric acid (g)	Water (litre)
1	Mango	1.0	0.60	13	3.3
2	Papaya	1.0	0.65	13	3.3
3	Guava	1.0	0.60	13	3.3
4	Bael	1.0	0.65	15	3.3
5	Jamun	1.0	0.70	7	3.3
6	Aonla blend (20 part part lime juice, 1 part	2.3	1.35	4	7.8

**Process:** Similar to that of preparation of RTS.

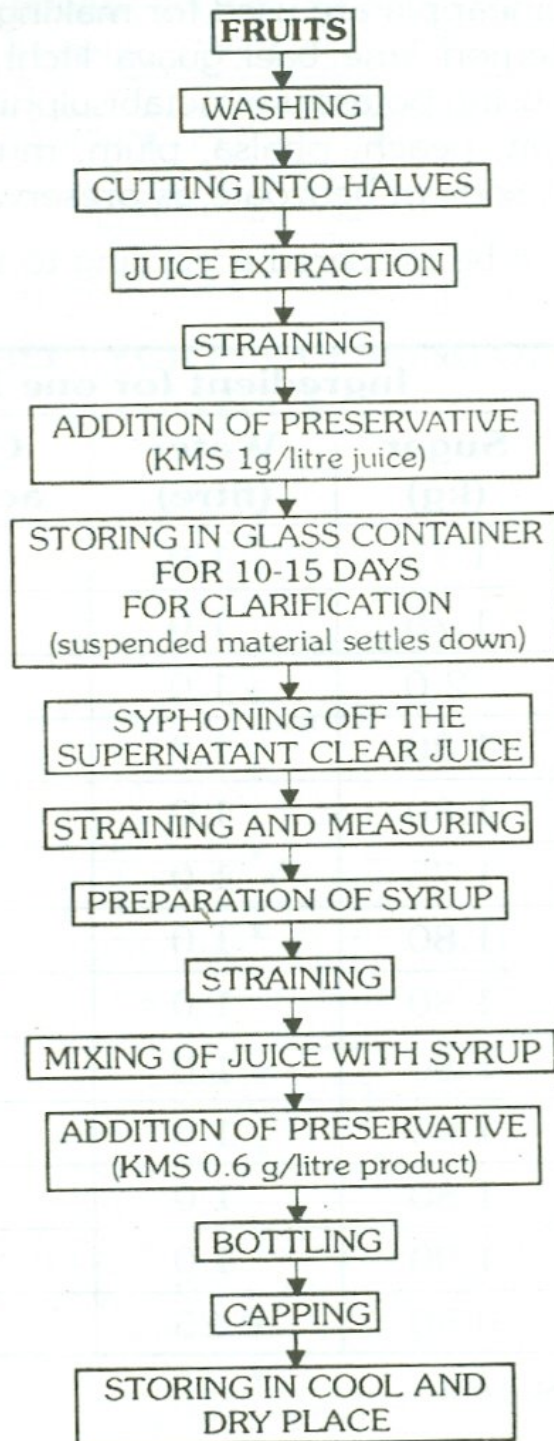
#### (4) Cordial

It is a sparkling, clear, sweetened fruit juice from which pulp and other insoluble. Substances have been completely removed. It contains at least 25 per cent juice and 30 per cent TSS. It also contains about 1.5 per cent acid and 350 ppm of sulphur dioxide. This is very suitable for blending with wines. Lime and lemon are suitable for making cordial. In homes, cordial can be prepared using the following recipe:

Lime/Lemon juice - 1.0 litre  
 Sugar - 1.25 kg  
 Water - 1.0 litre  
 Potassium metabisulphite - 2.0 g



## FLOW-SHEET FOR PROCESSING OF CORDIAL



This is a type of fruit beverage containing at least 25 per cent fruit juice or pulp and 40 to 50 per cent total soluble solids, commercially. It also contains about 1.0 per cent acid and 350 ppm sulphur dioxide or 600 ppm sodium benzoate. It is diluted before serving.

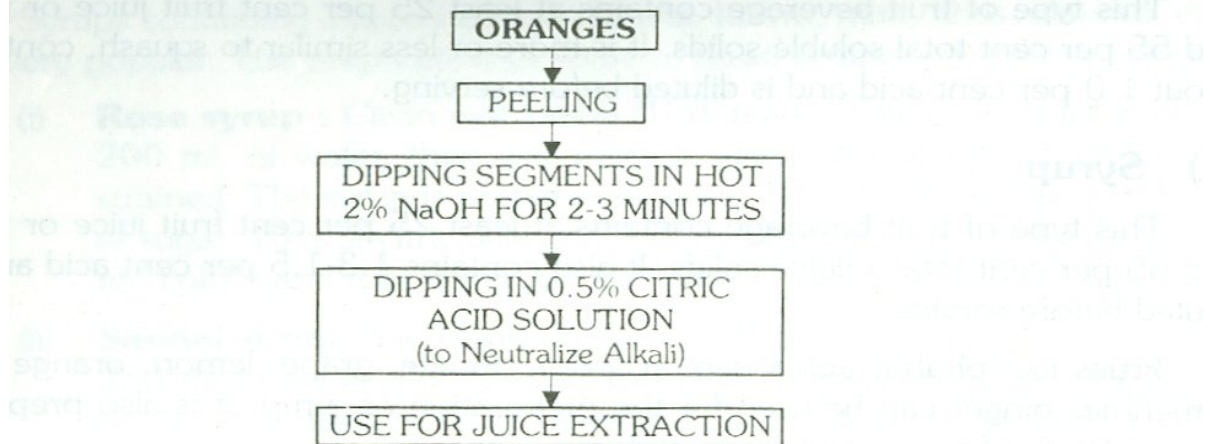
Mango, orange and pineapple are used for making squash commercially. It can also

be prepared from lemon, lime, bael, guava, litchi, pear, apricot, pummelo, musk melon, papaya, etc., using potassium metabisulphite (KMS) as preservative, or from jamun, passion-fruit, peach, phalsa, plum, mulberry, raspberry, strawberry, grapefruit, etc., with sodium benzoate as preservative.

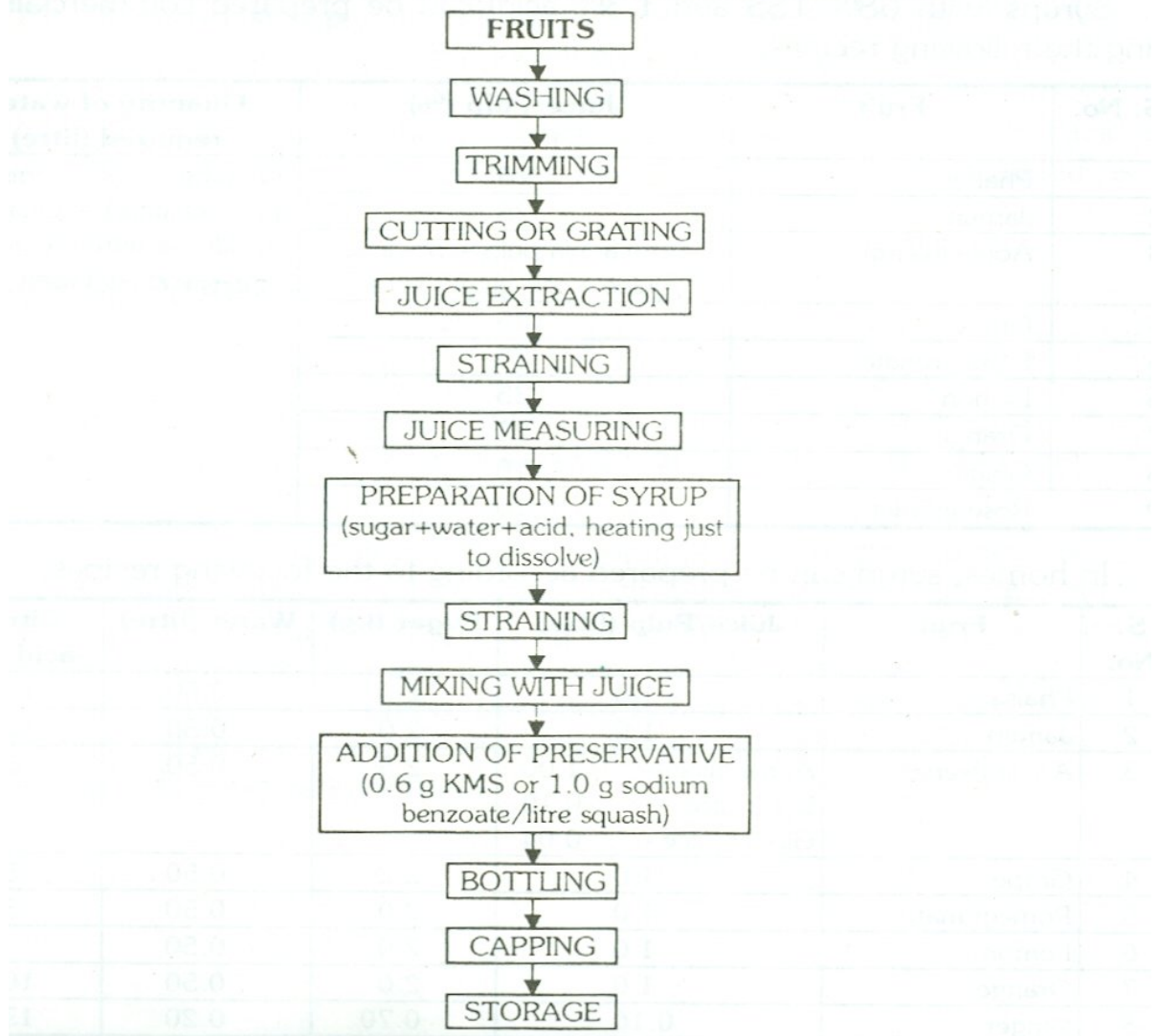
In homes, squashes can be prepared according to the following recipes:

S. No.	Fruit	Ingredient for one litre pulp/juice			
		Sugar (kg)	Water (litre)	Citric acid (g)	Preservative (g)
1	Orange*	1.75	1.0	20	2.5 KMS
2	Mango	1.75	1.0	20	2.5 KMS
3	lime, Lemon	2.0	1.0	-	2.5 KMS
4	Bael	1.80	1.0	25	2.5 KMS
5	litchi	1.80	1.0	25	2.25 KMS
6	Pineapple	1.75	1.0	20	1.9 KMS
7	Guava	1.80	1.0	20	2.0 KMS
8	Papaya	1.80	1.0	25	2.5 KMS
9	Karonda	1.80	1.0	5	4.0SB
10	Phalsa	1.80	1.0	5	4.0SB
11	Jamun	1.80	1.0	15	3.0SB
12	Plum	1.90	1.0	10	4.0SB
13	Water melon	0.50	0.25	10	1.5 SB
KMS= Potassium metabisulphite SB= Sodium					

## TECHNOLOGICAL FLOW-SHEET FOR REMOVAL OF ASTRINGENCY FROM ORANGE JUICE



## FLOW-SHEET FOR PROCESSING OF SQUASH



## (6) Crush

This type of fruit beverage contains at least 25 per cent fruit juice or pulp and 55 per cent total soluble solids. It is more or less similar to squash, contains about 1.0 per cent acid and is diluted before serving.

## (7) Syrup

This type of fruit beverage contains at least 25 per cent fruit juice or pulp and 65 per cent total soluble solids. It also contains 1.3-1.5 per cent acid and is diluted before serving.

Fruits like phalsa, 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.

Syrups (with 68% TSS and 1.3% acid) can be prepared commercially by using the following recipes:

S.	Fruit	Juice/Pulp (%)	Quantity of water required (litre)
1	Phalsa	25	Quantity of finished product (litre) - Quantity of [Juice (litre) + sugar (kg) + acid (kg)] used
2	Jamun	25	
3	Aonla (blend)	50% aonla pulp + 5% juice + 2% Ginger juice	
4	Grape	25	
5	Pomegranate	25	
6	Lemon	25	
7	Orange	25	
8	Ginaer	10	
9	Rose extract	10	

In homes, syrup can be prepared according to the following recipes:

S. No.	Fruit	Juice/Pulp (litre)	S	Water	Citric acid (g)
1	Phalsa	1.0		0.50	10
2	Jamun	1.0		0.50	15
3	Aonla (blend)	Aonla juice - 1.00 Lime juice - 0.10 Gingr juice - 0.04		0.50	5
4	Grape	1.0		0.50	5
5	Pomegranate	1.0		0.50	5
6	Lemon	1.0		0.50	-
7	Orange	1.0		0.50	10
8	Ginger	0.10		0.20	15

### Syrup from extracts

Syrups containing extracts of rose, sandal, kewra, mint, khus, almond, etc. are very popular. The preparation of some of these syrups is described below

- (i) **Rose syrup:** Clean rose petals (100 g) are soaked overnight in about 200 ml of water, then well rubbed, heated for about 5 minutes and strained. The syrup is prepared by using 100 ml of rose extract, 700 g of sugar, 10 g of citric acid and 250 ml of water. Sometimes raspberry red colour and rose water are also added.
- (ii) **Sandal syrup:** Sandalwood powder (50 g) is soaked overnight in about 250 ml of water, then heated for about 5 minutes and strained. The syrup is prepared by using the extract, 1.3 kg of sugar, 400 ml of water, and 10 g of citric acid. Sometimes Kewra essence is also added.
- (iii) **Almond syrup:** Almond kernels (50 g) are soaked in 200 ml of hot water for some time, the loosened skin is removed and the kernels are ground with 10 g of cardamom (small) and the juice is strained. Syrup is prepared by using above extract, 1.3 kg of sugar, 10 g of citric acid and 350 ml of water. Sometimes kewra or rose essence is added as re- quired.

### 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, raspberry, strawberry, khus, kewra, etc.) are manufactured and sold in various countries. These can be prepared by using 1.5 kg of sugar, 500 ml of water 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, kewra, orange, pineapple, strawberry, lemon etc are added as flavouring substances.

### **Fruit Juice Concentrates**

A fruit juice from which water has been mostly removed by heating or freezing is known as concentrate. Carbonated beverages are prepared from this. They contain pure juice with at least 32 per cent total soluble solids. The major advantages of concentrates are :

- (i) Reduced weight and bulk compared to juice result in economy in packaging, storage and transport.
- (ii) The whole crop of fruits is fully utilized during peak season, thus helping to stabilize the price.
- (iii) The product can be used as base material for making various food and beverage formulations.

### **Problems with concentrates**

- (i) Fermentation is not prevented,
- (ii) Non-enzymatic browning occurs, and
- (iii) Gel formation takes place.

In some countries, concentrates of pure fruit juices particularly of orange, apple, pineapple and grape are highly popular. The major methods deployed for production of fruit and vegetable concentrates are : (i) freezing and mechanical evaporation; (ii) low-temperature vacuum evaporation; and (iii) high-speed high temperature evaporation.

### **(9) Fruit juice powder**

Fruit juice can be converted into a free-flowing, highly hygroscopic powder by puff-drying, freeze drying, vacuum drying, spray drying or drum drying. The powder has the advantage of long shelf-life and is soluble in cold water. But during the drying process much of the characteristic fresh flavour is lost, which is compensated for by adding to the juice powder natural fruit flavour in powder form. Reconstitution of the powder mixture yields full strength fruit juice drink. Techniques have been standardized by Central Food Technological Research Institute, Mysore, for preparation of powder from mango, orange, lemon, guava, passion-fruit, banana, avocado, tomato, etc.

### **(10) Barley water**

Fruit beverage which contains at least 25 per cent fruit juice, 30 per cent total soluble solids and 0.25 per cent barley starch is known as barley water. It also contains about 1.0 per cent acid.

Barley water is prepared from citrus fruits such as lime, lemon, grapefruit and orange and of these lime and lemon are mostly used.

It is prepared by using about 1 litre of fruit juice, 2.0 kg of sugar, 15 g of barley flour and 1.3 litre of water. Essence and potassium metabisulphite (as in case of cordial) may be added if desired.

### **(11) Carbonated beverages**

The use of fruit juices in the preparation of carbonated drinks is practically unknown in India. Mostly, artificially flavoured drinks which have no nutritive value are prepared by this method. The use of fruit juices would increase the nutritive value of carbonated beverages.

The juice can be directly carbonated, or can be stored as such, or in the form of concentrate for carbonation whenever necessary. Carbonated beverages can keep well for about a week without addition of any preservative. If the products are to be kept for a longer period, 0.05 per cent sodium benzoate must be added. For example, while preparing carbonated orange syrup; juice, sugar and citric acid in the ratio of 1: 1.55:0.044 should be used. For carbonation, 42 to 56 g of this prepared syrup is filled in 285 to 340 g bottles. In the same manner syrups of pineapple, lime, lemon, etc. can be prepared. Lemonade, orangeade, ginger, strawberry, lime juice, are examples of carbonated beverages.

## FLOW-SHEET FOR PROCESSING OF BARLEY WATER

