FSN 421 COMMERCIAL AGRICULTURE (0+1)
AND
FSN 452 COMMERCIAL FOOD ENGINEERING (0+2)

COURSE MATERIAL

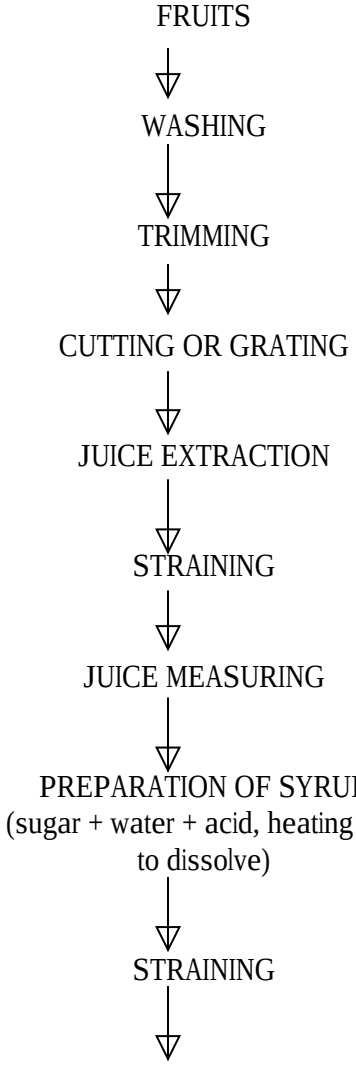
I. FRUIT BEVERAGE

A. SQUASH

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, 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.

FLOW-SHEET FOR PROCESSING OF SQUASH



MIXING WITH JUICE

⇩

ADDITION OF PRESERVATIVE
(0.6 g KMS or 1.0 g sodium
benzoate / litre squash)

⇩

BOTTLING

⇩

CAPPING

⇩

STORAGE

B. 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).

i) Guava

FLOW-SHEET FOR EXTRACTION OF GUAVA PULP

⇩

RIPE FRUITS

⇩

WASHING

⇩

CUTTING INTO PIECES

MIXING WITH WATER (1:1)

⇩

PASSING THROUGH PULPER

⇩

PULP

FLOW-SHEET FOR PROCESSING OF RTS BEVERAGES

FRUIT
(pulp / juice)

⇩

MIXING WITH STRAINED
SYRUP SOLUTION
(sugar + water + acid, heated just

to dissolve) according to recipe

↓

HOMOGENIZATION

↓

BOTTLING

↓

CROWN CORKING

↓

PASTEURIZATION
(at about 90°C) FOR 25 MINUTES

↓

COOLING

↓

STORAGE

C. 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.

FLOW-SHEET FOR PROCESSING OF CORDIAL

FRUITS

↓

WASHING

↓

CUTTING INTO HALVES

↓

JUICE EXTRACTION

↓

STRAINING

↓

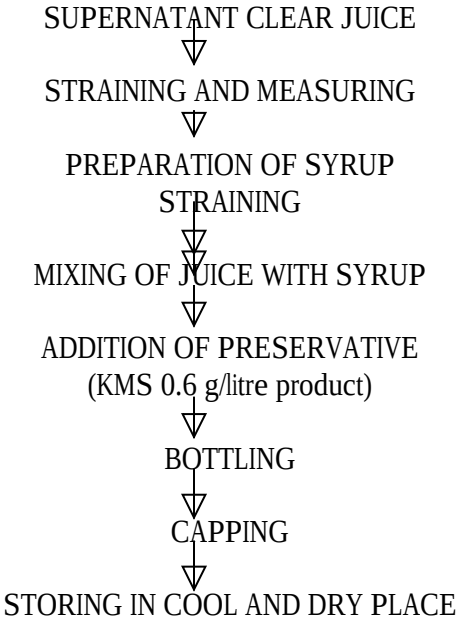
ADDITION OF PRESERVATIVE
(KMS 1g/litre juice)

↓

STORING IN GLASS CONTAINER
FOR 10-15 DAYS
FOR CLARIFICATION
(suspended material settles down)

↓

SYPHONINING OFF THE



D. 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.

S. No.	Fruit	Juice / Pulp (%)	Quantity of water required (litre)
1.	Mango	20	Quantity of finished product (litre) – Quantity of (juice (litre) + sugar (kg) + acid (kg) used
2.	Papaya	20	
3.	Guava	20	
4.	Bael	20	
5.	Jamun	20	
6.	Aonla (blend)	Aonla pulp 20 Lime 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.

II JAM, JELLY, MARMALADE

A. 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.

TECHNOLOGICAL FLOW-SHEET FOR PROCESSING OF JAM

RIPE FIRM FRUITS
⇓
WASHING
⇓
PEELING
⇓
PULPING
(remove seed and core)
⇓
ADDITION OF SUGAR
(add water if necessary)
⇓
BOILING
(with continuous stirring)
⇓
ADDITION OF CITRIC ACID
⇓
JUDGING OF END-POINT BY FURTHER COOKING UPTO 105°C OR 68-70% TSS OR BY SHEET TEST
⇓
FILLING HOT INTO STERILIZED BOTTLES
⇓
COOKING
⇓
WAXING
⇓
CAPPING
⇓
STORAGE
(at ambient temperature)

Problems in jam production

(i) Crystallization : The final product should contain 30 to 50 per cent invert sugar. If the percentage is less than 30, cane sugar may crystallize out on storage and if it is more than 50 the jam will become a honey-like mass due to the formation of small crystals of glucose. Corn syrup or glucose may be added along with cane sugar to avoid crystallization.

(ii) Sticky or gummy jam : Because of high percentage of total soluble solids, jams tend to become gummy or sticky. This problem can be solved by addition of pectin or citric acid, or both.

(iii) Premature setting : This is due to low total soluble solids and high pectin content in the jam and can be prevented by adding more sugar. If this cannot be done a small quantity of sodium bicarbonate is added to reduce the acidity and thus prevent pre-coagulation.

(iv) Surface graining and shrinkage : This is caused by evaporation of moisture during storage of jam. Storing in a cool place can reduce it.

(v) Microbial spoilage : Sometimes moulds may spoil the jam during storage but they are destroyed if exposed to less than 90 per cent humidity. Hence, jams should be stored at 80 per cent humidity. Mould growth can also prevented by not sealing the filled jar and covering the surface of jam with a disc of waxed paper because mould does not grow under open conditions as rapidly as in a closed space. It is also advisable to add 40 ppm sulphur dioxide in the form of KMS. In the case of cans, sulphur dioxide should not be added to the jam as it causes blackening of the internal surface of the can.

B. 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 to quiver when pressed.

Guava, sour apple, plum, karonda, wood apple, loquat, papaya and goose-berry are generally used for preparation of jelly. Apricot, pineapple, strawberry, raspberry, etc. can be used but only after addition of pectin powder, because these fruits have low pectin content. Fruits can be divided into four groups according to their pectin and acid contents.

IMPORTANT CONSIDERATION 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 the jelly.

(A) Pectin

Pectin substances present in the form of calcium pectate are responsible for the firmness of fruits. Pectin is the most important constituent of jelly.

The setting of pectin is also dependent upon the pH and sugar concentration.

Determination of pectin content :

The pectin content of the strained extract is usually determined by one of the following two methods.

(i) Alcohol test : This method, involving precipitation of pectin with alcohol, is outlined below :

One teaspoonful of strained extract is taken in a beaker and cooled, and 3 teaspoonfuls of methylated spirit are poured gently down the side of the beaker which is rotated for mixing and allowed to stand for a few minutes.

a. If extract is rich in pectin, a single, transparent lump or clot will form. An equal amount of sugar is to be added to the extract for preparation of jelly.
b. If extract contains a moderate amount of pectin, the clot will be less firm and fragmented. Three-fourths the amount of sugar is to be added.

c. It extract is poor in pectin, numerous small granular clots will be seen. One-half the amount of sugar is added.

(ii) Jelmeter test : The jelmeter is held in the left hand with the thumb and forefinger. The bottom of the jelmeter tube is closed with the little finger. The strained extract is poured intot he jelmeter with a spoon, held in the right hand, till it is filled to the brim. While still holding the jelmeter, the little finger is removed from the bottom end and the extract is allowed to flow or drip for exactly one minute, at the end of which the finger is replaced. The reading of the level of extract in the jelmeter is noted. This figure indicates how many parts of sugar are to be added to one part of juice.

(B) Acid

The final jelly should contain at least 0.5 per cent (preferably 0.75%) but not more than 1 per cent total acids because a larger quantity of acid may cause syneresis.

pH of extract : The optimum pH for a jelly containing 1 per cent pectin is approximately 3.0, 3.2 and 3.4 for 60, 65 and 70 per cent TSS, respectively.

(C) Sugar :

This essential constituent of jelly imparts to it sweetness as well as body. If the concentration of sugar is high, the jelly retains less water resulting in a stiff jelly, probably because of dehydration.

Inversion of sugar : When sugar (sucrose) is boiled with an acid, it is hydrolyzed into dextrose and fructose, the degree of inversion depending on the pH and duration of boiling. Because of partial inversion of the sucrose, a mixture of sucrose, glucose and fructose are found in the jelly. This mixture is more soluble in water than sucrose alone and hence the jelly can hold more sugar in solution without crystallization.

(D) Judging of end-point :

Boiling of jelly should not be prolonged, because excessive boiling results in a greater inversion of sugar and destruction of pectin. The important point to remember is that it is the fruit extract which requires boiling and not the added sugar. If a jelly is cooked for a prolonged period, it may become gummy, sticky, syrupy and deteriorate in colour and flaovur. The end-point of boiling can be judged in the following way :

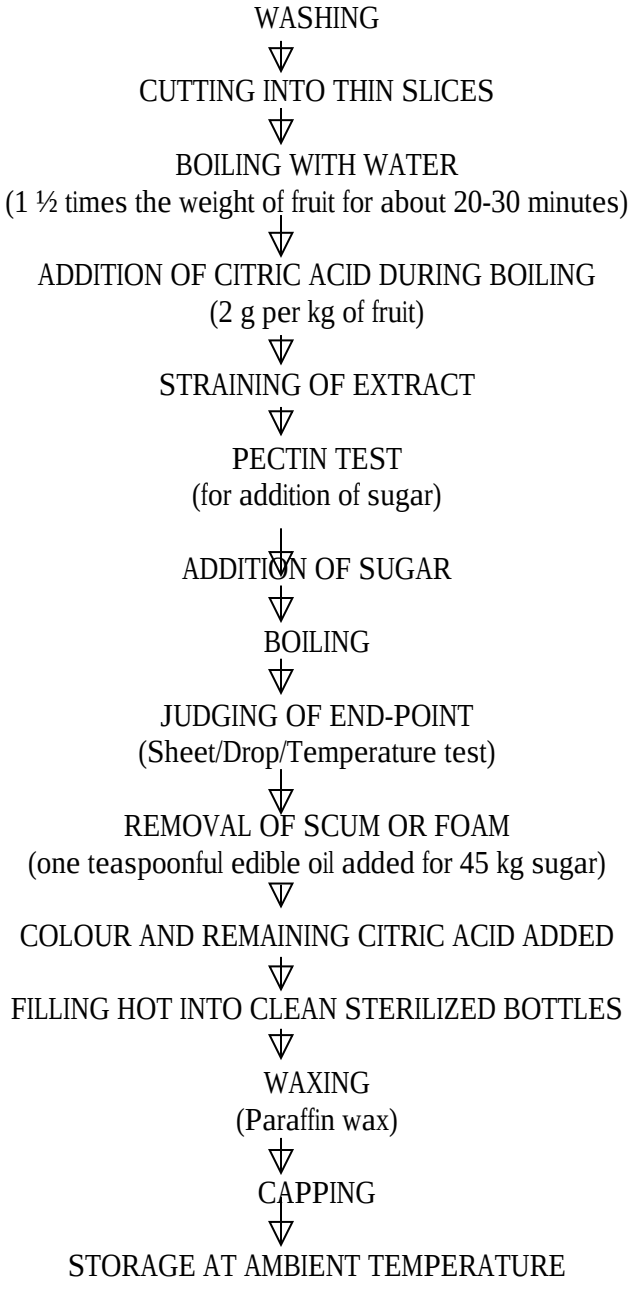
(i) Sheet or flake test : As described under jam.

(ii) Drop test : A drop of the concentrated mass is poured into a glass containing water. Settling down of the drop without disintegration denotes the end-point.

(iii) Temperature test : A solution containing 65 per cent total soluble solids boils at 105°C. Heating of the jelly to this temperature would automatically bring the concentration of solids to 65 per cent. This is the easiest way to ascertain the end-point.

TECHNOLOGICAL FLOW-SHEET FOR PROCESSING OF JELLY

FRUIT
(firm, not over-ripe)
⇩



Problems in jelly making : The most important difficulties that are experienced are as follows :

1. Failure to set : This may be due to :
   i. Addition to too much sugar : It results in a syrupy or highly soft jelly.
   ii. Lack of acid or pectin : Lack of acid or pectin, or of both, in the fruit used or insufficient cooking of the fruit slices resulting in inadequate extraction of pectin and acid.
   iii. Cooking below the end-point : If the cooking is stopped before the percentage of total soluble solids reaches 65, the jelly may remain syrupy and highly soft.
   iv. Cooking beyond the end-point : Jelly becomes tough due to over-concentration.

2. Cloudy or foggy jellies : It is due to the following reasons :

i. Use of non-clarified juice or extract.

ii. Use of immature fruits : Green, immature fruits contain starch which is insoluble in the juice and therefore, gives it a cloudy appearance.

iii. Over-cooking : Such jellies are gummy or sticky on account of their high viscosity and do not become clear after pouring into containers.

iv. Over-cooling : If the jelly is cooled too much, it becomes viscous and sometimes, lumpy and is always almost cloudy.

v. Non-removal of scum : The jelly becomes cloudy when the scum is not removed before pouring.

vi. Faulty pouring : When jelly is poured into containers from a great height, some air gets trapped in the form of bubbles and makes the jelly opaque. Hence, the pouring vessel should not be held more than about 2.5 cm away from the top of the container.

3. Formation of crystals : It is due to addition of excess sugar and also to over-concentration of jelly.

4. Syneresis or weeping of jelly : The phenomenon of spontaneous exudation of fluid from a gel is called syneresis or weeping and is caused by several factors :

i. Excess of acid : It causes breakdown of the jelly structure by hydrolysis or decomposition of pectin.

ii. Too low concentration of sugar : This causes the network of pectin to hold more liquid than it possibly can do under normal conditions.

iii. Insufficient pectin : This results in the formation of a pectin network which is not sufficiently dense and rigid to hold the sugar syrup.

iv. Premature gelation : This causes breaking of the pectin network during the pouring of jelly into containers and thus the jelly becomes weak and remains broken.

v. Fermentation : Though a high percentage of sugar (65%) prevents ordinary fermentation, it can takes place in jelly if syneresis occurs.

C. 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 (i) jelly marmalade, and (ii) jam marmalade.

1. Jelly marmalade :

The following combinations give good quality of jelly marmalade :

i. Sweet orange (Malta) and khatta or sour orange (Citrus aurantium) in the ratio of 2:1 by weight. Shreds of Malta orange peel are used.

ii. Mandarin orange and khatta in the ratio of 2:1 by weight. Shreds of Malta orange peel are used.

iii. Sweet orange (Malta) and galgal (*Citrus limonia*) in the ratio of 2:1 by weight. Shreads of Malta orange peel are used.

2. Jelly marmalade :

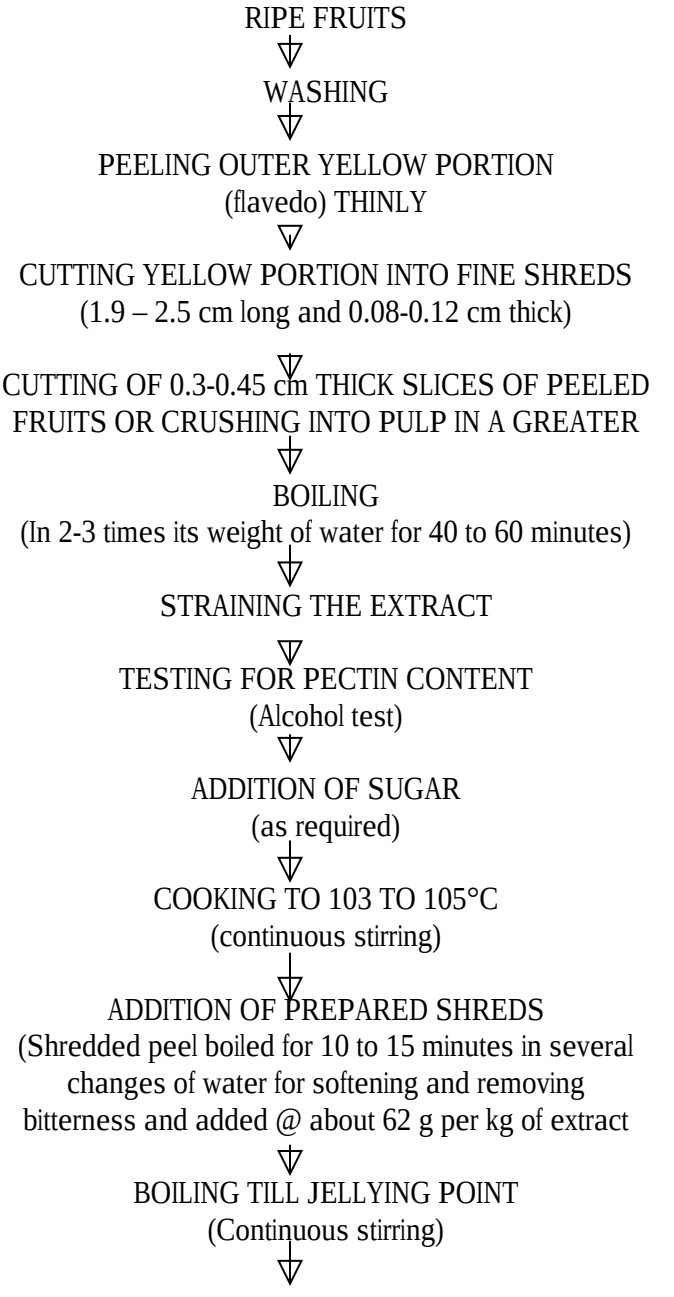
The method of preparation is practically the same as that for jelly marmalade. In this case the pectin extract of fruit is not clarified and the whole pulp is used. Sugar is added according to the weight

of fruit, generally in the proportion of 1:1. The pulp-sugar mixture is cooked till the TSS content reaches 65 per cent.

Problems in marmalade making :

Browning during storage is very common which can be prevented by addition of 0.09 g of KMS per kg of marmalade and not using tin containers. KMS dissolved in a small quantity of water is added to the marmalade while it is cooling. KMS also eliminates the possibility of spoilage due to moulds.

TECHNOLOGICAL FLOW-SHEET FOR PROCESSING OF MARMALADE



TESTING FOR END-POINT
(Sheet/Drop/Temperature test)
⇩
COOKING
(to 82-88°C with continuous stirring)
⇩
FLAVOURING
(orange oil)
⇩
FILLING IN STERILIZED BOTTLES
⇩
SEALING
⇩
STORAGE AT AMBIENT TEMPERATURE

III. CANDY

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 aonla, karonda, pineapple, cherry, papaya, apple, peach, and peels of orange, lemon, grapefruit and citron, ginger, etc.

The process for making candied fruit is practically similar to that for preserves. The only difference is that the fruit is impregnated with syrup having a higher percentage of sugar or glucose. A certain amount (25-30 per cent) of invert sugar or glucose, viz., confectioners glucose (corn syrup, crystal syrup or commercial glucose), dextrose or invert sugar is substituted for cane sugar. The total sugar content of the impregnated fruit is kept at about 75 per cent to prevent fermentation. 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 in vinegar making.

Glazed candy :

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 ladle 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 a 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 hours. When they become crisp, they are packed in airtight containers for storage.

Crystallized candy :

Candied fruits/ vegetables when covered or coated with crystals of sugar, either by rolling in finely powdered sugar or by allowing sugar crystals to deposit on them from a dense syrup are called crystallized fruits. The candied fruits are placed on a wire mesh tray which is placed in a deep vessel. Cooled syrup (70 per cent total soluble solids) is gently poured over the fruit so as to cover it entirely. The whole mass is left undisturbed for 12 to 18 hours during which a thin coating of crystallized sugar is formed. The tray is then taken our carefully from the vessel and the surplus syrup drained off. The fruits

are then placed in a single layer on wire mesh trays and dried at room temperature or at about 49°C in driers.

Problems in preparation of preserves and candied fruits :

i. Fermentation : It is due to low concentration of sugar used in the initial stages of preparation of preserves. Sometimes fermentation also occurs during storage due to low concentration of sugar and insufficient cooking. This can be prevented by boiling the product at suitable intervals, by adding the required quantity of sugar and by storage in a cool and dry place.

ii. Floating of fruits in jar : It is mainly due to filling the preserve without cooling and can be avoided by cooling the preserve prior to filling.

iii. Toughening of fruit skin or peel : It may be due to inadequate blanching or cooking of fruits hence blanching till tender is necessary. Toughness may develop when cooking is done in a large shallow pan with only a small quantity of syrup.

iv. Fruit shrinkage : Cooking of fruits in heavy syrup greatly reduces absorption of sugar and causes shrinkage. Therefore, fruits should be blanched first or cooked in low-sugar syrup.

v. Stickiness : It may develop after drying or during storage due to insufficient consistency of the syrup, poor quality packing and damp storage conditions.

If candied and crystallized fruits are stored under humid conditions, they lose some of their sugar due to absorption of moisture from the air. Further, they become mouldy if they are not sufficiently dried and are packed in wet containers.

There is considerable scope for exporting preserves and candies. Since these products are hygroscopic, water-proof packaging like metal and glass containers which are impermeable to water vapour should be used. Newer flexible plastic films would be cheap and highly effective. There is need for exploring the possibilities of utilizing various types of plastics for packaging of such products.

IV. PRESERVE

Intermediate-moisture foods or semimoist foods, in one form or another, have been important items of diet for a very long time. Generally, they contain moderate levels of moisture, of the order of 20-50% by weight, which is less than is normally present in natural fruits and vegetables, but more than is left in conventionally dehydrated products. In addition, intermediate-moisture foods contain sufficient dissolved solutes to decrease water activity below that required to support microbial growth. As a consequence, intermediate-moisture foods do not require refrigeration to prevent microbial deterioration. There are various kinds of intermediate-moisture foods : natural products such as honey; manufactured confectionery product high in sugar, jellies, jams, and bakery items such as fruit cakes; and partially dried products including figs, dates, etc. In all of these products, preservation is partially from high osmotic pressure associated with the high concentration of solutes; in some, additional preservative effect is contributed by salt, acid and other specific solutes.

A mature fruit / vegetable or its pieces impregnated with heavy sugar syrup till it becomes tender and transparent is known as a preserve. Aonla, bael, apple, pear, mango, cherry, karonda, strawberry, pineapple, papaya, etc. can be used for making preserves.

General considerations :

Cooking of fruit in syrup is difficult because the syrup has to be maintained at a proper consistency so that it can permeate the whole fruit without causing it to shrink or toughen. Cooking 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.

i. Rapid process : Fruits are cooked in a low-sugar syrup. Boiling is continued with gentle heating until the syrup becomes sufficiently thick. Soft fruits such as strawberries and raspberries, which require very little boiling for softening, unlike hard fruits like apples, pears and peaches, which require prolonged heating, can be safely cooked in heavy syrup. 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 per cent 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 tender. Sugar, equal to the weight of fruit, is then added to the fruit in alternate layers and the mixture allowed to stand for 24 hours. During this period, the fruit gives out water and the sugar goes into solution, resulting in a syrup containing 37-38 per cent total soluble solids. Next day the syrup is boiled after removal of fruits to raise its strength to about 60 per cent total soluble solids. A small quantity of citric or tartaric acid (1 to 1.5 g per 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 minutes and kept for 24 hours. On the third day, the strength of syrup is raised to about 65 per cent total soluble solids by boiling. The fruit is then left in the syrup for a day. Finally, the strength of the syrup is raised to 70 per cent total soluble solids and the fruits are left in it for a week. The preserve is now ready and is packed in containers. In practice, the number of steps may be varied.

iii. Vacuum process : The fruit is first softened by boiling and then placed in the syrup which should have 30-35 per cent total soluble solids. The fruit syrup blend is then transferred to a vacuum pan and concentrated under reduced pressure to 70 per cent total soluble solids. 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 per cent total soluble solids is then poured into the jars / containers which are then sealed airtight. In commercial scale production, however, it is better to sterilize the cans to eliminate any possibility of spoilage of product during storage.

V. TOMATO PROCESSING

a. Tomato sauce / Ketchup :

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

General considerations :

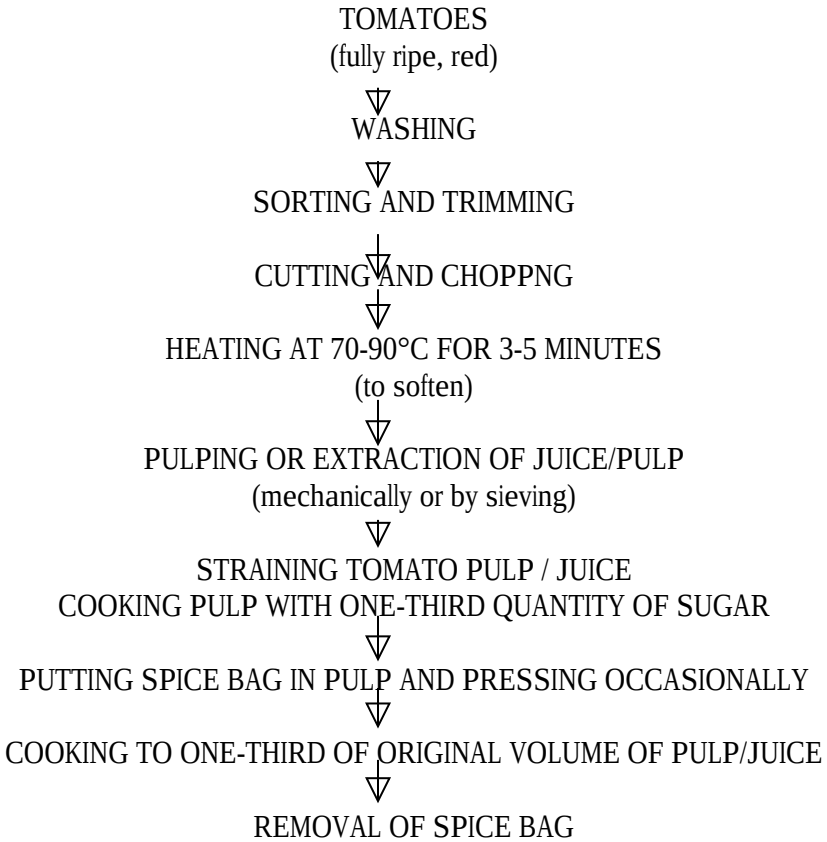
About one-third or the sugar required is added at the time of commencement of boiling to intensify and fix the red tomato colour. If the whole quantity of sugar is added initially, the cooking time will be longer and the quality of pulp will be adversely affected. Salt bleaches the colour of the tomato product; it is, therefore, desirable to add it towards the end of the cooking process. Spices are generally added in powdered form to the product by spice bag method. At present, spice extract is used in many industries for sauce / ketchup preparations.

The salt content of the product should be 1.3-3.4 per cent. Good quality vinegar is essential for the preparation of high quality sauce /ketchup. It should contain 5.0-5.5 per cent acetic acid and should be added when the product has thickened sufficiently. Tomato sauce / ketchup generally contains 1.25 – 1.5 per cent acetic acid. The ketchup should be filled hot (about 88°C) to prevent browning and loss of vitamins during subsequent storage. It is advisable to add 0.025 per cent sodium benzoate to the product before bottling and then pasteurize the bottles.

Recipe :

Tomato pulp – 1kg, sugar 75 g, salt 10 g, onion (chopped) 50 g, ginger (chopped) 10 g, garlic (chopped) 5 g, red chilli powder 5 g, cinnamon, cardamom (large), aniseed, cumin, black pepper (powdered) 10 g each, clove (headless) 5 numbers, vinegar 25 ml or glacial acetic acid 5 ml and sodium benzoate 0.25 g per kg final product.

PROCESSING FLOW-SHEET FOR TOMATO SAUCE/KETCHUP



(after squeezing in pulp)

⇩

ADDITION OF REMAINING SUGAR AND SALT

⇩

COOKING

⇩

JUDGING OF END-POINT
(tomato solids by hand refractometer / volume
by measuring stick, i.e. one-third of its original volume)

⇩

ADDITION OF VINEGAR / ACETIC ACID AND PRESERVATIVE

⇩

FILLING HOT INTO BOTTLES AT ABOUT 88°C
CROWN CORKING

⇩

PASTEURIZATION
(at 85-90°C for 30 minutes)

⇩

COOLING

⇩

STORAGE AT AMBIENT TEMPERATURE
(in cool and dry place)

b. Tomato Chutney :

Tomato 1 kg, sugar 500 g, salt 25 g, onion (chopped) 100 g, ginger (chopped) 10 g, garlic (chopped), 5 g, red chilli powder 10 g, cinnamon, black pepper, cardamom (large), aniseed, cumin (powdered) 10 g each, vinegar 100 ml and sodium benzoate 0.5 g per kg final product.

PROCESSING FLOW-SHEET FOR TOMATO CHUTNEY

TOMATOES
(Fully ripe, red)

⇩

WASHING

⇩

SORTING

⇩

BLANCHING FOR 2 MINUTES

⇩

PUTTING QUICKLY IN COLD WATER
(to crack skin)

⇩

PEELING

⇩

CRUSHING

⇩

ADDITION OF INGREDIENTS EXCEPT SALT AND VINEGAR AND COOKING GENTLY TO DESIRED CONSISTENCY

⇩

ADDITION OF SALT AND VINEGAR AND COOKING FOR 5 MINUTES

⇩

ADDITION OF PRESERVATIVE

⇩

FILLING HOT BOTTLES

⇩

SEALING

⇩

STORAGE AT AMBIENT TEMPERATURE
(in cool and dry place)

Problem in the preparation of sauces / ketchups :

Black neck : Formation of a black ring in the neck of bottles is known as black neck. It is caused by the iron which gets into the product from the metal of the equipment and the cap / crown cork through the action of acetic acid. This iron coming into contact with tannins in spice forms ferrous tannate which is oxidized to black ferric tannate. Black neck can be prevented by :

i. Filling hot sauce at a temperature not less than 85°C;
ii. Leaving very little head space in bottles (the more the air the greater is the blackening).
iii. Reducing contamination by iron, sources of iron being salt and metal equipment;
iv. Partial replacement of sugar by corn syrup or glucose syrup which contain sulphur and prevent blackening;
v. Addition of 100 ppm sulphur dioxide or 100 mg% ascorbic acid;
vi. Storing bottles in horizontal or inverted position to diffuse the entrapped air (O2) throughout the bottle thus reducing its concentration in the neck sufficiently to prevent blackening;
vii. Using cloves only after removing the flower / head.

DEHYDRATION OF FRUITS AND VEGETABLES

Dehydration means the process of removal of moisture by the application of artificial heat under controlled conditions of temperature, humidity and air low. In this process a single layer of fruits or vegetables, whole or cut into pieces or slices are spread on trays which are placed inside the dehydrator. The initial temperature of the dehydrator is usually 43°C which is gradually increased to 60-66°C in the case of vegetables and 66-71°C for fruits.

Basic types of drying process :

- Sun drying, solar drying;
- Atmospheric drying including batch (kiln, tower and cabinet driers) and continuous (tunnel, belt, belt-trough, fluidized bed, explosion puff, foam-mat, spray, drum and microwave);
- Sub-atmospheric dehydration (vacuum shelf/belt and freeze driers.

Sun and solar drying of fruits and vegetables is a cheap method of preservation because it uses the natural resource / source of heat; sunlight. This method can be used on a commercial scale as well at the village level provided that the climate is hot, relatively dry and free of rainfall during and immediately after the normal harvesting period.

- Large scale driers are more promising than small scale ones. However, small scale driers should not be neglected.
- The drier should be designed to maximize the utilization factor of the capital investment, i.e. multi-products (fruits, vegetables and other raw material) and multi-use (eg. Drying and heating water for domestic use).
- In general, an auxiliary heat source should be provided to assure reliability, to handle peak loads and also to provide continuous drying during periods of no sunshine.

Shade drying :

Shade drying is carried out for products which can lose their colour and / or turn brown if put in direct sunlight. Therefore, shade drying is carried out under a roof or thatch which has open sides.

Osmotic dehydration :

In osmotic dehydration the prepared fresh material is soaked in a heavy (thick liquid sugar solution) and / or a strong salt solution and then the material is sun or solar dried.

Common driers used for drying / dehydration :

a. Air Convection Driers
    i. Kiln drier
    ii. Cabinet, tray and pan driers
    iii. Tunnel and continuous belt driers
    iv. Belt trough drier
    v. Air lift drier
    vi. Fluidized bed drier
    vii. Spray driers
b. Drum or Roller Driers
c. Vacuum Driers
    i. Vacuum shelf driers
    ii. Continuous vacuum belt drier
    iii. Freeze-drying

FLOW-SHEET FOR DRYING / DEHYDRATION OF FRUITS AND VEGETABLES

FRUITS / VEGETABLES
(mature and free from insects and diseases)

⇓

WASHING

⇓

PEELING

⇓

PREPARATION
(as given in table for individual fruit / vegetable)

⇩

BLANCHING[1]

⇩

SPREADING ON FLAT WOODEN TRAYS

⇩

SULPHURING[2]
(usually @ 1.8 to 3.6 kg per tonne of fruit)

⇩

DRYING / DEHYDRATION
(with occasional turning)

⇩

SWEATING[3]

⇩

PACKING
(airtight tin containers or polythene bags)

⇩

STORAGE
(at ambient temperature in dry place)

[1] Blanching : Exposing fruit and vegetable to hot or boiling water as a pre-treatment before drying has the following advantages :

* it helps clean the material and reduce the amount of microorganisms present on the surface ;
* it preserves the natural colour in the dried products; for example, the carotenoid (orange and yellow) pigments dissolve in small intracellular oil drops during blanching and in this way they are protected from oxidative breakdown during drying;
* it shortens the soaking and/or cooking time during reconstitution.

During hot water blanching, some soluble constituents are leached out; water-soluble flavours; vitamins (vitamin C) and sugars.

Use of preservatives : Preservatives are used to improve the colour and keeping qualities of the final product for some fruits and vegetables. Preservatives include items such as sulphur dioxide, ascorbic acid, citric acid, salt and sugar and can either be simple or compound solutions.

[2]Sulphuring : Sulphur dioxide fumes act as a disinfectant and prevent the oxidation and darkening of fruits on exposure and thus improves their colour. Sulphur fumes also act as a preservative, check the growth of moulds, etc. and prevent cut fruit pieces from fermenting while drying in the sun. Vitamins in sulphured fruits are protected but not in unsulphured ones. Vegetables are not generally sulphured.

"Sulphur box" is a closed airtight chamber of galvanized iron sheet.

Dehydrated fruit and vegetable potential defects and means to prevent them are given below :

Defects	Causes	Prevention
Moulding	High product moisture, above equilibrium relative humidity corresponding to water activity a_w =	Reduce water content down to optimum values. Pack in hermetic airtight packages.

	0.70	
Infestation	Presence in dried products of larvae or insects	Storage room disinfection with toxic gases. Fumigation of packed products and of packages. Disinfection by heat (60-65°C) of products before packing.
Browning	Chemical reaction (Maillard, etc.)	Reduce as much as possible water content. Store at low temperature.
	Enzyme catalyzed reactions	Enzyme inactivation by blanching or steaming before drying.
Reduced rehydration ratio	Too high temperature in final stage of drying	Operate inside final temperatures as recommended.

Rehydration ratio :

If the weight of the dehydrated sample (a) used for the test is 5 g and the drained weight of the rehydrated sample (b) 30g, then

$$\text{Rehydration ratio} = \frac{B}{a} = \frac{30}{5} = 6{:}1$$

Rehydration coefficient :

If the drained weight of 10 g of dried sample containing 5% moisture after rehydration is 70g, and the fresh sample before drying contained 90% moisture, then

$$\text{Rehydration coefficient} = \frac{\text{Drained weight of re-Hydrated sample} \times (100 - \text{Moisture content of sample before Drying})}{\text{Weight of dried sample taken for for rehydration} - \text{Amount of moisture present in the dried sample taken for rehydration} \times 100}$$

$$= \frac{70 \times (100 - 90)}{10 - 0.5) \times 100} = 0.74$$

VII. PICKLE PRODUCTION

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. The stimulate the flow of gastric juice and thus help in digestion.

Pickling is the result of fermentation by lactic acid-forming bacteria, 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 per cent salt solution, whereas the growth of a majority of undesirable organisms is inhibited.

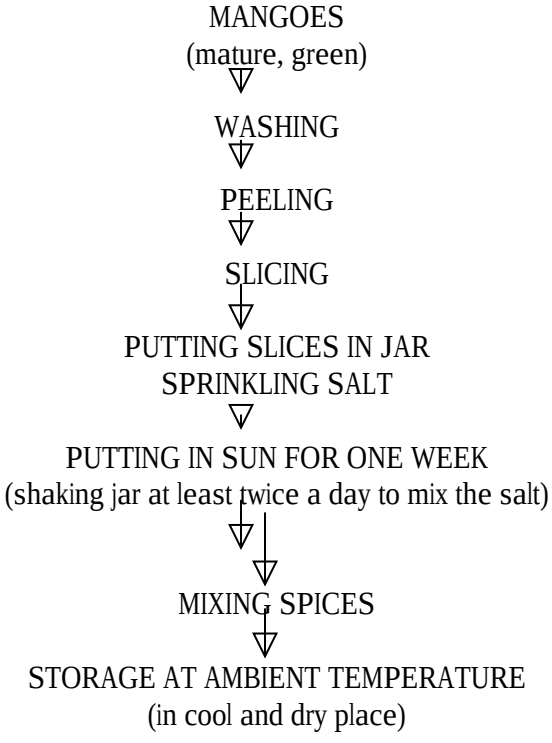
At present, pickles are prepared with salt, vinegar, oil or with a mixture of salt, oil, spices and vinegar.

1. Preservation with salt

Salt improves the taste and flavour and hardness the tissues of vegetables and controls fermentation. Salt content of 15 per cent or above prevents microbial spoilage. This method of preservation is generally used only for vegetables which contain very little sugar and hence sufficient lactic acid cannot be formed by fermentation to act as preservative. However, some fruits like lime, mango, etc. are also preserved with salt.

i. Mango pickle : Mango peeled and sliced 1 kg, salt 200 g, red chilli powder 10n g, asafetida 5 g, fenugreek, black pepper, cardamom (large), cumin and cinnamon (powdered) each 10 g, clove (headless) 6 numbers.

PROCESSING FLOW-SHEET FOR MANGO PICKLE



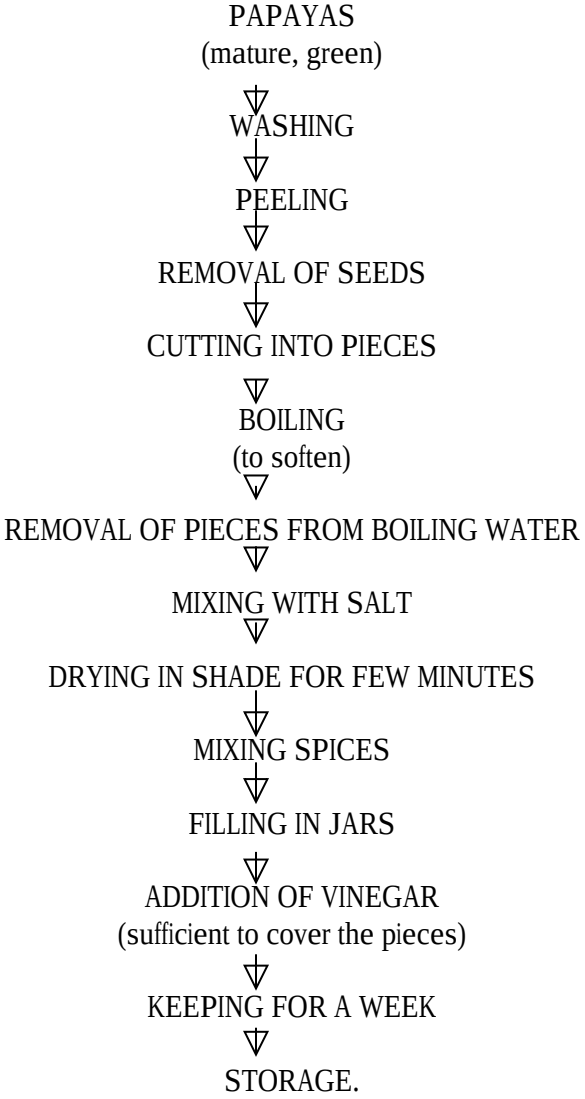
2. Preservation with vinegar

A number of fruits and vegetables are preserved in vinegar whose final concentration, in terms of acetic acid, in the finished pickle should not be less than 2 per cent. To prevent dilution of vinegar below this strength by the water liberated from the tissues, the vegetables or fruits are generally placed in strong vinegar of about 10 per cent strength for several days before pickling. This treatment helps to expel the gases present in the intercellular species of vegetable tissue.

Vinegar pickles are the most important pickles consumed in other countries. Mango, garlic, chillies, etc are preserved as such in vinegar.

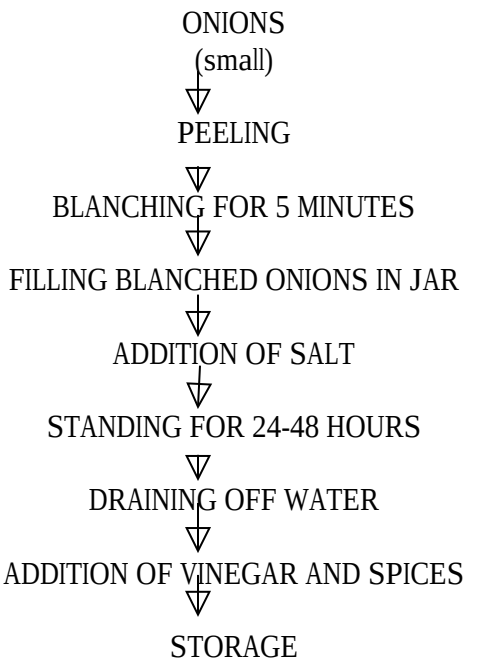
i. Papaya pickle : Peeled papaya pieces 1 kg, salt 100 g, red chilli powder 10 g, cardamom (large), cumin, black pepper (powdered) each 10 g, vinegar 750 ml.

PROCESSING FLOW-SHEET FOR PAPAYA PICKLE



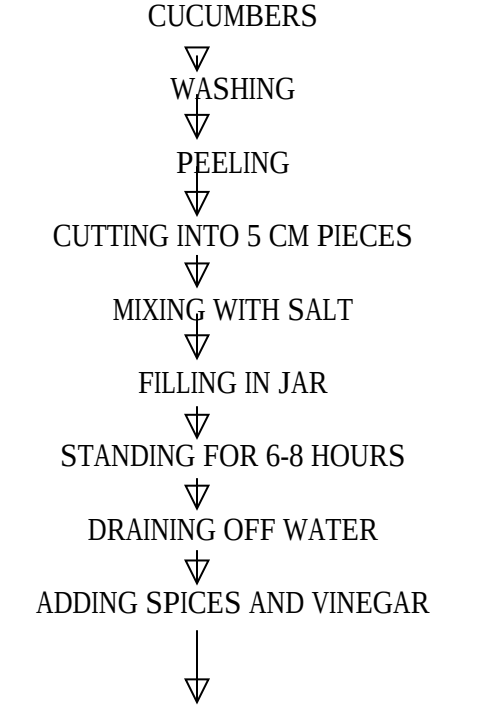
ii) Onion pickle : Onions 1 kg, vinegar 1 litre, slat 250 g, red chilli powder 10 g, cardamom (large), black pepper, cumin (powdered) each 10 g, clove (headless) 5 numbers.

PROCESSING FOW-SHEET FOR ONION PICKLE



iii. Cucumber pickle : Cucumber 1 kg, slat 200 g, red chilli powder 15 g, cardamom (large), cumin, black pepper (powdered) each 10 g, clove (headless) 6 numbers, vinegar 750 ml.

PROCESSING FLOW-SHEET FOR CUCUMBER PICKLE



KEEPING IN SUN FOR A WEEK

⇩

STORAGE

3. Preservation with oil

The fruits or vegetables should be completely immersed in the edible oil. Cauliflower, lime, mango and turnip pickles are the most important oil pickles.

i. Mango pickle : Mango pieces 1 kg, salt 150 g, fenugreek (powdered) 25 g, turmeric (powdered) 15 g, nigella seeds 15 g, red chilli powder 10 g, clove (headless) 8 numbers, black pepper, cumin, cardamom (large), aniseed (powdered) each 15 g, asafetida 2 g, mustard oil 350 ml (just sufficient to cover pieces).

PROCESSING FLOW-SHEET FOR MANGO PICKLE

MANGOES
(mature, green)

⇩

WASHING

⇩

CUTTING LENGTHWISE INTO FOUR PIECES

⇩

REMOVAL OF KERNEL

⇩

DIPPING PIECES IN 2% SALT SOLUTION
(to prevent browning)

⇩

DRAINING OFF WATER

⇩

DRYING IN SHADE FOR FEW HOURS

⇩

HEATING OIL

⇩

COOLING

⇩

MIXING SPICES IN A LITTLE OIL

⇩

MIXING WITH PIECES

⇩

FILLING IN JAR

⇩

KEEPING IN SUN FOR A WEEK

⇩

PRESSING THE MATERIAL
(to remove air)

⇩

ADD REMAINING OIL

⇩

STORAGE

4. Preservation with mixture of salt, oil, spices and vinegar

i. Cauliflower pickle :

Cauliflower (pieces) 1 kg, salt 150 g, ginger (chopped), 25 g, onion (chopped) 50 g, garlic (chopped) 10 g, red chilli, turmeric, cinnamon, black pepper, cardamom (large), cumin, aniseed (powdered) each 15 g, clove (headless) 6 numbers, tamarind pulp 50 g, mustard (ground) 50 g, vinegar 150 ml, mustard oil 400 ml.

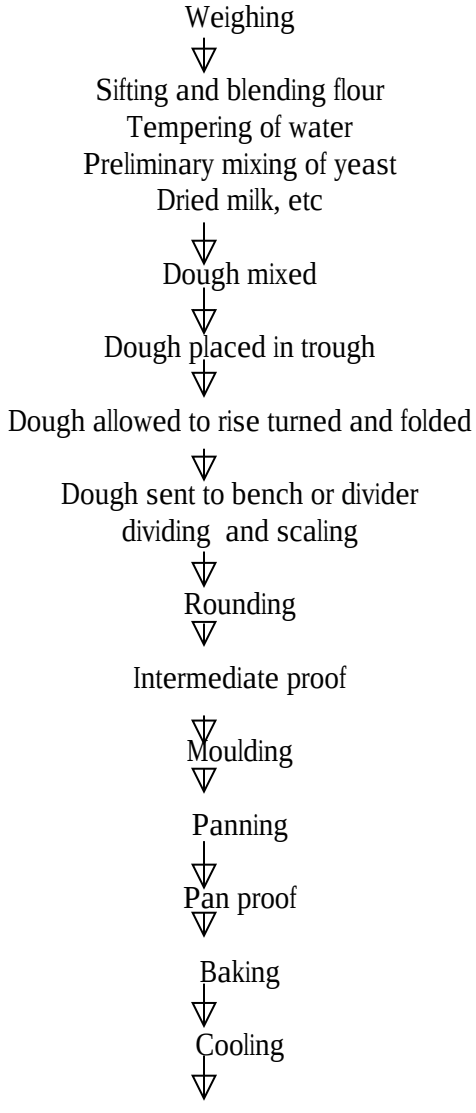
PROCESSING FLOW-SHEET FOR CAULFIFLOWER PICKLE

Problems in pickle making

1. Bitter taste : Use of strong vinegar or excess spice or prolonged cooling of spices imparts a bitter taste to the pickle.
2. Dull and faded product : This is due to use of inferior quality matrials of insufficient curing.

3. Shrivelling : It occurs when vegetables (e.g cucumber) are placed directly in a very strong solution of salt or sugar or vinegar. Hence, a dilute solution should be used initially and its strength gradually increased.
4. Scum formation : When vegetables are cured in brine, a white scum always form on the surface due to the growth of wild yeast. This delays the formation of lactic acid and also helps the growth of putrefactive bacteria which cause softness and slipperiness. Hence, it is advisable to remove scum as soon as it is formed. Addition of one per cent acetic acid helps to prevent the growth of wild yeast in brine, without affecting lactic acid formation.
5. Softness and slipperiness : This very common problem is due to inadequate covering with brine or the use of weak brine. The problem can be solved by using a brine of proper strength and keeping the pickles well below the surface of the brine.
6. Blackening : It is due to the iron in the brine or in the process equipment reacting with the ingredients used in pickling. Certain microorganisms also cause blackening.

Bakery course material:
BREADMAKING



Slicing

Several changes take place within the dough during the fermentation period, which cause the dough to produce good bread if the dough is handled properly for the rest of the process. In the process of fermentation part of the sugar is converted into a form that can be used as food to the yeast. Starches are converted into sugar that produce carbon dioxide gas and alcohol that causes dough to expand. The enzyme, protease the gluten to become soft and capable of stretching. As the dough ferments, acidity is developed in the dough which also helps to stretch it.

Makeup of the dough for loaves – After the dough has fermented to a desirable degree it is necessary to divide the dough into pieces and to shape the pieces for panning. The four steps involved in the make up are described in the following sub-paragraphs :

i. Divide into uniform pieces : The dough is divided into uniform piecesof the desired weight. The size of the loaves must be uniform. They must be of the same weight if they are to bake off uniformly.

In hand-operated shop, this is done by cutting off pieces of dough with the scrapper and weighing off the pieces, adding more dough if it is too light or removing some of the dough if the piece is too heavy. Sometimes this is called scaling because the pieces of dough are scaled to the exact weight desired.

In a machine-operated shop, the baker scales the pieces by machine adjusting it so that the pieces will be of the desired weight.

Rounding the dough – Round the dough for the intermediate proof by tucking in the raw edges of the piece and forming a round piece of dough. This stretches the skin over the piece of dough and seals in the raw edges left when the piece of dough was divided.

Intermediate proof – The intermediate proofing period is that period of time that the rounded piece of dough is allowed to rest between the time the dough is divided and rounded and the time when the piece of dough is formed for panning. The length of the intermediate proofing period should be just long enough for the piece of dough to recover from being divided and rounded. It should be loose enough so that it can be easily molded. This requires from 8 to 15 minutes, depending on the dough and the conditions of the shop.

Molding and panning :

The pieces of dough are shaped so that they can rise in the pan and form a desirable shaped loaf of bread. Use these steps in hand molding :

1. Take rounded pieces of dough and place on floured board with top (or rounded) side down.
2. Press out gas with palms of hands.
3. Pull dough lengthwise to shape into oblong piece the length of finished loaf.
4. Shape loaf by folding lengthwise to the center. Press firmly with fingers seal.
5. Fold over ½ of the dough and press for a final seal.
6. Roll dough to complete sealing and molding of the loaf.

Bread pans should be greased sufficiently to prevent the loaf from sticking but should not be excessively greasy. The pan should not be cold enough to chill the loaf (or not above 95°F). The seam

on the piece of dough should be placed down so it will be on the bottom of the loaf. The loaf should be in the centre of the pan.

Pan Greasing – The primary purpose of greasing the pan is to prevent the bread from sticking when it is removed.

Pan Proofing the loaves : After shaping and panning, loaves should be placed in a properly controlled room or cabinet called the proof box or proof cabinet, for the final or pan proof. Temperature of the cabinet should be maintained at 98°F and relative humidity at 88 per cent. During pan proofing, the action of the yeast is speeded up by higher temperature and the gluten becomes more mellow and more extensible.

Baking : The final stage in bread production is to place the pans of dough into an oven that is heated to a temperature of 425°F. This oven temperature is sufficient to heat quickly the dough mass, and the increased temperature causes the carbon dioxide of the dough to expand, thereby greatly increasing the size of the dough. The oven temperature also vaporizes moisture on the surface of the bread and ultimately causes caramelization of the sugars, starches, and other ingredients that make up the exposed dough surface.

Size and shape of loaf : If the loaf is large, the temperature of the oven will have to be regulated so the surface of the loaf will not burn before the loaf is baked. If the loaf is small, the temperature of the oven will have to be raised so the raised so the loaf will brown off before the crumb of the loaf is overbaked.

Cooling of the baked loaf : The loaf should be cooled so that it will not dry excessively. Conditions which cause this excessive drying are that the air is too dry or warm in the cooling room or there is excessive air circulation in the cooling room.

Storing and serving : Bread should be stored under conditions that will not dry the bread and where the temperature is cool. Bread baked should not be held more than 48 hours.

CAKE MAMING

The basic ingredients of a cake are divided into two types the ones that give structure to the cake – Flour, eggs and milk; and the ones that make the cake tender – sugar, shortening and baking powder.

SPONGE CAKE

Sponge cakes depend mainly upon the whipping of eggs for their lightness or aeration. This lightness is produced by the thorough beating of the eggs which causes formation of air bubbles. Due to heat, air and moisture in these bubbles expand during baking, causing the rising action.

Eggs are the most important ingredients in the sponge cakes, therefore, great care must be taken in their selection. They must be of good quality, fresh and of a pleasing flavour. It has been found that when eggs are heated upon 100-120°F they will produce the best results. Sugar has a mellowing or tenderizing effect upon the cell structure of the cake and when too high a percentage is used the cakes will sag in the centre or fall. Granulated sugar produces the best results.

Shortening provides better eating qualities to the sponge cake. However, shortening has a mellowing effect upon the cells structure of the cakes. Leavening and flour should be thoroughly sifted

together so that they will be well blended. Sponge cake batter breaks down readily when adding flour or other ingredients.

Addition of moisture to sponge cakes improves their keeping and eating qualities. Sponge cakes both straight and short are baked at a higher temperature ranging from 370° to 425°F depending upon the type and size of the cakes.

COOKIES

Cookies are often referred to as small sweet cakes. In our country these are commonly known as biscuits. Cookies are classified according to the mixing method and the recipe adopted. These may be divided into two categories i.e., batter type and foam type. Batter type cookies include the drop cookies, snaps and short breads while the foam type cookies include meringue and sponge cookies.

Care should be taken in choosing the ingredients for cookie production. Only quality ingredients with correct method of processing will produce products of high standards.

The finished results of all the bakery products are considerably influenced by flour. For cookies to be of premium quality, soft wheat flours are ideally suited. These soft wheat flours commonly termed as Pastry Flours are usually unbleached containing 8-10% protein and less than 0.4% ash. The colour of the flour may be a little darker but this type of flour will allow the cookies to have a better spread.

Sugars :

There are several grades and types of sugars used in cookies. Coarser granulated sugar in the recipe will give a cookie maximum spread during baking and retain its original granulation to a greater extent.

Shortening :

Regular hydrogenated shortening with a bland flavour is the most suitable type of shortening used in cookie production. Butter mainly due to its characteristic flavour should be used in equal parts with the shortening. Fat due to its shortening or mellowing action on gluten also helps in promoting the spread.

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Eggs :

Eggs have a binding action and when large amounts are used will result in giving cookie a rise rather than spread. Egg yolks alone will produce a tender cookie.

Milk solids :

Milk solids are solid materials of milk after the water has been removed. The milk solids have a binding action on the flour proteins.

Chemical leaveners :

The main function of the leavening agents are to provide volume, to adjust the flavour, to control the spread and to give lightness to the product. Baking powder is widely used as leavening in cookie production.

Mixing procedures :

The general procedure for mixing cookie doughs is to cream the sugar, shortening, salt and flavour. Then add the eggs and moisture and then the flour. The leavening is added at different stages. Cookie doughts should be mixed just enough to blend the ingredients homogenously.

Baking :

Baking temperatures depend upon type of cookies. Crisp type of cookies depending upon the size of the cookies will require a heat of approximately 380°F with a baking time of 10 to 12 minutes. In order to obtain the best baking results, cookies should be removed from the oven while they are still a little soft as they will continue to bake on hot pans. To avoid chances of breakage, cookies should be removed from the pans when they are still a little warm.

DANISH PASTRY

In the make up of assorted Danish pastry units, the principal factors are size, shape and uniformity of the units. Weight determines the size of the unit while the shape will depend upon the skill of the baker during make up. Uniformity is a combination of size and the shape and the manner in which the units are proofed, baked and finished to obtain the desired results.

The following basic formula can be tried in your bakeshop with necessary adjustments to suit your shop conditions.

Dried	Gms	%	
Yeast or	30	3	Suspend yeast in water (if dried yeast is used, dissolve)
Compressed	60	6	Yeast in warm water 110°F
Water	200	20	
Milk powder	50	5	Dissolve milk powder, sugar, Salt and eggs in water
Sugar	100	10	
Salt	15	1.5	
Egg	120	12	

Water (variable)	250	25	
Flour	1000	100	Add the yeast ferment and the water in which the milk powder, sugar, salt and eggs have been dissolved to the flour. Mix well along with the shortening to develop a smooth dough. Keep the dough covered and allow a short rest, for 20-30 minutes
Shortening	50	5	
Shortening (for roll-in)	600	60	Work the shortening until firm and has a plastic consistency

Proofing

Danish pastry when properly handled has a lot of oven spring and therefore, does not require a great deal of proof. It is recommended that units be given one half proof before placing them in the oven. The individual Danish pastry units after shaping should be kept for proofing. A desirable temperature range being from 80-85°F (50°C) with a relative humidity of 80-85%. Just before baking, brush over the pastry with egg wash.

Baking :

The over temperature for Danish should be about 400-450°F (200-235°C) depending upon the size of pastry unit. A glaze should be applied immediately after baking. A good glaze can be prepared by bringing to a good boil 3 parts of glucose to 1 part water by weight. Danish pastry should be iced with a thin roll icing when partially cooled.

Filling :

Left over cake crumbs can be converted into filling in the following ratios :

Cake crumbs : 130 gms
Icing sugar : 50 gms
Whole egg : 20 gms
Cinnamon powder to taste
Milk as required to give a spreading consistency.

Make up of Danish pastrics-Horse shoe)

Step-1 Roll out an oblong piece of dough to a rectangular shape approximately 8 ½' x 12"
Step-2 Spread the above mentioned filling over 2/3 of the surface
Step-3 Fold 1 over 2. After folding brush top of 1 wish egg wash. When washed, fold 3 over 1 and 2.
Step-4 After folding 3 over 1 and 2, place sealed side down and flatten slightly into a uniform strip
Step-5 Now place on sheet pan in a horse shoe shape
Step-6 Cut as indicated.

Cinnamon Rolls

Step-1 Roll out 2 kg to 3 kg piece of dough into a uniform sheet approximately 1/8" to 3/16" thick and 11" to 12" wide.

Step-2 Wash over with melted shortening, butter, water, or egg wash.

Step-3 Spread a filling of cinnamon, sugar and raisins.

Step-4 Roll up --- start at A, finish at B and seal seam.

Step-5 Cut into desired weight (controlled by thickness). A 2 K piece of dough generally yields approximately 5 dozen cinnamon rolls.

Step-6 The rolls may be baked on sheet pan on almost any size or shape individual pans.

Cinnamon bun

Step-1 Roll out a 1.5 kg piece of dough into a uniform sheet, approximately 1/8 in to 3/16 in thick, 11 in. to 12 in. wide. Wash over with melted shortening, butter, water or egg wash. Sprinkle on cinnamon-sugar mix and raisins or nuts, if desired. Roll up – start at A, finish at B, and seal seat.

Step-2 Cut into desired weights (controlled by thickness)

Step-3 The buns are placed ½ in apart and baked on sheet pans as shown.

Step-4 Wash, pan proof and glaze.

PUFF PASTRY

Puff Pastry is a rolled pastry in which layers of shortening are interleaved between layers of dough so that upon baking an open network of crisp and flaky layers are formed. The main ingredients used in puff pastry making are flour, shortening, salt and water.

1. Mix a dough consisting of
   2 kg. bread flour
   20 gms salt, and
   1.2 kg water (variable)
2. Shape the dough into rectangular form and keep it in the cool place preferably in a refrigerator. When the dough has cooled down, roll it out to one-third inch thickness retaining the rectangular shape.
3. Cover the two thirds of rolled dough by spreading 1 kg shortening and fold it over so that three layers of dough are separately by two layers of shortening. Roll the dough again to one-third inch thickness and fold similarly into three layers.
4. Return the dough to the refrigerator and allow it to rest for about an hour. Always cover dough from drying away. Repeat the process of sheeting and folding and once again to one-third inch thickness and fold similarly into three layers.
5. After cooling down the dough, roll it and cut into desired shape. Finish baking at 400°F for 10 to 20 minutes.

The average puff pastry dough consists of equal parts of flour and shortening. Bread flour is generally used but a combination of bread and cake flour in preferred by many bakers. If less shortening is used, the end products will be tougher. In order to get the best results, the dough and shortening should be of same consistency. A melted or a soft shortening will not produce good results due to the absorption of oil by the flour. This will eliminate part of the shortening layers and the product will have a low volume and soggy texture. If a shortening with low melting point is used it runs out during baking before the layers have a chance to set.

Salt has a toughening effect upon the gluten in the dough. Too much salt will deteriorate the strength of the gluten, which will lower the volume of the product. Edible acids such as vinegar, lemon juice etc., when added during mixing help in mellowing of the gluten. This facilitates the dough to roll out without difficulties and also makes the dough shorter.

The puff pastry dough should not be rolled too thin between foldings otherwise the layer of shortening and dough will become too thin which will lower the volume of the resultant product. The same is the case if the dough is given too many foldings. The dough and shortening come in close contact causing sogginess and lack of spring. The dough should always be given sufficient rest between the rollings for the gluten to relax. The dough should always be kept in a cold place if the refrigerated facilities are not available. This prevents the softening or melting of the shortening. Care should be taken to roll the dough as evenly as possible. It should be rolled in various directions so that the gluten will not be stretched in only one direction. Too much pressure should not be applied while rolling. Otherwise this will cause tearing or crushing of the layers of shortening and dough. Care should be taken not to use too much of dusting flour. Excess flour should be brushed off the dough before folding which will help the folds to stick together.

Always use sharp cutters and knives while cutting the dough into desired shapes. Blunt tools will seal the edges of the dough and this in turn may result in the finished product lacking volume, uneven rise and tipping of flaky layers. After the products are shaped allow them to stand in a cool place for 15 to 20 minutes before loading in the oven. Also dampen the baking sheets with cold water prior to deposition in the oven. This will prevent the product from shrinking during baking. If warm pans are used shortening in the dough will melt before the products go into the oven, resulting in inferior product.

Rich egg wash is used prior to baking to improve the appearance of the finished products. Care should be taken not to use wash in excess to prevent the wash running over the side of the product. Due to the instant congealing action of the wash proper raising action of the product is checked.

PIE

Pies are usually classified into three main groups :

a. Fruit filled pies
b. Mince or meat pies
c. Fried pies

Make up

The following recipe will offer a new variety to the bakers sales counter and will also help the baker to utilize more profitably the leftover cake trimmings and crumbs.

Bakewell Pie

Dough : Flour	100 gms	100%
Butter or shortening	50 gms.	50%
Salt	1.5 gms.	1.5%
Sugar	4 gms	4%
Water (variable)	30 gms.	30%
Filling : Butter	25 gms.	25%
Sugar	25 gms.	25%
Egg	One	
Cake crumbs	25 gms.	25%
Walnuts or cashewnuts	15 gms.	15% (optional)
Essence	a few drops	
Jam for spreading		

Method

Sift flour, salt and sugar. Rub the shortening lightly in the flour with finger tips. Mix gently to a stiff dough using very little cold water. Bind together. Allow rest for an hour. Sheet the dough lightly to the desired thickness (about 1/8") using minimum of dusting flour. Place the rolled pastry on the pie plates or patty pans. Trim the edges of the pan. These trimmings can be used for decorating the pie top after depositing the filling. Always dock the pie shell before depositing filling for uniform rising of the pie crust. Docking is done with the help of the fork or any other sharp instrument to allow the doughs rise uniformly without bursting during baking.

Filling

Cream butter and sugar. Add chopped nuts to the well sieved cake crumbs. Add this to the creamed butter and sugar alongwith the beaten egg. Add flavouring and blend well.

Spread jam over unbaked pie shell and spread the mixture evenly. Decorate the top with trimmings forming lattice design. Bake at 450°F for 12-15 minutes until the filling is firm and a golden brown.

The possible faults usually encountered during pie making can be broadly listed under

(i) Pie crust and (ii) Pie filling.

MACAROONS

Macaroons are a very popular type of cookie which has a demand all year round. It is a type of coookie composed chiefly of egg whites, sugar and traditionally ground almonds or coconut.

The three basic ingredients used in the making of Macaroons are fine granulated sugar, egg whites and nuts of any variety depending on your customer's choice. The basic formula which is generally used is 2.25 kg sugar, 2.25 kg. nuts and 1 litre egg whites. The nuts should be chopped finely before mixing. Usual care should be taken in the selection of the ingredients.

Macaroons may be mixed either by hand or machine. The most popular method is to cut the groundnut paste into small pieces and then add the sugar. These ingredients are mixed together until the paste is converted in very small lumps. The egg whites are then added gradually and mixing is continued until the batter is smooth. The batter should be just soft enough to spread slightly. The Macaroons may be bagged out with a plain tube or star tube.

Pans for the cookies may be lined with paper or the clean pan should be lightly greased and dusted with flour. Garnish the cookies, with half cherries, pieces of dried fruits or walnuts as soon as the cookies are bagged out.

DOUGHNUTS

Doughnuts are served quite extensively in hotels, restaurants and snack bars in many countries of the world. When made attractive and tasty, doughnuts can be served at most festive occasions. Doughnuts can become very popular in India for serving at tea time. The ingredients that go to make doughnuts are :

Flour	100%
Sugar (ground)	35%
Shortening	7%
Baking powder	4.5%
Egg	30%
Salt	1.5%
Nutmeg powder	0.5%
Cinnamon powder	0.5%
Baking soda	0.45%
Milk powder	5%
Water (variable)	40%

Lemon yellow colour as required

Method

1. Sieve together correctly scaled flour, salt, nutmeg powder, cinnamon powder, milk powder and baking powder thoroughly.
2. Cream shortening and ground sugar thoroughly
3. Add well beaten eggs to creamed shortening and sugar
4. Add lemon yellow colour to water
5. Add baking soda to creamed shortening and sugar to which beaten eggs have been added.
6. Mix to a smooth dough
7. Roll out the dough on a lightly floured board. Rolled dough should be 1/3 cm. thick.
8. Use doughnut cutter which has outer 7 cm diameter and 2½ cm inner diameter.
9. Place doughnuts into frying pan. The fat temperature should be around 380°F. The doughnuts will rise after few seconds. Then turn upside down. Fry till golden brown. Strain fat by using frying spoon before wrapping or serving.
10. When using 500 grams of flour and the above recipe, three dozen doughnuts of the size mentioned above could be obtained.

ICINGS

Icings are sweet coverings - plain or with vivid pattern in which sugar is the main ingredient. Type of an icing depends upon the materials used in the preparation as well as the method of mixing. There are various types of icing which can be classified under two groups :

1. Those icings which like flat icings including a fondant are melted by heat and when cooled will set to a firm coating. Fondants contain a high proportion of small sugar crystals that partially dissolve on warming and recrystalize on cooling.
2. Those highly aerated icings are composed of a creamed mixture of shortening, confectioners sugar, water, salt, flavour, eggs and milk powder. These are more suitable for spreading and piping where aeration or whipping is used to produce icings of stiff, non-flowing consistency.

Flat Icings

Flat icings are the combination of confectioners sugar, water, corn syrup and flavour. All the ingredients are to be mixed to a thick paste consistency and warmed to about 110°F. To avoid direct or overheating of icing, a double boiler method of heating should be used.

Fondant is prepared by using

2 par sugar
1 part water
a pinch of cream of tartar

BUTTER ICING

Ingredients

Butter - 250 gms
Icing sugar - 500 gms.
Vanilla - 1 t.s.p.

Method

1. Cream butter to a smooth consistency

Colouring - as desired

2. Add icing sugar little at a time and cream
3. Finally add vanilla and colour as desired

For making the cake the consistency of icing should be soft while for piping it should be stiffer.

ROYAL ICING

Ingredients

Egg whites - 2 nos.
Icing sugar - 450 gms
Cream of tartar - 1/4 t.s.p.
Colour and flavour - as desired

Method

1. Add cream of tartar to egg whites and beat gradually
2. Add icing sugar gradually and continue beating
3. Add colour and flavour as desired
4. Consistency for spreading should be softer, while for piping it should be stiffer

Precautions

1. Egg whites should be separated neatly. Minute presence of egg yolk will spoil the icing.
2. Utensils in sue should be absolutely grease free and dry.
3. Egg whites should be rested for sometime (3-4 hours) before using them.

FROSTING

Ingredients

Gr. Sugar - 450 gms
Water - 150 gms.
Egg whites - 2 nos.
Colour and flavour - as desired
Cream of tartar - 1/4 t.s.p.

Method

1. Boil sugar and water exactly as for foundant and boil to 239°F (115°C) or to soft ball consistency
2. Beat the egg white with cream of tartar to a stiff peak.
3. Add syrup in a trickle and continue beating upto the point of setting.
4. Pour on cake quickly before it sets completely.