Chapter - 3

SYRUPS, BRINES AND FOOD COLOURS

OBJECTIVES

After studying this chapter, you will be able to:

- Know how to make different syrups for preservation of fruits
- Diffirentiate between brine & syrup
- Define brining and describe the mehtods of brining
- Know about preservatives, their classification and uses in preservation of fruits, vegetables and flowers
- Classify preservatives
- Elaborate the role of food colours, their classification and uses

INTRODUCTION

In the previous chapter, you have studied about some value added products of fruits, vegetables and flowers. You have also read about some methods of preservation. In this chapter, you will get acquainted with syruping and brining, commonly used practices in preservation of some fruits and vegetables. In addition, we will also discuss about preservatives & their use in preservation of fruit and vegetables products and flowers. Similarly, discussion will also be held on food colours, their uses and limitations. Let us first understand what is syrup or brine and what are their uses in fruit and vegetable industry.

Syrup

A solution of sugar in water is called a syrup and process of adding syrup in fruit product is called as syruping. White, refined sucrose is used for making syrup. Usually, sucrose syrup is used in canning. Syrup is added to improve the

Syruping is commonly done in fruits and brining in vegetables. The objective of syruping and brining is to improve the flavor of product and to serve as a medium of heat transfer during canning. Cane sugar or sucrose is used for making syrup while common salt is used for making a brine solution.

flavour and to serve as a heat transfer medium for facilitating processing. Syruping is done only for fruits.

Strained, hot syrup of concentration 20 to 55° Brix is poured on the fruit. Fruits rich in acid require more concentrated syrup than less acid fruits. The syrup should be filled at about 79 to 82°C, leaving a head space of 0.3 to 0.5 cm. Sometimes citric acid and ascorbic acid are also mixed with the syrup to improve flavour and nutritional value of the product, respectively.

The quantities of sugar to be dissolved in one litre of water to make syrups of different concentrations are given in the table below:

Sugar (kg)	Syrup concentration (%)
0.250	20
0.333	25
0.428	30
0.538	35
0.666	40
0.818	45
1.000	50
1.222	55

Syrups of various strength can be'made by dissolving 1 kg of sugar in different volumes of water as shown shown hereunder:

Syrup strength	Water (litre)
Light	2.0
Medium	1.5
Heavy	1.0

Brining

Brine is a solution of salt in water is called a brine. The objective of brining is similar to syruping, however brining is done only in vegetables. Good quality common salt is used for making brine of different concentrations. However, in general hot brine of 1-3 % concentration is used for vegetables filled at 79-82ºC. Brines of different concentrations can be prepared by dissolving known quantity of salt in one litre of water as under:

Salt (g)	Brine concentration (%)	Salt (g)	Brine concentration (%)
10.0	1	47.33	5
20.4	2	111.11	10
30.92	3	176.47	15
41.66	4		

Use of preservatives

In several food products, chemical preservatives are used to enhance their life and attractiveness. Any substance which is capable of inhibiting, retarding or arresting the process of fermentation, acidification or other decomposition of food or masking is called a preservative. However, salt, sugars, vinegar, spices or oils extracted from spices are not called as chemical preservatives. Chemical food preservatives are added in very small quantities (up to 0.2 per cent) and they do not alter the organoleptic and physico-chemical properties of the foods. Certain preservatives are used either intentionally or accidentally for centuries, which include sodium chloride (common salt), sugar, acids, and alcohols. In addition to preservation, these compounds contribute to the quality and identity of the products.

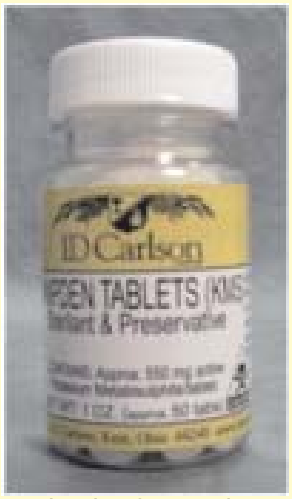
Preservatives for fruits and vegetable products

Several preservatives are used for keeping fruits, vegetables or flowers in good conditions for longer time. In general, chemical food preservatives can be classified as Class I and Class II preservatives. Class I preservatives include common salt, sugar, dextrose, spices, vinegar and honey. They are mainly natural products, which are used, in comparatively higher concentrations than Class II preservatives. On the other hand, Class II preservatives are synthetic chemicals used in small quantities. Benzoic acid and its salts, sulphur dioxide and salts of sulphurous acid, nitrites and nitrates, sorbic acid and its salts, propionic acid and its salts, lactic acid and its salts are commonly used and are called as class II preservative.

Mode of action of food additives involves alteration of cell wall permeability, alteration of colloidal nature of protoplasm, damage of the cell wall, damage of proteins, inhibition of enzyme activity, disruption of cytoplasmic membrane, bacteriostatic or bactericidal action (toxicity of the antimicrobial agent towards microorganisms) and interference with synthetic processes.

Sulphur dioxide (as potassium metabisulphite) and its derivatives can be considered as "universal" preservative. They have an antiseptic action on bacteria as well as on yeasts and moulds.

The advantages of using sulphur dioxide are : (a) it has a better preserving action than sodium benzoate against bacterial fermentation, (b) it helps to retain the colour of the beverage for a longer time than sodium benzoate, (c) being a gas, it helps in preserving the surface layer of juices also, (d) being highly soluble in juices and squashes, it ensures better mixing and hence their preservation, and (e) any excess of sulphur dioxide present in the food them can be removed either by heating the juice to about 71°C or by passing air through it or by subjecting the juice to vacuum.



A bottle of potassium metabisulphite (KMS)


Sodium benzoate granules

The major limitations of sulphur dioxide are : (a) it cannot be used in the case of some naturally coloured juices like those of *phalsa*, *jamun*, pomegranate, strawberry, coloured grapes, plurn, etc., on account of its bleaching action, (b) it cannot also be used for juices, which are to be packed in tin containers, because it not only corrodes the tin causing pinholes, but also forms hydrogen sulphide, which has a disagreeable smell and reacts with the iron of the tin container to form a black compound, both of which are highly undesirable, and (c) sulphur dioxide gives a slight taste and odour to freshly prepared beverages but these are not serious defects if the beverage is diluted before drinking.

Benzoic acid (as sodium benzoate) and its derivatives have a preservative action, which is stronger against bacteria than on yeasts and moulds. Sorbic acid acts on moulds and certain yeast species, which in higher dosage levels, also acts on bacteria. Formic acid is more effective against yeasts and moulds and less on bacteria.

The preservative should never be added in solid form but should be dissolved in a small quantity of juice or water, and the solution added to the bulk of the product. If this care is not taken, the solid may settle undissolved at the bottom of the container with the result that fermentation may start before the action of preservative begins.

Floral preservatives

In the above paragraphs, we discussed preservatives used for fruits and vegetables products. These preservatives are not used for extending the vase life of flowers. For this, different set of preservatives have been recommended. Although several preservatives have been recommended but sucrose solution, 8-HQC (8-hydroxyquinoline citrate), silver nitrate, aluminium sulphate, cobalt chloride, physan, HQS (8-hydroxyquinoline sulphate), STS (silver thiosulphate), copper nitrate etc., are widely used. These preservatives are used either alone or in combination with other preservative. The concentration of these preservative also varies from crop-to-crop.

FOOD COLOURS

When we go to market for purchasing any fresh fruit or vegetable or their processed products, the first thing, which attracts us, is the colour of commodity. After this, we look for varieties of a fruit or vegetable. Similarly, when we cook food in our kitchen, we add several items to make it attractive and tasty. Sometimes artificial colour is also added (e.g. turmeric powder is added in every cooked vegetable in India) during the processing of fruits and vegetables. Colours are of two types: natural colouring matters and synthetic colours

A. Natural colouring matters

The natural colours (pigments) in fruits and vegetables have been classified as carotenoids (yellow-orange), chlorophylls (green), flavonoids and anthocyanins (red, blue, purple) and anthosanthins (cream-yellow). In plant based foods, the following pigments are present either singly or in combination.

Candy with different colours

a. **Chlorophylls:** These are green coloured, fat soluble pigments, responsible for photosynthesis in plants. Most abundant in leafy vegetables. They are related to porphyrins, an important group of biological pigments which includes haemoglobin. There is always some deterioration of chlorophylls on storage, whatever the processing method is used.

b. **Carotenoids:** Carotenoids are fat-soluble, orange-yellow pigments that are present in many vegetables and fruits such as carrot, pumpkin, mango and orange. The first carotenoid isolated was from carrot and, therefore, was named carotene. The most widely distributed carotenoids are lutein, violaxanthin, and neoxanthin, which are found in green leaves. Lycopene

in tomato, capsanthin in red pepper and bixin in annatto are some predominant pigments found in vegetables. Carotenoids are extracted from annatto, saffron, paprika, tomato, etc., and are used as natural food colourants.

c. **Anthocyanins :** These are the red, blue and purple water-soluble compounds occurring in the cell sap of some fruits and vegetables, e.g., coloured grapes, red cabbage, chery, apple and in most flowers. At low pH, the colour of anthocyanins is an intense red, which changes to orange and red to blue or purple as the pH value rises. Sulphite or sulphur dioxide rapidly bleaches the colour of anthocyanins. Sugars influence the stability of anthocyanins.

Natural colorant from black carrot

d. **Flavonoids :** These are very widely distributed in the plant kingdom. They are water-soluble, polyphenolic substances, similar in structure to anthocyanins, which also occur as glycosides, and include the sub-groups of flavones, flavonols, flavanones, and chalcones. Flavonoids may be the sole pigments in vegetables such as potato, cauliflower and yellow-skinned onion. Flavones and anthoxanthins are responsible for the yellow-white or creamy white colour of potato and cauliflower. Flavanones occur mainly in citrus plants and can be used as synthetic sweeteners. Flavonoids are usually more stable to heat and oxidation than the anthocyanins.

Natural colorant from yellow capsicum

e. **Tannins:** These are colourless or yellow substances, which turn brown when fruits and vegetables containing them (e.g., brinjal, bottle gourd, apple) are cut and exposed to air. Thus, tannins are responsible for enzymatic browning and also for the astringency of foods. Tannins are a complex mixture of polymeric polyphenolics also known as tannic acid or gallotannic acid, and derivatives of flavones. They are divided into two major groups: (i) condensed tannins, e.g., catechins and related compounds, and (ii) hydrolyzable tannins, e.g., gallic acid (gallotannins) and ellagic acid (ellagitannins).

f. **Quinones and Xanthones :** A large number of pigments found in the cell sap of flowering plants, fungi, bacteria and algae are derivatives of anthraquinone, naphthoquinone and benzoquinone and range in colour from pale yellow to almost black. Anthraquinone derivatives are the largest group of such pigments, followed by those of naphthoquinone and benzoquinone. Xanthones are a group of yellow pigments. One well-known member is mangiferin, which occurs as a glucoside in mangoes.

g. **Betalains:** Betalains are a group of red and yellow pigments found in red beet (*Beta vulgaris*) and, to some extent, in cactus fruits, pokeberries and a number of flowers (Bougainvillea). They resemble the anthocyanins and flavonoids in structure but unlike them, contain nitrogen. Betalains are stable in the pH range 4-6 but are degraded by thermal processing as in canning. Colour in the food may not always come from plant and animal pigments. It could be due to browning reactions that may be enzymatic or nonenzymatic.

A number of naturally occurring substances are used for colouring foods. According to the Fruit Products Order, India (1955), the following natural colouring matters are permitted to be added to any food.

- Cochineal or carmine
- Carotene and carotenoids
- Chlorophyll
- Lactoflavin
- Caramel
- Annatto
- Ratanjot
- Saffron
- Curcumin

Dehydrated beet powder, carrot oil and juices of fruits (e.g., strawberries and cherries), which impart a pink colour to ice-crearn are also approved as natural colour additives.

B. Synthetic colours

Only pigments from natural sources were available and used for colouring food till

the coming of the first coal tar dye in 1857. Thereafter, a large number of dyes were synthesized and some were used as food colourants. However, gradually restrictions have been placed on their use as food additives in many countries. In India, no coal tar dyes or a mixture thereof, except the following are permitted to be used in food (F.P.O., 1955).

Colour	Common name	Colour	Common name
Red	Ponceau 4R, Carmoisine Fast Red, Amaranth & Erythrosine	Blue	Indigo Carmine, Brilliant Blue FCF
Yellow	Tartrazine, Sunset Yellow FCF	Green	Fast Green S, Green FCF

How to use food colour?

Colours are generally available in the form of powders or ready-to-use solutions. The powder should first be made into a paste with a little cold water and the requisite quantity of almost boiling water added to the paste with constant stirring. The solution is allowed to stand till cool and any sediment formed is removed by filtration. To prevent sedimentation, glycerine is usually added to the solution to increase its density. About 10 per cent glycerine is sufficient for this purpose. Isopropyl alcohol also helps in increasing the solubility of the powder.

Although colours make the food attractive, it is better to avoid their use as far as possible and educate the consumer to use products not containing colourants. Colours can often be used to cover defects in the natural products.

ACTIVITIES/EXERCISES

1. Plan a visit to a food processing industry of your area. Note down the products which are made there. Note down the colour and whether it is of natural or synthetic origin.
2. Go to a shop, which deals with preserves or pickles. Note down the concentration of syrup in preserve and of brine in pickle if used.
3. Take help of your mother or sister for preparation of syrups and brines at your home. Preserve locally grown vegetable or fruits in these solutions.

CHECK YOUR PROGRESS

1. What is syrup and brine? How can you prepare syrups and brines of different concentration?

2. What is the importance of colour in fruit and vegetable industry? Enlist different colours used in food industry.

3. What is preservative?. Classify them. What are major advantages of using SO_2 as preservative in fruit or vegetable products?

FILL IN THE BLANKS

- Syrup is prepared by dissolving known quantity of ……. in known quantity of water.
- Brine is prepared by dissolving known quantity of ……. in known quantity of water.
- Anthocyanins are ……soluble pigments.
- Red colour of tomato is due to …….
- Chemical food preservatives are added in very small quantities i.e., up to ……per cent.
- Betalains are a group of red and yellow pigments found in ……
- The most widely distributed carotenoids are…..…… and …… which are found in green leaves.
- Class I preservatives include ……. , ……. and ……etc.
- ……. and ……. are examples of Class II preservatives.
- Sulphur dioxide cannot be used in juice of …… and ……on account of bleaching action on colour.

FURTHER SUGGESTED READINGS

- Bhattacharjee, S.K. and De, L.C. (2004). Advances in ornamental horticulture, Vol. IV, Pointer Publishers, Jaipur.

- Chaudhary, M.L. and Prasad, K.V. (2003). Value addition in Horticulture. DAHS, Division of Floriculture and Landscaping, IARI, New Delhi-12
- Sharma, S.K. (2010). Postharvest management and processing of fruits and vegetables. NIPA, New Delhi.
- Siddappa, G. and Tandon, D.K. (1998). Presrvation of fruits and vegetables. ICAR, New Delhi
- Srivastava, R.P. and Kumar, S. (2001). Fruit and vegetable preservation: Principles and practices. International Book Distributing Co., Lucknow, India.