

Review Article

Role of Preservatives in Preservation of Fruits and Vegetables: A review

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Abstract

Food preservative is the food additive used to preserve food by lowering down the pH value and settling the redox potential of the food. Each and every packaged food items has some preservatives, without them the food has no longer survive. Preservatives may be anti- microbial preservatives, which inhibit the growth of bacteria and fungi, or antioxidants such as oxygen absorbers, which inhibit the oxidation of constituents. Preservatives may be natural or artificial. Natural substances like salt, sugar, vinegar and spices have been used as preservatives since time immemorial. Artificial food preservatives may act as antioxidants. Since the use of the synthetic preservative for food preservation can cause certain health problems, replacing these synthetic preservatives with natural preservatives are much safer for human and environment [1]. Preservation of food is liable for spoilage due to the action of microorganisms, insects and enzymes [2].

Keywords: Preservatives, Natural and artificial preservatives, anti-microbial, antioxidants

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Introduction

Food is any substance or material eaten or drunk to provide nutritional support for the body or for pleasure. It usually consists of plant or animal origin, which contains essential nutrients such as carbohydrates, fats, proteins, vitamins and minerals, and is ingested and assimilated by an organism to produce energy, stimulate growth and maintain life [3]. Food preservatives becomes an essential thing nowadays, this plays an important role during food transportation. This will preserve the food for a long duration from the spoilage [4]. Fresh food is mainly spoiled by various microorganisms and by inherent enzymes. Various methods are used to check contamination and to increase their shelf life. Apart from traditional methods like application of heat, low temperature, dehydration etc used to retard the number of microorganisms in food or at least holding those in check from further multiplication. Preservatives are natural or synthetic substances that are added to fruits, vegetables, prepared food items, cosmetics and pharmaceuticals in order to increase their shelf life and maintain their quality and safety by inhibiting, retarding or arresting their fermentation, acidification, microbial contamination and decomposition [5].

Preservatives

According to FSSAI, Preservatives means a substance which when added to food is capable of inhibiting, retarding or arresting the process of fermentation, acidification or other decomposition of food. Preservatives are substances that are intentionally added to food product to prevent spoilage caused by mould, yeast and bacteria. Preservatives are used to increase the shelf life of food and to maintain the quality for longer time [6].

Need

- Inhibit the growth of microorganisms like bacteria and fungi.
- Increase shelf life.
- Preserve the appearance of food.
- Preserve the food characteristics like odour, taste and food is preserved for a long time.

Characteristics of a good Preservative:

- Broad anti-microbial spectrum.
- Non toxic to human.
- Effective at small doses.
- Free of odour, colour and flavour.
- Cost-effective and should available in dry forms.

- Water soluble.
- Stable during storage.
- It should have higher shelf life.

Classification of preservatives: There are two classes of preservatives;

1. Class I : Natural preservatives
2. Class II: Chemical preservatives

Natural Preservatives

It is defined as any compound from plant, plant parts, animals and microorganisms that when added to food tend to prevent or retard microbial growth, food deterioration and thus increase the shelf life. Major natural preservatives are common salt, sugar, honey, vinegar, vegetable oil and spices.

Advantages of Natural Preservative:

- Non toxic
- Easily available.
- Less deleterious effect on the organoleptic properties of food.
- Economical to produce.
- Stable during storage.
- Extend shelf life of processed or unprocessed food.

Salt

Salt is one of the most widely used food additives as a preservative, enhancing the flavor [7] and to improve water absorption [8]. Salt is used to increase shelf life. It is a taste enhancing compound in combination with other preservatives. It reduces enzymatic browning and discoloration.

Mechanism of Action:

- Decrease the water activity.
- Decrease the solubility of oxygen in water.
- Restrict the growth of micro organisms.

Applications:

- Highest concentration of salt is used to process pickles e.g.: Unripe mangoes, lemons etc.
- Vegetables pickled in weak solution of salt subjected to lactic acid fermentation. E.g: Sauerkraut, pickled gherkins.
- 15-25% salt preserves almost all the products.

Sugar

The primary function of sugar in food products is to provide sweetness and energy, in addition, sugar plays a very important role in preservation [9]. Mainly produced from sugarcane juice or beetroot. It is readily soluble in water. Sugar is used in the canning and freezing of fruits to improve flavor and texture, and to preserve natural color and shape. Through osmosis, sugar replaces some of the water in fruit. This natural process preserves the fruit's inherent color, texture and shape by preventing the fruit's remaining water from leaving its cellular structures. As a result, the fruit's texture is protected against weakening during freezing and canning.

Mechanism of action:

- By osmosis water from fruits leached in to sugar solution and enters to the fruit.
- Sugar reduces the solubility of oxygen in water.
- It decreases the water activity of food and inhibits the growth of microbes.

Application:

- Jam, jelly and marmalade.
- Fruits dipped in 75% sugar syrup does not require any other preservatives.

- Fruit canning and RTS beverages.

Honey

Honey is a solution of fructose and glucose. It's preservative action is mainly due to lowering of water activity. Phenolic compounds, amino acids and reducing sugars are among the substances responsible for honey antioxidant activity. Most of phenolic compounds also exert antimicrobial activity against a number of pathogens and spoilage microorganisms [10]. Honey prevents and kills microbes through different mechanism such as elevated pH and enzyme activities [11].

Vinegar

It is made from fermentation of sugar and water solutions and it acts as an effective natural preservative. The acetic acid present in vinegar kills microbes and inhibits food spoilage. As per PFA vinegar should contain a minimum of 3.75% acetic acid. Vinegar retards microbial growth and contributes sensory properties to a number of foods [12].

Antimicrobial action:

- Lowers the pH of food products.
- At pH < 3.5 : 10 to 100 times more powerful than other acids.
- Penetrates bacterial cell wall and denatures the cell plasma proteins.
- Reduce the heat sensitive bacteria.
- Less action when the pH is >5.

Vegetable oil

It is used in the preservation of pickles. Use of oil prevents spoilage of pickles because bacteria cannot live in such an environment.

Mechanism of action:

- In pickles prevents the entry of micro organisms by forming an impervious layer. It prevents the entry of oxygen, creating anaerobic condition.

Spices

Spices are homogeneous group of substances extracted from various plant parts. Spices can also exert antimicrobial activity in two ways, by preventing the growth of spoilage microorganisms and by inhibiting the growth of those pathogenic microorganism's. Besides adding flavor and taste to dishes, they help prevent and alleviate various health problems [13]. Eg : Turmeric – curcumin, Pepper- piperin, Clove- eugenol .

Mechanism of action:

- Damage the membrane integrity of microorganisms.
- Cause leakage of ions, ATP, nucleic acids and amino acids from microorganisms.
- At high concentration affect pH of the microorganisms.

Chemical preservatives

Also called as class II preservative. It is defined by Food and Drug Administration , as any chemical that when added to food tend to prevent or retard microbial growth, food deterioration and thus increase the shelf life. Commonly used chemical preservatives are: Sulphur dioxide including its salts and benzoic acids including its sodium and potassium salts.

Sulphur dioxide

Sulphur dioxide is an important and universally permitted food preservative extensively used in the processing and preservation of foods of both plant and animal origin [14]. It is being used in various food products like dry fruits, fruit juices and pulps etc., which inhibit the enzyme action acts as antioxidant, inhibit browning and growth of microorganisms. FORMS of sulphur dioxide : Sodium sulphite , Sodium bisulphate, Sodium metabisulphite, Potassium sulphite, Potassium bisulphate, Potassium metabisulphite.

Mode of action: Sulphur dioxide is used in the form of potassium metabisulphite (KMS). It is crystalline salt and fairly stable in neutral and alkaline medias. Potassium metabisulphite is added to the fruit juice or squash, the potassium radicle reacts with acids of juice forming corresponding potassium salt and sulphur dioxide is liberated and forms sulphurous acid with water of the juice which has got preservative effect.

Advantages:

- It has better preserving action against bacterial fermentation.
- It helps in retain the colour of the beverage for long time.
- It has strong effect in retarding oxidation.
- Preventing discolouration and loss of flavor in products.
- It is highly soluble in squashes and juices ensures better preservation.

Disadvantages:

- ssIt can't be used in naturally colored juices.
- It should not used in juices that are stored in tin containers.

Benzoic acid

It is used in the form of sodium benzoates in the preservation of fruit juices and squashes.

Mode of Action: It inhibits the growth of microorganisms by inhibition of action of enzymes that control the acetic acid metabolism and oxidative phosphorylation. It inhibit the growth of yeasts and moulds.

Advantages:

- It is used in colored juices.
- Most active against yeast and moulds.

Conclusion

Preservatives are very useful in extending the shelf-life and maintaining the texture, flavour and appearance of the product, even stored at ambient temperature. Therefore, the seasonal availability of fruits and vegetables can be overcome by processing them into suitable products by using preservatives with less energy requirement.

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