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EFFECT OF POTASSIUM-BI-SULPHATE AS FOOD PRESERVATIVE- A REVIEW

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Abstract: Preservatives are chemical substance that are added to products to prevent their natural degradation. They prevent degeneration of enzymes and micro-organisms. Preservatives are classified into organic and inorganic preservatives bases on their chemical composition. Antimicrobial preservatives prevent the deterioration of food by certain microorganisms and the antioxidants prevent the oxidation of fat present in the food on exposure to air. An example for antimicrobial preservative is lactic acid butylated hydroxy anisole (BHA) which is commonly used synthetic antioxidant. There are also some non-synthetic preservatives such as citric and ascorbic acid which prevent degradation of fruits by targeting the enzymes responsible for it. There are several physical and chemical factors which effect the preservatives. Mostly it includes concentration, temperature, time of exposure etc. Some preservatives also show chemical reactivity towards food components. The lack of knowledge among the individuals of today's civilized society is posing a threat to their lives by using certain harmful preservatives. The most commonly used food preservatives in India are Benzoic acid and Sulphur dioxide. Sodium benzoate used as an alternative to benzoic acid as they both have almost same chemical properties. The present review gives the information about Potassium bi-sulphate which acts as a preservative and is a source for Sulphur dioxide which in-turn prevent the degradation of food and also provides the information about the several methods which are implemented to add preservatives into food substances and also effects of concentration, temperature, time of exposure on preservatives.

Keywords: Antioxidants, Food additives, Preservatives, Potassium bi-sulphate.

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INTRODUCTION

A preservative is a substance or a chemical that is added to product such as food, beverages, pharmaceutical drugs, and many other products to prevent decomposition by microbial growth or by undesirable chemical changes. In general, preservation is implemented in two modes, chemical and physical preservation entails processes such as refrigeration or drying (Luck *et al*., 2000). Preservatives are classified into organic and inorganic preservatives bases on their chemical composition. Antimicrobial preservatives prevent the deterioration of food by certain microorganisms and the antioxidants prevent the oxidation of fat present in the food on exposure to air. An example for antimicrobial preservative is lactic acid butylated hydroxy anisole (BHA) which is commonly used synthetic antioxidant. There are also some non-synthetic preservatives such as citric and ascorbic acid which prevent degradation of fruits by targeting the enzymes responsible for it. There are several physical and chemical factors which effect the preservatives. Mostly it includes concentration, temperature, time of exposure etc. Some preservatives also show chemical reactivity towards food components. The lack of knowledge among the individuals of today's civilized society is posing a threat to their lives by using certain harmful preservatives. The most commonly used food preservatives in India are Benzoic acid and Sulphur dioxide. Sodium benzoate used as an alternative to benzoic acid as they both have almost same chemical properties. Food preservatives are specific additives to prevent

deterioration from enzymes, micro-organisms and exposure to oxygen. All chemical preservatives must be non-toxic and readily soluble, not impart off the flavors, exhibit anti-microbial properties over the pH range of the food, and be economical and practical (Bauer *et al*., 1985).

ORGANIC AND INORGANIC FOOD PRESERVATIVES

Food preservative constitute a group of compounds of widely different molecular structures, they are organic and inorganic substances with the different functional and tendencies to form ions. Organic and inorganic acid preservatives may be added in the form of un-dissociated acid or a variety of salts. In food, the ionic composition is determined largely by concentration and p^H **(**MacDonald and Reitmeier, 2017).

Anti-Microbial Preservatives: Antimicrobial preservative prevent degradation by bacteria. This method is most traditional and ancient type of preserving ancient method such as pickling and adding honey prevent microorganism growth by modifying the p^H level. The most commonly used antimicrobial preservative is lactic acid (Wedzicha, 2003; Carocho *et al.,* 2014). Nitrates and nitrites are also antimicrobial (Dalton, 2002). The detailed mechanism of these chemical compounds ranging from inhibiting growth of the bacteria to the inhibition of specific enzyme water-based home and personal care products used broad-spectrum preservatives, such as iso-thiazolinone and formaldehyde releasers, which may cause sensitization, allergic skin reaction and toxicity to aquatic life (Field, 2007)**.**

Antioxidants: The oxidation process spoils most food, especially those with a high fat content. Fats quickly turn rancid when exposed to oxygen. Antioxidants prevents or inhibit the oxidation process. The most antioxidant additives are ascorbic acid (vitamin C) and ascorbates (Grobe *et al*., 2008)**.** The term antioxidant is mostly used for two entirely different group of substances; industrial chemicals that are added to products to prevent oxidation and naturally occurring compounds that are prevent in food and tissue (Bhat *et al*.,2012)**.** Antioxidant dietary supplements have not been shown to improve health in humans or to be effective at preventing diseases (Amiri and Amiri, 2017). Supplements of beta- carotene, vitamin A and vitamin E have no positive effect on mortality rate (Bjelakovic *et al.,* 2013; Abner *et al*., 2011), or cancer risk (Jiang *et al.,* 2010) Additionally, supplementation with selenium or vitamin E does reduce the risk of cardiovascular diseases (Hermund,2018**).** Synthetic phenolic compounds, like butylated hydroxytoluene (BHT), and butylated hydroxy-anisole (BHA) are efficient chain-breaking antioxidants and widely used as food preservatives. Some naturally occurring phenolic compounds such as tocopherol, ascorbic acid, or caffeic acid are used as chain-breaking antioxidants but are typically less efficient compared with the synthetic ones, but that again depends on the type of food product (Shekelle *et al*., 2004)**.**

Extrinsic and Intrinsic Preservatives: Food preservatives can be extrinsic (intentionally added) intrinsic (normal constituent of food) or developed produced during fermentation (Potter and Hotchkiss,1995; Marshall *et al*., 2016)**.**

Non-Synthetic Compounds for Food Preservation: Citric and ascorbic acids target enzymes that degrade fruits and vegetable, e.g. mono/polyphenol. Oxidase which turn surfaces of cut applies and potatoes brown. Ascorbic acid and tocopherol, which are vitamins, are common preservatives. Smoking entails exposing food to a variety of phenol, which are antioxidants. Natural preservatives include rosemary and oregano extract**.**

Factor affecting preservatives include

a) Concentration of Inhibitors.
b) Kind, number and age of microorganisms (older cells are more resistant)
c) Temperature
d) Time of exposure (if long enough some microbes can adapt and overcome inhibition)
e) Chemical and physical characteristics of food (water, activity, p^H, solutes etc.)

Some examples of inorganic preservatives are Sodium Chloride (NaCl), benzoate and bi-sulphates etc. Sodium Chloride lowers water activity and causes plasmolysis by withdrawing water from cells. The sodium salt of benzoate is used to improve solubility in foods sulphates and bi-sulphates have been used to prevent enzymatic and non-enzymatic browning in some fruits and

vegetables (Warth,1991). Chemical food preservatives are widely used in the food industry and are invariably cheap ingredients that are effective against a wide range of spoilage organisms. Chemical food preservatives include components such as sodium benzoate, benzoic acid, nitrites, sulphates, sodium sorbate and potassium sorbate. Forced by public opinion the demands for natural or label-friendly alternatives has increased (Banerjee *et al.,* 2017).

CHEMICAL REACTIVITY OF PRESERVATIVES TOWARDS FOOD COMPONENTS

Chemical reaction between food preservatives and components of microbial cells, or with food components where these are implications with regard to anti-microbial action. Some food preservatives and particularly sorbic acid, Sulphur dioxide sulphates and nitrite ions are capable of more extensive reactivity with food components. Sulphur dioxide and sulphates species in a food decreases with time, and the shelf life may be limited by this reactivity (Jha *et al*., 2013).

Preservatives as Food Additives: Every civilized society is using food preservatives but such practice can pose a threat to public health. Safe efficient preservatives development for perishable food items is a matter of intensive research (Warth,1991). In urban slums of highly populated countries, the knowledge about contents of food tends to be extremely low, despite consumption of these imported foods (Andress, 2013).

Commonly used food preservatives in India are:

a) Benzoic acid or sodium benzoate.
b) Sulphur dioxide or potassium bi-sulphate.

Benzoic acid or sodium benzoate: Benzoic acid and its salts are used as food preservatives. Benzoic acid inhibits the growth of mold, yeast. Benzoic acid or benzene-carbonic acid is a mono basic aromatic acid, moderately strong, white crystal in powder, very much soluble in alcohol, ether and benzene, but poorly soluble in water. Benzoic acid has the advantage that it doesn't affect the odor or taste of the food if it is in smaller quantities. It is the sodium salt of benzoic acid used as a white crystalline or amorphous powder.

Sulphur dioxide or potassium bi-sulphate: Potassium hydrogen sulphate or potassium bi-sulphate is the chemical compound with the formula $KHSO_3$. It is used for the preservation of color less food materials such as fruit juice, squashes, apple etc. this is not used for the preservation of colored food materials because Sulphur dioxide produced from this chemical is a bleaching agent $KHSO_3$ reaction with acid of the juice liberates Sulphur dioxide which is very effective in killing harmful microbes and thus preventing spoilage.

$$HSO_3^-{}_{(aq)} + H^+{}_{(aq)} \longrightarrow H_2O_{(l)} + SO_{2(g)}$$

The advantage of this method is that no harmful chemical is left in the food. Food preservatives are used primarily to present or relate microbial growth. The most typical food preservatives are sorbic-acid, benzoic acid, Sulphur dioxide etc., sample preparation depends mainly on the matrix. Preservative food additive can be anti-microbials which inhibit the growth of bacteria or fungi including mold. Food preservation may also include processes that inhibit visual deterioration such as the enzymatic browning. Many processes design to preserve food involve more than one food preservation method. Preserving fruit by turning it into jam, for example, involves boiling (to reduce the fruit moisture content and to kill bacteria etc.) sugaring (to prevent their regrowth) and sealing with an airtight jar (to prevent contamination).

CONCLUSION

Food-borne illness happens more often in our country. Public awareness of food preservatives is uneven. The increasing demand for ready to eat fresh food products had let to challenges for food distributers regarding the safety and quality of food. Increased amount of preservative in food materials can cause negative side effect. So there is a need to undergo research to check the good preservatives which will not cause harmful effect to the consumers.

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