

Food preservatives and their uses: A short report

Abstract

Packaged foods and beverages are consumed all over the world for their nutritional value, longer durability, thirst quenching properties, stimulating effect or for their medicinal values. With changing lifestyle and requirements, people now often prefer packaged food products over homemade products. Although, various food products including the beverages pass through several, quality, safety and regulatory mandates, consumers are concerned about food preservatives as in some cases allergic reaction to generally recognized as safe (GRAS) has been reported. The study represents the usages of different forms of preservatives in packaged food industry along with their beneficial and adverse effects and also highlights their antioxidant and antimicrobial potential to serve the consumer's needs.

Keywords: Beverages, Preservatives, Health, Shelf-life, Antimicrobial, Antioxidant

Introduction

Packaged food industry has been serving as one of the fastest growing network in the present era. Numerous forms of preservation techniques such as pasteurization, freezing, drying and application of chemicals have been designed to extend the shelf-life of the food products, not only by reducing the microbial growth, but also to maintain the antioxidant potential to serve the consumers' needs [1, 2]. To make the packaged food quality stable for a reasonable time period, preservatives are often used in different quantity and concentrations. Traditionally, food preservation has three goals; the preservation of appearance, the preservation of nutritional characteristics, and a prolongation of the time that the food can be stored. Hence, food preservatives can be defined as the "food additives used to inhibit the growth of micro-organisms like yeast, molds and bacteria and prevent the spoilage by different anti-oxidative reactions in order to maintain the quality, texture, consistency, taste, colour, alkalinity or acidity" [3, 4]. Several forms of chemical preservatives are being currently in use in food and beverages industries such as benzoate, Sorbates, Vitamins, fruit extracts, Sodium salts etc. as listed in Fig 1. [5, 6]. Preservatives can mainly divide into two groups based on their purpose of usages i.e. preservatives as antimicrobial and preservatives as antioxidants (Fig. 1).

Antimicrobial

Antimicrobial preservatives reduce the microbial spoilage of foods by inhibiting the growth and proliferation of bacteria, yeasts and molds. Benzoates (E210 -E219), Sorbates (E200 – E209), Nitrates (E240 – E259), and Sulfites (E220 – E229) are categorized under the group of antimicrobial preservatives [7]. Sodium Benzoate (Produce Benzoic Acid when dissolved in water) and Benzoic Acids are the most common used preservative and widely used in acidic food products like fruit juice, carbonated drinks,

pickles and jams [8]. The maximum concentration level of benzoates approved by FDA is 0.2% and when used along with Ascorbic acid is 0.1%. Sulfites like Sodium bisulfite and Potassium meta-bisulfites are used in food by dissolving in cold water. Upon dissolving they produce Sulfurous Acid that inhibits the growth of bacteria and molds and to some extent yeast such as *Oospore lactis*. Sorbates like Potassium Sorbate, Sodium Sorbate are used as the preservatives in products having high pH value up to 6.5 [9]. Nitrites are mostly used to prevent the growth of yeast and molds in food products. The maximum concentration level allowed is 0.1%. Nisin peptide is an alternate food preservative which is prepared during the food fermentation by *Lactococcus lactis* bacteria. Nisin is a polypeptides containing about 34 numbers of amino acids [10]. It is highly effective on the gram positive bacteria and their spores through interfering in biosynthesis of bacterial cell wall [10]. Though it is less effective on gram negative microorganisms and fungi, the FDA and WHO recommend this to use because of its non-toxicity and less adverse reaction [11].

Antioxidants

Chemicals that prevent oxidation in other molecule are known as antioxidants. Ascorbates (E300 – E305), Tocopherols (E306 – E309), Erythorbates (E310 – E319), Lactates (E320 – E329), Phosphates (E340 – E349), Succinates (E360 – E369) are all effectively used as antioxidants for food and beverages. Ascorbic Acid (E301) is a common antioxidant in beverages and pickles. Foods containing unsaturated fats are easily attacked by oxidation. Oxidation causes them to turn rancid in order to discoloring and unpleasant tastes like metallic or sulfurous [12]. Hence, the Tocopherols (Normally Vitamin E) are used in rich fat foods for preservation.

Adverse effects of preservatives

Though preservatives are beneficial to packaged food, they do have some negative effect on human health. All preservatives cause hyper activity on regular usage. Some of the common preservatives and their harmful effects on human health are listed below;

- a) **Nitrates and Nitrites:** For curing of meat products these additives are used. But sometimes it reacts to cause urticarial, itching and anaphylaxis in human beings. Sodium Nitrite is used in meat product during cooking to prevent botulism, but during high heat it reacts with the proteins to produce carcinogenic N-Nitrosamines which are linked to different forms of cancers like liver, intestinal and oesophageal cancer [13, 14].
- b) **Benzoates:** Benzoate contained foods are strictly abandoned for asthma patients because it worsens the condition. Benzoates are also reported to cause rhinitis, chronic urticarial and flushing in some cases [6]. Sodium Benzoate which is used to enhance the self-life for a long time is found to form carcinogenic benzene while used with vitamin C or Ascorbic acid. Though the

amount of benzene form is low but it is a risk factor to cause cancer [15]. It is also reported that Benzoates can cause brain damage [16].

c) **Sorbates:** Sorbates can cause urticarial and contact dermatitis in some cases [17].

d) **Sulphates:** Copper sulphate is generally used in coloring of peas and other vegetables. It is found that the copper, when added to the vegetables, forms a compound which is not easily soluble in the human body [18].

Conclusion:

Food preservation presents an opportunity to move alternative food practices away from an individualistic, consumer-oriented politicsto a politics based upon relationships to self, others, and the earth, enabling activist's to connect more deeply to the goals of food movements. Although there are certain risk in use of preservatives but its importance and contributions to packaged food industry can't be overlooked. A lot of researches are needed to be done to find out the natural and harmless preservatives like Nisin Peptide. The food manufacturer should give special attention during their formulation for healthy preservatives as combination of different preservatives has been known to improve not only the shelf life of the product but also enhance the quality and health benefits.

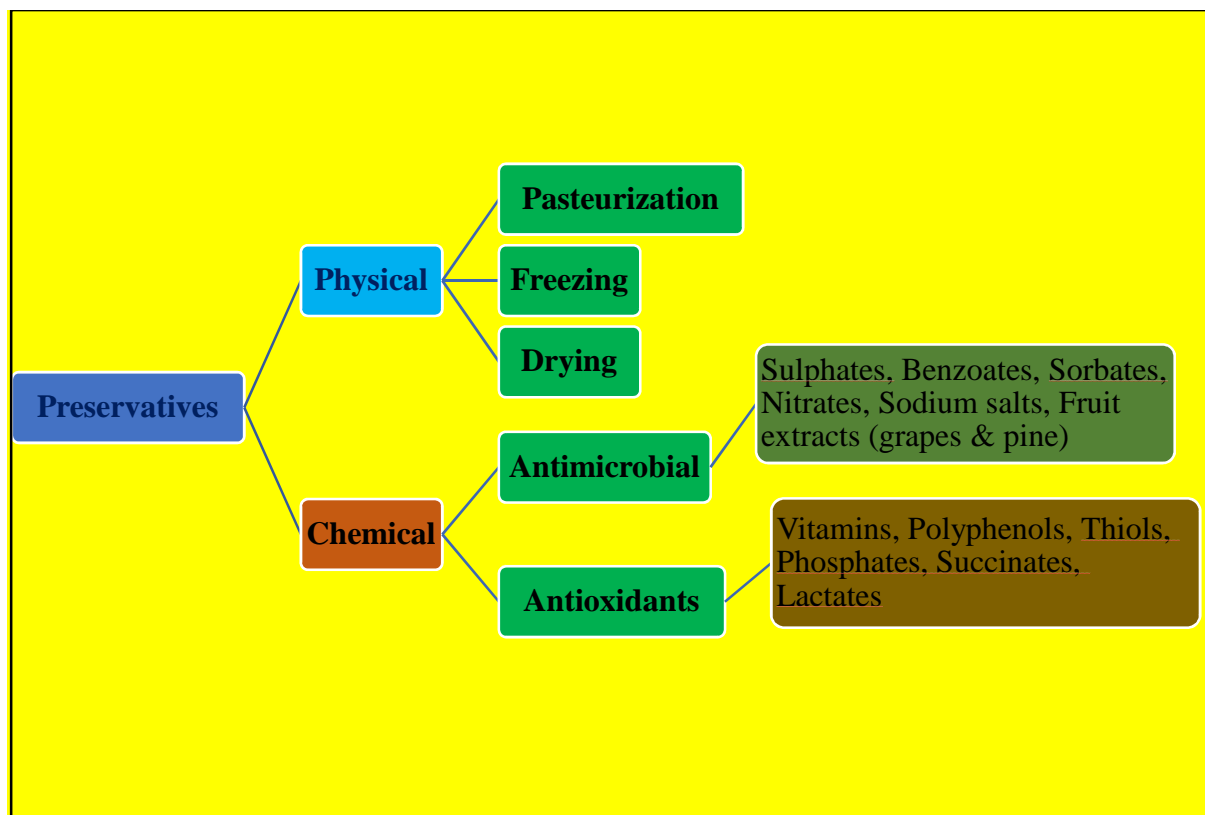


Fig 1: Diagrammatic representation of usages of preservatives

Acknowledgements: Authors are grateful to respective organization for support.

References

- [1] Yadav P, Garg N, Kumar S. Improved shelf stability of Mulberry juice by combination of preservatives. *Indian J Natural Prod Resources*. 2014;5(1):62-66.
- [2] Sarkar S, Saha S, Rai C, Bhattacharyya S. Effect of storage and preservatives on antioxidant status of some refrigerated fruit juices. *Int J Curr Microbiol App Sci*. 2014;3(7):1007-1013.
- [3] World Health Organization (WHO). Principles for the safety assessment of food additives and contaminants in food. *Env Health Criteria*. 1987:70.
- [4] Tuormaa TE. The adverse effects of food additives on health: A review of the literature with special emphasis on childhood hyperactivity. *J Orthomol Med*. 1994;9(4):225-243.
- [5] Doughari JH, Alabi G, Elmahmood AM. Effect of some chemical preservatives on the shelf-life of Sobo drink. *Afr J Microbio Res*. 2007;2:037-041.
- [6] Sharma S. Food Preservatives and their harmful effects. *Int J Sci Res Pub*. 2015;5(4):1-2.
- [7] Abdulmumeen HA, Risikat AN, Sururah AR. Food: Its preservatives, additives and applications. *Int J Chem Biochem Sci*. 2012;1:36-47.
- [8] Mirza SK, Asema UK, Kasim SS. To study the harmful effects of food preservatives on human health. *J Med Chem Drug Discovery*. 2017;2(2):610-616.
- [9] Hwang C, Huang L. The effect of potassium Sorbate and pH on the growth of *Listeria monocytogenes* in ham salad. *J Food Proc Preser*. 2014;38:1511–1516.
- [10] Alexander JH, Judicael P, Adam M, Boyan BB. Nisin-induced changes in *Bacillus* morphology suggest a paradigm of antibiotic action. *Proce Nat Acad Sci*. 2006;103(52): 18896-901.
- [11] Carlo DM, Sacchetti G, Mattia CD, Compagnone D, Mastrocola D, Liberatore L, Cichelli A. Contribution of the phenolic fraction to the antioxidant activity and oxidative stability of olive oil. *J Agric Food Chem*. 2004;52(13):4072–79.
- [12] Toaima W, Trak J, Alkowwatly KA. Nisin peptide as promising natural food preservative for food. *J Chem Pharma Res*. 2015;7(4):11-14.
- [13] Anon MI. Food Irradiation – A technique for preserving and improving the safety of Food. WHO, Geneva. 1991.
- [14] Theron MM, Lues JF. Organic acids and meat preservation: A review”. *Food Rev Int*. 2007;23: 141-158.
- [15] Jha KH, Taneja A, Kabra KK, Sadiq HM. A study on consumer awareness, safety perceptions and practices about food preservatives and flavoring agents used in packed/canned foods from South India. *National J Community Med*. 2013;4(3):402-406.

- [16] McCann D, Barrett A, Cooper A, Crumpler D, Dalen L, Grimshaw K, Kitchin E, Lok K, Porteous L, Prince E, Sonuga-Barke E, Warner JO, Stevenson J. Food additives and hyperactive behaviour in 3-year-old and 8/9-year-old children in the community: A randomised, double-blinded, placebo-controlled trial. *The Lancet*. 2007;370(9598):1560-67.
- [17] Kinderlerer JL, Hatton P. Fungal metabolites of sorbic acid. *Food Addit Contam*. 1990;7(5):657-69.
- [18] Elhkim MO, Heraud F, Bemrah N, Tanaka T, Ogata A. New consideration regarding the risk assessment, intolerance reactions and maximum theoretical daily intake in France. *Regulatory Toxicology and Pharmacology*. 2007;43(3):308-16.