

Exploration on the Application of Potassium Sorbate in Multiple Fields

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Abstract

Potassium sorbate is a common preservative widely used in many fields such as food, cosmetics, and medicine. This paper introduces the physicochemical properties as well as the preservative mechanism of potassium sorbate and specifically describes the application of potassium sorbate in various types of food, including vegetables and fruits, meat products, aquatic products, soy sauce, pickles, pastries, candies and preserves, animal feeds, etc. Meanwhile, the application of potassium sorbate in cosmetic and pharmaceutical products to inhibit the growth of microorganisms and guarantee the quality of products was also explored. Through the study of its application, the remarkable value of potassium sorbate in safeguarding product safety and extending shelf-life was revealed, and the future development prospect of potassium sorbate was comprehensively analyzed.

Keywords

Potassium Sorbate; Preservative; Application Fields; Safety.

1. Introduction

The application of preservatives is crucial in the production and preservation of modern food, cosmetics, and pharmaceuticals. Among them, potassium sorbate plays an indispensable role as a widely recognized and used preservative. As people's concern for the quality of life and health continues to increase, the requirements for the safety and stability of food and related products are becoming increasingly stringent. Potassium sorbate, with its safety, low toxicity, and high efficiency, plays a key role in safeguarding product quality and extending shelf life.

However, there are still some controversies and issues that need to be explored in depth regarding the application of potassium sorbate. For example, the precise control of the dosage of its use, its interaction with other ingredients, and the difference of its effect in different products. An in-depth study on the application of potassium sorbate is of great practical significance for optimizing the production process of products and ensuring the health of consumers.

2. Introduction to Potassium Sorbate

2.1. Properties of Potassium Sorbate

Potassium sorbate is made from sorbic acid and potassium hydroxide through the neutralization reaction, sorbic acid is difficult to dissolve in water, it needs to be made into a potassium salt that can be dissolved in water, that is, potassium sorbate and potassium sorbate and sorbic acid have the same antiseptic mechanism and effect. The chemical name of potassium sorbate is "2,4-ethylene potassium", it is white or light yellow granule or powder, slightly smelly or odorless, easily soluble in water, and the pH value of 1% aqueous solution is

7-8. It has flammability and moisture absorption, it is precarious in the air, it easily oxidizes and becomes brown, it can't be placed in the air for a long time, but it is more stable under the condition of light and heating. It is very unstable in air, easily oxidized, becomes brown, and can not be placed in the air for a long time, but it is more stable in light and heating conditions, and it will be dissolved and decomposed when it is about 270 °C.

2.2. Preservation Mechanism of Potassium Sorbate

The preservative effect of potassium sorbate is mainly to inhibit microbial metabolic processes. Potassium sorbate can effectively inhibit the activity of microbial intracellular deoxygenase systems, especially for molds, aerobic bacteria, and yeast activity has a significant inhibitory effect, and it can also prevent microbial reproduction of staphylococcus, botulinum toxin, salmonella, etc., but is ineffective against microorganisms such as anaerobic bacillus and Lactobacillus acidophilus[1].

2.3. Toxicological Effects of Potassium Sorbate

When potassium sorbate is ingested by the human body, it is distributed in various human tissues, utilized as an aliphatic carboxylic acid as a fatty acid in living organisms, and participates in the normal metabolism of the human body in the form of CO₂, with a small amount excreted in the form of urine and feces, which is basically harmless to the human body. The results of genotoxicity tests of potassium sorbate, such as chromosome aberration test and micronucleus test, were mostly negative in vitro and in vivo. Short-term or sub-chronic toxicity tests are also dominated by negative results, and no meaningful biological changes have been observed[2].

3. Applications of Potassium Sorbate in the Food Industry

3.1. Application to Vegetables and Fruits

Fresh vegetables and fruits, if not preserved promptly, will soon lose their luster and moisture, become dry and wrinkled on the surface, and are prone to mold and mildew leading to decay, and resulting in unnecessary waste. If the surface of vegetables and fruits with potassium sorbate preservative, at a temperature of up to 30 °C can be preserved for a month, but also to maintain the green degree of vegetables and fruits do not change. The surface was sprayed with potassium sorbate preservation solution of apples, and stored at room temperature for 4 months, with only about 5% of the apples rotting and deterioration of the phenomenon. Potassium sorbate can also prevent the tinplate of canned vegetables from oxidizing and rusting[3].

3.2. Application in Meat Products

Meat products are rich in nutrients, with high protein content, while their moisture content is also large, suitable for the growth and reproduction of microorganisms, so it is very easy to cause product corruption and deterioration, which caused great losses to meat processing enterprises, but also a lot of waste of manpower, material and financial resources, which meat processing enterprises are used to add preservatives to inhibit product corruption and deterioration[4].

For meat products, such as ham, sausage, and bacon, potassium sorbate can inhibit the growth of bacteria and reduce the occurrence of spoilage. It can be combined with other preservation measures, such as vacuum packaging and low-temperature storage, to safeguard the quality and safety of meat products jointly. According to GB 2760-2014 "National Standard for Food Safety, Standard for the Use of Food Additives", meat preservatives include 12 kinds of preservatives such as sorbate and nitrate, among which the maximum use level of sorbic acid and potassium sorbate in meat products is 1.5 g/kg[5].

3.3. Application in Drinks

Potassium sorbate is one of the common preservatives in all types of beverages, including carbonated drinks, fruit juice beverages, and lactic acid beverages. It can prevent beverages from being contaminated by microorganisms in production, storage, and sale, and ensure the safety of drinking for consumers.

China's "Hygienic Standard for the Use of Food Additives" stipulates that the maximum use limit of sorbic acid and potassium sorbate for carbonated beverages is 0.2g/kg, that for juice beverages is 0.5g/kg, and that for lactobacillus beverages is 1.0g/kg. When sorbic acid and potassium sorbate are used together, the maximum use limit shall not be exceeded in terms of sorbic acid[6].

3.4. Application in Soy Sauce and Pickle Products

Soy sauce is rich in nutrients, rich in amino acids, vitamins, reducing sugar and calcium, iron, zinc, selenium, and other trace elements, but it is a low-acid food, with pH 4.7 ~ 4.9, and the water activity is in the range of 0.78 ~ 0.85, in the process of production and storage is very susceptible to contamination by harmful molds, bacteria, etc., especially when the temperature is higher than 20 °C or more. To prevent the infection of microorganisms and deterioration, manufacturers generally add preservatives to inhibit microbial activity to extend the shelf life of food. Soy sauce preservatives are chemical preservatives and natural preservatives of two categories, people mainly use chemical preservatives, in soy sauce appropriate addition of potassium sorbate, can be stored at high temperatures for 70 days without rotting mold[7]. Beetroot, pickled cucumber, and other pickle products use potassium sorbate to preserve freshness, you can add the appropriate amount of potassium sorbate to the vinegar containing salt. Usually, to avoid the phenomenon of turbidity of the brine in pickle products, the spices, salt, and potassium sorbate can be dissolved in water before adding vinegar. Pickles use a direct addition of salt and potassium sorbate mixture for preservation and freshness.

3.5. Application in Confectionery

Potassium sorbate can be used in the preservation of yeast and bakery products such as bread and pastries. Due to the high water content and sufficient nutrients such as sugar in bread and cakes, bacteria and other microorganisms can grow easily and accelerate the deterioration of food. Therefore, in the preservation process baked goods need special compound preservatives, and potassium sorbate is an important part of this type of preservative, which can greatly extend the shelf life of food by adding or spraying on baked goods. There are many varieties of mooncakes in China, and new colors and varieties are constantly emerging. As a festive food, carrying the beautiful symbol of "happiness, fullness, and reunion", mooncake is a pivotal delicacy of the Mid-Autumn Festival, and the market share of mooncakes have been increasing year by year in recent years. Fengzhen mooncakes have a long history as a local traditional food in Fengzhen, Ulanqab City, Inner Mongolia Autonomous Region. As a local specialty, Fengzhen mooncakes have long enjoyed a wide market reputation, and with its reputation forged over the years and its real "substance", it has become a big player in the mooncake market in the central and western regions of Inner Mongolia. It contains rich nutrients such as protein, fat, and sugar, and is becoming more and more popular. However, mooncakes are rich in nutrients that can easily breed and multiply microorganisms, and the addition of appropriate amounts of preservatives is an important means of preventing microbial contamination of food[8].

3.6. Application in Candied Fruit and Candy Products

To ensure the anticorrosive preservation effect of some high sugar-content confectionery products, then the amount of potassium sorbate added should be increased appropriately. Peanut sugar, marzipan, and general sandwich candies can be directly preserved by adding the appropriate amount of potassium sorbate.

3.7. Animal Feed Industry

Potassium sorbate is used as a legal feed additive in animal feed in the USA and the EU. Potassium sorbate can inhibit the growth of molds in feedstuffs, especially the growth of aflatoxin. The addition of potassium sorbate has a very significant effect on the formation of feed, so it is effective in preventing spoilage and remains resistant to the growth of microorganisms in the animal's intestinal tract. In addition, the neutral taste of potassium sorbate makes it suitable for use in feedstuffs, since animals are more sensitive to changes in the taste of foodstuffs than humans. In addition, as an unsaturated fatty acid, potassium sorbate is easily digestible as a feed ingredient and has no adverse effects on animals. Feed is susceptible to spoilage during storage as well as transportation and distribution, so there is a huge market for potassium sorbate in the feed industry. Corn silage (*Zea mays* L.) is characterized by high yield and rich nutrition, known as the "king of feeds", and is the most important source of feed for milk, meat, and other livestock products in the world. To solve the problem of short storage time of silage after opening the cellar, potassium sorbate can be added to the lactic acid bacteria silage additives. Sorbic acid destroys the enzyme system of many spoilage bacteria, thus inhibiting their activity, and sorbate and sorbic acid have the same effect[9].

4. Potassium Sorbate in the Cosmetics Industry

Cosmetics are susceptible to microbial contamination during production, storage, and use, thus affecting the quality and safety of the products. Potassium sorbate is widely used in cosmetics in products such as aqueous, emulsions, and creams. It can effectively inhibit the growth of bacteria, molds, and yeasts, prolong the shelf life of cosmetics, and protect the safety of consumers [10].

5. Application of Potassium Sorbate in Pharmaceutical Field

In pharmaceutical preparations, potassium sorbate is commonly used in the preservation of eye drops, oral liquids, injections, and other products. As pharmaceutical products require high safety and stability, the low toxicity and good preservative effect of potassium sorbate make it one of the indispensable preservatives in the pharmaceutical field.

6. Safety of Use of Potassium Sorbate

Potassium sorbate is considered to be a relatively safe food additive within the prescribed range of use. It has been verified by numerous toxicological studies and practical applications that its toxicity is low and does not pose a significant risk to human health. However, excessive intake may still cause some adverse reactions, such as allergic reactions. Therefore, it is crucial to strictly control the amount and scope of use of potassium sorbate.

7. Potassium Sorbate Application Prospects and Development Summary

As people's concern for food safety and health continues to increase, the requirements for preservatives are becoming more and more stringent. In the future, the application of potassium sorbate is expected to develop in the direction of greater precision, efficiency, greenness, and safety. For example, a more environmentally friendly and healthy preservative system can be developed through synergistic effects with other natural preservatives; new technologies can be utilized to improve the production process of potassium sorbate, improve product quality, and reduce costs; and further in-depth studies on the antiseptic mechanism of

potassium sorbate can be carried out to provide a theoretical basis for a more scientific and rational application of potassium sorbate.

As an important preservative, potassium sorbate has an irreplaceable role in the application of food, cosmetics, medicine, and other fields. Through an in-depth understanding of its nature, antiseptic mechanism, and application, we can use potassium sorbate more scientifically and rationally to protect the quality and safety of products. At the same time, with the continuous progress of science and technology and in-depth research, the application of potassium sorbate will continue to optimize and innovate, providing stronger support for the development of related industries.

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