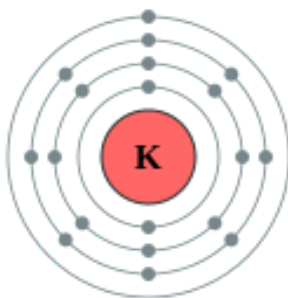


1. Introduction

19: Potassium

2,8,8,1

What is Potassium?



The chemical element potassium has the atomic number 19 and the letter K (which stands for kalium in Neo-Latin). Potassium is a silvery-white metal that may be easily and gently sliced with a knife. Within seconds of exposure, potassium metal quickly combines with air oxygen to produce flaky, white potassium peroxide. It was initially separated from potash, which is made up of plant ashes and from which it gets its name. Potassium is an alkali metal in

the periodic table. All alkali metals have a single valence electron in the outer electron shell, which can be removed easily to produce a positive-charged ion called a cation, which interacts with anions to form salts. Only ionic salts include potassium in nature.

Uses of Potassium

The greatest demand for potassium compounds is in fertilizers. Many other potassium salts are of great importance, including nitrate, carbonate, chloride, bromide, cyanide, and sulfate. Potassium carbonate is used in the manufacture of glass. Potassium hydroxide is used to make detergent and liquid soap. Potassium chloride is used in pharmaceuticals and saline drips.

The abundance of Potassium

In the crust of the Earth, potassium is the sixth most common metal. By mass, it accounts for 2.4%. The planet is home to reserves of billions of tonnes of potassium chloride. Every year, mining extracts around 35 million tonnes.

The majority of soluble potassium minerals are found in igneous rocks. From these minerals, the metal is hard to extract. However, there are additional minerals that are discovered in deposits created by the evaporation of old oceans or lakes, such as sylvite (potassium chloride), sylvinite (a combination of potassium and sodium chloride), and

carnallite (potassium magnesium chloride). These make it simple to recover the potassium salts. The ocean also contains potassium salts, but they are less common than sodium salts.

Food Preservation Using Chemical and Natural Methods

A food material can be colonized by the growth of microbes by introducing specific chemical compounds. However, chemical chemicals shouldn't be dangerous to people. Chemical preservatives are such chemicals that are added to food products to stop them from spoiling. In our nation, two chemical preservatives with limited applications are: 1. Benzoic acid or (sodium benzoate) and 2. Sulphur dioxide or (potassium bisulphate).



When potassium sulphate is combined with sulfuric acid, a crystalline salt known as potassium bisulphate is created. This salt, also known as potassium hydrogen sulphate, is used primarily to make cream of tartar and as a flux. Sulfuric acid's

potassium acid

salt, potassium bisulphate, is an inorganic substance having the chemical formula KHSO_4 . This solid is white and water-soluble. The crystalline solid potassium bisulphate has an odor of sulfur and is colorless. If consumed, potassium bisulphate may make you sick. Potassium bisulphate may release poisonous fumes if heated to high temperatures. Fertilizers and wine are both made with potassium bisulphate.

Potassium bisulfate is an odorless white crystalline solid that begins to decompose at its melting point. It is deliquescent, meaning that has such a strong tendency to absorb moisture from the air that it becomes wet and dissolves in the water it has absorbed. Potassium Bisulfate is generally immediately available in most volumes. High purity, submicron and nanopowder forms may be considered.



fig - Humphry Davy (discovered potassium)

General Description

A white, crystalline substance with a sulfuric smell is potassium bisulfate. Ingestion of potassium bisulfate may result in sickness. Potassium bisulfate may release poisonous gases when heated to high temperatures. Fertilizers and wine both employ potassium bisulfate as a component. A water-soluble inorganic salt called potassium bisulfate is mostly employed as a preservative, a flux, and to make fertilizers.

The inorganic potassium salt is potassium bisulfate. When heated between 300 and 700°C, it turns into a molten state, and Raman spectra have been used to study the reactions that take place during this transition. Evaluation of its electrical conductivity values (T = 0-700C, Pressure = up to 4000bars)

Health Hazard

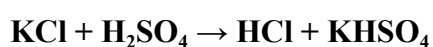
It is very toxic in nature; skin contact, ingestion, or inhalation of the substance may result in serious harm or even death. Severe burns to the skin and eyes can result from contact with molten materials. Avoid making touch with your skin. Contact or inhalation effects could take time to manifest. Gases that are toxic, corrosive, or unpleasant may be produced by the fire. Water used for fire suppression or diluting runoff may be poisonous or caustic and result in pollution.

Reactivity

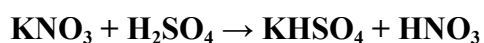
Salts that are acidic, like potassium bisulfate, are typically soluble in water. The resultant solutions have pH values below 7.0 and include moderate amounts of hydrogen ions. To neutralize bases, they respond as acids. These neutralizations produce heat, albeit much less so than when inorganic acids, inorganic oxoacids, and carboxylic acids are neutralized. It is uncommon for them to operate as oxidizing or reducing agents, but it is not impossible. Organic reactions are catalyzed by many of these substances.

How is Potassium Bisulphate prepared?

1. The exothermic reaction of potassium chloride and sulphuric acid.



2. It is also a by-product during the preparation of nitric acid from potassium nitrate and sulphuric acid.



Chemical Properties of Potassium Bisulphate:

1. Thermal decomposition of potassium bisulphate forms potassium pyrosulphate



2. Above 600 °C potassium pyrosulphate converts to potassium sulphate and sulfur trioxide



Potassium bisulfate doesn't seem to be available as a pH-lowering agent for swimming pools, in contrast to its sodium equivalent. Hydrogen peroxide and potassium bisulfate are produced when Oxone is added to water. Another byproduct will be potassium sulfate. The water-soluble crystals of KHSO₄, also known as acid potassium sulfate and potassium acid sulfate, melt at 214°C. It serves as a flux, a food preservative, and is utilized in the production of fertilizer and wine.

Structure of Compound:

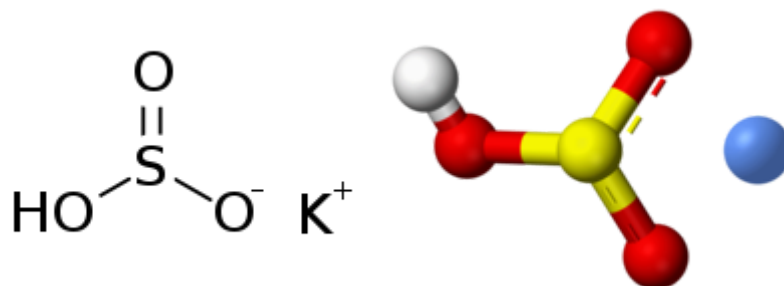


fig - (i): structure of potassium bisulphate

Occurrence of Compound:

The mineral mercallite is a relatively uncommon type of potassium bisulphate. With the formula K₈H₆(SO₄)₇, misenite is another more complicated kind of potassium bisulphate.

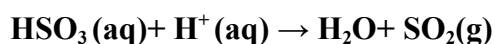
2. Theory

Notable Properties of Potassium Bisulphate

1. Chemical Formula: **KHSO_4**
2. Molar Mass: **136.169 g/mol**
3. Appearance: **Colorless, Solid**
4. Odor: **odorless**
5. Density: **2.245 g/cm^3**
6. Melting Point: **197°C**
7. Boiling Point: **300°C**
8. Solubility: **soluble in acetone, ethanol**
9. Magnetic susceptibility: **$-49.8 \cdot 10^{-6} \text{ cm}^3/\text{mol}$**



For the preservation of colorless food items such as fruit juices, squashes, apples, and fresh mango chutney, potassium bisulphate is utilized. The fact that this chemical produces bleaching powder in the form of sulfur dioxide prevents it from being utilized to preserve colored food products. When potassium bisulfate reacts with the acid in the juice, sulphur dioxide is released, which is particularly effective in killing the bad microorganisms that are present in food and keeps it from spoiling.



Mechanism of Preservation

When we dissolve potassium bisulphate in water, sulphurous acid. The acid will lower the pH and prevent the growth of harmful beings which can include bacteria like E. coli and yeast and mold. It also prevents browning or discoloration of the food. But when humid, it may oxidize and lose some power.

Uses of the Compound

To make potassium bitartrate for winemaking, potassium bisulfate is frequently utilized. In analytical chemistry, potassium bisulfate is also employed as a disintegrating agent or as a precursor to potassium persulfate, a potent oxidizer. A water-soluble inorganic salt called potassium bisulfate is mostly employed as a preservative, a flux, and to make fertilizers. Potassium metabisulphite slows down the rate at which food spoils by acting as a negative catalyst. Uses for potassium bisulfate as a food ingredient The substance is on the list of "Generally Regarded as Safe" substances maintained by the U.S. Food and Drug Administration.

The list includes substances that, despite not having been tested, are believed to be safe for intake by humans. Because it prevents the growth of fungi, bacteria, and insects that cause food to decay, potassium bisulfate is a preservative used in food. In cake mix, it serves as a leavening agent as well. One of its most crucial applications is in the production of wine, where it is employed to turn a few chemicals present naturally in grapes into potassium bitartrate. In addition to being utilized as a flux, potassium bisulfate is also used in the production of fertilizers, the analysis of ores and silica compounds, and the production of methyl and ethyl acetate.

Human tissue is severely irritated by potassium bisulfate. It can burn tissue and cause skin rashes, irritated nasal passages, throat discomfort, and eye damage if it is spilled on the skin, inhaled, or swallowed. Additionally, stomach and mouth burns could happen. These risks do not provide a problem when used as a food additive and are large of concern to those who work directly with the substance. A water-soluble inorganic salt called potassium bisulfate is mostly employed as a preservative, a flux, and to make fertilizers.

A potassium base is partially neutralized to produce potassium bisulfate, an acid salt of potassium with the chemical formula KHSO_4 . A water-soluble inorganic salt called potassium bisulfate is mostly employed as a preservative, a flux, and to make fertilizers. The inorganic potassium salt is potassium bisulfate.

Handling the compound

The skin, eyes, and mucous tissues will become irritated upon contact with potassium bisulfate. Potassium bisulfate solutions have a substantially lower pH than many acids themselves, despite being a salt rather than a fully saturated acid, and should be handled carefully. During storage, it could also give off odors of sulfuric acid.

It should be stored in closed plastic or glass containers. For the disposal of this compound, it can be neutralized with any base.

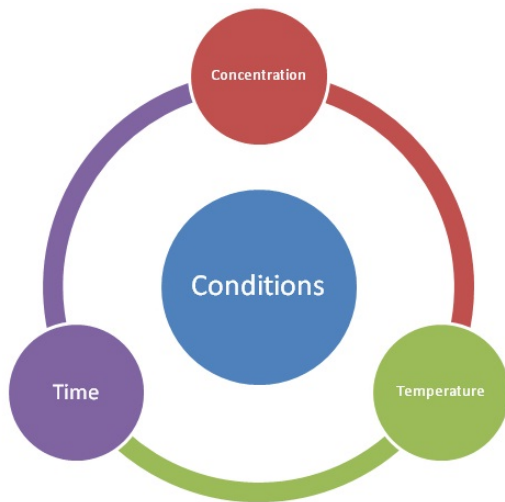


Effects of Using Potassium Bisulphate as a Food Preservative

The acid reduces the food's pH, which aids in preventing the growth of dangerous germs like E. coli as well as yeast and mold. Additionally, the bisulphite stops food from browning or discoloring. Compared to potassium sulfate, potassium bisulphite is more stable. Due to the fact that the sulphur dioxide produced by this chemical is a bleaching powder, it is not used to preserve colored food products. In combination with the acid in the juice, potassium bisulphate releases sulphur dioxide, which is particularly powerful at destroying the bad microorganisms present in food and keeping it from spoiling. Because it prevents the growth of fungi, bacteria, and insects that cause food to decay, potassium bisulfate is a preservative used in food.

Food with a higher sugar content should not be stored for an extended period of time. The preservative potassium bisulphate works well. The main use of potassium bisulphate is as a commercial product. Potassium bisulphate will be used in the production of concentrated juice drinks to lengthen the shelf life of their goods. The preservative is also offered for use at home. Sulphates, including potassium bisulphate, can cause an asthma attack in those with the condition. Potassium bisulphate may irritate the lungs. In food processing, sodium erythorbates is used to keep a wide variety of foods fresh – from meats to canned fruits and

vegetables, as well as wines, jams, and soft drinks. When used in pickled products, it prevents



cancer-causing chemicals called nitrosamines from forming. Sodium erythorbate has antioxidant properties that are more potent than ascorbic acid. It inhibits the oxidation of food, which helps keep the food fresh.

Some Common Questions Asked:

1. How do preservatives work?

→ To prevent spoilage of foods by molds, yeast, and bacteria, preservatives have an acidic nature that makes the organisms unable to grow in the food.

2. How can I tell which foods contain preservatives?

→ All 'additives', including preservatives, must be labeled on food packages. You may commonly see the word 'preservative' followed by its additive number or name. For example, preservative (220) or (sulphur dioxide). This system makes it easy to identify preservatives in foods.

3. What foods contain preservatives?

→ You may be surprised at how many foods you commonly eat contain preservatives. Items such as bread, soft drinks, cheese, margarine, wine, dried fruit, processed meats, fruit juice, and raw prawns may contain preservatives.

4. Can preservatives cause reactions in sensitive people?

→ The body can react to all sorts of natural and artificial chemicals found in the environment and in foods. Particular preservatives may cause reactions in sensitive people, with symptoms including skin rashes and itching, breathing difficulty, sneezing, or gastrointestinal upsets.

3. Objective

After the study of this research paper, the reader will have a concise understanding of the following topics:

1. Potassium
 - a. Uses of Potassium
 - b. The abundance of Potassium
2. Potassium Bisulphate and Potassium Bisulphite
 - a. Chemical Properties
 - b. Occurrence and Handling
3. Theory
 - a. Notable Properties
 - b. Mechanism of Preservation
 - c. Handling the Compound
 - d. Effects of using as a food preservative
 - e. Commonly Asked Questions

4. Research Methodology

4.1. Quantitative Method:

3.1.1. Existing Data:

Going through 10s of exercises from 10s of books written by experts in the field was a hassle, but fascinating, which helped me learn things about Metals and their real-world applications.

4.2. Qualitative Methods:

4.2.1. Focus Groups:

After a bit of research, I found focus groups and communities on Facebook and Reddit. I got to ask queries without hesitation, and everybody was somewhat helpful and welcoming. In the future, I will be helping others on topics I am familiar with in these focus groups.

4.2.2. Books:

Text Books based on the curriculum of grade 12 like “Pioneer Chemistry”, “Heritage's Chemistry” and “University Chemistry” by Bruce H. Mahan helped me a lot to collect quality information.

5. Observation

Potassium bisulphate, a crystalline salt, is produced when potassium sulfate and sulfuric acid are mixed. The main applications for this salt, also known as potassium hydrogen sulphate, include the production of cream of tartar and flux. Potassium bisulphate, the potassium acid salt of sulfuric acid, is an inorganic compound with the chemical formula KHSO_4 . It is a white, water-soluble substance.

Potassium bisulphate is a white, crystalline substance with a sulfuric smell. Potassium bisulphate can make you sick if you consume it. If heated too high temperatures, potassium bisulphate may emit toxic fumes. Potassium bisulphate is used to make both fertilizers and wine.

Unlike its sodium cousin, potassium bisulfate does not appear to be a common pH-lowering substance for swimming pools. When Oxone is introduced to water, hydrogen peroxide and potassium bisulfate are created. Potassium sulfate will be another byproduct. Acid potassium sulfate and potassium acid sulfate are other names for the water-soluble crystals of KHSO_4 , which melt at 214°C . It is used to produce fertilizer, wine, and as a food preservative in addition to serving as a flux.

Potassium bisulfate does not seem to be a common pH-lowering agent for swimming pools, unlike its sodium relative. Potassium bisulfate and hydrogen peroxide are produced when oxygen is added to water. Another byproduct will be potassium sulfate. The water-soluble crystals of KHSO_4 have different names such as acid potassium sulfate and potassium acid sulfate. They melt at 214°C . In addition to being a flux, it is used to make wine, fertilizer, and food preservatives.

Food with a higher sugar content should not be kept for an extended period of time. The preservative potassium bisulphite works well.

6. Analysis

After the study of this project research paper we can transparently learn about food preservation techniques as well as about potassium and its preservative compounds.

Uses

As a food preservative, potassium bisulfite has a variety of applications. According to Manitoba Agriculture, Food, and Rural Initiatives, this solution effectively stops mold, yeast, and bacterial growth in food. It is a component of homemade wine as well.

Some iced beverages and concentrations of fruit juice contain potassium bisulfate. Sulfites are a typical preservative found in dried fruits and smoked or processed meats. It could aid in preventing food from browning or discoloring when used as a spray.

Availability

The main use of potassium bisulfite is as a commercial product. This chemical might be present in meat processing facilities. Potassium bisulfite is used by producers of juice drinks and concentrates to lengthen the shelf life of their goods. The preservative is also offered for use at home.

Allergies

Sulphites, such as potassium bisulfite, can cause an asthma attack in people with the condition. Potassium bisulfite may irritate the lungs.

7. Conclusion

Sulphate additions can cause a variety of symptoms in people who are sensitive to them, including gastrointestinal, respiratory, and dermatological issues. However, the majority of sulphate sensitivity situations include reactions that show up in the respiratory system.

Although it is commonly accepted that between 3 and 10% of adult asthmatics may show adverse reactions to the sulphate additions, with some of these people developing life-threatening reactions, the real prevalence of asthmatic responses to the sulphates is yet unknown. It is crucial to remember that many people suffer a wide range of symptoms after being exposed to the sulphates; hence, cutaneous, intestinal, and respiratory reactions may happen at the same time, in different combinations, and with varying degrees of severity.

Sulphate additions undoubtedly contribute to the chronic symptoms that some people suffer in addition to precipitating episodic and acute symptoms. Chronic skin problems, particularly on the hands, perineum, and face, have been recorded in sensitive people who habitually use cosmetics or topical drugs that include sulphates. Occupational exposure to sulphates has also been linked to long-lasting skin problems. It is possible that some sensitive people's unrecognized regular exposure to the sulphate additions may contribute to the chronic asthma symptoms they experience. Although the potential that exposure to sulphates may contribute to chronic asthma has not been extensively researched, it is feasible.

In conclusion, many people, especially asthmatics, suffer greatly from sensitivity to sulphate additions. This is a very genuine issue. The possibility of sulphate sensitivity should be taken into account when people exhibit negative reactions to a variety of exposures with no discernible pattern, especially when these people experience worsening asthma symptoms after consuming foods like dried fruits and wines or negative skin reactions after using cosmetics or prescription creams.

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