Subject: Sulfuric acid production and use in agriculture

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Abstract: This article analyzes industrial methods of sulfuric acid production and its importance in agriculture. The role of sulfuric acid in fertilizer production, regulation of soil pH, and its application in agricultural technologies are discussed. In addition, environmental impacts, safety issues, and ways to reduce negative effects of sulfuric acid production are considered.

Keywords: Sulfuric acid, production, agriculture, fertilizers, soil pH, ecology, safety.

Introduction. Nowadays, agriculture is in great need of chemical industry products to ensure high productivity. One of such important chemicals is sulfuric acid (H_2SO_4). Sulfuric acid is the “main product” of the chemical industry, and its production volume is considered one of the important indicators of the country's industrial development. In agriculture, sulfuric acid is widely used, mainly in the production of mineral fertilizers, in improving soil properties, and in agrotechnical measures. Therefore, this article will provide a detailed description of the production technologies of sulfuric acid and its importance in agriculture.

The main part. Sulfuric acid production methods

Industry, sulfuric acid is mainly produced by two methods: the contact method and the nitrous method.

The contact method is currently the most common and effective method. In this process, sulfur or sulfide ores are burned to produce sulfur dioxide (SO_2). Then, SO_2 is oxidized with oxygen in the presence of a catalyst (V_2O_5) to sulfur trioxide (SO_3). SO_3

reacts with water to form sulfuric acid. This method is characterized by high productivity. The nitrous method is less commonly used and is largely an older technology. In this method, nitrogen oxides act as a catalyst.

Importance of Sulfuric Acid in Agriculture

Sulfuric acid plays an important role in agriculture in the following areas:

Fertilizer Production: It is the main raw material in the production of mineral fertilizers such as superphosphate and ammonium sulfate.

Adjusting soil pH: It helps plants absorb nutrients better by increasing acidity in alkaline soils.

Promoting plant growth: The element sulfur is an important nutrient for plants and increases productivity.

Irrigation water purification: In some cases, it is used to normalize the composition of water.

Literature analysis.

In recent years, the importance of sulfuric acid (H_2SO_4) in the development of the chemical industry and agriculture has been widely covered in scientific literature. Many researchers consider sulfuric acid to be the main product of the chemical industry and consider its production volume to be an important indicator of industrial development. The Kirk-Othmer and Ullmann encyclopedias state that sulfuric acid is one of the most widely produced inorganic acids in the world.

Scientific sources have thoroughly analyzed the technologies for the production of sulfuric acid, especially the contact method. According to studies, the contact method is characterized by high efficiency, economic feasibility and high purity of the product. The use of a vanadium (V_2O_5) catalyst has been repeatedly proven in the scientific literature to increase the efficiency of the conversion of SO_2 to SO_3. At the same time,

some authors indicate the decrease in the activity of catalysts during long-term operation as one of the main problems.

The agricultural literature emphasizes the role of sulfuric acid in the production of fertilizers. According to scientific research, sulfuric acid is the main raw material for fertilizers such as superphosphate and ammonium sulfate. Agricultural encyclopedias note that fertilizers produced using sulfuric acid help develop the root system of plants, increase productivity, and improve soil fertility.

The importance of sulfuric acid in regulating soil pH has been widely discussed in soil science. Researchers have noted that moderate use of sulfuric acid in alkaline soils improves plant uptake of micronutrients such as phosphorus, iron, and zinc. However, there are warnings in the literature that excessive use of sulfuric acid can lead to soil degradation.

From an ecological point of view, scientific sources indicate that sulfur dioxide (SO_2) and sulfur trioxide (SO_3) gases released during the production of sulfuric acid are the main sources of environmental risk. According to studies, the release of these gases into the atmosphere can lead to the formation of acid rain, damage to plants and water resources. Therefore, modern literature emphasizes the need to introduce gas cleaning technologies.

Scientific studies on safety issues note that sulfuric acid is a highly corrosive substance, and that strict technical safety rules must be observed during production and use. The authors consider the use of personal protective equipment, improved ventilation systems in production areas, and emergency preparedness measures to be important.

Research discussion. The analysis of this topic revealed that sulfuric acid is a very important substance for agriculture. However, there are environmental hazards and safety issues in the production process.

Research shows that these negative impacts can be significantly reduced through modern technologies, gas purification devices and increased energy efficiency. At the same time, the correct and moderate use of sulfuric acid is important in increasing soil fertility.

Summary. In conclusion, sulfuric acid is a chemical of strategic importance for agriculture. It plays an important role in the production of mineral fertilizers, improving soil quality and increasing productivity.

At the same time, its production can have a negative impact on the environment. Therefore, it is important to adhere to environmental safety measures, modernize production and introduce sustainable technologies.

List of used literature

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