Soluble sulfates in soils

GLOBE		*Related SDGs:*	*Type of activity*
Sphere	**Protocols**		
Pedosphere	pH soil texture	4 Quality Education 12 Responsible Consumption and Production	Research

Overview

The presence of sulfates produces different effects on soil properties and plant physiology. The main of these compounds is hydrated Calcium Sulfate ($CaSO_4x2H_20$), known as gypsum, which in specific quantities is used as a natural fertilizer and as a soil amendment increasing its productive capacity.

In some soils, gypsum is very abundant (gypsum soils). Since their presence can have agronomic importance, it is essential to verify their presence.

Time
2 classes.

Prerequisites
Chemical reactions.

School level

High school (K-10 to K-12)**.**

Purpose

Establish the presence of sulfates in the soil studied, their characteristics, and contributions to their functionality.

Student outcomes

- Know the influence of sulfates on soil pH.
- Recognize acid-base neutralization chemical reactions.
- Know the characteristics and effects of gypsum in its application in soils.

Introduction

When gypsum is applied with fine particle size, it allows a rapid availability of nutrients. It provides calcium to soils, maintaining cationic ratios at ideal levels. It contributes to increasing the availability of nutrients such as phosphorus, potassium, and calcium. It increases the cation exchange capacity and favors the supply of calcium (Ca) and sulfur (S) to plants.

In plants, nitrogen and sulfur are essential to achieve protein blockage. Sulfur deficiency will severely reduce nitrogen use efficiency and limit protein synthesis.

Guiding research questions

- What is the contribution of sulfates to the cation exchange in soils?
- What are the advantages and disadvantages of the presence of gypsum in the soil?

Materials and tools

- Test tubes
- Distilled or demineralized water
- Funnel and filter paper.
- Barium chloride solution, $BaCl_2$, 15%

Scientific concepts

- Acid-base chemical reactions
- Concept of pH
- Plasters
- Anionic and cationic exchanges
- Soluble sulfates
- Precipitates

What to do and how to do it

Beginning

- Considering samples of at least three different types of soil, take some soil from each and place it in test tubes (one for each); Add distilled or demineralized water and shake. Once properly shaken, the tube contents are filtered by a funnel and filter paper. When the soil is of texture, it may be necessary to filter the extract several times so that it is transparent and the sediment can be seen if it appears in the next stage, or it can be filtered through two papers.

Development

- To check whether the soils in question contain gypsum or other sulfates, a few drops of the barium chloride solution are added to each of the filter liquids, where

the appearance of turbidity, attributable to the formation of a white precipitate of barium sulfate, will be easily observable,

Closing

- Using corresponding GLOBE protocols, establish the texture and pH of each sample and infer the relationships between the deduced characteristics. Prepare an experience report with details, deduction of the equations of the chemical processes that occurred in the tests.

Frequently asked questions

-How to systematize the concepts and applications developed?

Perform a literature search to deduce the importance of soluble sulfates in soils, their causes, and potential benefits for their function as substrate Priority of the function of pH and texture. Arrange your previous findings in an exhibition format to communicate to your immediate community.

Resources

- GLOBE soil work and research materials (www.globe.gov)

Bibliography

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