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AGROECOLOGICAL PROPERTIES OF SAPROPEL AND PROSPECTS FOR ITS APPLICATION IN AGRICULTURE

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Abstract: This article examines the origin, composition, physicochemical properties, and agricultural applications of sapropel. Sapropel is a natural sedimentary resource formed by the long-term accumulation of organic and mineral substances at the bottom of freshwater bodies. It contains essential nutrients, humic substances, and biologically active compounds that are beneficial for soil fertility and plant growth. The findings indicate that sapropel improves soil productivity, enhances agroecosystem sustainability, and contributes to environmentally friendly agricultural production.

Keywords: sapropel, organic fertilizer, soil fertility, agroecology, humus, microelements, biologically active substances, agriculture.

Introduction: The preservation of soil fertility and the implementation of environmentally sustainable agricultural practices have become major challenges in modern agriculture. Excessive use of mineral fertilizers often leads to soil degradation, water pollution, and reduced crop quality. Therefore, the search for natural and eco-friendly alternatives is of increasing importance.Sapropel is one such natural resource. It is formed through the accumulation and decomposition of plant and animal residues together with mineral particles at the bottom of freshwater reservoirs. Due to its rich chemical composition and biological activity, sapropel has significant potential for improving soil quality and increasing agricultural productivity.Soil degradation and declining fertility are among the most pressing issues facing global agriculture. The use of organic materials rich in nutrients and humic substances can help restore soil health and reduce dependence on synthetic fertilizers. Sapropel is considered a promising resource because of its ability to improve soil structure, stimulate microbial activity, and enhance nutrient availability.Therefore, studying the properties and practical applications of sapropel is highly relevant for the development of sustainable agricultural systems.To investigate the agroecological properties of sapropel and evaluate its significance in agricultural production.

Research Objectives

- To study the process of sapropel formation;
- To analyze its chemical composition;
- To determine its physicochemical properties;
- To evaluate its impact on soil fertility;
- To assess the prospects for its agricultural application.

The study was based on the analysis of scientific literature, comparative evaluation of research findings, and synthesis of available statistical and experimental data. Scientific publications concerning the composition, properties, and agricultural use of sapropel were reviewed and analyzed.Sapropel is formed under conditions of limited oxygen supply at the bottom of freshwater lakes and reservoirs. It results from the microbiological decomposition of aquatic plants, algae, plankton, and animal residues over hundreds or even thousands of years. Consequently, thick layers of organic-rich sediments accumulate.

The composition and quality of sapropel vary depending on environmental conditions, biological diversity, and geological characteristics of the water body.Sapropel contains a wide range of organic and mineral components essential for plant development.

Component	Content (%)
Organic matter	30–90
Nitrogen	1–5
Phosphorus	0.2–2
Potassium	0.3–3
Calcium	1–15
Humic substances	10–40

Additionally, sapropel contains trace elements such as copper, zinc, manganese, boron, and molybdenum, which play important roles in plant metabolism.The main physicochemical characteristics of sapropel include:

- High water-holding capacity;
- Strong adsorption properties;
- High organic matter content;
- Significant microbiological activity;
- Ability to improve soil structure.

When applied to soil, sapropel increases porosity, enhances moisture retention, and promotes the development of beneficial microorganisms.Sapropel is widely used as an organic fertilizer and soil conditioner. It improves soil physicochemical properties and supplies plants with essential nutrients.The major agricultural benefits of sapropel include:

1. Improvement of soil fertility;
2. Increase in organic matter content;
3. Enhancement of root system development;
4. Increase in crop productivity by 10–30%;
5. Promotion of environmentally friendly agricultural production.

The application of sapropel contributes to environmental protection by reducing the need for mineral fertilizers and supporting soil biological balance. Furthermore, the extraction of excessive organic sediments from water bodies can improve their ecological condition and reduce eutrophication processes.

Results and Discussion**:**The analysis of scientific literature demonstrates that sapropel significantly contributes to soil restoration due to its high content of organic matter and biologically active compounds. Soils treated with sapropel exhibit increased microbial activity, improved nutrient availability, and enhanced plant growth.Moreover, the water-retention capacity of sapropel makes it particularly valuable in arid and semi-arid regions where efficient water use is essential. These characteristics highlight its importance in the context of climate change and sustainable agricultural development.

Conclusion: Sapropel is a valuable natural organic resource with considerable potential for agricultural use. Its rich content of humic substances, macroelements, and microelements contributes to improved soil fertility and increased crop productivity. The application of sapropel supports environmentally sustainable farming practices, reduces soil degradation, and enhances agroecosystem resilience. Further research and practical implementation of sapropel-based fertilizers are recommended to maximize its agricultural and ecological benefits.

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