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RESEARCH ARTICLE

Research of Reclamation Properties of Agricultural Glaukonite Ores on Salted Soils

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ABSTRACT

The article presents the results of studies of the agro-ore of glauconite of Karakalpakstan, its reclamation properties when used on saline soils of the Aral Sea region. The results of the studies showed that the annual application of enriched glauconite leads to a decrease in chloride and sulfate salts in the soil, and the content of harmless salts increases.

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Introduction

Currently, more and more attention is paid to such methods of plant protection that have a minimal impact on the external environment. The problem of selecting effective drugs against soil salinization remains acute, which negatively affects seed germination, plant growth and development, and crop harvests.

Soil salinization is caused by the accumulation in the soil of a large amount of water-soluble salts-cations Ca+ 2, Mg+2, K+, Na+, and anions Cl -, SO4-2, CO3 -, HCO3 - 2, NO3 -.

Table 1 shows the data on the influence of the degree of soil salinity on plant productivity, which shows that in order to obtain full-fledged crop harvests, it is necessary to carry out measures to desalinate the soil. However, this is very costly.

The most acceptable method is to create chemicals with pronounced reclamation properties that would provide protection from toxic ions during the development of plants.

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Table 1. The degree of soil salinity and harvest of plants

Degree of soil salinity	Plant condition	Harvest, % of sustainable on saline soils
Non-saline	Good	100%
Lightly salted	Weakly oppressed	80%
Medium-saline	The oppressed	50%
Highly saline	Severely oppressed	30%

New fertilizer compositions are needed that bind toxic salts, especially bicarbonate and sodium chloride into complex and other compounds, and thereby neutralize their negative effect on the seed and their embryos, as well as plants in the initial phase of development.

It is known that one of the ecological features of the Republic of Karakalpakstan is the salinity of soils with soluble salts. Moreover, it is observed that in recent years there is a secondary salinization of soils, which violates the ecological balance of the region. Studies show that 95 percent of the irrigated land is saline (the total area of irrigated land in Karakalpakstan is about 500 thousand hectares).

The salinity of soils mainly refers to the harmful (in terms of the effect on agricultural crops) sulfate and sulfate-chloride types of salts. These salts have a negative impact on crop yields. Currently, in Karakalpakstan, the issue of salinization of irrigated areas is acute. To desalinate the soil, the soil is washed.

Experimental

This method of soil desalination requires additional water consumption. In our opinion, one of the alternative methods of soil desalination is the use of glauconite, since the introduction of glauconite reduces the content of salts harmful to plants.

Figure 1. shows the results of field studies on the effect of enriched glauconite on the content of chloride salts, the analysis of which shows that the annual application of enriched glauconite at the rate of 800 kg / ha leads to a decrease in the salt content. At the same time, the analysis of the graph shows that the dependence of the salt content on time is approximated by a linear function in the direction of decreasing the salt content.

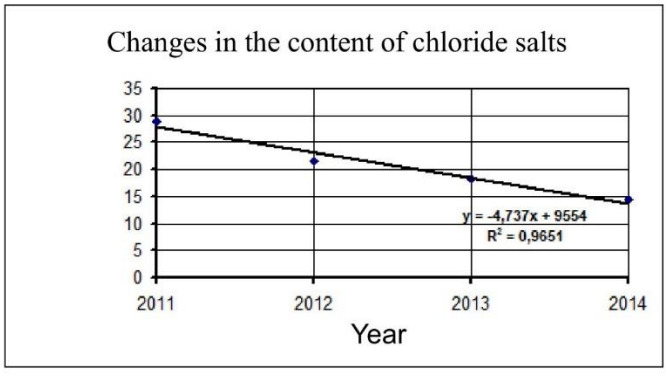

Fig. 1. Effect of application of enriched glauconite (60%) at the rate of 800 kg / ha on the content of chloride salts

Similar results were obtained when studying the effect of the application of enriched (60%) glauconite at the rate of 800 kg / ha on the content of sulfate salts harmful to crops. Figure 2 shows a graph describing the effect of enriched glauconite on the content of harmful sulfate salts, the analysis of which shows that the annual introduction of glauconite reduces the content of sulfate salts. At the same time, the experimental results showed that the dependence of the content of harmful sulfate salts on time (with the annual introduction of enriched glauconite) is approximated by a linear function in the direction of decreasing the content of sulfate salts.

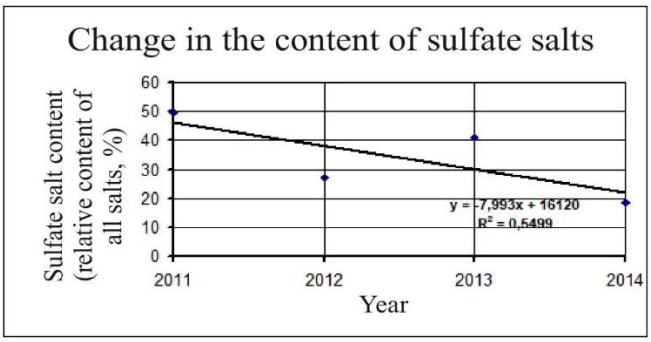

Fig. 2. Effect of the application of enriched glauconite (60%) at the rate of 800 kg / ha on the content of sulfate salts.

Figure 3 shows the results of studies on the effect of glauconite on changes in the content of non-harmful salts for agricultural crops, the analysis of which shows that glauconite leads to an increase in the content of salts: CaSO4; Ca(HCO3).. This is due to the fact that harmful salts under the influence of glauconite are transformed into harmless salts, to confirm this, the results of experimental studies are given below.

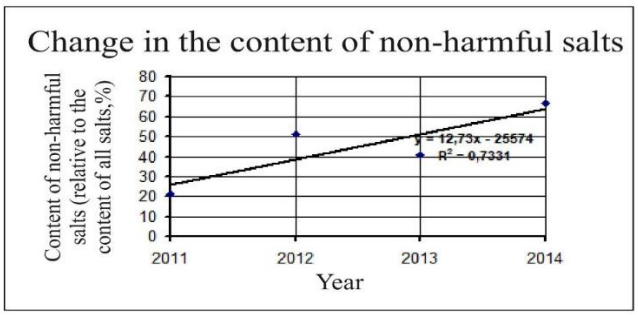

Fig. 3. Effect of application of enriched glauconite (60%) at the rate of 800 kg / ha on the content of salts harmless to crops: CaSO4; Ca(HCO3)

To compare the results of our scientific and agrochemical research, a literature review was made by other authors who have dealt with the same problem before and in other countries.

In the studies of Levchenko M. L. [1,2], it is said that glauconites have high adsorption and cation exchange properties (exchange capacity 15-20 mg / eq per 100 g of rock). All this gives reason to consider glauconites as a multifactorial fertilizer that allows not only to enrich the soil with potassium, but also to improve its structure, preserve

moisture, stimulate growth and reduce the incidence of plant diseases.

Results and Discussion

To confirm this, the results of studies [3]on the study of the features and sorption-exchange properties of glauconite from the Bagaryak deposit (Russia) are presented below. Figure 4.5 shows the results of experimental studies on the sorption properties of glauconite. Sorption of cations was carried out from chloride or sulfate solutions of metals. Figure 4 shows the results of experiments on the sorption of cations by glauconite from chloride or sulfate solutions at different pH values. Analysis of these results shows that in the pH < 3 and pH > 8 ranges, an increase in sorption is observed., i.e., glauconite reduces the alkalinity and acidity of the solution.

The author of the article (3) speaks about the molecular sorption of hydrochloric acid and potassium hydroxide by aluminosilicate of glauconite material. This suggests that the glauconite normalizes the acid-alkaline balance. In the same work, it is shown that the amount of metal ions adsorbed by glauconite increases with an increase in the hydrogen pH (Fig. 5).

This, in turn, shows that glauconite is able to break down solutions of salts that are harmful to plants and turn harmful salts in relation to plants into harmless salts.

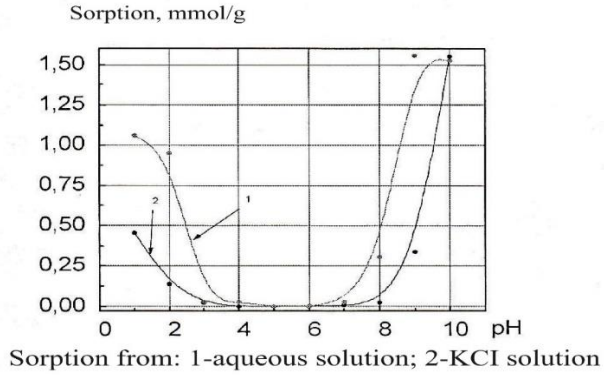

Figure 4. Sorption of acid and alkali by glauconite

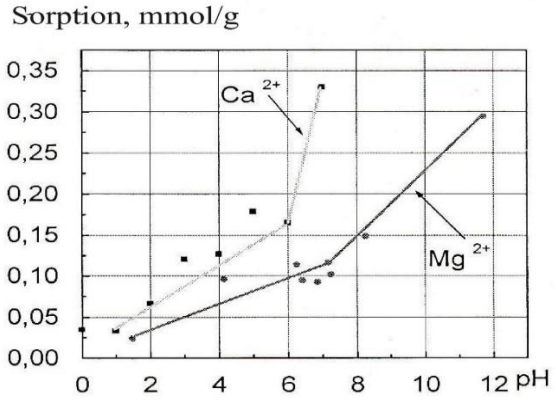

Figure 5. Sorption of metal ions as a function of pH (10)

Similar results were obtained by E. A. Materova [6]. In this work, studies were conducted to study the process of barium adsorption in various values of the hydrogen index. E. A. Matereva found a linear relationship between the concentration of hydrogen ions in the equilibrium solution (pH) and the amount of adsorbed Ba2 + ion at a constant concentration of barium in the solution (Fig. 6). Figure 6 shows the results of experiments on the study of ion exchange on glauconite, obtained by the example of the exchange capacity of Ba2+ and the hydrogen index at a constant concentration of glauconite. The analysis of the results of the studies presented in Fig. 6 shows that the number of adsorbed barium ions increases with the growth of the hydrogen index.

The resulting relationship between the absorption of the metal cation and the pH of the solution is characteristic of weak acid-type absorbers, for which there is a gradual increase in the exchange capacity with increasing pH due to the entry of increasingly weak exchange groups into the exchange. This process, under certain conditions, leads to the transformation of harmful salts for plants into harmless salts.

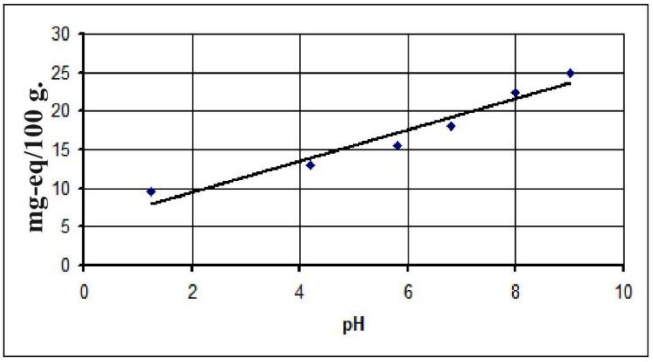

Figure 6. The relationship between the exchange capacity of Ba2+ and the pH of the glauconite solution.

In the work [7] it is indicated that in Russia, in Ukraine, companies have been created that process and sell glauconite fertilizers. The Internet sites of these companies provide the results of scientific research. As stated in the source [7], the addition of glauconite to the soil allows:

- Ensure the cultivation of environmentally friendly products.
- Increase the germination and survival rate of plants.
- Increase the yield of all types of vegetables, fruits and greens.
- Improve the structure and permeability of the soil.
- Restore the natural biochemical processes in the soil, regulate its acidity, develop its beneficial microflora.
- Block toxic substances in the soil and prevent them from entering the plants: radionuclides, pesticides, herbicides, Chlorine, ammonia, heavy metals (it "binds" 99% of lead, 64% of mercury, 96% of copper, 97% of cobalt).
- Increase the saturation of plants with micro-and macronutrients.

"Glauconite" has strong ion - exchange properties and a large ion-exchange capacity, which allows it to convert water-insoluble chemical complexes present in the soil into

water-soluble and easily digestible forms for plants, this property is based on the exchange of cations, the mobility of light, "Noble" metals and the formation of organometallic substances useful for humification, the same property allows it to decompose complex substances (nitrates, petroleum products, many dioxins, pesticides, etc.) into simpler and less dangerous compounds, for this property "Glauconite" received the name-cationic destructor (destroyer).

Glauconite can also be used to stop desertification. As stated in the source [5], the mineral complex "Glauconite" has properties due to which it can replace the soil on any surface and under any climatic conditions:

- Able to absorb and retain water (up to 80% of its mass).
- Helps to maintain a balanced chemical composition of the soil (pH = 7).
- Has a sterile microflora.
- Does not stick, does not crumple.
- Prevents the growth of fungal pathogens of crops and plants.
- Has a unique structure (more than 20 micro and macro elements).
- Retains its properties, in a wide temperature range.

Conclusions

Glauconite is used in the rehabilitation of areas affected by radionuclides or having a high technogenic load as a result of the activities of industrial enterprises. Due to the relatively high content of potassium dioxide (6-7%), and phosphorus pentoxide (up to 3%), glauconite can be used to produce potash fertilizers, or as a natural fertilizer without processing. In particular, the introduction of glauconite flour into the soil increases the yield of a number of cereals and potatoes by 10-20%, significantly increases the yield of fruit trees.

Robots are being developed to create a new natural organo-potassium-phosphorus fertilizer based on glauconites. The stimulating effect of glauconite on the development of useful microflora of soils that determine their fertility was revealed (5). The prerequisite for this, first of all, is the high content of potassium oxide in glauconites (from 5.0 to 9.5%), its ability to quickly break down in the soil with the release of potassium in the form of easily digestible compounds.

The addition of glauconite and fertilizers to biohumus and sapropels allowed us to obtain a bio-fertilizer of the V generation, which allows us to obtain high harvests on poor, saline and polluted soils, increases the plant's resistance in stressful situations: adverse environmental reboots (frost, heat, disease), etc. The drug helps the plant to reveal its genetic properties, causes its rapid development, stimulates growth, has a therapeutic effect in diseases, eventually the yield increases by 1.5-2 times. This was experimentally established for corn, sunflower, and potatoes. [8]

Acknowledgements

The results of our scientific and agrochemical tests and the analysis of published research papers on the use of glauconite for soil restoration allow us to conclude that the introduction of this agro-ore into the soil contributes to:

- Increase in the content of humus in the soil.
- An annual 12-16% reduction in the content of sulfate and chloride types of salts harmful to crops.
- Increase the germination and survival rate of plants;
- Increase the harvest of all types of vegetables, fruits and greens;
- Improving the structure and permeability of the soil;
- Restoration of natural biochemical processes in the soil, regulates its acidity, develops its useful microflora;
- Blocking in the soil, and excluding the ingress of toxic substances into plants: radionuclides, pesticides, pesticides, herbicides, chlorine, ammonia, heavy metals (it "binds" 99% of lead, 64% of mercury, 96% of copper, 97% of cobalt);
- Increases the saturation of the plant with micro-and macronutrients.
- Absorption and retention of water in the soil (up to 80% of its mass).

As you know, the soils of the Aral Sea region are highly saline. Our studies have shown that as a result of the use of glauconite agronomic ore, all soil parameters are improved, and the soil is also restored.

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