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STUDY OF THE PROCESS OF OBTAINING LIQUID FERTILIZER WITH PHYSIOLOGICAL ACTIVITY

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ABSTRACT

In the work to substantiate the process of obtaining liquid fertilizers based on solutions of potassium sulfate, ammonium nitrate, urea, copper sulphates and monoethanolammonium. The dependence of changes in the physicochemical properties of solutions on the composition of components has been studied. On the basis of the data obtained, "composition-properties" diagrams are constructed.

Keywords: Solution, urea, diagram, system, ammonium nitrate, potassium sulfate, fertilizers, properties, composition, ratios.

INTRODUCTION

For normal growth, development and creation of high yields of plants, along with nitrogen-phosphorus, potassium fertilizers are needed, which contribute to the normal course of vital processes in the plant body. The lack of mobile forms of potassium in the soil reduces yields, worsens the assimilation of nitrogen and phosphorus fertilizers.

The range of potash fertilizers includes potassium chloride and potassium sulfate, as well as mixed potassium salts. However, the systematic application of chloride forms of potassium leads to the accumulation of chloride ions in the soil, which adversely affect the yield and quality of many industrial crops. Its use is especially unfavorable in the conditions of Central Asia, where most of the soils are of the gray-earth type, prone to chloride salinization.

Among the chlorine-free forms of potash fertilizers, potassium sulfate has the greatest prospects for production and use, feeding plants with potassium and sulfur. Potassium sulfate is a valuable chlorine-free fertilizer. Potassium sulfate has a much more effective effect on the yield and its quality if it is used in combination with nitrogen and phosphorus fertilizers In the cultivated fruits, vegetables and berries, the content of sugars and vitamins increases markedly, the resistance of plants to various diseases increases, and the percentage of damage to finished products by heartwood and gray rot decreases. Potassium sulfate as a fertilizer must be used to provide perennial plants with a safe winter. By feeding fruit and berry trees and shrubs with potassium sulfate in the fall, you can expect that they will survive even the most severe frosts with insignificant losses [1].

One of the effective ways to produce mineral fertilizers is to obtain them in liquid form. The production of such fertilizers leads to a reduction in a number of processes and, compared to solid fertilizers, leads to a noticeable reduction in costs.

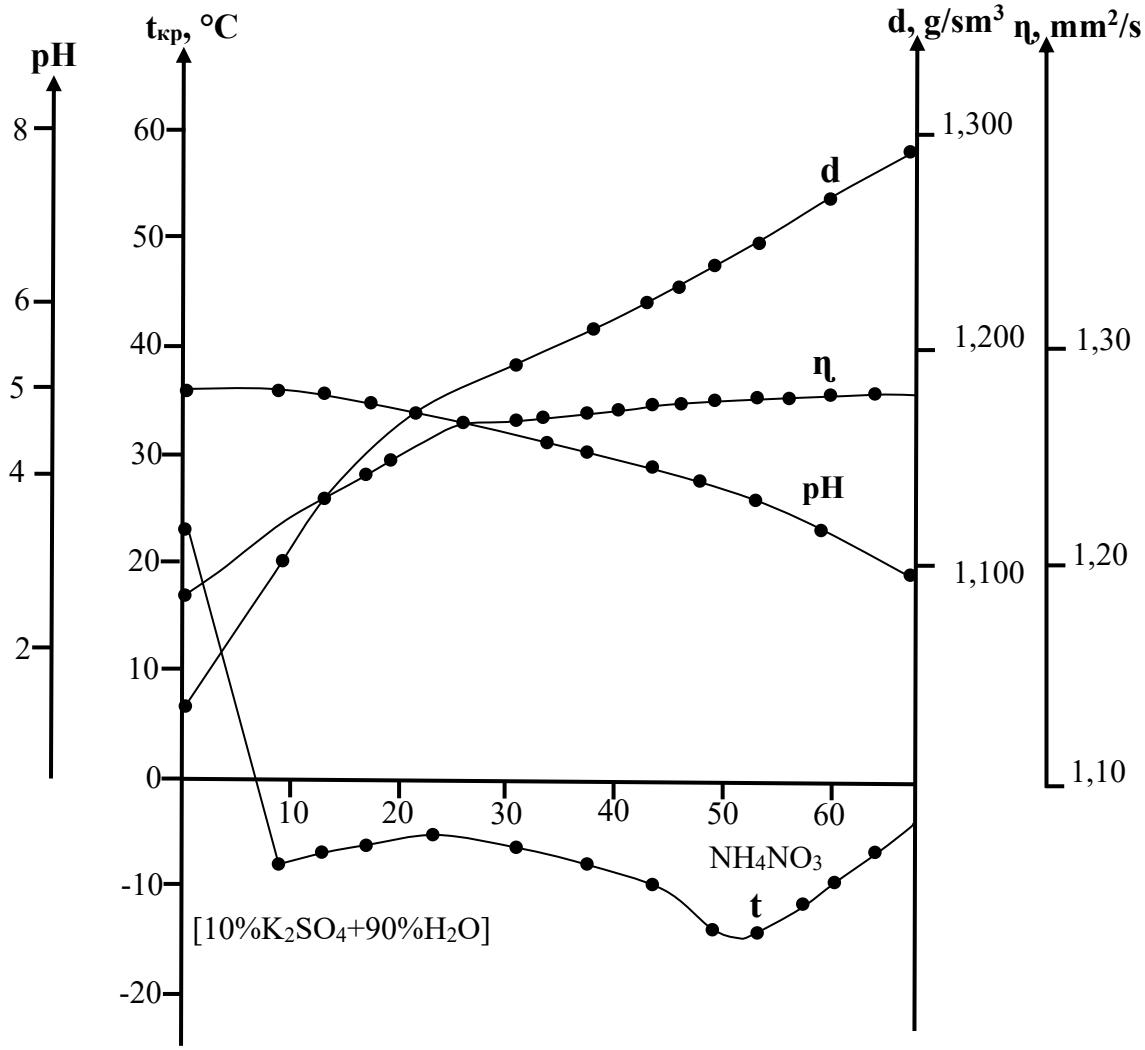
Today, one of the important tasks is the development and improvement of technologies for obtaining new fertilizers of complex action based on local raw materials. To solve this problem, it is important to use potassium sulfate produced by Maxam-Chirchik JSC as a raw material,

followed by enrichment of the potassium sulfate solution with components of nitrogen fertilizers, physiologically active substances and trace elements.

RESULTS AND DISCUSSION

To substantiate the process of obtaining liquid fertilizer based on a solution of potassium sulfate and ammonium nitrate, the dependence of changes in the physicochemical properties of solutions on the composition of components in the system [10%K2SO4+90%H2O]+NH4NO3 was studied.

In order to find out the mutual influence of the components on the physicochemical properties of the solutions of this system, the change in the crystallization temperature, pH of the medium, density and viscosity of solutions depending on the composition of the components was determined [2-4]. On the basis of the data obtained, a diagram of the "composition-properties" of the system is constructed (Fig. 1).



Rice.1 Diagram of the "composition-properties" of the system [10%K2SO4+90%H2O]-NH4NO3

According to the data obtained, the composition-temperature diagram of crystallization is characterized by the presence of three branches of crystallization with obvious fractures on the solubility curve. The first branch corresponds to the crystallization of K2SO4 and

continues to 9.4% of ammonium nitrate. In the range of ammonium nitrate concentrations of 9.4÷50.0%, K2SO4 and NH4NO3 crystallize in the system.

ammonium more than 50% in the system crystallizes NH4NO3, which was confirmed by the results of chemical and X-ray phase analysis.

Analysis of the composition-properties diagram of the studied system shows that as ammonium nitrate is added to the initial solution of potassium sulfate, the pH values of the newly formed solutions gradually decrease. The density and viscosity values of the system solutions gradually increase, respectively: d from 1.086 to 1.29 g/cm3 and ɳ from 1.134 to 1.282 mm2/s.

With this ratio of components, a solution with satisfactory physical and chemical properties is formed: crystallization temperature of -9.0°C, density of 1.22 g/cm3, viscosity of 1.268 mm2/s and pH of 4.24.

It is known that physiologically active substances are now widely used to obtain high yields with good qualities

(auxins, kinins, gibberenes and others), which have high activity and the ability to influence the intensity of all processes occurring in a plant organism [5,6]. They can enhance cell growth, stimulate cell division, and promote protein and nucleic acid synthesis.

Physiologically active substances have a beneficial effect on the growth, development and accumulation of plants, significantly increase resistance to various diseases and improve the assimilation of basic nutrients by plants, increase yields, reduce the ripening period and improve the quality of products [7,8].

The most effective, economically and agrochemically expedient method of using physiologically active substances is their combined use with basic fertilizers. At the same time, additional costs for the application of each preparation separately are eliminated, their uniform distribution in the soil is achieved, and the efficiency of fertilizers increases [9-12].

Thus, the combined use of physiologically active substances with fertilizer improves the use of all mineral nutrients and increases the efficiency of fertilizers. Therefore, research on obtaining more effective forms of fertilizers, which, along with the main nutrients, contain physiologically active substances, is relevant.

To obtain a liquid fertilizer containing such nutrients as K2O, S, N, as well as FAV sulfate monoethanolammonium, the physicochemical properties of solutions in the system {60%[10%K2SO4+90%H2O]+40%NH4NO3}-H2SO4·NH2C2H4OH were studied.

On the basis of the data obtained, a diagram of the "composition-properties" of the system is constructed (Fig. 2).

Analysis of the diagram shows that as monoethanolammonium sulfate is added to the initial solution of the composition {60%[10%K2SO4+ 90%H2O]+40%NH4NO3}, the crystallization temperature values of the newly formed solutions gradually decrease from -9.0°C to -12.5°C. The values of density, viscosity and pH of solutions gradually increase÷. the results of the study of this system and the results of agrochemical tests indicate the possibility of obtaining a liquid fertilizer containing FAV by dissolving monoethanolammonic sulfate in the initial solution based on potassium sulfate and ammonium nitrate at a mass ratio of 1.0:0.002÷0.003. The resulting solution has crystallization temperatures of -11.0÷11.5°C, density of 1.2244÷1.2252 g/cm3, viscosity of 1.283÷1.287 mm2/s and pH of 5.0÷5.1.

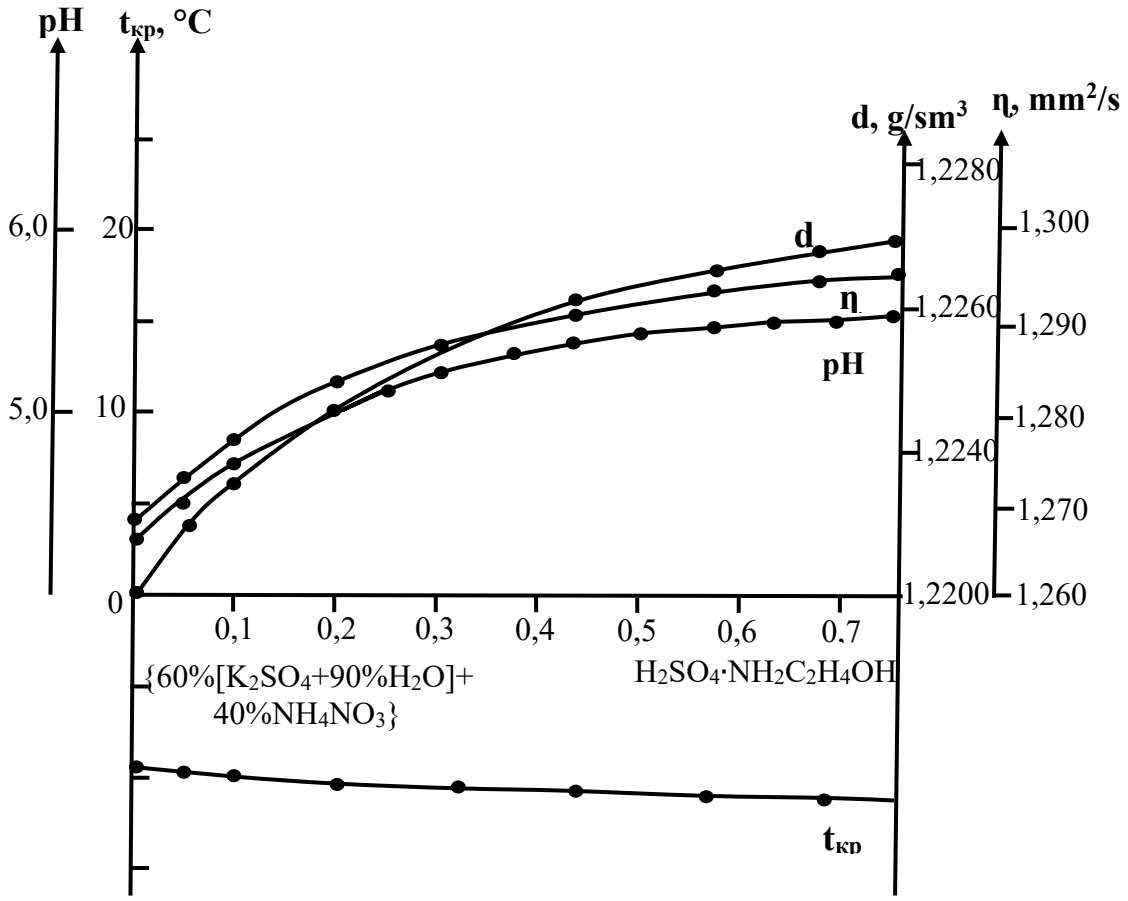


Fig.2 Diagram of the "composition-properties" of the system {60%[10%K2SO4+90%H2O]+40%NH4NO3}-H2SO4·NH2C2H4OH

An inseparable component of measures to increase crop yields is the use of trace elements, since the use of mineral and organo-mineral fertilizers alone is not enough for the normal development of plants. The role of trace elements in plant nutrition is multifaceted. Micronutrients increase the activity of many enzymes and enzyme systems in the plant organism and improve the use of macrofertilizers and other nutrients from the soil by plants [13].

In order to introduce a trace element into the composition of the obtained fertilizer, the dependence of changes in the rheological properties of solutions in the system {59.7%[10%K2SO4+90%H2O]+40%NH4NO3+0.3%H2SO4· NH2C2H4OH}-$CuSO_4 \cdot 5H_2O$ was studied by measuring the crystallization temperature, density, viscosity and pH of the solution medium. On the basis of the data obtained, a diagram of the "composition-properties" of the system is constructed (Fig. 3).

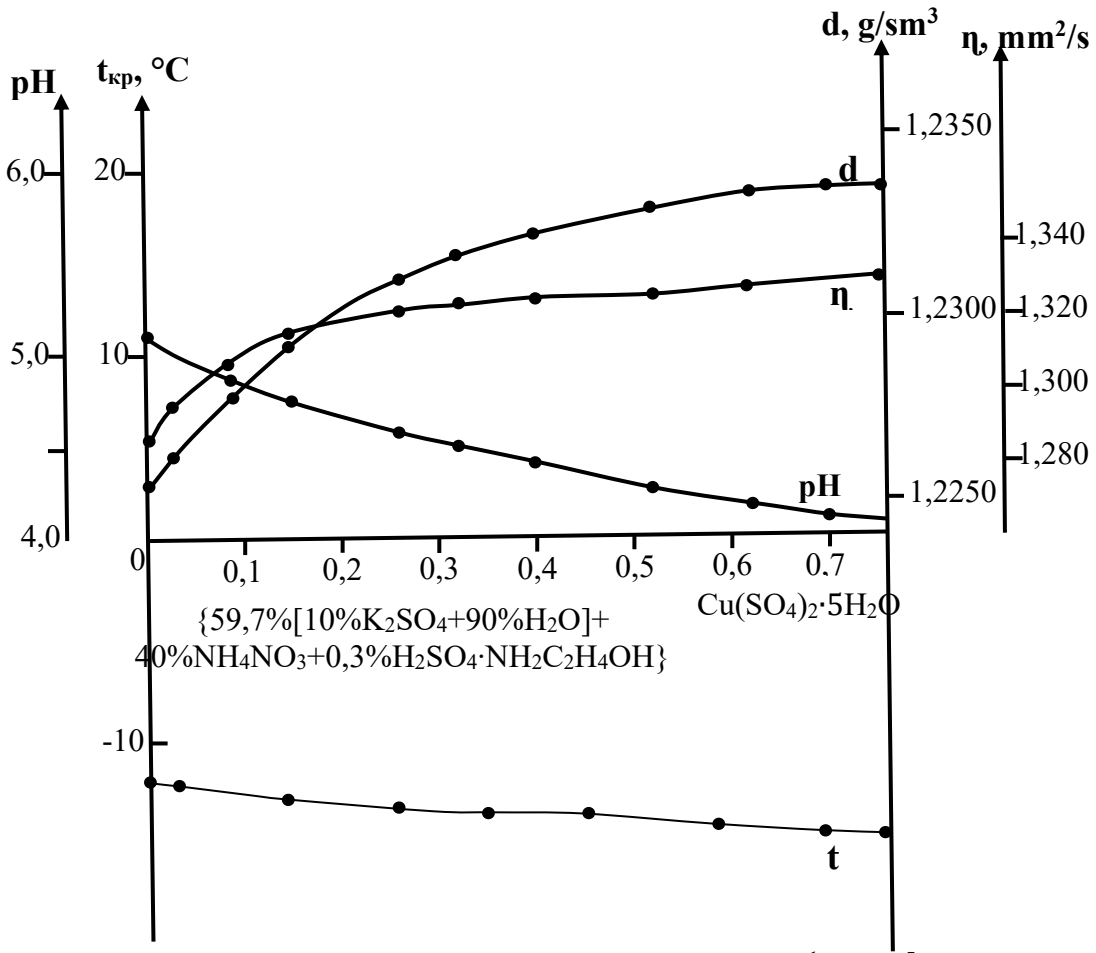


Рис.3 Диаграмма «состав-свойства» системы {59,7%[10%K2SO4+ 90%H2O]+40%NH4NO3+0,3%H2SO4·NH2C2H4OH}-$CuSO_4 \cdot 5H2O$

Analysis of the diagram shows that no fractures are observed on the curves of the composition-temperature of crystallization, density, viscosity and pH of this system of fractures, that is, within the studied concentration limits in the system, there are no changes in the crystallizing solid phases and the components retain their individuality, and therefore physiological activity.

CONCLUSION

Thus, based on the results of the studied systems and preliminary agrochemical tests of various compositions, it follows that in order to obtain a liquid fertilizer of complex action containing a trace element (Cu), it is necessary to dissolve copper sulfate in the initial solution, based on potassium sulfate, ammonium nitrate, monoethanolammonium sulfate, at a mass ratio of 1.0:0.001÷0.002.

The resulting fertilizer solution has the following physical and chemical properties: blue solution, tkr = -12°C, d=1.2300 g/cm3, η=1.317 mm2/s, pH = 4.58 and contains wt%: N=14.07; K2O=3,21; S=1,84; FAV=0.3; Cu=0,02.

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