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STUDY OF THE PRODUCTION OF LYSINE AND UREA IN A NEW COMPLEX SUBSTANCE USING X-RAY SPATIAL AND THERMAL, PHYSICO-CHEMICAL ANALYSIS METHODS

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Abstract: In order to increase plant growth and resistance to abiotic factors, research work was carried out to add biologically active substance amino acid to KAS fertilizer. Based on the theoretical principles of these methods, 1M solutions of urea and lysine were prepared and crystals were grown for 2 months. In order to determine the composition of the resulting crystalline substance, physical and chemical methods of analysis, X-ray phase analysis, and thermal analysis were performed. And these methods show that a new substance with fertilizer properties has been created.

Key words:KAS (urea ammonium nitrate), biologically active substance, lysine, X-ray phase analysis, thermal analysis, component, precursor, abiotic stress, regulators

Plants produce the amino acids they need, but their synthesis is a process that requires a lot of energy. Providing ready amino acids allows plants to conserve energy, especially during critical periods such as abiotic stress (cold, drought, excess moisture). Amino acids are precursors for the synthesis of a number of plant hormones, including growth regulators, so supplying plants with these amino acids from the leaf allows them to produce more hormones (eg, growth hormone). This, in turn, accelerates the growth of vegetative mass and thereby increases the yield of fruits.

Many scientists have studied the properties of complex formation of amino acids, including lysine. Lysine derivatives help to form complexes with metals and other organic compounds. However, there is no information in the literature about the synthesis of a complex combination of urea and lysine, which is part of KAS (urea ammonium nitrate). The Ostromyslensky-Job isomolar series method and the polythermal analysis method, respectively , theoretically explained the formation of new compounds of urea and lysine in a 1: 1 ratio at 60 ° C.

Based on the theoretical laws of these methods, crystals were grown within 1-2 months after preparing 1M solutions of urea and lysine. In order to determine the composition of the resulting crystalline substance, physical and chemical methods of analysis, X-ray phase analysis, and thermal analysis were performed.

X-ray phase analysis. It was conducted on a Shimadzu powder diffractometer (Japan) using CuK α radiation in the 2 angle range from 3 to 70°. Burning current - 25 mA, shooting speed - 4 degrees/min.

This method was used to check the phase purity of the compound we synthesized. Figure 1 shows the results of X-ray phase analysis of the synthesis product (**lysine-urea) and starting components (lysine and urea).** The results of the obtained data also **confirm the formation of the lysine-urea complex** (Table 1).

Figure 1. X-ray phase analysis: (a) lysine-urea; (b) lysine; (c) Urea.

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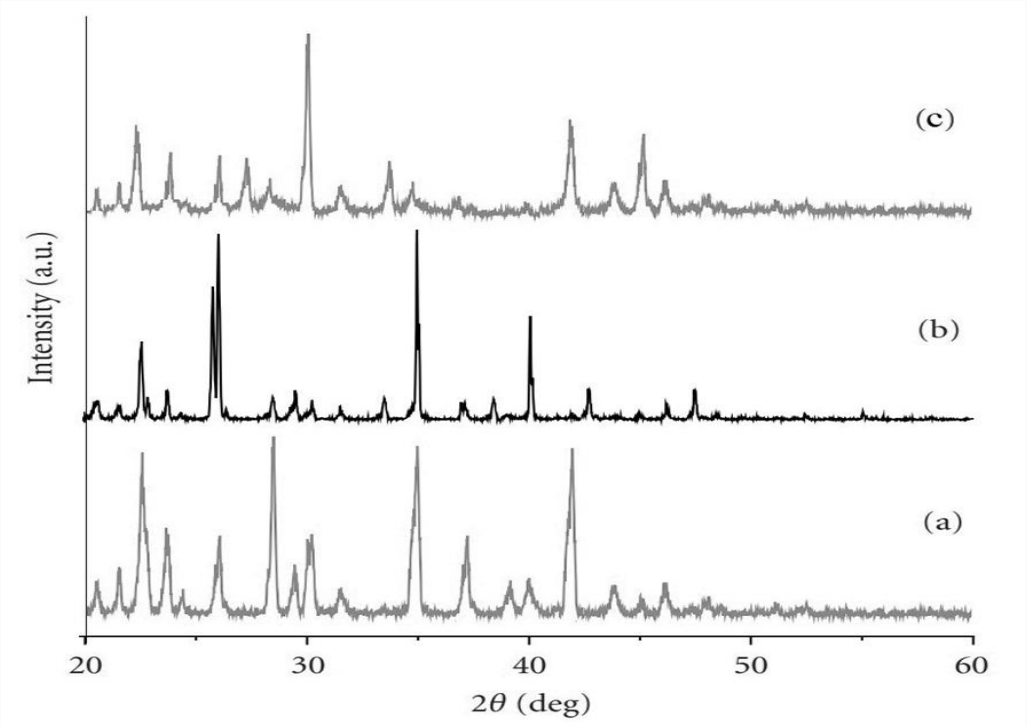


Table 1 . Comparison of the 2ø value of lysine-urea

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Lysine	Lysine-urea
1	**2**
20.59	20.07
21.59	21.23
22.59	21.99
22.87	22.62
24.37	23.08
26.07	25.13
26.35	25.78
28.47	26.82
29.48	27.18
30.39	28.07
35.01	31.41
37.11	33.58
39.17	34.95

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40.11	37.14
42.05	38.52
44.05	39.43
45.09	41.71
46.23	44.06
55.03	51.67

Thermal analysis. Thermal analysis of the mixtures was carried out in air and in an inert argon atmosphere under programmed non-isothermal heating conditions at a heating rate of 10 degrees/min in a mixture with a 1:1 a -Al $_2$ O $_3$ standard. Temperature range 25–400 ° C on a synchronous TG–DSC thermoanalyzer NETZSCH STA 449 C Jupiter.

In Figure 2, 87.7% of the mass loss in the initial stage in the temperature range of 230-260°C was caused by the decomposition of lysine. A sharp peak at DTA 266°C was the melting point of the crystal. This indicates that melting and decomposition occur simultaneously. The melting point of lysine-urea is 284 °C, indicating that lysine-urea is more thermostable than lysine.

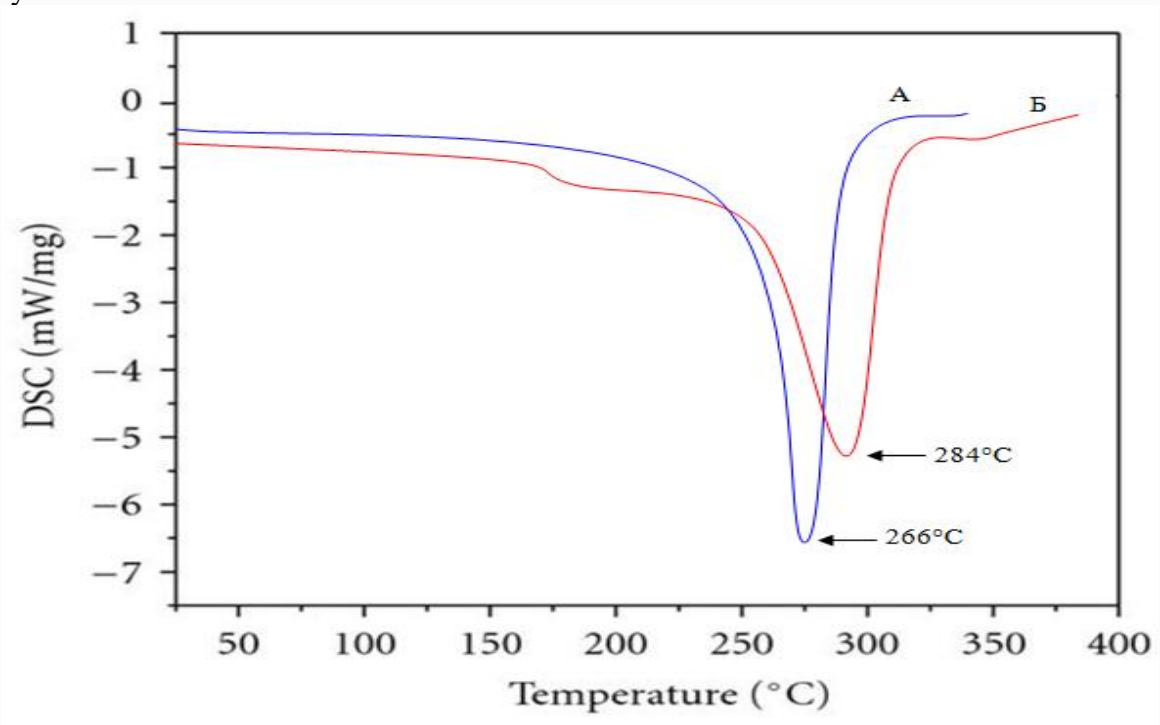


Figure 2 Tremic analysis of lysine (A) and lysine-urea (B) .

The components of KAS fertilizer, i.e. urea, lysine, were studied in order to obtain new liquid fertilizers with high efficiency and to accelerate the process of growth and development of plants, to achieve abundance. The results of physico-chemical studies of complex aqueous systems showed that an aqueous system with new fertilizer properties was created.

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