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STUDY OF INTERACTIONS OF UREA, PHOSPHATE UREA AND ETHANOL IN AQUEOUS SYSTEMS

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Abstract. Plant phytohormones "auxin, gibberellin, cytokinin, abscisic acid, ethylene" have a great role in the growth and development of plants, increasing productivity and short-term harvest [1-2]. By administering these phytohormones, we can achieve the desired result. In particular, auxin plays an important role in plant growth, flowering, and crop development, while ethylene affects plant flowering, crop development, and leaf shedding [3-4]. An increase in the amount of auxin leads to an increase in the amount of ethylene in the plant body, which makes it possible to control the faster ripening of the crop [5-6].

Introduction. Adding nutrients, ethylene-forming substances [7-8] and phosphate substances to the composition of preparations used in plants leads to an increase in productivity.

Urea is one of the widely used nitrogen fertilizers for agricultural crops. Ethanol is easily converted to ethylene under the action of dehydrating reagents and thus contributes to the increase of ethylene content in the plant organism [9-10] .

The purpose of the study, consists of studying urea-ethanol-water and phosphate urea-ethanol-water systems at high concentration and temperature range.

The solubility system $CO(NH_2)_2$ - C_2H_5OH - H_2O was studied in the temperature range from -56.0 to 34.8 ℃ by visual polythermic method, and the solubility diagram was constructed through binary systems, eleven inner sections, Fig. 1.

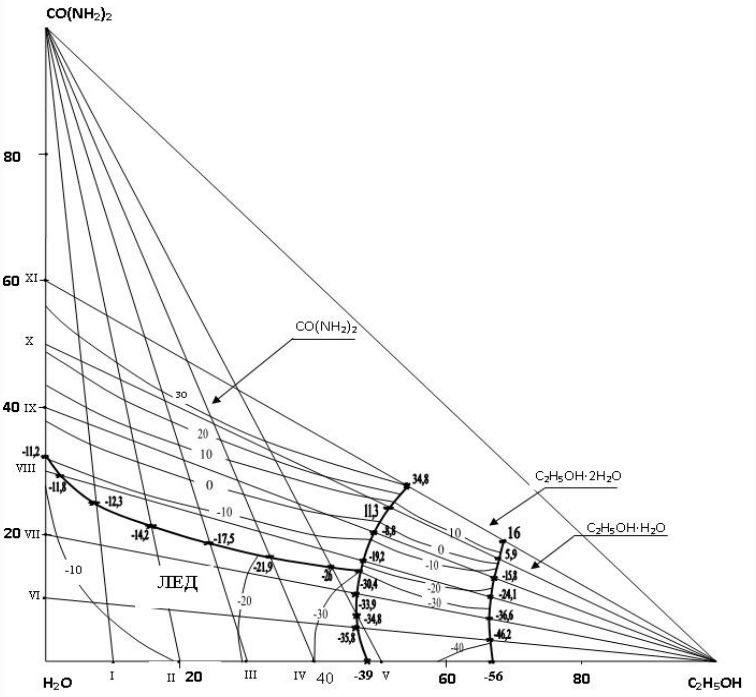


Figure 1. $CO(NH_2)_2$ - C_2H_5OH - H_2O polythermal solubility system

The crystallization areas of ice, urea, ethanol dihydrate, and ethanol monohydrate were delimited on the diagram and internal isotherms were studied at every 10 °C. The phases in the diagram converge at a single ternary point, at a temperature of -30.4°C corresponding to 15.2%

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urea, 46.8% ethanol, and 38.0% water. At this temperature, urea, ethanol dihydrate, and ice are present.

Also, the system $H_3PO_4 \cdot CO(NH_2)_2$ - C_2H_5OH - H_2O was studied in the temperature range from -75.9 °C to 30.0 °C using observational polythermal method.

Initially, phosphate urea was synthesized by reacting phosphoric acid to urea in a 1:1 mol ratio solution. Binary systems of obtained phosphate urea and ethanol were studied. The crystallization areas of ice , $C_2H_5OH \cdot 2H_2O$, C 2 H 5 OH · H_2O and C 2 H 5 OH in the C 2 H 5 OH - H 2 O binary system were determined .

Based on the studied two-component systems and 9 internal sections, a diagram of the $H_3PO_4 \cdot CO(NH_2)_2$ - C_2H_5OH - H_2O system was constructed in a wide temperature and concentration range. Fig. 2. Nine internal cuts were made and studied in the diagram. Of them, sections I - VI are $H_3PO_4 \cdot CO(NH_2)_2$ - by H_2O to C_2H_5OH , and sections VII - IX by C_2H_5OH - H_2O to $H_3PO_4 \cdot CO(NH_2)_2$ drawn to the tip. In the polythermal solubility diagram of ice, $C_2H_5OH \cdot 2H_2O$, $C_2H_5OH \cdot H_2O$ and $H_3PO_4 \cdot CO(NH_2)_2$ was separated into crystallization areas and its presence was confirmed using chemical analysis methods.

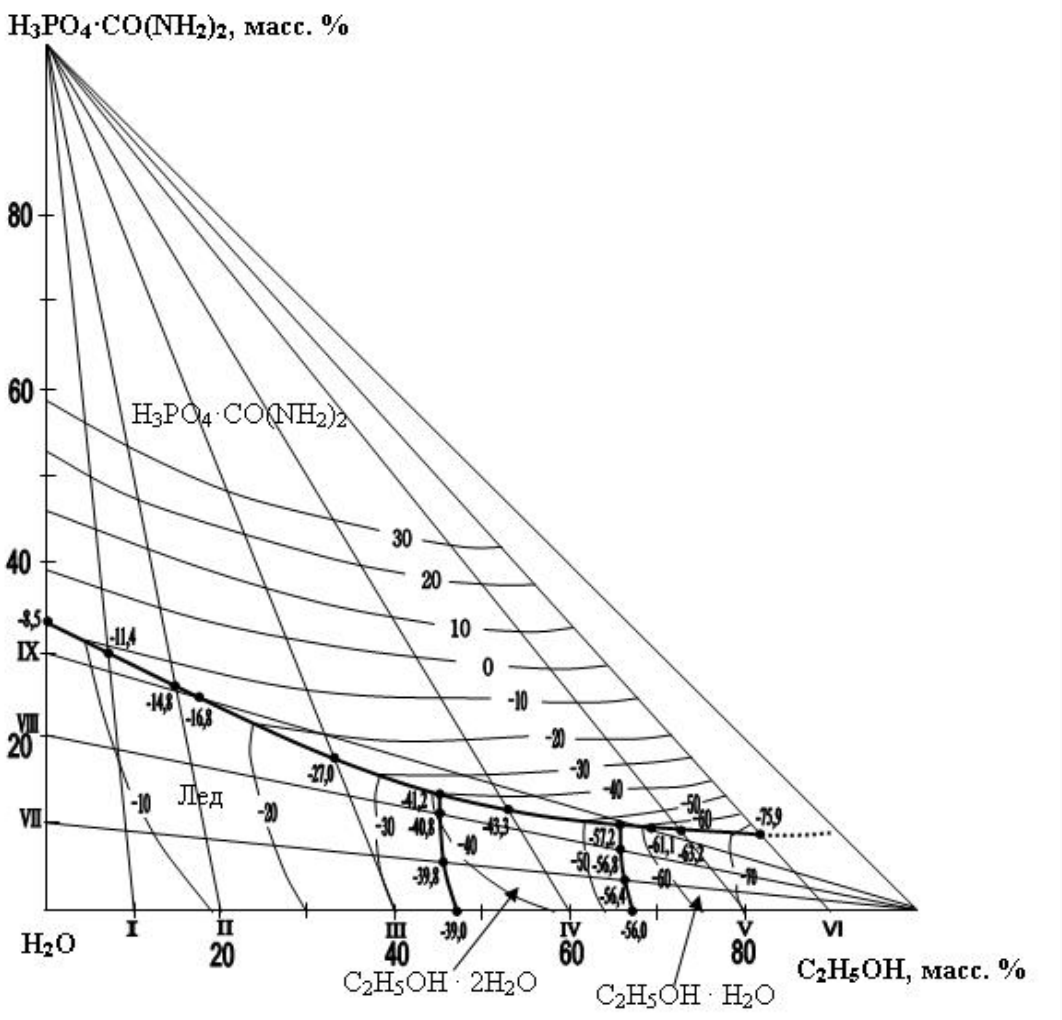


Figure 2. $H_3PO_4 \cdot CO(NH_2)_2$ - C_2H_5OH - H_2O solubility diagram

Phases separated in the diagram connect at two tertiary points Table 1. The first tertiary point corresponds to 13.2% urea phosphate, 45.9% ethanol, 40.9% water at -41.2°C. At the second tertiary point at -57.2°C, 9.2% urea phosphate corresponds to 66.0% ethanol and 24.8% water.

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In the polythermal solubility diagram of $H_3PO_4 \cdot CO(NH_2)_2 - C_2H_5OH - H_2O$, the isotherms were transferred at a temperature of 10 °C, and this system belongs to a simple eutonic type and showed that no new chemical compound is formed.

crystallizes together with ice in the temperature range of -8.5 ÷ -41.2°C, and with dihydrate ethanol at a temperature of -41.2 ÷ -57.2°C . Dihydric ethanol crystallizes with ice in the temperature range of -39 , 0 ÷ -41 , 2°C and monohydrate ethanol at -56 , 0 ÷ -57 , 2°C .

Table 1

Secondary and tertiary points of $H_3PO_4 \cdot CO(NH_2)_2 - C_2H_5OH - H_2O$ system

Liquid phase composition , %			Crystal . temperature , ° C	Hard phase
$H_3PO_4 \cdot CO(NH_2)_2$	C_2H_5OH	H_2O		
33.5	-	66.5 _	- 8.5	Ice + $H_3PO_4 \cdot CO(NH_2)_2$
29.8	7.1	63.1	-11.4	-//-
26.3	14.9	58.8	-14.8	-//-
24.8	17.8	57.4	-16.8	-//-
17.8	33.0	49.2	-27.0	-//-
13.2	45.9	40.9	-41.2	Ice + $H_3PO_4 \cdot CO(NH_2)_2$ + $C_2H_5OH \cdot 2H_2O$
10.9	46.0	43.1	-40.8	Ice + $C_2H_5OH \cdot 2H_2O$
5.3	46.7	48.0	-39.8	-//-
-	47.8	52.2	-39.0	-//-
11.5	53.1	35.4	-43.3	$H_3PO_4 \cdot CO(NH_2)_2$ + $C_2H_5OH \cdot 2H_2O$
9.2	66.0	24.8	-57.2	$H_3PO_4 CO(NH_2)_2$ + C_2H_5OH 2 H_2O + C_2H_5OH H_2O
6.8	66.2	27.0	-56.8	$C_2H_5OH \cdot 2H_2O$ + $C_2H_5OH \cdot H_2O$
3.5	66.8	29.7	56.4	-//-
8.8	71.1	20.1	-61.1	$H_3PO_4 CO(NH_2)_2$ + C_2H_5OH H_2O
8.6	73.0	18.4	-63.2	-//-
8.3	82.4	9.3	-75.9	-//-

The analysis of the studied solubility systems shows that the area of the crystallization phase of urea in the $CO(NH_2)_2 - C_2H_5OH - H_2O$ solubility system, $H_3PO_4 \cdot CO(NH_2)_2 - C_2H_5OH - H_2In$ the O polythermal solubility diagram, the separated phosphate is smaller than the crystallization phase of urea. This shows that urea and phosphate urea are more soluble in ethanol than urea.

it is possible to obtain a drug containing urea, urea phosphate and ethanol, confirmed by these studied solubility systems.

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