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INFLUENCE OF PARAMETERS ON TECHNOLOGICAL PROCESSES OF MECHANICAL ACTIVATION OF LOW-GRADE PHOSPHORITES WITH ACID SALTS FOR OBTAINING COMPLEX FERTILIZERS

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Annotation
The article discusses the production of highly digestible mineral fertilizers by mechanical activation using various types of phosphorite ores of the Central Kizilkum and acid salts

Keywords: Mineral fertilizers, technology, complex phosphorus-containing fertilizers, digestibility, optimal regime, mixed fertilizers, phosphorus, phosphoric acid

Introduction

In the world, the rapid growth of the world's population exacerbates the problem of food. The possibilities for expanding the sown area in the world are limited and the main ways to increase agricultural production are related to increasing the yield of fields. The latter is largely predetermined by the introduction of mineral fertilizers and, first of all, phosphates into the soil. Nitrogen-phosphorus deposits in the world are running out, and phosphorus is one of those types of mineral fertilizers that are

not replenished or replaced. In connection with the growth of phosphorite mining and the production of phosphate fertilizers, the problem of developing new effective technologies for processing low-grade phosphorite raw materials into complex phosphorus and phosphorus-containing fertilizers is an important national economic task.

In recent years, activation methods seem to be fundamentally promising in the processing of phosphorites, which allow solving the issues of saving decomposing reagents and improving the quality of the products obtained. These include mechanical, chemical, thermal methods and their combinations - mechanochemical and thermochemical methods of activation [1].In the world, the rapid growth of the world's population exacerbates the problem of food. The possibilities for expanding the sown area in the world are limited and the main ways to increase agricultural production are related to increasing the yield of fields. The latter is largely predetermined by the introduction of mineral fertilizers and, first of all, phosphates into the soil. Nitrogen-phosphorus deposits in the world are running out, and phosphorus is one of those types of mineral fertilizers that are not replenished or replaced. In connection with the growth of phosphorite mining and the production of phosphate fertilizers, the problem of developing new effective technologies for processing low-grade phosphorite raw materials into complex phosphorus and phosphorus-containing fertilizers is an important national economic task.

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Activation by grinding, or mechanoactivation, is a new way of intensifying physical and chemical processes. It is based on a change in the reactivity of solids under the action of mechanical forces. Already now it is possible to determine the prospects for the use of mechanoactivation in a number of areas of science and production [2]. The need for chemical activation of phosphorites is due to the electronic nature and structural features of phosphate, carbonate and silicate ions in their composition. [3].

Methodology and Results

At present, the Kyzylkum phosphorite complex in the Republic of Uzbekistan is the main resource base of the republic's enterprises producing phosphate fertilizers. The raw material base of the Kyzylkum phosphorite complex (KPC), which is under construction, is based both on the reserves of the Dzheroyskoye deposit and through

the involvement of new deposits of Karakata, Northern Dzhetymtau. Dzheroysky phosphorite deposit of the Central Kyzylkum region. Reserves of phosphorite raw materials by industrial categories to a depth of 40 - 50 meters are estimated at 303.6 million tons of ore, 57.7 million tons of phosphorus pentoxide, which can meet the needs of agriculture in phosphate fertilizers for more than 100 years.

Classical methods for the production of phosphate fertilizers are associated with huge expenditures of sulfuric acid used to completely decompose the original ore or concentrate. In this case, the reaction product is not ready-to-use phosphorus fertilizer, but only reactive phosphoric acid, which is used to prepare superphosphate. In our studies, the process of obtaining complex phosphorus-containing fertilizers by mechanical activation of low-grade phosphorites of the Central Kizilkum with the addition of acidic potassium and ammonium salts was studied.

To obtain highly digestible mineral fertilizers by mechanical activation, we used various types of phosphorite ores and acid salts. At different ratios of phosphorite and salt for 30 to 120 min, mechanical activation of the mixture formed was carried out and the digestibility of P_2O_5 for citric acid was determined. In this method, the optimal mode and reaction time (activation) is determined to obtain a highly digestible complex fertilizer (Table 1).

Table 1 The effect of activation time, in the ratio of $NH_4H_2PO_4$ and phosphorite on the digestibility of P_2O_5

Ratio, %	phosphorus content	$NH_4H_2PO_4$	Time, min	P_2O_5 digestibility for citric acid	P_2O_5 digestibility P_2O_5 general.	P_2O_5 general
1:9	90	10	30	5,13	26,16	19,61
3:7	70	30	30	7,02	27,78	25,12
5:5	50	50	30	8,27	27,02	30,60
7:3	30	70	30	9,55	29,20	32,70
1:9	90	10	60	14,09	49,80	28,29
3:7	70	30	60	17,80	58,0	30,70
5:5	50	50	60	31,35	84,68	37,02
7:3	30	70	60	32,52	83,45	38,97
1:9	90	10	120	15,07	52,49	28,17
3:7	70	30	120	18,20	62,0	29,35
5:5	50	50	120	30,57	83,02	36,83
7:3	30	70	120	31,97	84,01	38,06

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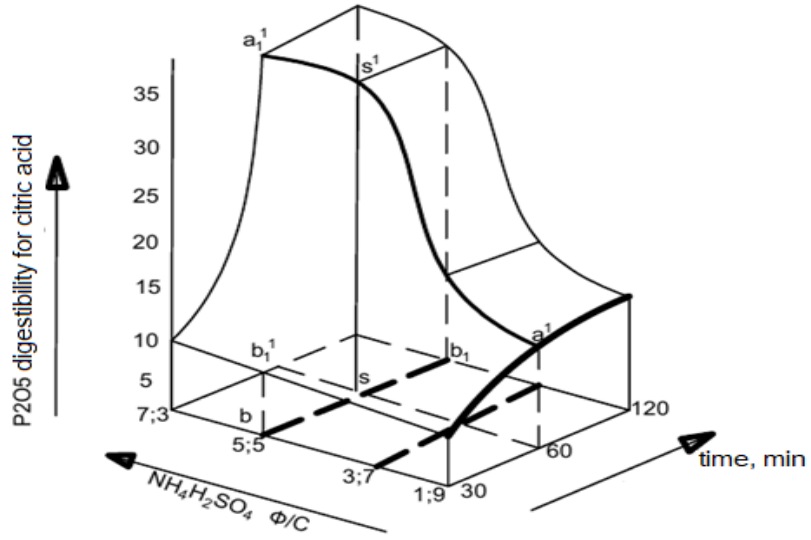
t can be seen from the tables that with an increase in the activation time from 30 to 60 minutes and the ratio of low-grade phosphorites with ammonium dihydrogen phosphate at 5:5, the digestibility of P_2O_5 was 31.35, and when the activation time was 120 minutes, the digestibility decreased to 30.57. This shows that the main indicators of the reaction do not change with increasing time. The pattern of digestibility is preserved with a change in the ratio of phosphorite / acid salt, but it should be noted that within 120 minutes of activation, the digestibility of P_2O_5 decreases.

Figure 1 shows the determination of the optimal technological parameters, the time and ratio of the initial components for obtaining complex fertilizers according to the assimilable form of phosphorus in the form of a nomogram.



Rice. 1. Nomogram of the influence of the ratios of the initial components and the reaction time on the digestibility of phosphorus anhydride

n experimental studies, it was revealed that, to obtain complex fertilizers, a mixture of $NH_4H_2PO_4$ and phosphorite at a ratio of optimal parameters to processing time is 5:5 at 60 minutes. The influence of activation time and the ratio of phosphorite / acid salt on the digestibility of P_2O_5 was also studied. It is known that among the main indicators for the production of phosphate fertilizers, the activation time and the ratio of the initial components, etc., play an important role. Based on the above works, we studied the activation process of low-grade phosphorites with the addition of $(NH_4)_2HPO_4$ to obtain mixed fertilizers and their main indicators.

From the experimental data, it was revealed that the digestibility of P_2O_5 plays an important role for phosphorus fertilizers. Taking this into account, we conducted experiments on obtaining complex fertilizers depending on the activation time (Table 2).

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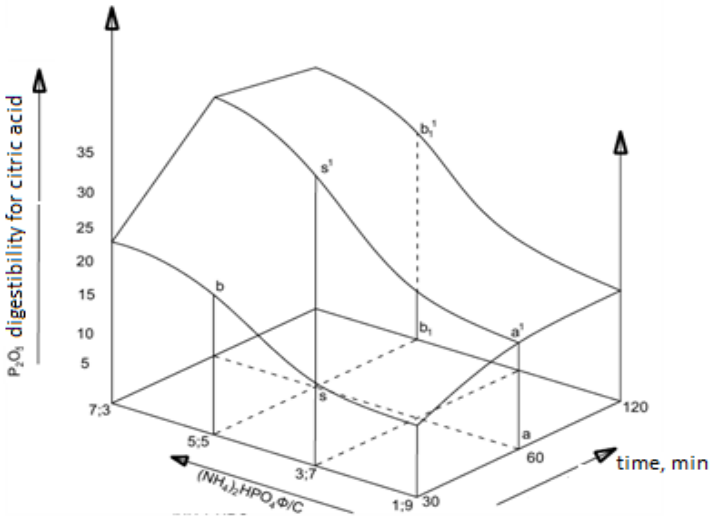
Table 2 The effect of activation time, at a ratio of (NH_4) $2HPO_4$ and phosphorite, on the digestibility of P_2O_5

Ratio, %	phosphorus content	$(NH_4)_2HPO_4$	Time, min	P_2O_5 digestibility for citric acid.	P_2O_5 digestibility P_2O_5 general.	P_2O_5 general
1:9	90	10	30	7,45	36,5	20,70
3:7	70	30	30	8,64	38,7	22,17
5:5	50	50	30	14,68	44,50	33,40
7:3	30	70	30	17,60	45,74	38,70
1:9	90	10	60	10,65	50,2	21,22
3:7	70	30	60	12,79	57,0	22,45
5:5	50	50	60	22,22	62,26	35,69
7:3	30	70	60	28,01	65,40	42,84
1:9	90	10	120	11,27	50,82	22,10
3:7	70	30	120	13,20	56,17	23,50
5:5	50	50	120	22,00	61,47	35,80
7:3	30	70	120	27,00	64,75	41,70

When using the addition of ammonium hydrophosphate, the amount of digestibility of P_2O_5, at a ratio of 9:1 and 3:7,. in reaction time intervals of 60 min. rises from 50.2% to 65.40%. With an increase in time to 120 minutes, the digestibility decreases by almost 1%, this is due to the fact that with an increase in the time of mechanical activation, a decomposition process occurs, as well as a loss of mass.

From the results of the experiments, a nomogram was compiled to determine the optimal parameters for the production of NP fertilizers.



Rice. Fig. 2. Nomogram for determining the optimal parameters of the process of mechanical activation of phosphorites and ammonium hydrophosphate

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As can be seen from the nomogram, the assimilation of P_2O_5 is greater than in the other ratios of 5:5 with an activation of 60 minutes. It can be concluded that the most optimal parameters are the one that produces a ratio of 5:5 at 60 and 120 minutes.

Table 3 The effect of activation time, at a ratio of (NH4)2HSO4 and phosphorite, on the digestibility of P2O5

Ratio, %	phosphorus content	$(NH_4)_2HSO_4$	Time, min	P_2O_5 digestibility for citric acid.	P_2O_5 digestibility P_2O_5 general.	P_2O_5 general
1:9	90	10	30	3,73	25	14,92
3:7	70	30	30	3,73	27	13,80
5:5	50	50	30	3,38	38	8,90
7:3	30	70	30	1,88	40	4,70
1:9	90	10	60	5,84	37	15,80
3:7	70	30	60	5,70	39,5	14,40
5:5	50	50	60	4,66	46,5	10,02
7:3	30	70	60	2,40	45,30	5,30
1:9	90	10	120	6,1	38	16,04
3:7	70	30	120	6,08	40	15,20
5:5	50	50	120	4,54	42	10,80
7:3	30	70	120	2,87	47	6,10

Conclusion

It has been established that mechanical and chemical activation leads to a high softening of phosphate raw materials in the presence of acid salts. In this method, due to the destruction of the structural rings of phosphates under the action of strong shocks and friction, its crystallinity decreases, the specific surface area increases, and it becomes amorphous. As a result of mechanical and chemical activation, a plant-assimilable form of P_2O_5 is formed in phosphorites.

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