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RATHEMATIC DEVELOPMENT OF PHOSPHORUS EXIT PROCESS FROM AM MATERIALS

Abstract: *The effects of some components on the process of decomposition of apatite concentrate in the presented study were investigated, and the specificity of the superphosphate obtained from the study was determined by appropriate elements. Based on the lessons studied, a regression model of the degree of intensity and time dependence of the degree of decomposition on the problem using the "Recession" tool in MS Excel was obtained. Thus, based on the evidence obtained, a mathematical model reflecting the regularity of the rate of change of the raw material fragmentation under these conditions was developed, and it was proved that the model adequately describes the process along with the kinetic description of the process. However, the results of the research indicate that the process of phosphate fertilizers can meet the requirements of the technological process, which has a greater advantage in this area by intensifying the process of separating the apatite concentrate and eliminating of other noted deficiencies.*

Key words: *superphosphate, phosphoric flour, fluorides, chamber technology, apatite concentrate, sulfuric acid, silicon oxafluoride, MS Excel, regression equation, Fisher criteria, proxy error, breakdown rate.*

Language: *English*

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Introduction

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The need for mineral fertilizers of various compositions used to increase productivity and product quality in agriculture continues to grow. Therefore, for this reason, the expansion of the mineral fertilizer industry is an important issue that needs to be addressed. The most needed mineral fertilizers are various phosphorus fertilizers. Improving the quality of phosphorus fertilizers, reducing the cost of their production is a very important issue.

Method

The purpose of this research is to develop a mathematical model thatcan adequately describe the process, as well as provide a kinetic description of theprocess, reflecting the regularity of changes in the rate of decomposition of rawmaterials under these conditions, based on evidence obtained by studying the effect of certain components on the decomposition of phosphorus-containing raw materials.

Problem statement. Studies have shown that certain mixtures have a positive effect on the decomposition of raw materials, which form the basis of the production of phosphorus fertilizers [1-6]. Thus, when the minimum ratio of and to 2.5%, phosphate decomposes faster than raw apatite concentrate, which does not contain magnesium. It should be noted that the importance of the presence of small amounts of many elements, including magnesium, along with the basic nutrients for the

growth and development of plants. During the process, part of the phosphorus in the raw material and relatively less soluble compounds are transferred to. In addition, difficult-to-resolve and compounds are also formed. Fluorides remain in the product mainly in the form of fluorides, and fluorsilicates of.

At present, the production of phosphorus fertilizers is carried out mainly using camera technology. As it is known, when apatite concentrate is used in the productionof superphosphate by camera technology, the rate of decomposition reaches 85-86% during 1.5-2 hours in the chamber. The process of obtaining superphosphate is completed only after a long period of storage (2-3 weeks) of superphosphate. Simple superphosphate is granulated to improve its physical and agrochemical properties. In powdered superphosphate for granulation, free phosphoric acid is first neutralized with chalk, limestone, bone or phosphate flour, then mixed with a small fraction of the granulated product (retur) and granulated in a drum. and dried in a drying drum.

Results of certain studies show that the composition MgO introduction of phosphorite flour into the reaction zone, a weakly acidic mixture of (H_2SO_4 + HCl) Decomposition of phosphorus crops allows to shorten the duration of the technological process or completely shorten the ripening stage of the warehouse [2].

Apatite concentrate (from) in the following composition for the described research work (%):

P_2O_5 - 39,4; CaO - 54,0; F - 3,1; containing waste from simple superphosphate and aluminum workshops. (consistency 8-12% H_2SiF_6) silicium hexafluoric acid and the resultingsilisium heksaflüorid K_2SiF_6, $(NH_4)_2SiF_6$ salts, dusts formed during the combustion of mixtures of phosphate, coke, silicon oxides in the furnace (%-lə): P_2O_5 - 25-28, K_2O - 15,3-16,2; SiO_2 - 16-18; CaO - 1-2; F - 4-5,9; Na_2O , Fe_2O_3 , density at the same time 75% H_2SO_4 used sulfuric acid.

Qeyd olunduğu kimi, kalium və azotla modifikasiya olunmuş superfosfatın is-tehsalını çoxaltmaq məqsədilə silisium heksaflüorid turşusundan @ K_2SiF_6 və $(NH_4)_2SiF_6$ @duzlarından istifadə olunmuşdur [7-12]. Bu duzlardan superfosfat istehsalında istifadə edərkən əvvəlcə duzların əlavəsi ilə ApK -nın parçalanma prose- sinin kinetikası öyrənilmiş və alınmış nəticələr işlənilmişdir. As noted, silicon hexafluoric acid salts K_2SiF_6 and $(NH_4)_2SiF_6$ have been used to increase the production of potassium and nitrogen modified superphosphate [7-12]. When using these salts in the production of superphosphate, the kinetics of the decomposition process of əvvəl with the addition of salts was first studied and the results obtained were developed.

Results and discussion

K_2SiF_6 və $(NH_4)_2SiF_6$ In the study of the decomposition of s with a mixture of additive, sulfuric and silicon hexafluoric acids, the ratio of waste (IST-1) to H_2SO_4 H_2SiF_6 was 95: 5. The concentration of acid mixtures is between 50-65%, the norm of this mixture is 100 parts by mass, 70 parts by mass, and the initial decomposition temperature of the mixture is 55ºC. In all experiments, the conditions were the same and the quantities of K_2SiF_6 and $(NH_4)_2SiF_6$ - were different In certain experiments, the acid mixture was taken from 69 parts per 100 parts by mass and its concentrations (in%) were kept at 50, 55, 60, 63. The results are shown in Figure 1. In addition to the above, experiments havebeen carried out to increase the concentration of acid over time in order to clarify the regularities of the decomposition of. Based on the evidence obtained, the process was analyzed and certain results were obtained. These are shown in Table 1 and Figure 2. decomposition coefficient

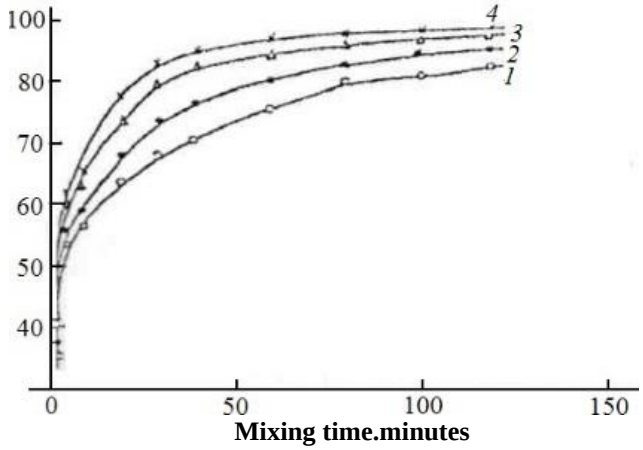
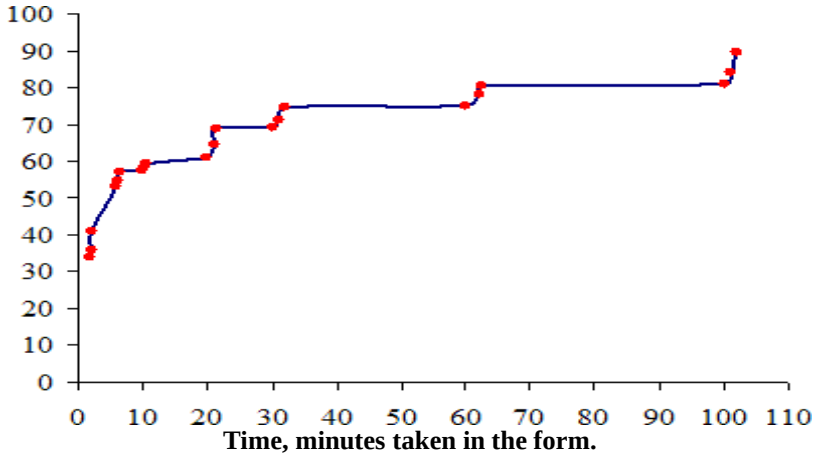


Figure 1. Processed sulphate (IST-1) in the presence of potassium-containing waste mass and H2SiF6 change of decomposition coefficient in different concentrations of acid mixtures: concentrations of acid mixtures (%) 1-50, 2-55,3-60, 4-63.

Table 1. change in the decomposition coefficient of

Row №	*Decomposition coefficient K*, %	residue, *C*, %	time, t, min.	Row №	*Decomposition coefficient K*, %	residue, *C*, %	time, t, min.
1	34	50	2	12	68,6	66,4	21,5
2	36	55,6	2,1	13	69	50,4	30
3	41	60,3	2,2	14	71,2	51	31
4	53	50,4	6	15	74,5	65,7	32
5	54,5	55,6	6,2	16	75	50,3	60
6	57	60,4	6,5	17	78	56,1	62
7	57,4	50,3	10	18	80,3	65,8	62,4
8	58,1	55,7	10,3	19	81	50,5	100
9	59,5	61,2	10,7	20	84	56,6	101
10	61	50,2	20	21	89,6	67,3	102
11	64,5	55,8	21,1				

Regression model of the dependence of the degree of fragmentation on the density and time for the problem under consideration using the tool "Regression" in MS Excel $K = 29{,}53371 + 0{,}39218C + 0{,}374854t$



Time, minutes taken in the form.

Figure.2. The degree of fragmentation depends on time

Estimation of model accuracy.

The y actual values of the y_i variables differ by up to y_i quantities from the values of the $e_i = y_i$ $\tilde{y}$ 4 variables calculated on the model. This quantity is an absolute approximation error for each indicator. But these quantities cannot be compared with each other.

Thus, if the error in one indicator is 5 and in the other 10, it does not mean thatin the latter case, the model gives a bad result. Therefore, in order to make the estimates comparable, A_i relative estimates are considered (ratio of e_i tendencies to y_i actual values (in percent)). If "tendencies can be both negative and positive, then tendencies are definitely taken into account [13-14].

$A_i = \frac{|y_l - \tilde{y}_l|}{y_i} \cdot 100\%,\ i = 1,2,\ldots,n$ is called the relative approximation error. To get a general idea of

the accuracy of the model, calculate the average relativeapproximation error:

$$\overline{A} = \frac{1}{n}\sum_{i=1}^{n}\frac{|y_i - \tilde{y}_i|}{y_i}\cdot 100\% = \frac{1}{n}\sum_{i=1}^{n}\frac{|e_i|}{y_i}\cdot 100\%$$

If the value of the average relative approximation error does not exceed 10%, the obtained regression equation is considered good.

The calculations for the issue under consideration are given in Table 2.

Table 2. Relative approximation error

Row №	Experimentalestimates of fragmentation	Don't break upprices on the model	Errors	***Relative approximation error***
1	34	49,89244073	-15,89244073	31,85340404
2	36	52,12613629	-16,12613629	30,93675733
3	41	54,0068695	-13,0068695	24,0837316
4	53	51,54872892	1,451271075	2,815338235
5	54,5	53,66303773	0,836962272	1,559662494
6	57	55,65795978	1,342040223	2,411227842
7	57,4	53,00892693	4,391073074	8,2836483
8	58,1	55,23915721	2,860842794	5,179012386
9	59,5	57,54609093	1,953909073	3,395381062
10	61	56,71824899	4,281751014	7,549159382
11	64,5	59,32679855	5,173201449	8,719839221
12	68,6	63,63385223	4,966147767	7,804254484
13	69	60,54522516	8,454774839	13,96439573
14	71,2	61,1553874	10,0446126	16,42473873
15	74,5	67,29529307	7,204706933	10,70610826
16	75	71,75162742	3,248372582	4,527245861
17	78	74,77598167	3,224018331	4,311569383
18	80,3	78,730073	1,569926995	1,994062669
19	81	86,82422389	-5,824223888	6,708063288
20	84	89,59137824	-5,591378245	6,240978043
21	89,6	94,16256237	-4,562562371	4,845410168
				Mean relative approximation error
				9,729237548

$\overline{A} = 9{,}73\%$ The resulting regression equation is considered good.

Fisher's F-criterion is used to assess the significance (adequacy) of the model.The actual value of Fisher's F-scale is calculated as follows:

$$F = \frac{R^2}{1-R^2}\cdot\frac{n-k-1}{k}.$$

where n is the number of experiments; k is the number of factors (independentvariables) in the model.

The table value of the F-criterion on the Fisher

distribution tables is found to be $F_{c\,l}$ To do this, there are α levels of importance (usually take $\alpha = 0{,}05\alpha$) and two degrees of freedom

$k_1 = k$ və $k_2 = n-k-1$ is given.

The actual value of the F-criterion is compared with the value of F_ (α, k_1, k_2). $F > Ftab_{c\,ə}$ (α, k_1, k_2) the regression equation is considered important. Actual value of Fisher's F-scale:

The actual value of the F-criterion is compared with the value of $1F_c$ (α, k_1, k_2) . $F > F_{tab}$ (α, k_1, k_2), (α, k_1, k_2)), the regression equation is considered important. Actual value of Fisher's F-scale: $F = 28{,}86$

a = 0,05; $k_1 = k = 2$; $k_2 = n-k-1 = 21-2-1 = 18$;

$F_{tab}(\alpha, k_1, k_2) = 3{,}55$

$F > F_{tab}$ (α, k_1, k_2), hence, the regression equation adequately describes the process under consideration.

Conclusions

However, it is clear from the results of the research that by intensifying the decomposition process of phosphorus fertilizers and eliminating other shortcomings, the technological process, which has a greater advantage in this area, will be able to meet the requirements. At the same time, environmental problems will be solved by preventing harmful emissions into the environment during the long-term production process.

Result.

In this study, the effect of salts of silicon hexafluoric acid on the decomposition of apatite concentrate was studied and it was found that in the presence of these salts, superphosphate is modified with both potassium and nitrogen, and It was determined that the quality does not lag behind fertilizers.

In addition, on the basis of evidence obtained as a result of research, a model has been developed that reflects the regularities of changes in the degree of decomposition of raw materials under these conditions. This model reflects the dependence of the degree of fragmentation on the density and time of the components, which is important in the process, thus giving a kinetic description ofthe process, as well as the model obtained has been proven to adequately describe the process and can be applied to appropriate processes

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