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RESEARCH ON THE ELIMINATION OF FOAMING IN THE PROCESS OF EXTRACTION OF PHOSPHORIC ACID FROM HIGH-CARBONATE PHOSPHORITE RAW MATERIALS

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Annotation: The process of decomposing carbonated phosphorite raw materials from the Tashkura mine with sulfuric acid and extracting phosphoric acid, and the foaming frequency of the resulting phosphate slurry and its elimination methods were studied. The height and density of the foam formed in the process of decomposition of light carbonate phosphorite raw materials in the presence of phosphoric and sulfuric acids under optimal conditions were determined, and the methods and optimal conditions for reducing the foam density using "PAA-gel" and "Struktol SB-2195" as defoaming reagents were investigated.

Key words: Tashkura mine carbonate phosphorite raw materials, phosphoric acid slurry, foaming rate, PAA-gel, "Struktol SB-2195" EFK, decomposition.

Annotatsiya: Tashkura koni yoqri korbonatli fosforit xomashyosini sulfat kislotasi bilan parchalash va ekstraktsion fosfor kislotasi olish jarayoni va unda hosil bo'ladigan fosfatkislotali bo'tqaning ko'piklanish karraligi va uni bartaraf etish usullari o'rganildi. Yoqri korbonatli fosforit xomashyosini maqbul sharoitda fosfat va sulfat kislotalari ishtirokida parchalash

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jarayonida hosil bo'ladigan ko'pik balandligi va karraligi aniqlandi hamda ko'piklanishni bartaraf etuvchi reagentlar sifatida "PAA-gel" va "Struktol SB-2195" ishtirokida ko'pik karraligini kamaytirish usullari va maqbul sharoitlari tadqiq qilindi.

Kalit so'zlar: Tashkura koni yoqri korbonatli fosforit xomashyosini, fosforkislotali bo'tqa, ko'piklanish karraligi, PAA-gelь, "Struktol SB-2195"' EFK, parchalash.

Аннотация:Изучен процесс разложения серной кислотой высококарбонатного фосфоритного сырья месторождения Ташкура и получения экстракционной фосфорной кислоты, кратность пены образующейся в ней фосфорнокислотной пульпы и способы ее устранения. Определены высота и кратность пены, образующейся при разложении высококарбонатного фосфоритного сырья в присутствии фосфорной и серной кислот в оптимальных условиях, а также исследованы методы и оптимальные условия снижения кратности пены в присутствии "ПАА-гель" и "Структол СБ-2195" в качестве пеногасителей.

Ключевые слова:Высококарбонатное фосфоритовое сырье месторождения Ташкура, фосфорнокислый пульпы, пенообразователь, ПАА-гель, «Structol SB-2195» ЭФК, разложения.

Literature review. "Kyzilkum Phosphorite Complex" LLC of Central Kyzylkum (MK) in Navoi region produces 3 types: washed-burnt phosphorite (YuKFK), washed-dried phosphorite (YuQF) and high-carbonate phosphorite raw materials (YuKFX). In our republic, only "Ammofos-Maxam" JSC produces EFC from YuKFK by the dihydrate method [1, 2]. "Kyzilkum Phosphorite Complex" LLC has an annual production capacity of 716,000 tons (~ 26.2% P_2O_5), but produces 450,000 tons of UFK per year on average. [3, 4].

The foaming produced in the processes of obtaining double superphosphate, monodicalcium phosphate, precipitate [5, 6] by decomposing BFX in the presence of different standards of EFK, phosphorsulfurcalcium RS-agro and enriched superphosphate SPF-26, SPF-23 [7, 8] in the presence of sulfuric and phosphoric acids, nitrophos fertilizers [9] by decomposing them in the presence of nitric acid, and various technological and technical methods. studies have been conducted on elimination using However, chemical reagents were not used in the research to reduce foaming during the decomposition of BFX with mineral acids.

Research methods. In carrying out research work, MQ YuKFX (OzDSt 2825:2018, produced at "Kyzilkum Phosphorite Kombinati" LLC), EFK (TSh 6.6-21:2018, produced at "Ammofos-Maxam" JSC) and sulfuric acid (GOST 2184-2013) and PAA-gel (Ts 00203849-64-2016, produced at "Navoiyazot" JSC) and "Struktol SB-2195" (Struktol SB-2195, Schell+Seilacher GmbH, Germany) reagents were used.

Discussion and results: The chemical composition of YuKFX used in research works is as follows, heavy. %: P_2O_5 - 21.8; CaO - 49.8; MgO - 1.20; Al_2O_3 - 0.31; Fe_2O_3 - 0.65; CO_2 - 12.10; Cl^- - 0.24; CaO/P_2O_5 - 2.285; insoluble residue - 4.5; H_2O - 1.2; organic carbons - 2.0 was determined on the basis of chemical and physico-chemical analysis.

In the research work carried out in the experimental device, the effects of the duration of the process and the amount of "PAA-gel" and "Struktol SB-2195" substances on the foaming process (foam height, foam density (Kk), foam "living" period) during phosphate and sulfuric acid decomposition of YuKFX from the Tashkura mine were studied. The formed Kk and the period of existence - "living" time were taken as the factors characterizing the foaming process.

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The height of the foam was measured according to the values specified in the dimensions, and the "living" time of the foam was measured with a stopwatch. Kk was defined as the ratio of foam volume Vk to the liquid volume Vs used for its formation [10, 11].

Kk = Vk /Vs = Vg + Vs / Vs, where Vg is the gas volume in the foam.

The "living" time (U) of the foam is determined by the amount of liquid released at time t (sec) or the rate of liquid release from the foam, i.e. U = Vs / t [12].

The extraction process of EFK was carried out at H2SO4 rate - 104%, Q:S = 1:3.0, decomposition process temperature - 80 ℃ and duration - 90 minutes. In this case, the extraction process of EFK was carried out in two stages. In the first stage, the foam height and Kk were determined in the 12% EFK circulation solution for 20 minutes, and in the 93% sulfuric acid digestion process for 90 minutes. At the initial stage, YuKFX was added to a circulating solution of 12% P_2O_5 EFK and 93% H_2SO_4 to the obtained slurry at the same rate for 10 minutes, and the height of foam and precipitate was measured.

The effects of PAA-gel and Struktol SB 2195 substances and their concentration and quantity on the foaming process during the sulfuric acid decomposition of high-carbon phosphorite of the Tashkura mine in the experimental model device in laboratory conditions were determined. The results of the scientific research are presented in Figures 1, 2 and 3 below. In these pictures, the effects of initial and surface passive substances ("PAA-gel" and "Struktol SB 2195") on the process of foam formation (foam height, foam density, foam residence time, etc.) during the decomposition of YuKFX from the "Tashkura" mine with 93% H_2SO_4 in an experimental model device in laboratory conditions were studied. In this case, the phosphorite decomposition process was carried out in two stages, and the foam height and frequency were studied in the first stage for 20 minutes in a 12% EFK circulating solution and for 70 minutes in 93% sulfuric acid decomposition processes. The rate of sulfuric acid was -104%, the Q:S phases were in the ratio of 1:3, the duration of the process was -90 minutes, and at the initial stage, phosphorite was added to the circulating solution of 12% P_2O_5 EFK, and 93% H_2SO_4 was added to the obtained slurry at the same rate for 10 minutes. 10 in relation to the amount of phosphorite; Graphs of the effect of surfactants "Struktol SB 2195" and "PAA-gel" on the foam density up to 25 and 50 g/t are presented. When breaking up without surfactants and in the presence of them, the foam density was 2.50-1.00 and in the second stage 3.35-1.05, surface passive agent "Struktol SB 2195" and 10 of "PAA-gel"; The effect of 25 and 50 g/t on foam density is 1.60-1.03 in the first stage, respectively; 1.47-1.00; 1.31-1.00 and 1.32-1.03; 1.28-1.02; 1.24-1.00 and in the second stage 2.16-1.06; 2.05-1.00; 1.80-1.00 and 1.85-1.12; 1.67-1.07; It was found to decrease to 1.58-1.01.

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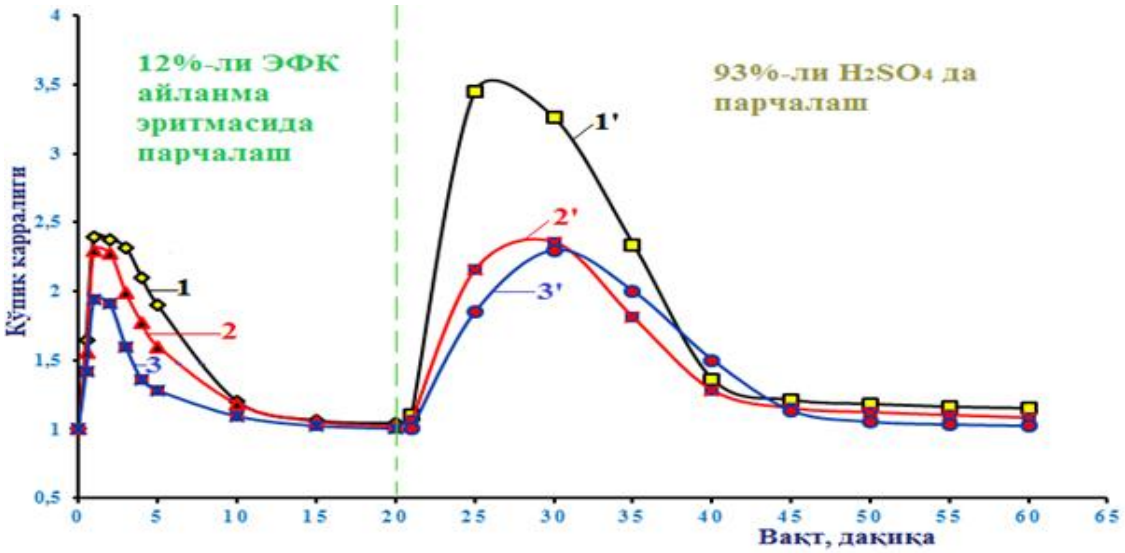
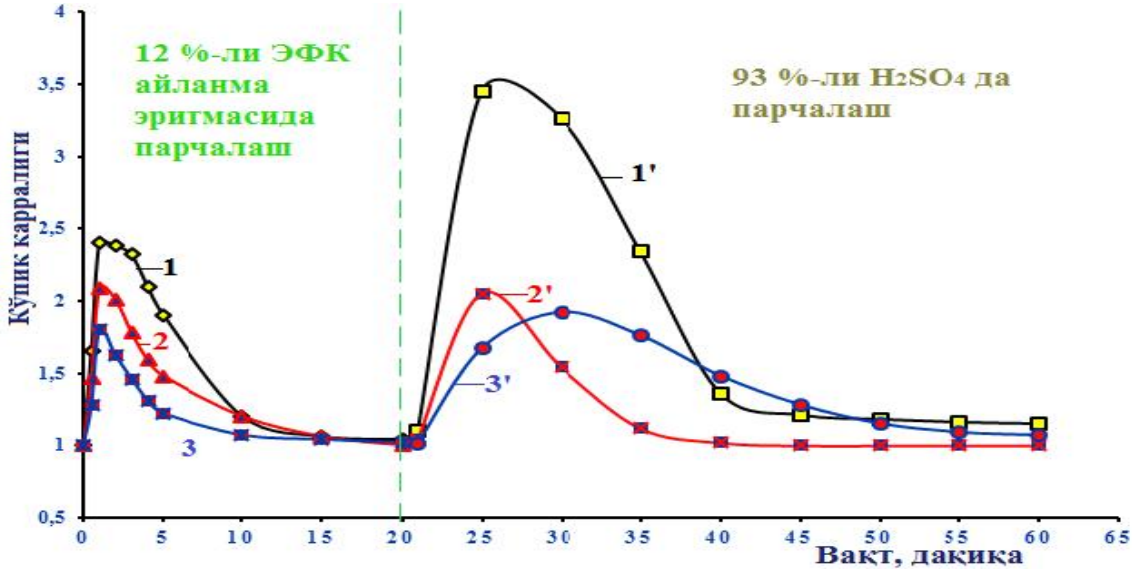


Picture 1. The dependence of the foaming rate on the duration of the process in the presence of initial and surface passive substances in the decomposition of YuKFX with 12% P_2O_5 EFK circulating solution and H_2SO_4. PAA-gel and "Struktol SB 2195"-10 g/t; Decomposition with 12% P_2O_5 circulating solution (1; 2; 3) and H_2SO_4 (1”; 2”; 3”): 1; 1"-without the participation of SPM; 2; 2"-"Struktol SB 2195"; 3; 3"-PAA-gel. (H_2SO_4 rate is 104% and Q:S=1:3.0).



Picture 2. The dependence of the foaming rate on the duration of the process in the presence of initial and surface passive substances in the decomposition of YuKFX with 12% P_2O_5 EFK circulating solution and H_2SO_4. PAA-gel and "Struktol SB 2195"-25 g/t; Decomposition with 12% P_2O_5 EFK circulating solution (1; 2; 3) and H_2SO_4 (1”; 2”; 3”): 1; 1"-without the participation of SPM; 2; 2"-"Struktol SB 2195"; 3; 3"-PAA-gel. (H_2SO_4 rate is 104% and Q:S=1:3.0).

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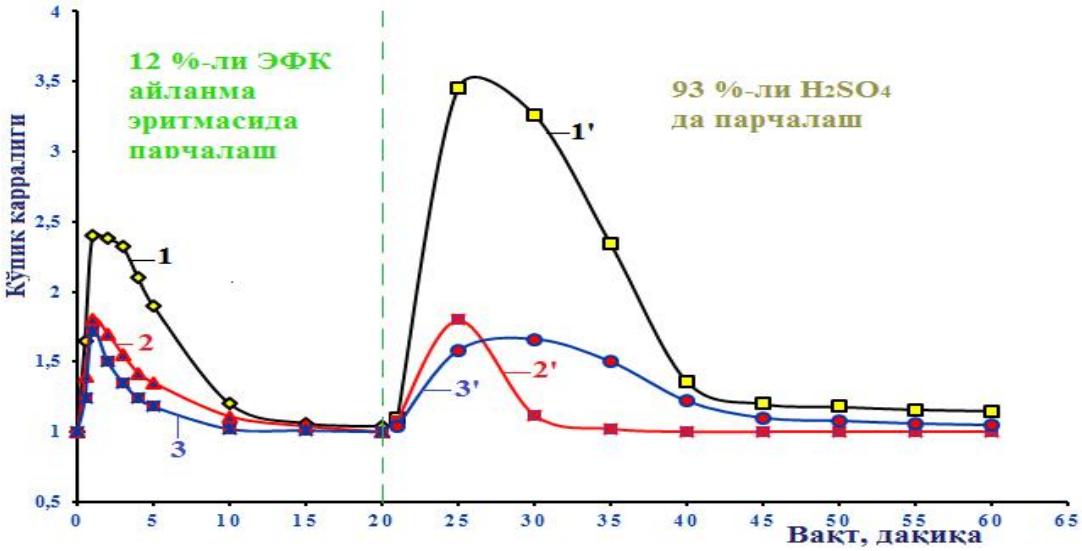
In the process of decomposition of phosphorite in the presence of 12% P_2O_5 EFK circulating solution, the value of the foam multiplier was initially 2.5 (without the participation of a surfactant), 10 from the surfactants "Struktol SB 2195" and "PAA-gel"; When added in amounts of 25 and 50 g/t, the foaming ratio is 2.4, respectively; 2.09; 1.77 and 1.87; 1.80; was 1.72, i.e. 1.04; 1.19; 1.41 and 1.31; 1.36; It decreased by 1.42 times.



Picture 3. The dependence of the foaming rate on the duration of the process in the presence of initial and surface passive substances in the decomposition of YuKFX with 12% P_2O_5 EFK circulating solution and H_2SO_4. Decomposition with PAA-gel and "Struktol SB 2195"-50 g/t; 12% P_2O_5 EFK circulating solution (1; 2; 3) and H_2SO_4 (1; 2; 3"): 1; 1"-without the participation of SPM; 2; 2"-"Struktol SB 2195"; 3; 3"-PAA-gel. (H_2SO_4 rate is 104% and Q:S=1:3.0).

In the first stage, 10 of the surfactants "Struktol SB 2195" and "PAA-gel"; The value of the foam factor when breaking down the slag with 93% H_2SO_4 when added in amounts of 25 and 50 g/t (the foam factor was 3.45 without the addition of a surfactant) is 2.16, respectively; 2.05; 1.80 and 1.85; 1.67; was 1.58, i.e. 1.59; 1.68; 1.91 and 1.86; 2.06; decreased by 2.18 times.

Also, the extraction process of phosphoric acid was studied based on processing of Toshkura mine YuKFX with sulfuric acid. The process of extraction of MQ YuKFX and phosphoconcentrates under the influence of sulfuric acid depends on the temperature and acid concentration in the system, and it was found that calcium sulfate crystals in the obtained product are formed in different states.

It was observed that plate-like crystals of size (80-140)x(20-60) μm are formed from thermoconcentrate porridge, and needle-like, fan-shaped or star-shaped gypsum crystals are formed from the decomposition of high carbonate phosphorites.

In the dihydrate method of obtaining extractive phosphoric acid (EFK), the process of sulfuric acid decomposition of new unenriched phosphorite raw materials from Toshkura mine was carried out at a temperature of 80-90 ℃, with 104% sulfuric acid in a ratio of 1:3, with a circulating solution (EFK) containing 10-16% P_2O_5 and 96% sulfuric acid for 4 hours.

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In this case, the chemical composition of the slurry obtained from the Toshkura mine YuKFX, circulating solution containing 10-16% P_2O_5 and 96% sulfuric acid was studied on the basis of laboratory analysis. Data obtained on the basis of chemical laboratory analyzes are presented in table 1.

Table 1.

The chemical composition of the porridge obtained on the basis of sulfuric acid decomposition of Toshkura mine YuKFX

№	H_2SO_4 standard	Circulating Solution: Amount of P_2O_5 in EFK, %	Chemical composition of porridge, mass. %				
			P_2O_5	CaO	MgO	SO_3	F
1	104	10	10,34	9,95	0,45	0,78	1,19
2		12	11,56	9,95	0,45	0,78	1,19
3		14	12,78	9,95	0,45	0,78	1,19
4		16	14,00	9,95	0,45	0,78	1,19

In this case, it was found that the chemical composition of the porridge obtained from the decomposition of the solid and liquid phases (Q:S) in the ratio of 1:3 for 4 hours with a sulfuric acid standard of 104%, the amount of P_2O_5 in the circulating solution increased by 10.4 - 14.0% when the acid standard and the concentration of the circulating solution increased. Also, It was found that CaO is 9.95%, MgO is 0.45%, SO_3 is 0.78%, and F is 1.19%.

Table 2

Chemical composition of EFK obtained on the basis of sulfuric acid decomposition of Toshkura mine new YuKFX

№	Amount of P_2O_5 in circulating EFK	Chemical composition of EFK, mass.					According to P_2O_5 $K_{parch.}$
		P_2O_5	CaO	MgO	SO_3	F	
1	10	15,07	0,31	0,42	3,15	0,84	96,5
2	12	16,71	0,35	0,39	2,80	0,70	97,4
3	14	18,37	0,39	0,37	2,54	0,56	98,3
4	16	20,22	0,43	0,34	1,92	0,42	98,7

The amount of P_2O_5 in the dihydrate method of extractive phosphoric acid (EFK) production depends on the composition of phosphate raw materials and the concentration of the circulating solution. The process of decomposition of phosphate raw materials takes place at a temperature of 80-90 °C, and the concentration of P_2O_5 in the liquid phase of the obtained porridge depends on the concentration of the circulating solution, the amount of sulfate ions in it is 1.0-1.5%, the ratio of S:Q phases is 3:1, the extraction time is 3.5-4.5 hours, and the average duration of 4 hours is the optimal conditions for the technological processes of EFK production. In this case, when the P_2O_5 concentration of the circulating solution changes from 10 to 16%, the phosphorite decomposition coefficient increases from 96.5 to 98.7%, and the P_2O_5 concentration in the obtained EFK also increases from 15.07 to 20.22%. The results of the study are presented in Table 2.

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Conclusion. Thus, the conclusion from the obtained results is that in the technological factors carried out above, it was found that the substance "PAA-gel" eliminates more foaming than the surface passive substance "Struktol SB 2195" (1.01-1.14 times under optimal conditions in the first stage, and 1.17-1.22 times in the second stage) and the optimal amount of surfactants "PAA-gel" and "Struktol SB 2195" is 25-40 is g/t. In the research work, it would be appropriate to study the ratio of liquid and solid phases, the rate of acids, the concentration of the circulating solution, the duration of the process, temperature and other technological factors in a relatively wide range, and then draw a conclusion based on the analysis of the results.

The processing of Toshkura mine YuKFX was studied in two stages, in the first stage with circulating solution (EFK), and in the second stage with 93% sulfuric acid decomposition process research was studied. The effects of P_2O_5 content in the circulating solution up to 10-16% for obtaining high-concentration EFK were studied. From the obtained results, it was found that the higher the concentration of the circulating solution, the higher the concentration of the obtained EFK.

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