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Extraction Phosphoric Acid From Washed Calcined Phosphorite Concentrate

Nodirov Alisher Avazovich[1], Nozimov E'zoz Sadikzhanovich[2], Azimjonov Shohjahon Atxamjon son[3]

[1]Namangan State Pedagogical Institute, acting associate professor, [2]Chemistry teacher at Chust district secondary school No. 18, [3]and student of Chemistry.

Abstract

The article presents the results of studying the processes of extractive phosphoric acid production from phosphate waste - mineralized mass (MM) - formed during the thermal processing of Central Kyzylkum (MC) phosphorite by the clinker method. The influence of sulfuric acid concentrations on the quality indicators of the obtained EFK was studied, as well as the processes of extracting EFK from phosphate acid gypsum slurry using different concentrations of a phosphate acid solution.

Keywords: mineralized mass, sulfate acid, extraction phosphate acid, decomposition coefficient, separation coefficient and filtration rate.

Introduction. Currently, there are two methods for producing phosphoric acid from phosphate raw materials (PRM) in the world industry: the first is the dry (electric furnace) method, in which the phosphorus contained in the PRM is reduced to a free state, the obtained phosphorus is oxidized and phosphoric acid is obtained from the resulting P_2O_5. Phosphic acid produced from phosphate raw materials by the electric furnace method is called thermal phosphoric acid (TPA). The second method is called the extraction method, in which phosphoric acid is separated from the phosphates using mineral acids (nitric, hydrochloric, and sulfuric acids), and the separated phosphoric acid is called extractive phosphoric acid (EPA). Despite the purity and high concentration of TPA, its cost is much higher than EPA. However, TPA is used to obtain phosphorus compounds necessary for the food and pharmaceutical industries. EPA is mainly used to produce simple and complex phosphorus-containing fertilizers.

The obtained results and their discussion. The main raw material for the production of phosphorus-containing fertilizers in Uzbekistan are phosphorites of the Central Kyzylkum (CK). However, they are poor in the content of the main component (P_2O_5). Currently, washed roasted phosphorus concentrate (WRPC) is produced from such phosphorites by roasting. There are a number of problems in obtaining wet-process phosphoric acid (WPA) from WRPC using sulfuric acid: a sharp increase in the process temperature due to the increased CaO content in WRPC, low $P_2O_{5\ content}$ and increased fluorine content in the obtained WPA, and the impossibility of directly processing it into food-grade phosphates [1, 2]. The aim of the study is to obtain WRPC with a higher $P_2O_{5\ content}$ and a lower fluorine content from WRPC using sulfuric acid using the clinker method. The process of obtaining EFC from MOFK using the clinker method was carried out on a laboratory setup consisting of a tubular glass reactor equipped with a screw stirrer driven by an electric motor.[3,4]

For the experiments we used washed roasted phosphorite concentrate (WRPC) from phosphorites of the Central District of Krasnodar Krai, the main composition of which is (wt. %): 25.92 P_2O_{5total} ; 2.14 $P_2O_{5wot.}$.; 45.69 CaO ; 1.81 MgO; 6.48 CO_2 ; 0.61 Al_2O_3 ; 1.03 Fe_2O_3 ; 2.14 SO_3 ; 2.63 F and 2.51 insoluble precipitate. The sulfuric acid standards were: 95 , 100, 103, 105 and

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110% (relative to CaO in the phosphorite raw material). The concentration of sulfuric acid varied from 70 to 93%. The decomposition time of phosphorite was 30 minutes. The phosphoric acid formed from the clinker was isolated with a solution of EFA containing 10% P_2O_5 at a ratio of MOFK:10% EFA solution = 1.0:3.0 with stirring for 5-10 minutes and filtered under vacuum. The decomposition coefficients of MOFK (Kdecomp), the P_2O_5 release coefficients in EFA (Keq .) and the filtration rates of phosphoric acid-gypsum suspensions were calculated . The obtained EFA and the main substances of phosphogypsum were analyzed by known methods.[5,6]

Is evident that with the increase in the sulfuric acid rate, the P_2O_5 content in the obtained EFA will increase. For example, with an increase in the sulfuric acid rate from 95 to 110%, the P_2O_5 content in the obtained EFA will increase from 23.71 to 25.02%. The content of CaO and SO_3 in the obtained EFA ranges from 0.22 to 0.62% and from 2.49 to 2.69%, respectively.[7,8] The amount of fluorine in the obtained EFA is in the range from 0.05 to 0.10%. For the process of obtaining EFA of various concentrations from MO FC, the following main technological parameters were obtained: $K_{dec.}$ - 94.26-97.59% and K_{out} – 92.34-93.83%, dry sediment filtration rate – 1135-1295 kg/m2 h . From these tabular data it is also clear that the acid concentration also significantly affects the composition of the EFK and technological indicators about the process of obtaining EPA. For example, with an increase in the sulfuric acid concentration from 70 to 93%, the P_2O_5 content in the resulting EFA increases from 24.01 to 24.59%. The content of CaO and SO_3 in the resulting EFA ranges from 0.28 to 0.42% and from 2.37 to 2.58%, respectively. The amount of fluorine in the resulting EFA ranges from 0.04 to 0.07%.

Table 1. The influence of the norm and concentration of sulfuric acid on the main composition of the EPA

$N_{H_2SO_4}$,%	$C_{H_2SO_4}$,%	Amount of substances, % EPA				To diff., %	To the exit, %	Filtration rate, kg/ m2 ·h
		P_2O_5	CaO	SO_3	F			
95	93	23,71	0.62	2,49	0.05	94.26	92.34	1135
100		23.92	0.51	2,53	0.06	95.70	92.59	1197
103		24,59	0.42	2,58	0.07	96,37	93,28	1240
105		24.93	0.33	2,64	0.08	96.98	93.41	1280
110		25,02	0.22	2,69	0.10	97.59	93.83	1295
103	70	24.01	0.28	2.37	0.04	97.82	94.16	1362
	75	24.14	0.31	2.42	0.05	97.69	94.02	1341
	80	24.26	0.34	2.47	0.05	97.55	93.79	1329
	85	24.38	0.38	2.51	0.06	97.50	93.56	1294
	90	24.48	0.40	2.54	0.06	97.45	93.45	1280
	93	24,59	0.42	2,58	0.07	97.37	93, 28	1240

The main technological parameters, i.e. $K_{divergence}$ and K_{out}, depending on the concentration of sulfuric acid, are within the range of 97.37-97.82% and 93.28-94.16%, respectively. Filtration rate for dry sediment – 1240-1362 kg/m2 h . Here, a decrease in the filtration rate of dry sediment is observed due to a decrease in the amount of water in phosphoric acid suspensions.

Bibliography

B.E. Sultonov, E.S.Nozimov, D.S. Kholmatov. Obtaining activated phosphorus fertilizers on the base of local phosphate waste //"Prospects of development of Science and Education" №17, December, 2023, pp.7-10, https://humoscience.com/index.php/pdce/article/view/2375/4227

B.E. Sultonov, E.S.Nozimov, D.S. Kholmatov. Recycling of local phosphate waste-mineralized mass into activated phgosphorus fertilizers // Chemical Science International Journal, Volume 32, Issue 6, page 108-114, 2023; Article no. CSIJ.110442.

Nozimov, E., Sultanov, B., Kholmatov, D., Sherkuziev, D., & Nodirov, A. (2024). Phosphorus fertilizer technology activated from phosphorus powder and mineralized mass. Scientific and Technical Journal of Namangan Institute of Engineering and Technology, 9(2), 129-134.

Nodirov, A. A., Sultonov, B. E., Sherkuziyev, D. S., & Abdulxayev, A. A. (2025, July). Research of the composition of phosphogypsum produced during the extracting of phosphoric acid from mineralized mass by the clinker method. In AIP Conference Proceedings (Vol. 3304, No. 1, p. 040021). AIP Publishing LLC.

Nodirov, A. A., Sultonov, B. E., Abdullajanov, O. A., & Kholmatov, D. S. (2021). The clinker method of extracting phosphoric acid from Central Kyzylkum phosphorites. Scientific Bulletin of NamSU, 7, 69-75.

Sultonov B. E., Nodirov A. A., Xolmatov D. S. Research of the Composition of Phosphogypsum Produced During the Extracting of Phosphoric Acid from Ordinary Phosphorite Powder by the Clinker Method //Chemical Science International Journal. – 2023. – T. 32. – №. 2. – C. 51-58.

Avazovich Nodirov Alisher, Sultonov Bohodir Elbekovich, and Holmatov Dilshod Sattorjonovich. "The main chemical composition of phosphogypsum. formed at the obtaining of extraction phosphoric acid by clinker method." International scientific review LXXXIX (2023): 6-8.

8.Нодиров, А. А., Султонов, Б. Э., & Холматов, Д. С. (2022). Влияние нормы и концентрации серной кислоты на параметры экстракционной фосфорной кислоты, полученных клинкерным способом из мытого обожженного фосфоритового концентрата. Universum: технические науки, (3-5 (96)), 38-43.