THE MAIN CHEMICAL COMPOSITION OF PHOSPHOGYPSUM. FORMED AT THE OBTAINING OF EXTRACTION PHOSPHORIC ACID BY CLINKER METHOD

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At present day. the extraction of phosphoric acid from phosphate raw materials using sulfuric acid can be divided into two directions. first one is that decomposition of phosphate raw materials with wet-processing phosphoric acid (WPPA) and then extraction with sulfuric acid (wet method) [1] and second one is that initially. phosphate raw material is treated with 93-98% sulfuric acid in the solid phase. and then phosphate acid is extracted from it with water (clinker method) [2.3]. The former method. the wet method. is very common around the world. This method is used in countries with almost phosphate raw materials. In these processes. calcium sulfate is formed as a precipitate and it is separated from the main suspension.

The second method of WPPA production. (clinker method). is currently not used in practice around the world. However. this method has also been studied in foreign countries. In the invention presented by US scientists. phosphorite ore is treated with 98% sulfuric acid. and 65% of the total fluorine is released into the gas phase. The resulting mixture is heated in a rotating oven at 200-300°C for 10-30 minutes and in this case another 25% of fluorine gas is phased out. In general. 90% of fluoride is removed from the system. 99% of total phosphorus goes to WPPA [2]. In another invention [3] presented by US scientists. phosphate raw materials are mixed with 98% sulfuric acid and granulated. the grains are heated at 200-240°C or 350-400°C to remove fluorine. and phosphoric acid is extracted from obtained mixture using water. Production of WPPA in this way has a number of advantages: high concentration of P_2O_5 and low amount of fluorine in the received WPPA. Extraction of phosphoric acid from ordinary phosphorite powder (OPP). which is Central Kyzylkum (CK) phosphorite. by clinker method. and the influence of OPP decomposition time duration on its quality indicators. as well as the processes of extracting WPPA from phosphate-acid-gypsum porridge through water and phosphoric acid solution were studied. It was shown that 8.19-9.37% P_2O_5-containing WPPA (extracted with water) and 16.57-17.39% P_2O_5-containing WPPA (extracted with 10% WPPA) were formed at the given decomposition times [4]. However. in the above-mentioned scientific research study. the composition of phosphogypsums and the reduction of P_2O_5 in them were not conducted. In this scientific research. the composition of phosphogypsum formed in the process of obtaining WPPA from OPP . which is CK phosphate raw material by clinker. and the results of research on reducing the amount of P_2O_5 in it are presented.

For laboratory studies. OPP with the following composition was used: 17.76% $P_2O_{5total(t.)}$; 3.15% P_2O_5 acceptable by citric acid (ac.c.a.); 47.51% CaO; 1.79% MgO; 17.02% CO_2; 0.95% Al_2O_3; 0.73% Fe_2O_3; 3.27%SO_3; 2.26% F; 1.02% H_2O; CaO:P_2O_5 – 2.68 and 5.25% insoluble residue. and 98% sulfuric acid.

The results of the laboratory experiments are presented in Table 1. From the results presented in Table 1. it can be seen that when OPP:H_2O=1.0:2.5 and phosphogypsum is washed without mixing, the amount of P_2O_5 in phosphogypsum is 2.63%. and the values of CaO and SO_3 will be equal to 29.85% and 42.40%

Table 1

The main chemical composition of phosphogypsum samples formed when washed with water

The content of phosphogypsum	N_{H2SO4}. %								
	100	103	105	100	103	105	100	103	105
	When washed without mixing at OPP:H_2O=1.0:2.5			When phosphogypsum is washed with mixing					
				OPP:H_2O=1.0:0.5			OPP:H_2O=1.0:1.0		
P_2O_5	2.63	2.55	2.52	1.01	0.92	0.80	0.82	0.75	0.69
CaO	29.85	29.90	29.93	30.28	30.34	30.41	30.44	30.51	30.54
SO_3	42.40	42.45	42.50	43.25	43.35	43.44	43.49	43.58	43.63
The content of phosphogypsum	N_{H2SO4}. %								
	100	103	105	100	103	105	100	103	105
	When phosphogypsum is washed with mixing								
	OPP:H_2O=1.0:1.5			OPP:H_2O=1.0:2.0			OPP:H_2O=1.0:2.5		
P_2O_5	0.70	0.65	0.61	0.66	0.62	0.55	0.61	0.57	0.52
CaO	30.60	30.64	30.67	30.73	30.70	30.68	31.05	30.98	30.93
SO_3	43.71	43.77	43.81	43.83	43.86	43.90	44.19	44.26	44.36

respectively (when the acid norm is 100%). When the acid values are 103 and 105%. P_2O_5 will be equal to 2.55 and 2.52%, CaO will be 29.90 and 29.93% and SO_3 will be equal to 42.45 and 42.50%, respectively. When the resulting phosphogypsum is washed with mixing water it is observed that phosphogypsum is further purified. For example, when OPP:H_2O is in ratio of 1.0:0.5 and an acid value is 100%, contents of P_2O_5, CaO, SO_3 will be equal to 1.01%, 30.28%, 43.25% respectively. Similar conditions are observed in 103 and 105% norms of sulfuric acid. It is observed that, as the value of the OPP :H_2O ratio decreases, that is, due to the increase in the amount of water, the content of P_2O_5 in phosphogypsum is significantly reduced. and the purity of phosphogypsum, that is, the values of CaO and SO_3 in it also slightly increase. For example, when the OPP:H_2O ratio increased from 1.0:0.5 to 1.0:2.5 at 100% sulfuric acid norm, the amount of P_2O_5 decreased from 1.01 to 0.61%. while the values of CaO and SO_3 increased from 30.28 to 31.05% and from 43.25 to 44.19% respectively. When the acid norm was 103%, the content of P_2O_5 in phosphogypsum decreased from 0.92 to 0.57%. while the values of CaO and SO_3 increased

from 30.34 to 30.98% and from 43.35 to 44.26%. respectively. When the rate of sulfuric acid was 105%, the amounts of the above substances decrease from 0.80 to 0.52%, from 30.41 to 30.93%, and from 43.44 to 44.36%, respectively. From the above values, it can be seen that when phosphogypsum is washed with mixing water, the amount of P_2O_5 remaining in it is significantly reduced. It is also observed that the clarity of phosphogypsum increased from 91.38 to 93.40%, it can be concluded from the above discussion, in order to minimize the amount of P_2O_5 in the phosphogypsum samples, it should be washed the phosphogypsum samples mixed with water, and the ratio of OPP :H_2O should be 1.0:1.0, more than this ratio. that is. when there is less water. it becomes difficult to wash the phosphogypsum samples, and when there is more water, water consumption will increases and will appear solutions with less WPPA in large amounts.

The main chemical composition of phosphogypsum formed by processing OPP with sulfuric acid to obtain WPPA was studied. Phosphogypsum formed by washing a sample of phosphogypsum formed in 103% of sulfuric acid without mixing with water obtained in the ratio OPP:H_2O=1.0:2.5 contains 2.55% P_2O_5. 29.90% CaO and 42.45% - SO_3. When the same phosphogypsum sample is washed with water obtained in the ratio OPP:H_2O=1.0:1.0, the resulting phosphogypsum contains 0.75% P_2O_5, 30.51% CaO and 43.58% - SO_3.

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