N E W S
OF THE NATIONAL ACADEMY OF SCIENCES OF THE REPUBLIC OF KAZAKHSTAN
SERIES CHEMISTRY AND TECHNOLOGY
ISSN 2224-5286
Volume 2, Number 428 (2018), 44 – 51

UDC 631.893

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THE PHYSICO-CHEMICAL COMPOSITION OF THE NATURAL ALUMINOSILICATE SORBENTS USED FOR THE PHOSPHORUS EXTRACTION FROM PHOSPHORIC SLIME

Abstract. The research results of the physico-chemical features of initial raw materials of bentonite clay, vermiculite and Lenger clay of the South Kazakhstan fields with definition of chemical and material structures are given in the article.

The mechanism of phosphoric slime formation, technogenic withdrawal of production of the yellow phosphorus which is formed at a phosphorus condensation stage is studied. According to modern representations, phosphoric slime represents the phosphorus emulsion in water, stabilized with fine firm particles.

Considering phosphoric slime as stabilized with highly active pollution of an emulsion in the water, the way of phosphorus extraction is chosen from slimes, with usage firm porous sorbents on the basis of natural aluminosilicates.

The researches on definition of physico-chemical features of initial materials for obtaining from them sorbents were conducted with usage of modern methods of the physico-chemical analysis. The analysis of the scientific results has shown that intensive ranges of absorption are characteristic to fluctuations of valent link of the alumosilicate and hydroaluminate compounds. The microstructure of the studied tests is characterized by prevalence of montmorillonite crystals in bentonite clay and sodium-potassium-calcium minerals of feldspar in the vermiculite. As a result of acid activation of sulfuric acid and heat treatment was reached the high mechanical durability, bloating and bulk density of the received granules.

Keywords: Vermiculite, bentonite, montmorillonite, kaolinite, aluminosilicate, sorbents, hydromica.

Introduction. The production of yellow phosphorus with electrothermal method is large tonnage, material-andpower-intensive production[1-3], necessary for electrothermic treatment production and preparation of phosphorites more than 50%, the sizes 0÷10 mm appear thin details and off-balance phosphatic and siliceous slate stone[4-7]. Besides, during preparation of technological processing, and crushing of metallurgical coke to 20% and more [8-10], the size 0÷5 mm appear thin details. Therefore reusage of production wastes of the phosphoric industry will allow along with the solution of economic problems on improvement of the ecological state [11-13].

The phosphorus-containing slimesappear at the production of yellow phosphorus under the influence of many factors (quality, preparation of raw materials, furnace conditions, etc.) [14-16]. There is a question of utilization of these slimes, processings, considerably, and today topical issue, and not just "new" slimes, and development of the slimes [17-19]., which are saved up for many years, is a problem. Now in devices of cyclonic thermal phosphoric acid by combustion of phosphorus there are remains in the infusion composition not less than 40-50% . However, in the course of combustion of slag,the mineral part of slime is secondary waste[20].

Experimental part. By means of the sorbents obtained from natural aluminosilicates with absorption method and phosphorus-containing slimes are also refinedfrom organic and mineral impurity, allocating from composition pure phosphorus in this article. For preparation of the specified sorbents, are used the aluminosilicatesobtained from the local field, emergence and stabilization of phosphoric slime happens at phosphorus concentration at a stage of free energy at phosphorus-water the interphase borders which are developed for the moment. The adsorptive layers formed phosphorus reduce growth of the emulsion consolidated stabilizers, the drop on the surface of phosphoric drops is adsorbed and creating their liofilization the organic substancesobtained from the phosphoric phase and mineral additives from firm oven are considered as the emulsions stabilizer.

Silicon and fine details of carbon make basis of the phosphoric slime, their small portion is simple phosphorus and create gel like colloidal structure, this disperse environment is yellow phosphorus.

Table 1- Analysis of some samples of slimes of the enterprises on the yellow phosphorus production

Slime composition, %				
Wet			In conversion to dry	
P_4	H.O.	H_2O	P_4	H.O.
35,50	18,70	45,80	25,60	34,40
36,65	21,73	31,62	23,42	31,78
30,50	18,67	40,83	38,45	31,55
14,99	22,53	62,48	29,95	60,05
21,10	35,04	43,86	37,68	62,38
17,95	38,04	44,01	32,06	67,94

Table 2 -The chemical composition of raw materials obtained from different fields

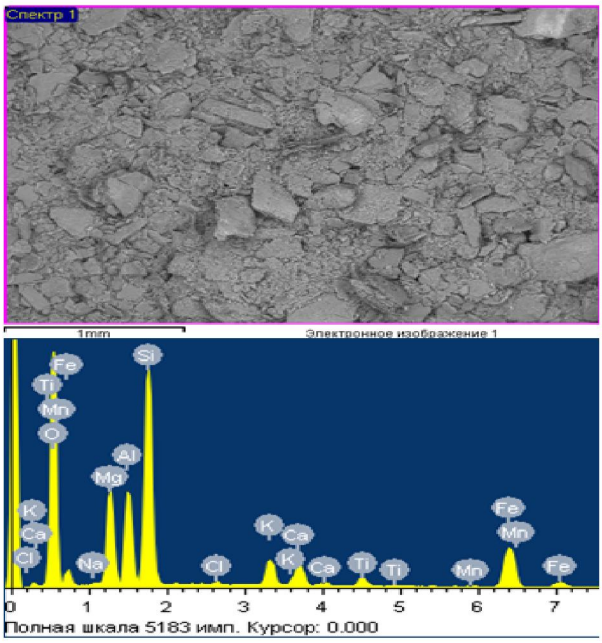
The name of the field	Componenents, %									
	SiO_2	Al_2O_3	TiO_2	Fe_2O_3	MgO	CaO	K_2O	Na_2O	P_2O_5	ппп
1	2	3	4	5	6	7	8	9	10	11
Kulantau vermiculite	37,65	13,2	3,42	14,72	15,31	1,81	5,16	0,41	-	8,22
Syrdarya bentonite	60,51	16,06	1,95	6,43	3,03	1,27	1,2	2,41	0,12	6,92
Lenger clay	58,29	20,76	2,17	4,16	1,59	0,52	1,16	1,40	1,29	8,56

Raw materials vermiculite is a mineral class of the silicates of layer type relating to hydro mica group when heating they are bent as worms and bulk up to 1,5-2,5 times [7-8]. The biotite belongs to pseudomorphoses. Its colour is brown, yellow, bronze colors, gloss as a glass, hardness -1-1,5MPa very mature, specific weight -2, 4-2, 7 g/cm^3 when burning becomes very easy, both bulk up and does not sink in water. Vermiculite is formed generally at a low temperature the phlogopite and biotite breeds at hydrothermal changes, and sometimes it is formed at slaking biotite. Vermiculite in the burned look is applied in production of wallpaper as warmly-and soundproofing material.

Consumer importance of vermiculite arises when calcinating it is increased and turns into light material with a volume density from 0,06 to 0,15 kg/m^3 a polyfoam. The uniqueness of the increased vermiculite in the adsorption is connected with the increased humidity processes. The vermiculite can absorb and carry out 4-5 times more water more than its body weight.

The vermiculite microstructure obtained from Kulantau field, element structure is given in Pic.1.

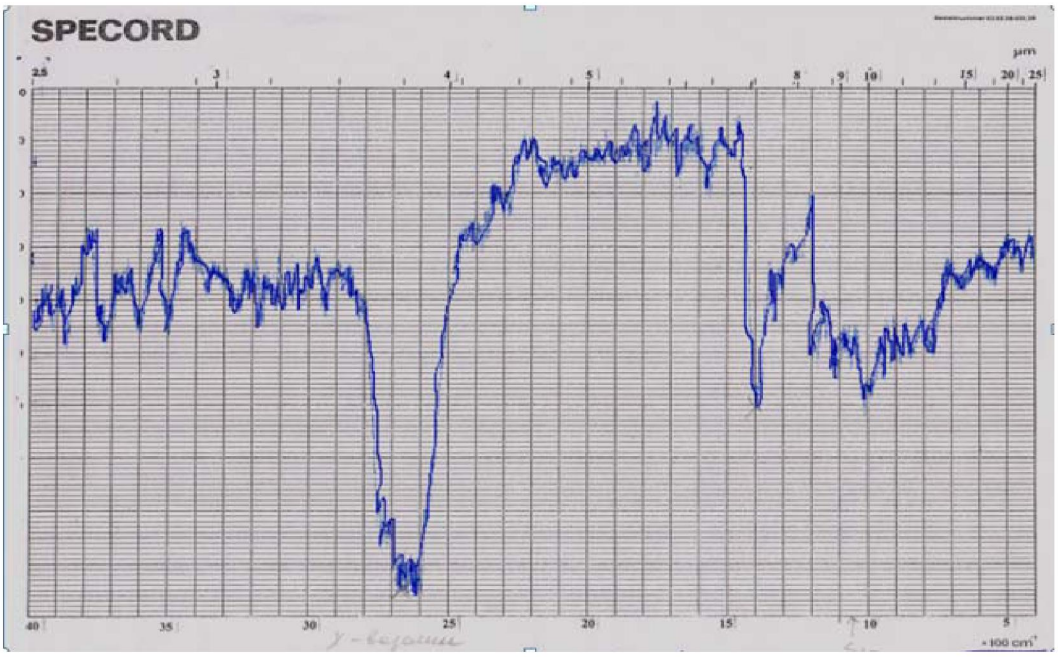
Elements	Weight%
O	46.73
Na	0.15
Mg	8.62
Al	7.69
Si	17.27
Cl	0.24
K	2.83
Ca	2.45
Ti	1.23
Mn	0.08
Fe	12.71



Picture 1- Ultimate composition and microstructure of the vermiculite obtained from Kulantau field

Unique properties of vermiculite can be used as a sorbent for absorption of mineral and organic compounds at extraction of phosphorus from phosphorus-containing slimes.

Now raw materials of vermiculite have loose weight and are friable adjournment which consist from the closed cover of feldspar, mica and amfibold. IR spectrum of the vermiculite received from the Kulantau field is given in the picture 2.



The picture 2 - IR Spectrum of the vermiculite obtained from the Kulantau field υ * cm^2

For Kulantau vermiculites are characteristic 700-1500sm-1 length of waves of a range of the absorption territory. Poorly intensive 600-650sm^{-1} and 70-850^{-1} ranges of absorption α and β characterizes modifications AI–O compounds, and on average intensive waves 830-850 cm^{-1} characterizes