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Improvement of the Technology of Production of High-Quality Potassium Chloride from Sylvinite of the Tyubegatan Deposit

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Abstract: The article presents the physicochemical principles of various methods for obtaining gallurgic potassium chloride. Theoretical justification for the process of obtaining high-quality pure potassium chloride by dissolving potassium chloride flotation cake. Justification of optimal technological parameters for obtaining potassium chloride by gallurgic methods.

The influence of process parameters on the granulometric composition of white crystalline potassium chloride was studied.

Keywords: potassium chloride, gallurgy, solubility, ammonia, flotation, technology.

Potassium chloride is produced in granulated or coarse-crystalline form; for the second and third grades, the content of grains with sizes of 2-4 mm should be no less than 80%, and 1-2 mm - no more than 20%. The grain sizes for the highest and first grades of brand K are not standardized. At the request of the consumer, potassium chloride is also produced in powder form (fine-crystalline). In order to avoid caking of potassium chloride supplied to agriculture, GOST allows its treatment with amines or other reagents. The product of grade K of the highest and first grades and granulated is packed in five-layer bags made of bituminized kraft cellulose paper, the product of the second and third grades is allowed to be shipped in bulk.

To obtain pure potassium salts, one of the main initial salts is technological potassium chloride with a content of at least 98% KCl. The content of potassium chloride in the flotation product of JSC Dekhkanabad Potash Plant does not exceed 95%.The aim of this work was to study the influence of temperature, solubility and the ratio L:S on the granulometric composition of white crystalline potassium samples. A eutectic saturated solution of potassium and sodium chloride at 10 and 20 °C was used as a solvent. The dissolution process was carried out at 90 and 100 °C.

The resulting suspension was separated into a mother liquor and a solid phase consisting of sodium chloride and the insoluble portion present in the cake of the flotation concentrate. The mother liquor was cooled to a temperature of 10 or 20 °C and separated into production white crystalline potassium chloride and circulating secondary mother liquor.

The product potassium chloride and the second mother liquor were analyzed for the content of sodium ions; potassium, chlorine, sulfate and insoluble part using well-known methods.

The analyses showed that the potassium chloride content in the product was not less than 98,5-99,0%.

Fig. 3 shows the granulometric composition of the obtained samples, where it is evident that the average particle diameter is within 0.045-1 mm. The relative proportion of particles depends on the conditions of the dissolution and crystallization process.

When using solution No. 1, the main constituent fraction is particles of size 0,063 mm, 0,125-0,250 mm (11-26%); 40-43 and 17-32; at 90 °C and 10-12; 42-46 and 37-41% at 100 °C. From this it is clear that with an increase in the L:S ratio from 3,5:1 to 5,5:1 at a dissolution temperature of 100 °C, the content of the 0,125 and 0,250 mm fraction increases by 4-5%.

It should be noted that when carrying out the dissolution process at 90°C, the main fraction is 0,125 mm and the content of the 0,065 mm fraction increases to 26%, especially at L:S=3,5:1.

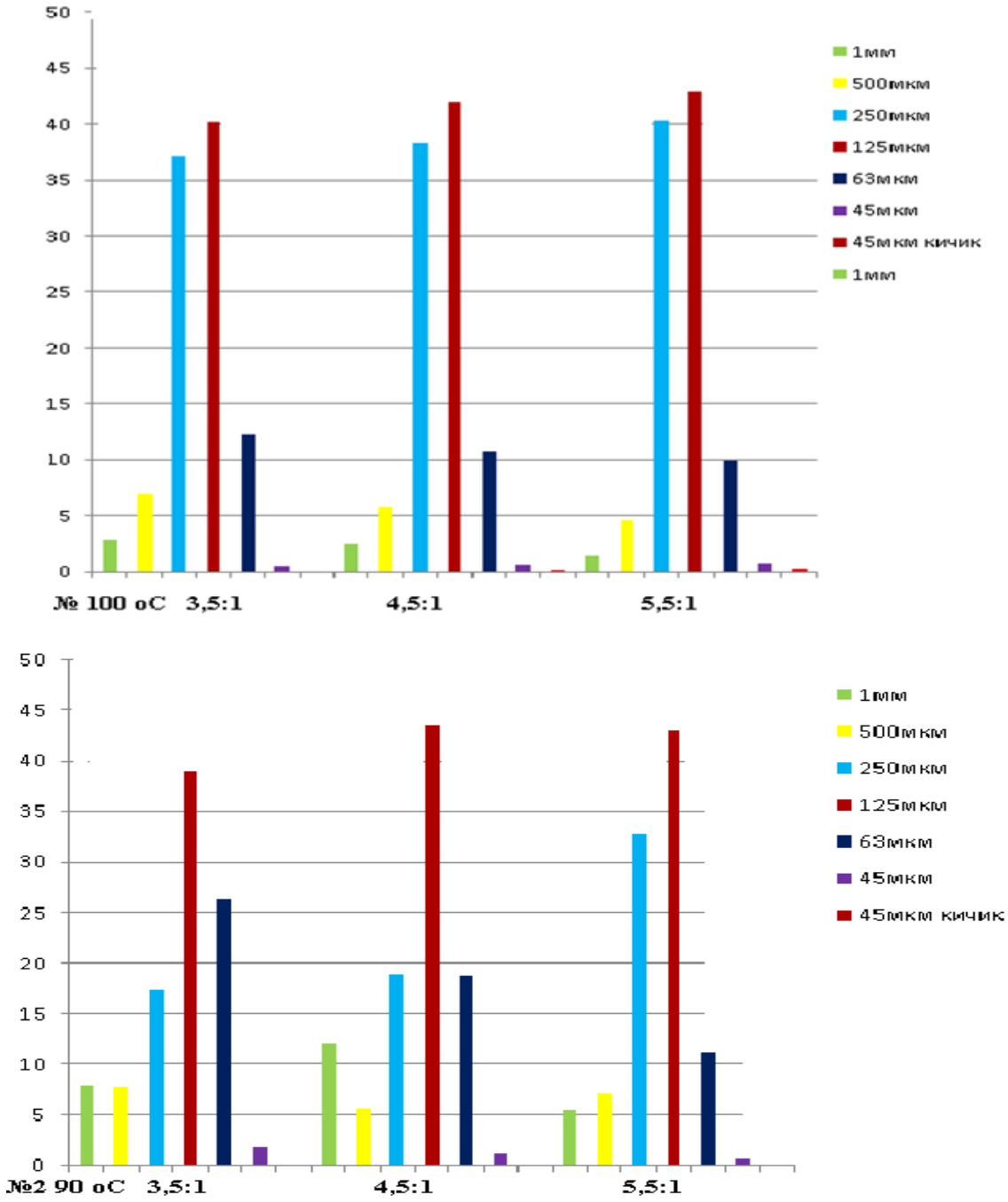
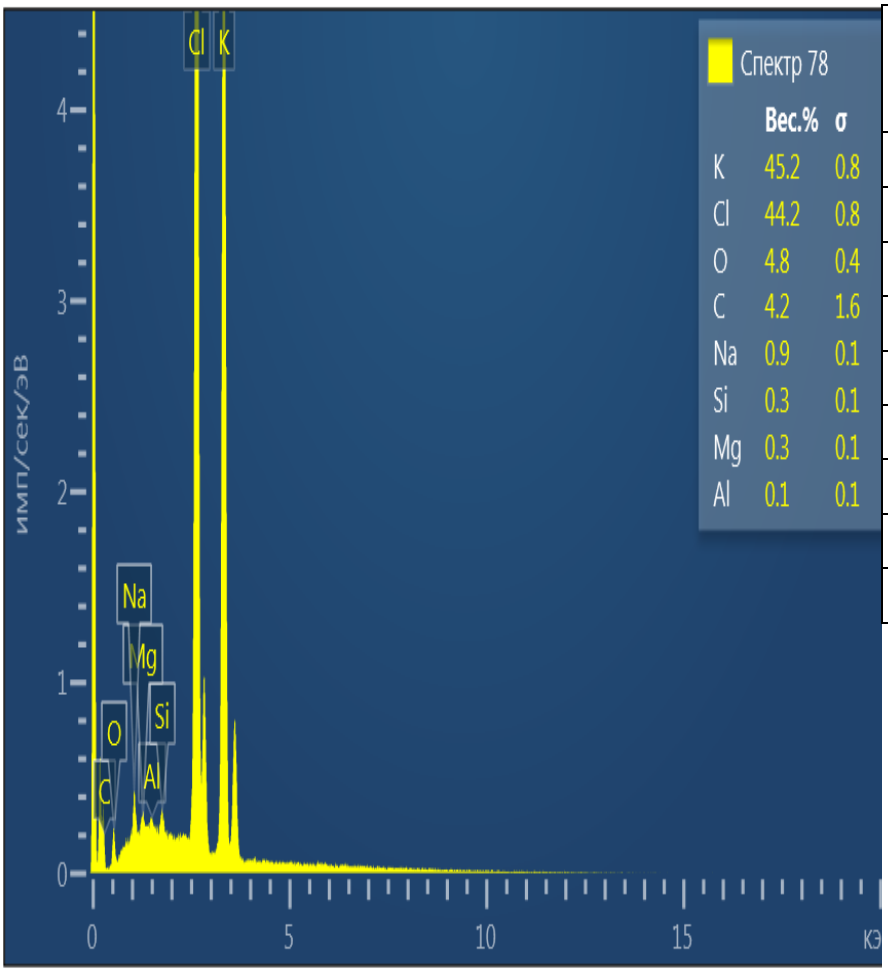
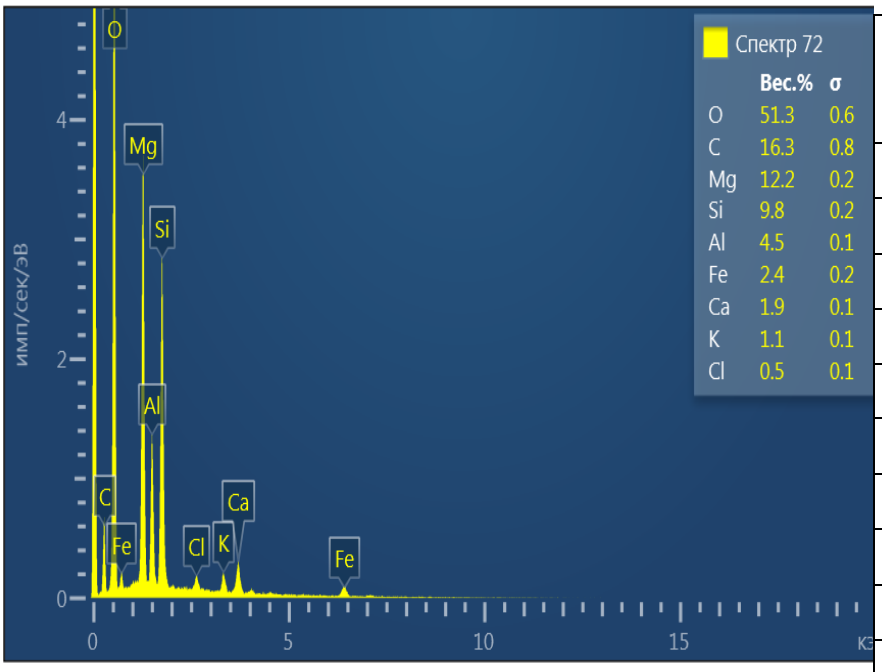


Fig. 1. Granulometric composition of crystalline potassium chloride depending on the process conditions.



Element	Weight .%	Sigma Weight %
C	4.20	1.61
O	4.78	0.36
Na	0.89	0.08
Mg	0.28	0.06
Al	0.12	0.06
Si	0.34	0.05
Cl	44.22	0.79
K	45.17	0.81
Sum :	100.00	

a)



Element	Weight .%	Sigma Weight %
C	16.28	0.84
O	51.28	0.58
Mg	12.18	0.18
Al	4.49	0.11
Si	9.81	0.16
Cl	0.54	0.06
K	1.07	0.07
Ca	1.92	0.08
Fe	2.43	0.16
Sum:	100.00	

б)

Fig. 2. Energy dispersive spectrum of samples: a - concentrate cake; b - sludge.

The resulting pure white potassium chloride consists of potassium and chlorine elements in a total amount of more than 98%.

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