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Study of Low Silvinite Enrichment Process in Tubegatan Deposit

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ABSTRACT: Most of the mineral fertilizers produced in our country are currently exported to foreign countries. The identification of potash ores in the Dekhkanabad district of the Kashkadarya region and the launch of the production of potash fertilizers solved the problem of purchasing this mineral fertilizer from abroad for foreign currency. However, the uneven distribution of potassium chloride in the raw material, the abundance of the insoluble part in the composition of low-grade sylvinites has a negative effect on the quality of the product. Therefore, obtaining a high-quality product from low-grade raw materials that meets the requirements of the world and the state is one of the most pressing issues today.

The article examines the influence of technological factors - temperature, solid: liquid ratio, time and temperature of cooling on the enrichment process of low-grade sylvinite, and also reveals the possibility of introducing a technology for separating pure edible salt and crystalline white potassium chloride from low-grade sylvinite

KEYWORDS:low grade silvinite, water, temperature, solid: liquid ratio, time, melting time, return solution, crystallization, potassium chloride, sodium chloride

I. INTRODUCTION

Most of the mineral fertilizers produced in our country are currently exported to foreign countries. Identification of potassium ores in the territory of Dehkanabad district of Kashkadarya region and the launch of production of potassium fertilizers - solved the problem of purchasing this mineral fertilizer in foreign currency. However, the uneven distribution of potassium chloride in the raw material, the abundance of insoluble part in the composition of low-grade sylvinites has a negative impact on product quality. Therefore, how to obtain a quality product from raw materials that can meet global and national requirements is one of the most pressing issues today [1-5].Our research is aimed at solving such a task.

II. SIGNIFICANCE OF THE SYSTEM

Most of the mineral fertilizers produced in our country are currently exported to foreign countries.The study of literature survey is presented in section III, methodology is explained in section IV, section V covers the experimental results of the study, and section VI discusses the future study and conclusion.

III. METHODOLOGY

The stripping process was carried out for 1-5 minutes in an isothermal cylindrical reactor at a maximum temperature of 100 ° C. The studies used the following physicochemical methods of analysis: electron microscopic, thermoanalytical and X-ray phase.The morphology and microstructure of the samples were measured using a scanning electron microscope SEM - EVO MA 10 (Carl Zeiss, Germany); The local elemental composition of the powders was determined using an EDX energy dispersive elemental analyzer (Oxford Instrument).During preparation, the sample was dried and placed on a microscope stage, on which aluminum foil with double-sided glue was glued. Powder was glued to this foil, then a stage was installed in the working chamber of the microscope, from which air was evacuated to create a vacuum.For measurements, an accelerating voltage of 10 kV was applied to the filament. The working distance was 8.5 mm. Local elemental analysis was carried out on a scale of 100 μm using the Aztec Energy Advanced software [6,12].TG-DSC conditions: Thermoanalytical studies of the presented samples were carried out on a Netzsch STA 409 PG analyzer (Germany) with a K type thermocouple (Low RG Silver) and aluminum crucibles. All measurements were carried out in an inert nitrogen atmosphere at a nitrogen flow rate of 50 ml / min. Temperature range of measurements-

25-370 ° C; heating rate 5 K / min. The amount of sample for measurement is 5-10 mg. The measuring system was calibrated with a standard set of substances KCl, In, Bi, Sn, Zn [7, 8].Conditions for X-ray phase analysis. The samples were identified on the basis of diffraction patterns recorded on an XRD-6100 apparatus (Shimadzu, Japan) with computer control. We used CuKα radiation (β-filter, Ni, 1.54178, current mode and tube voltage 30 mA, 30 kV) and a constant detector rotation rate of 4 deg / min with a step of 0.02 degrees. (connection ω / 2θ), and the scanning angle varied from 4 to 800 [9-10].

IV. EXPERIMENTAL RESULTS

To study the effect of particle size on the kinetics of the melting process of raw materials in the galurgical enrichment of low-grade sylvinites, the effect of temperature, solid: liquid ratio, melting time on the kinetics of the process of melting of low-grade sylvinites in the Tyubegatan deposit. Dissolution of low-grade sylvinites in water was carried out at a temperature of 60, 80, 100^{o}C, S:L=1: 2, 1:4, 1:6 and a particle diameter of 5 mm. The melting kinetics of the samples were studied. Melting time was 15, 30, 45, 60 minutes. The results of the study are presented in Table 1 and Figure 1.

Table 1.
Temperature in the process of melting low-grade sylvinites,S:L ratio, the effect of melting time.

№	Solid: liquid	Temperature,^{o}C	Time			
			15	30	45	60
			Solubility,%			
1	1:2	60^{o}C	80.2	84.15	84.9	85.0
2		80^{o}C	80.5	85.0	85.2	85.51
3		100^{o}C	81.1	85.2	86.1	87.9
4	1:4	60^{o}C	90.44	94.05	94.2	94.6
5		80^{o}C	91.26	95.26	95.4	96.0
6		100^{o}C	92.88	95.6	95.8	96.4
7	1:6	60^{o}C	95	95.44	95.6	96.0
8		80^{o}C	96.3	96.56	96.65	96.78
9		100^{o}C	96.6	96.88	96.91	97.0

To see more of the effect of technological factors on the melting process, the results obtained were expressed in the form of a volume diagram. The volume diagram shown in Figure 1 shows the change in solubility kinetics with increasing S: L and temperature.

As can be seen from the diagram, with increasing temperature and S: L ratio, the solubility rate varies from 80.2% to 92.88% in 15 minutes. The solubility level also increases with time. In the range of change of parameters, the solubility increases from 85% to 96.4%, respectively. A change in S: L from 1: 2 to 1: 6 results in an increase in the solubility level from 81.1% to 95.6%, i.e., a 1.18-fold increase over 15 minutes at 100 ^{0}C.

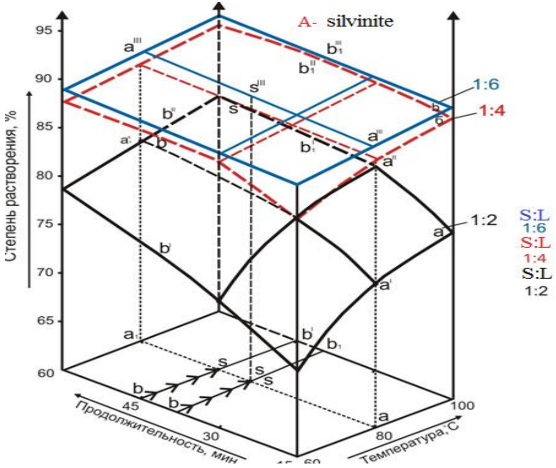

Figure 1. Temperature, S: L ratio and melting time of low-grade sylvinites of Tyubegatan deposit.

Detection volume diagram This difference decreases with increasing solubility duration, i.e., the difference in solubility at 100 ^{0}C after 60 minutes is 9.1%, i.e., 0.65 times smaller than at 15 minutes. Using this diagram, it is possible to predict in advance what percentage the solubility rate may increase after a certain time at a given temperature and S: L ratio. To do this, we draw a line a-a1 parallel to the time axis from the given temperature. From the points a-a1 found, we draw a line parallel to the coordinate axis of the degree of solubility, i.e., perpendicular to the temperature axis. From the points a-a1 found, we draw a line parallel to the coordinate axis of the degree of solubility, i.e., perpendicular to the temperature axis.

From the points of intersection of the curves showing the temperature dependence drawn for the ratios on the solubility surfaces (1: 2, 1: 4, 1: 6) of our perpendicular, i.e. a^{1}, a^{11}, a^{111} and, respectively, a^{11}, a^{111}, a^{111} we obtain, i.e., a curve of change in the degree of solubility with a change in time over time at a given temperature. To find the degree of solubility at a given time interval from the curve at this temperature, we draw a line parallel to the temperature axis from a given time (b-b1). From the point S of the point of intersection of the lines b-b1 and a-a1 we draw a line parallel to the coordinate axis of solubility. We determine the points of intersection of the solubility curve of this line at a certain S: L and temperature, and determine the points S^{1}, S^{11}, S^{111}. The found S- S^{1}, S -S^{11}, S -S^{111} shears show the solubility level in 1: 2, 1: 4, 1: 6 ratios at a given temperature and solubility duration, respectively.

Thus, experiments on the effect of S: L, melting time, temperature on the melting process of low-grade sylvinites, the solubility of samples in water S: L ratio 1: 2 to 1: 6, temperature 60 to 100^{o}C, melting time 15 to 60 showed an increase in the solubility of the samples with an increase of up to min.

To study the effect of technological factors on the processing of low-grade sylvinite, the effect of technological factors such as temperature, S: L ratio, time and cooling temperature on the solubility of low-grade sylvinite in the reverse solution was considered.

The effect of temperature, S: L ratio, melting time on the melting process of low-grade sylvinites in the return solution of the Tubegatan deposit was studied. The melting of low-grade sylvinites in the return solution was carried out at a temperature of 100oS, Q: S = 1: 0.85, 1: 1.5, 1: 2, 1: 2.5, 1: 3 and a particle diameter of 5 mm. Melting time was 30 minutes. The results of the study are presented in Table 2.

Table 2.
Temperature of melting of low-grade sylvinites in reversible solution, S: L ratio, the effect of melting time

№	S: L	Sludge content,%		The solid and liquid phases formed when the solution is cooled,mass.%				Change in sediment composition with increase in evaporation rate of filtrate (%), mass.%							
		NaCl	KCl	Solid phase		Liquid phase		10		20		30		40	
				NaCl	KCl	NaCl	KCl	NaCl	KCl	NaCl	KCl	NaCl	KCl	NaCl	KCl
1	1:0,85	91,1	8,9	15,4	84,6	20,4	9,6	90,4	9,6	88,1	11,9	81,7	18,3	70,2	29,8
2	1:1,5	91,2	8,8	15,2	84,8	20,8	9,8	91,1	8,9	89,3	10,7	81,7	18,3	71,6	28,4
3	1:2	93,6	6,4	12,2	87,8	20,2	9,8	92,6	7,4	90,8	9,2	82,3	17,7	75,1	25,2
4	1:2,5	95,7	4,2	10,2	89,8	19,4	10,2	94,1	6,2	95,3	4,7	85,2	14,8	78,9	21,1
5	1:3	97,2	2,8	6,4	93,6	18,9	9,9	95,6	4,4	96,0	4,1	69,9	30,1	84,9	15,1

Table 2 (continued)
Temperature of melting of low-grade sylvinites in reversible solution,
S: L ratio, the effect of melting time

Change in sediment composition with increase in evaporation rate of filtrate (%), mass.%						The composition of the solid and liquid phases formed by cooling the solution after evaporation of 40% NaCl, mass.%			
50		60		70		Solid phase		Liquid phase	
NaCl	KCl	NaCl	KCl	NaCl	KCl	NaCl	KCl	NaCl	KCl
63	37	61,1	38,9	51,2	48,8	4,4	95,6	22,2	9,6

63,7	36,3	62,3	37,7	52,1	47,9	4,2	95,8	21,1	8,9
66,4	33,6	64,1	35,9	54,9	45,1	3,1	96,9	20,4	8,2
69,2	30,8	65,2	34,8	55,1	44,9	1,55	98,45	21,4	9,4
71,6	28,4	67,4	32,6	56,3	43,7	1,25	98,75	20,7	8,84

With a reversible solution at 25 ^{0}C, S: L = 3: 1, with a duration of 30 minutes, 53% of the mass obtained at 100^{0}C is dissolved, and when the solution is cooled to 25^{0}C, 40% of the potassium chloride transferred from the raw material to the solution falls into the crystal. When we evaporate the remaining solution to 24% by evaporation, sodium chloride crystals fall into the solid phase.

If we increase the evaporation to more than 20%, potassium chloride crystals will also start to fall into the solid phase. When we increase the evaporation rate from 30% to 70%, the amount of potassium chloride in the solid phase increases from 15% to 43.7%. In this regard, by dissolving low-grade silvinites containing 18% potassium chloride in a saturated solution at 25^{0}C and evaporating the crystallization solutions to 20%, the pure sodium chloride salt and the solution are cooled to separate additional pure galuric potassium chloride and return the remaining solution to the process. it is possible to introduce the technology of extraction of pure table salt and crystalline white potassium chloride from low-grade sylvinites

V. CONCLUSION AND FUTURE WORK

To study the effect of technological factors on the process of enrichment of low-grade sylvinite in the Tyubegatan deposit, the effect of temperature, S: L ratio, melting duration on the kinetics of the melting process of low-grade sylvinite was studied. The influence of technological factors such as temperature, S: L ratio, time and cooling temperature on the solubility of low-grade sylvinites in water and return solution was considered. The experiments performed showed that the solubility of the samples increased with increasing water solubility S: L ratio 1: 2 to 1: 6, temperature 60 to 100^{o}C, melting time 15 to 60 minutes.

Dissolution of low-grade sylvinites with a saturated solution at 25^{0}C and evaporation of the crystallization solution to 20% by evaporation of pure sodium chloride salt and cooling of the solution to separate additional pure galuric potassium chloride and return the remaining solution to the process. it was determined that the introduction of potassium chloride extraction technology is possible.

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