STUDY OF THE CHEMICAL AND MINERALOGICAL COMPOSITION OF POTASSIUM ORES OF TUBEGATAN MINE

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Abstract. *Identification of potash deposits and production of potash fertilizers in the territory of Dehqonabad district of Kashkadarya region solved the problem of buying this mineral fertilizer from abroad for foreign currency. However, the non-uniform distribution of potassium chloride in the raw materials, the large amount of insoluble part in the composition of low-grade sylvinite negatively affects the quality of the product. Therefore, how to get quality products from raw materials that can meet world and state requirements is one of the urgent issues today.*

In the article, the chemical composition of the low-grade sylvinites of the Tubegatan mine, the change in their strength depending on the change in the fractional composition of the particles was studied, and it was determined that the strength of the samples increases as the size of the particles increases and the amount of potassium chloride in the samples decreases.

Keywords: *low-grade sylvinite, fractional composition, chemical composition, strength, physical-chemical analysis, potassium chloride.*

Tubegatan potash salt mine is located in Dekhkanabad district of Kashkadarya region, 75 km south of Guzor city and adjacent to the southwestern part of the Hisar range. The mine is located on the border of Uzbekistan and Turkmenistan [1-2].

In Uzbekistan, sylvinite from the Tubegatan mine is used as a raw material for the production of potash fertilizers. The composition of sylvinite mineral consists of halite (NaCl), sylvin (KCl), gypsum, insoluble part and others. The average amount of KCl in the inspected area is 33.05% (from 15 to 60%), in some sections - KCl - 92%, $MgCl_2$ - from 0.08 to 2.61%.

Sylvinite mineral is found in nature as large minerals. When the ore is crushed to 1 mm, it is possible to separate sylvin (KCl) and halite (NaCl) crystals from each other, which makes it easier to process it by mechanical methods, while allowing to preserve the natural structure and chemical composition of salt minerals [3]. Tubegatan potash salt deposit consists of halogen salt layer and clay soil layer. The main composition of clay soil layer is aluminosilicate and carbonates [4]. In order to intensify the sylvinite enrichment process and qualitatively separate the potassium chloride contained in it, the chemical composition of Tubegatan mine potash minerals, their strength changes depending on the change in the fractional composition of the particles were studied. In order to determine the chemical composition of Tubegatan potash ores, the change in their strength depending on the change in the fractional composition of the particles, samples of potash raw materials with the following average weight content of potassium chloride were studied: 1-sylvinite (9.2% KCl), 2-sylvinite (13.2% KCl), 3-sylvinite (18.3% KCl), 4-sylvinite (26.1% KCl), 5-sylvinite (31.1% KCl).

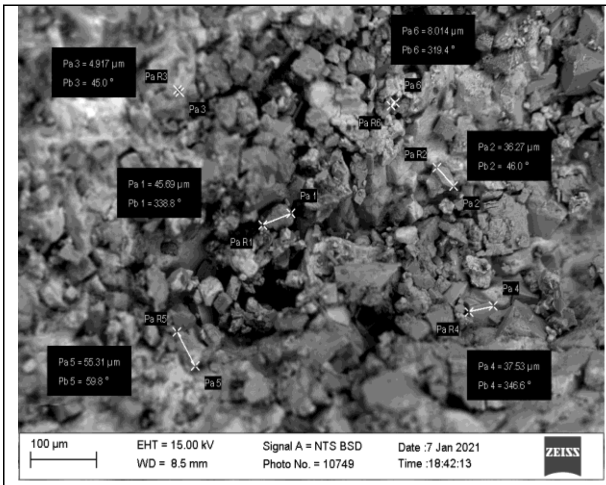
Crushed samples 0.5mm; 1mm; 3mm; 5mm; From a set of 7mm and 10mm sieves was carried out and the size of the particles is -10+7 mm; -7+5mm; -5+3mm; -3+1mm; -1+0.5mm; Divided into fractions of -0.5+0. The weight of the fractions was measured, and the percentage composition and consistency were determined. The results of the experiment are presented in Table 1. According to Table 1, the largest amount of fractions with particle sizes of -10+7 and -7+5 mm was observed in sample 1: the fraction with -10+7 mm was 23.80%, and the fraction with -7+5 mm was 31. made up 35%. In the remaining samples, the amount of these fractions varied from 10.4 to 17.3%. The amount of fraction with -5+3 mm is almost the same in all samples and ranges from 9.25 to 14.60%. Fractions with particle size -3+1 and -1+0.5 mm are mostly in samples 2-5 - 20.85-26.40%, and the fraction with -0.5+0 mm is in samples 8, It varies from 55 to 14.33%. The results of the study of the dependence of the strength of potassium raw material samples on the particle size showed that the strength of the samples increases as the size of the particles increases and the amount of potassium chloride in the samples decreases. For example, the strength of the first sample (9.2% KCl) with a particle size of -0.5+0 mm was 3.67 MPa, and the strength of the fraction with -10+7 mm was 4.30 MPa.

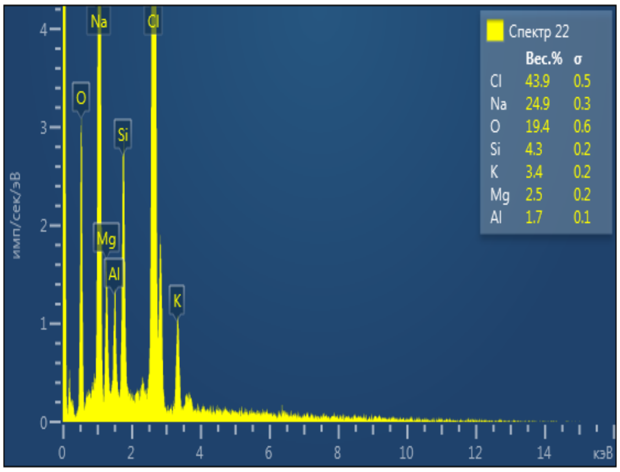
1 - table

Dependence of strength of potash ores of Tubegatan mine on change of fractional composition of particles

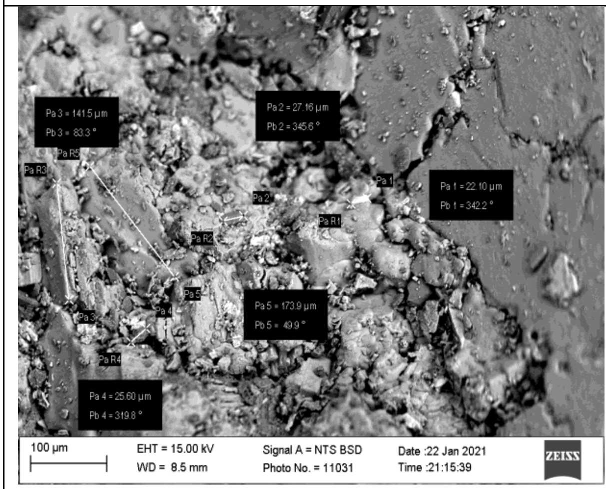
№	Particle size, mm	Number of examples									
		1		2		3		4		5	
		Amount of fraction, %	Strength, MPa	Amount of fraction, %	Strength, MPa	Amount of fraction, %	Strength, MPa	Amount of fraction, %	Strength, MPa	Amount of fraction, %	Strength, MPa
1	-10+7										62
2	-7+5	3 35	3,92	16,18	3,54	1 3	2,95	1 7	2,63	1 2	2,46
3	-5+3	1	3,62	12,04	3,26	12,42	2,74	9,25	2,51	1	2,34
4	-3+1	1	3,14	2	2,97	2	2,36	2	2,18	2	2,08
5	-1+0,5	1 0	3,43	20,85	3,14	24,22	2,57	2 3	2,34	2 3	2,25
6	-0,5+0	8,55	3,67	14,33	3,32	12,06	2,87	13,85	2,62	1 2	2

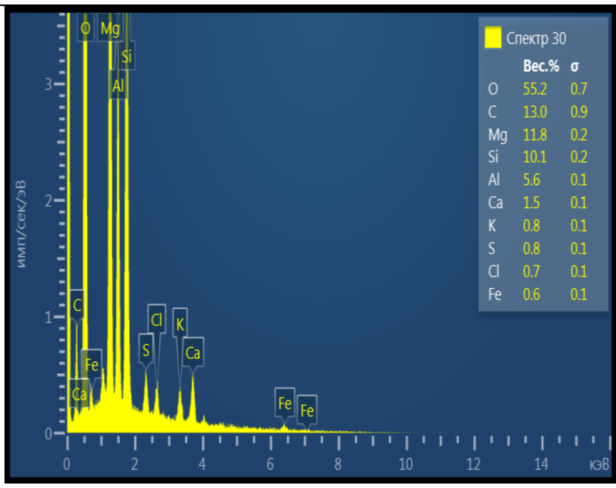
Compared to the other samples, the strength in sample 1 reached its highest value (4.30 MPa), while in the other samples, as the potassium chloride content increased from 13.2 to 31.1%, the strength decreased to 2.08 MPa. At the same time, the strength of the samples decreased from the fraction of -10+7 mm to the fraction of -3+1 mm, and on the contrary, the strength increased in the fractions of -1+0.5 mm and -0.5+0 mm. For example, in the fifth sample (31.1% KCl), as the particle size decreased from -10+7 mm to -3+1 mm, the strength also decreased from 2.62 to 2.08 MPa, with -1+0.5 mm and In the fractions of -0.5+0 mm, it is possible to see an increase in strength up to 2.25 and 2.40 MPa, respectively. The same situation was observed in the remaining samples. This is related to the chemical composition of the samples. The chemical composition of samples of different sizes was determined using physico-chemical analysis methods. The energy-dispersive element analysis method was used to determine the elemental composition of the samples and their water-insoluble residue (e.q.), and the quantitative composition of the following elements was determined: O, Na, Mg, Al, Si, S, Cl, K, Ca, Fe, C. The obtained results are presented in Figure 1.





Example -1.4





Example -1.4 e.d.

Figure 1. Electron image and energy dispersive spectra of the samples and their insoluble residue (the numbers on the sample correspond to the numbers in Table 1)

According to the results of determining the elemental composition of samples of different sizes and their water-insoluble residue (e.q.), the average amount of elements in samples 1, 2, 3, 4 and 5 was found to change accordingly: sodium element 21.8, 24.0, 27, 1, 26.2 and 25.9%, and the potassium element increases to 4.87, 7.06, 9.65, 13.8 and 16.2%, while the particle size of the samples decreases from -10+7mm , it can be seen that the amount of sodium element decreases and potassium element increases in them, but the potassium element decreases in fractions with -0.5+0 mm. X-ray analysis method was used to study the mineralogical composition of sylvinite samples of different sizes and their insoluble residues. The obtained results are presented in Figure

2. According to the results of the X-ray phase analyzes of the samples, the main mineralogical composition of the samples is halite and sylvine. The percentage of halite varied from 52.2 to 70.5%, and sylvine from 7.2 to 32.9%. Also, the samples contain compounds such as calcium sulfate, magnesium, calcium carbonates, magnesium chloride, aluminum, calcium silicates. As the amount of KCl in the samples increases, the amount of calcium sulfate, silicon compounds, and aluminosilicates in their content decreases. The fractions of sample 1 contained a large amount of calcium sulfate, silicon compounds, and aluminosilicates, which caused a large amount of insoluble residue in these samples and, as a result, a high strength in the samples.

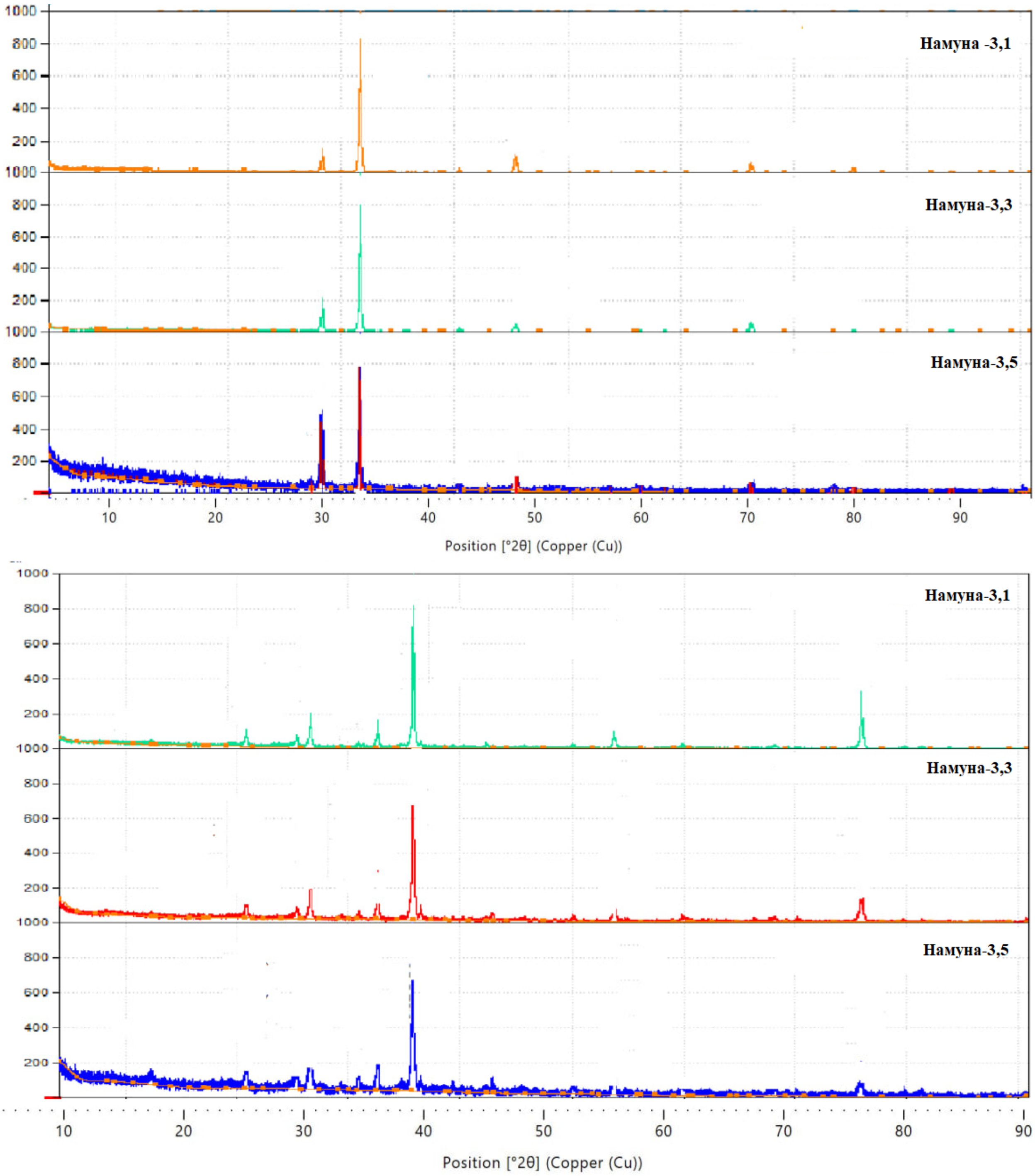
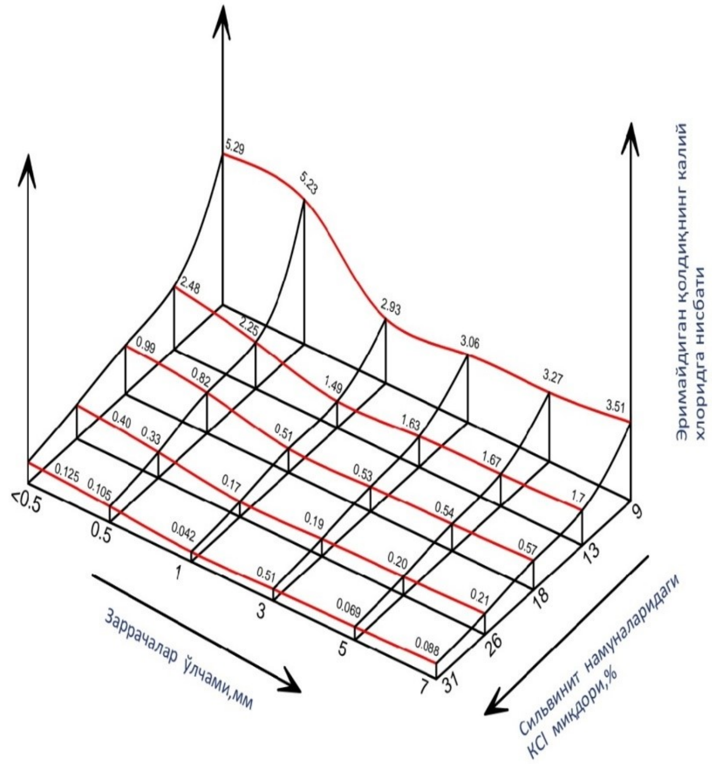


Figure 2. X-ray images of samples and their water-insoluble residues (sample numbers correspond to those in Table 1)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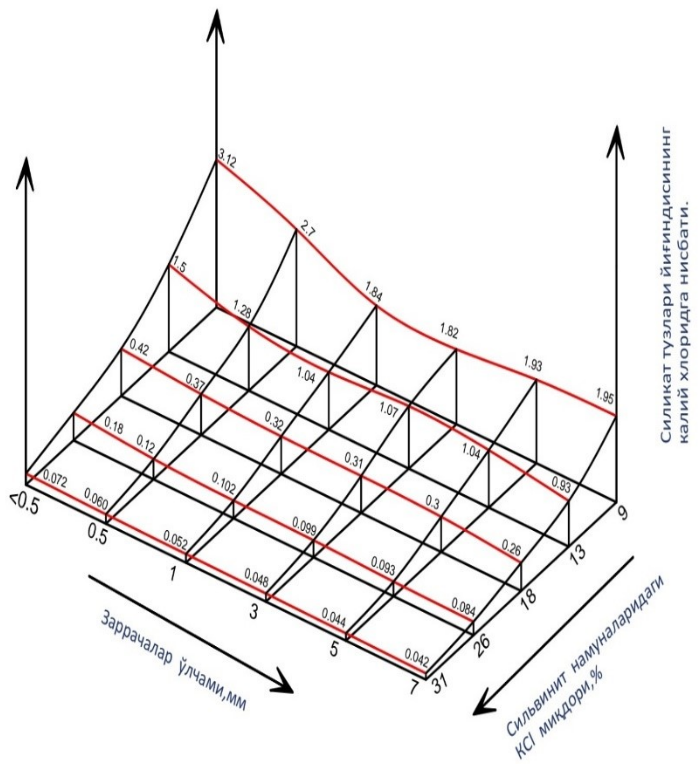
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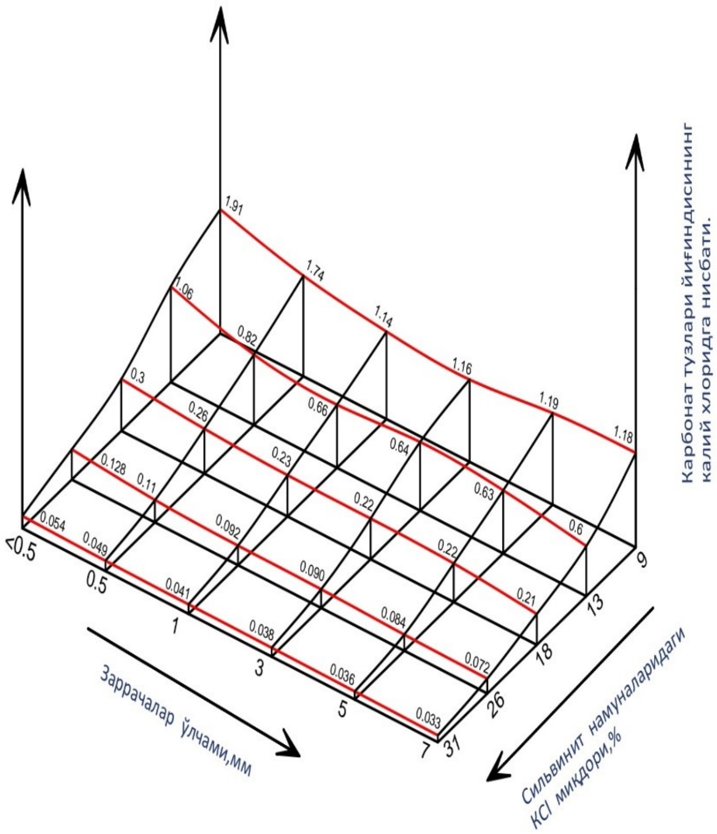

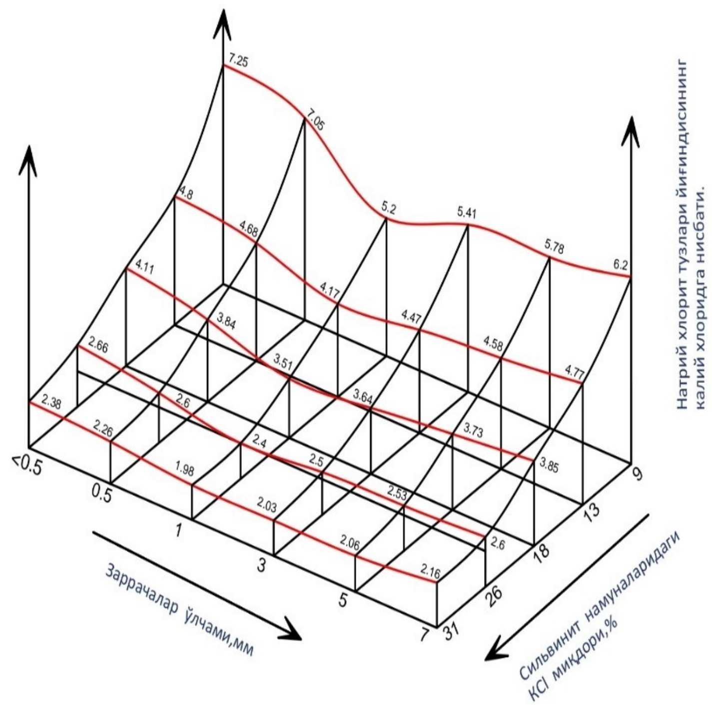

The ratio of water-insoluble residue, silicate, carbonate, sodium chloride salts to KCl in the samples was studied in order to clearly show how the insoluble residue, silicate, carbonate, sodium chloride salts in the content of potash minerals changes with the amount of potassium chloride in the ore and the size of the ore particles. The obtained results are presented in Figures 3-6.

According to the results, as the amount of KCl in the samples decreases, the ratio of the amount of insoluble residue in small particles to KCl increases sharply. This ratio decreases to 0.139 as the KCl content increases and the particle size increases.

The maximum ratio of insoluble residue to KCl was 9.15.

The ratio of silicate, sodium chloride, carbonate salts to KCl in the samples also maintains the above law.

In the first sample (9.2% KCl), the ratio of the total amount of silicate salts to the amount of potassium chloride increased with the decrease of the particle size, with the decrease in the size of the particles from -10mm to +0.5mm, the ratio of the amount of silicate salts to the amount of potassium chloride increased from 1.95 to 3.12 increased. to the amount of potassium chloride of raw silicate salts in the 2nd (13.2% KCl), 3rd (18.3% KCl), 4th (26.1% KCl), 5th (31.1% KCl) samples ratio increased with decreasing particle size.

As the amount of potassium chloride in the sample decreases, the ratio increases, that is, the ratio increases from 0.93 to 1.5 in sample 2, from 0.26 to 0.42 in sample 3, from 0.084 to 0.18 in sample 4. And in sample 5, it can be seen that the ratio increased from 0.042 to 0.072.

In conclusion, it was determined that the chemical and mineralogical composition of Tubegatan potash ores, their strength change depends on the change in the fractional composition of particles. The results showed that the strength of the samples increased as the particle size increased and the amount of potassium chloride in the samples decreased. The highest index of strength (4.30 MPa) was observed in a sample of low-grade sylvinite with a potassium chloride content of 9.2% and a particle size of -10+7mm. As the amount of potassium chloride in the samples increases, their strength decreases and, as a result, they are easily crushed, while the samples with high strength more crushing, that is, the use of high-power crushing equipment during the crushing process will be necessary.

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