ENRICHMENT OF WASTE BY GRAVITY METHOD. MINERAL-GEOLOGICAL CHARACTERISTICS OF WASTE PRODUCTS

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The material composition of man-made waste was studied using traditional and modern mineralogical-geochemical research methods.

In order to study the material composition of the waste, the samples were washed on a concentration table, mineralogical analysis was carried out on the obtained products. The mineral composition of the enrichment products was studied under binoculars. Artificial slides were prepared from the primary tailings, and slides were prepared from the gravity enrichment tailings to determine the mineral content in transmitted and reflected light.

The chemical composition of prepared samples and their enrichments was determined by chemical analysis of individual components. Elemental composition of waste and gravity enrichment products was determined by semi-spectral and mass-spectral analysis.

According to the chemical composition, the average amount of silica in the wastes of the copper beneficiation plant is 66.93%. After that, the majority of components are iron and aluminum oxides, the total amount of (FeO+Fe2O3) is 18.5%, and aluminum oxides are 6.89%.

The average content of sulfur oxides (SO3um.) is 6.15%, sulfur sulfide in them - 2.3%. Magnesium, calcium, potassium, sodium, and titanium oxides are also involved (tables 2.3).

Copper-porphyry ores of Kalmokir, Saricheku and other Almalyk mining regions are enriched at the Almalyk copper beneficiation plant [23]. That is why minerals from these mines are found in waste. Quartz and feldspar are more common than ore minerals in wastes from copper smelters. Feldspar is mainly a potassic type, with a smaller amount of plagioclase.

2 samples of 3 kg of AGMK MOF waste were crushed to 0.5 mm for enrichment on a concentration table. The working order of the concentration table is as follows: frequency of vibrations - 105 times/min; amplitude of vibrations - 9-10 mm; the transverse slope of the deck - 20 mm; consumption of washing water ~4.6 l/min. As a result of enrichment, the sample was separated into concentrate, intermediate product, light fraction and slurry. The products were weighed after drying and the percentage yield of each product was determined. The obtained results are presented in Table 1.

Table 1
Extraction of fractions in gravity enrichment

Sample №	Sample weight, (g)	Yield of enrichment products,%							
		Heavy faction		Intermediate product		Light fraction		Sludge	
		g	%	g	%	g	%	g	%
№1	3000	237,0	7,90	486,2	16,21	1820,0	60,67	456,8	15,23
№2	3000	189,0	6,30	612,7	20,42	2063,7	68,79	134,6	4,49

Enrichment, intermediates and light fractions were observed with binoculars and their mineral content was determined. The composition of enrichments obtained from MOF waste is different. Sulfide enrichments were obtained from MOF waste.

In manual magnetic separation, 70-80% magnetic fraction was separated from the initial enrichments. As a result of gravity enrichment of MOF waste, the amount of enrichment was 6.3-7.9%.

The gravity enrichment fractions of AGMK MOF waste are represented by the following products:

- the heavy fraction of the waste consists mainly of sulfides. Pyrite is more common in the enrichment, followed by chalcopyrite, iron oxides and molybdenite. Sphalerite and galena are also found here and there. Iron oxides are present in the form of magnetite and hematite. In the beneficiation, feldspar, biotite can be found in combination with quartz sulfides or separately. The yield of beneficiation for MOF waste is 6.3-7.9%.

According to the results of ICP-MS analysis, the amount of copper in the heavy fraction is 1396-2289 g/t, and the amount of molybdenum is 168-183 g/t. Chemical analysis of individual components showed that the amount of copper in the enrichment is 0.14-0.21%.
The amount of gold in the beneficiation according to the results of ICP-MS analysis showed that it is 0.997-1.76 g/t, and according to the results of atomic-adsorption analysis it is 1.3-1.8 g/t. It was also found that the amount of Bi, Re, Se, Te, Pb, Zn and other elements is high. Even in one sample, the amount of tellurium was 5260 times higher than that in the ground. The amount of rare earth and scattered elements is less compared to their amount in the ground, except for Re, Se, Te.

- In the intermediate products of gravity enrichment of MOF waste, quartz and potassium feldspar are more common, their amount varies from 50 to 70% and from 10 to 30%, respectively. Dark colored minerals are expressed as up to 5% biotite and amphibole. Plagioclase, clay minerals, carbonates are also found. Ore minerals and followed by chalcopyrite, iron oxides and occasional molybdenite are prominent.

The light fraction consists mainly of quartz, feldspar, clay minerals, carbonates.

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