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Application of New Flotoreagents in the Enrichment of Sulfide Ores

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Abstract. *As a result of the conducted research, a recommended scheme for flotation of copper ores with new reagents was developed, and a flotation concentrate with a yield of 1.55% was isolated, containing 26.7% copper and 42.35% sulphur while extracting 83.5% copper and 16.8% sulphur.*

Keywords: *ore, copper, deposit, material composition, grinding, analysis, valuable component, reagent.*

In the conditions of independence, the mining and metallurgical industries of the Republic faced a whole range of complex problems. This is primarily an increase in environmental protection requirements, an increase in the demand for non-ferrous and precious metals, including gold, silver, copper, lead, etc., a shortage of flotation reagents, requirements for the purity of the resulting product, etc. The implementation of a program to localize production on local raw materials and the tasks of searching for sources of imported products are relevant for existing mining enterprises.

Currently, the Almalyk Mining and Metallurgical Combine uses expensive flotation reagents imported from abroad to process copper ores in large quantities. Replacing them with locally produced products will reduce the foreign exchange costs of imports and rationally use local waste.

In this regard, the study of the possibility of using local import-substituting reagents in the flotation of copper ores instead of traditional ones and the development of an effective, cost-effective technology are relevant.

Reagents synthesized at the Department of General Chemistry of TASHSTU from waste from neurochemical industries and conventionally designated SI-1 and SI-2 were tested as collector reagents.

The reagents were tested on a sample of copper ores from the Yeshlik-1 deposit. The material composition of ore samples was studied by chemical, spectral, phase, and mineralogical analyses. The results of the chemical analysis performed in the IGMR chemical laboratory are shown in Table 1.

The results of the chemical analysis of the average ore sample.

Table 1

Components, elements	Content, %	Components, elements	Content, %
Silica	57,60	Sulfide sulfur	2,70
Common iron	8,5	Sulphate sulfur	0,92
Titanium Oxide	0,48	Carbon monoxide (+4)	2,05
Manganese oxide	0,14	Phosphorus oxide (+5)	0,35
Alumina	11,67	Lead	0,07
Calcium oxide	2,62	Copper	0,39
Magnesium Oxide	3,2	Zinc	0,006
Potassium oxide	3,54	Arsenic	0,003
Sodium oxide	4,64	Gold, g/t	0,19
Sulfur is common	3,6	Silver, g/t	2,9

As can be seen from the data in the table, the main valuable component of ore samples is copper, whose content in the ore is 0.19 g/t gold and 2.9 g/t silver.

The technological sample under study characterizes primary sulphide copper ore. The results of mineralogical analysis show that the main ore minerals are chalcopyrite, molybdenum, pyrite, magnetite, and hematite.

Pyrrhotite, bornite, chalcosine, sphalerite, and galena are found in small quantities. Non-metallic minerals are mainly represented by plagioclase, feces, feldspar, sericite, chlorite, hornblende, quartz, and carbonate.

Copper is the main industrially valuable component of the ores under study; more than 90% is represented by honey sulphide and iron chalcopyrite. Copper is characterized by small grain sizes as well as close and thin accretions with related minerals, which also redefines the difficulties in obtaining high-quality concentrates. Based on the study of the material composition of the ore, the nature of the inclusions of the minerals composing them, and the experience of previous studies of ores similar in material composition to those studied, flotation was adopted as the main method. Flotation reagents used in flotation are purchased abroad (Russia, China, etc.) for foreign currency. Flotation experiments were carried out on flotation machines with a capacity of 3 liters. And the most honest operations in flotation machines with a capacity of 1 liter and 0.5 at NJ = 1: 3 and 1: 4

The results of the experiments on the flotation of ore from the Yeshlik-1 deposit are shown in Table 2.

Table 2

Products	Content,%		Extraction, %		Expenses: g/t
	g/t	%	g/t	%	
	Copper	Sulfur	Copper	Sulfur	
Concentrate	20,25	35,25	88,2	18,8	The consumption
Tails	0,043	2,85	11,8	81,2	of BCC reagents
Ore	0,40	3,15	100	100	is 150

As can be seen from Table 2, during the flotation of the Yeshlik-1 ore deposit with traditional reagents, a copper concentrate containing 20.25% copper and 35.25% sulphur was isolated while extracting 88.2% and 18.8%, respectively. To compare the actions of two different collectors, BCC and SI, experiments were conducted under optimal conditions developed for each collector separately.

The results of ore flotation experiments with new reagents are shown in Table 3.

Table 3

Products	Exit,%	Content,%		Extraction, %		Expenses: g/t
		g/t	%	g/t	%	
		Copper	Sulfur	Copper	Sulfur	
Concentrate	1,35	26,7	35,25	83,5	16,8	SI 150
Tails	98,65	98,65	2,94	16,5	93,2	
Ore	100	0,40	3,15	100	100	

The new reagent is a collector of SI, allowing for the production of concentrates of higher quality with a lower yield. The flotation scheme included the operation of the II control flotation, and the loading of the SI was provided for the first re-cleaning. Thanks to this addition to the scheme, it was possible to reduce copper losses to a minimum.

As a result of the conducted research, a recommended scheme for flotation of copper ores with new reagents was developed, and a flotation concentrate with a yield of 1.55% was isolated, containing 26.7% copper and 35.25% sulphur while extracting 83.5% copper and 16.8% sulphur.

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