Conference Paper

Modified Collector: New Approaches

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Abstract

The process of complex raw materials is currently characterized by the fine-dispersed mineralogical structure and difficult structural characteristics complicating the flotation process. In this study, the processing methods for flotation of Aktogay deposits of copper-molybdenum ore were performed by using basic and modified agents. The properties of modified collector based on Kumkol deposit and diesel fuel were studied using the standard methods. The testing technology included the grinding of initial ore to a particle size of 65% of the class -0.074 mm, collective flotation to produce coarse copper-molybdenum concentrate, desorption, regrinding of the collective copper-molybdenum concentrate to 95% of the class -0.074 mm, selection of the collective concentrate. It was established that this application increased the extraction of copper/molybdenum concentrate by 3.8 % without loss of concentrate quality. This technology is applicable to mining and beneficiation enterprises processing molybdenum ores.

Keywords: copper, molybdenum concentrate, modified agent.

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The economy of Kazakhstan is based on the mining and metallurgical complex, which plays an important, and in a number of sectors, strategic role not only in Kazakhstan, but also in the world. In the technology for producing non-ferrous metals, the primary operation determining the degree of their extraction is flotation beneficiation. The flotation reagents used in the technological cycle are foreign origin, which results to the import dependence. Therefore the development of methods for producing of new flotation reagents based on domestic raw materials is an urgent task, which is intensified in light of the decrease in stocks of relevant raw materials.

In recent years interest in heteroorganic compounds of oil has grown substantially in terms of their use in the flotation of polymetallic ores [1–3].

Emulsified apolar reagents are especially useful for flotation of slimy minerals. New and effective methods with mechanical and especially ultrasonic emulsification can provide the preparation of stable emulsions having finely dispersed, uniform in particle size distribution. Their usage during flotation as collectors allows to reduce their consumption to a minimum. However oil application to the flotation process as apolar collectors increases the cost of the beneficiation process. In this regard it is necessary to find more cheap organic compounds, and their adding to oil would reduce its consumption without compromising the quality of the flotation properties of the final composition. In preliminary studies we showed that such cheap organic compounds can be heating oil and diesel fuel.

Kumkol oils are light, low-sulfur, low-paraffin, and light-curing ores. According to Infared measurement spectra it was found that normal and isostructure paraffin structures prevail in the studied samples. The presence of naphthenic and aromatic structures is detected. These compounds are contained in significantly smaller quantities than paraffin. There is no carbonyl group, oil is not oxidized [4, 5].

The oil of the Kumkol deposit contains (sulfur compounds), natural emulsifiers and affecting the stability of emulsions obtained for flotation beneficiation.

According to the data of physical and chemical studies the heating oil contains mainly aliphatic hydrocarbons, and aromatics in a much smaller amount whereas aromatic compounds predominate in diesel fuel as compared to heating oil.

For further research diesel fuel and oil of the Kumkol deposit were selected and mixtures were prepared on their basis to obtain the flotation reagents (see table below).

Emulsions of apolar reagents were prepared as follows: 50 ml of water and 1 ml of the initial reagent were poured into a cylinder with a stopper. Vigorously mixed on an ultrasonic disperser ”USDN-A1200T” company ”NPP” Ukrrospribor ”. It has been previously established that the optimal exposure time for ultrasound is 6 minutes. Immediately after receiving the emulsion, it was poured from a glass into a test tube to determine the time of separation into two phases. The experimental results are presented in table 1.

Table 1: The experimental results of determining the stability of the emulsion

№ p/p	Ratio of components	Stratification time, day
1	Modified Reagent 1: 1 (oil + diesel fuel)	3
2	Modified Reagent 1: 2 (oil + diesel fuel)	1
3	Modified Reagent 2: 1 (oil + diesel fuel)	6

From the data obtained it is clear that the longest time for separation of the mixture is observed for emulsion No. 3, consisting of one part of diesel fuel and 2 parts of oil, i.e. this emulsion is the most stable. However, from the point of view of production, this period is quite long, mixture No. 1 is more acceptable. The mixture No. 2 is least stable.

The surface tension of emulsions based on a mixture of oil from the Kumkol deposit and diesel at different pH values was determined by the Wilhelmy method [5]. From the data obtained (see table below) it is evident that the surface tension of emulsions

Table 2: Surface tension value

№ p/p	pH value	Concentration of emulsions, C %	The ratio of the mixture of oil and diesel fuel, σ, mN / m		
			1:1	1:2	2:1
1	pH – 6,0	0,5 1,0 1,5	56 68 67	51 63,5 63,5	48 60 65
2	pH – 8,0	0,5 1,0 1,5	55 69 70	52 66 63	42 58 62
3	pH – 10,0	0,5 1,0 1,5	54 68 69	58 66 68	48 63 67

Table 3: Closed cycle copper-molybdenum ore flotation results

Product Name	Output, %	Content%		Extraction%		Note
		Mo	Cu	Mo	Cu	
Cu concentrate	0.23	0.6	**20.0**	5.53	**63.25**	Basic technology (with kerosene) – 150 gram/tonna
Mo concentrate	0.056	**35.0**	5.0	**78.50**	3.85	
Tails	99.714	0.004	0.024	15.97	32.90	
Ore	100	0.025	0.073	100	100	
Cu concentrate	0.22	0.53	**21.0**	4.96	**63.23**	Modified Reagent 1: 1 (oil + diesel fuel) – 125 gram/tonna
Mo concentrate	0.054	**35.8**	3.6	**82.31**	2.66	
Tails	99.726	0.003	0.025	12.73	34.11	
Ore	100	0.023	0.073	100	100	

based on oil and diesel fuel, taken in a ratio of 2: 1, is lower compared to 1: 2 and 1: 1 at all pH values. With an increase in the concentration of modified flotation reagents in the emulsion, the surface tension also increases, and with an increase in pH, on the contrary, it decreases. The latter can be explained by the fact that the molecules of the tested emulsions lose their activity due to the deterioration of their dissociation in an alkaline medium.

Thus the results of surface tension measurements showed that the emulsion with a reagent ratio of 1: 1 and a concentration of 1% at a pH of 8.0 has the highest surface activity at the “liquid – gas” interface.

The enlarged laboratory tests of the technology for the selection of collective copper-molybdenum concentrate using a modified reagent MF were carried out. The testing technology included the grinding of initial ore to a particle size of 65% of the class -0.074 mm, collective flotation to produce coarse copper-molybdenum concentrate, desorption, regrinding of the collective copper-molybdenum concentrate to 95% of the class -0.074 mm, selection of the collective concentrate. The results of flotation in a closed cycle in comparison with the basic technology are presented in table 3.

Due to the process of processing copper-molybdenum ore using a modified reagent, a copper concentrate with a copper content of 21.0 % was obtained when extracting 63.2 % and a molybdenum concentrate with a molybdenum content of 35.8 % was extraction 82.3 %.

Thus the use of a modified reagent allows to increase the extraction of molybdenum in molybdenum concentrate by 3.8% without loss of concentrate quality.

References

[1] Crozier, R. D. (1984). Plant reagents. *Mining Mag*., vol. 151, issue 3, pp. 202-223.

[2] Cousin, Z. P. (1999). Intensification of Flotation of Lead-Zinc Ores using Heteroorganic Compounds of Oil as an Additional Collector. (PhD dissertation, Krasnoyarsk, 1999).

[3] Berkova, O. N., Levkovskaya, G. G. and Mirskova, A. N. (1997). Effective Reagents for Collective Flotation of Copper-Molybdenum Ores. *Journal of Mining Science*, vol. 33, issue 3, pp. 265-268. Retrieved from https://link.springer.com/.

[4] Karnaukhov, S. N., Dancer, S. S. and Vilkova, N. V. (2011). Molybdenum-Containing Ore Processing Technology. *Mining Journal*, issue 8-9, pp. 55-61. Retrieved from www.rudmet.kz.

[5] Tusupbaev, N. K., *et al*. (2012). Improving the Technology of Selection of Copper-Molybdenum Concentrate using Modified Teagents. *Complex of the mineral processing*, issue 3, pp.15-24. Retrirved from http://kims-imio.kz.