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Extraction of a Tungsten-Containing Product from the Left Tails of the Ingichin Factory

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ABSTRACT: In the Republic of Uzbekistan, special attention is paid to the mining and metallurgical industry, the development of improved technologies for the processing of tungsten-containing ores. In paragraph four of the fourth direction of the Strategy for the Further Development of the Republic of Uzbekistan "... Effective mechanisms to stimulate research and innovation, the use of scientific and innovative developments ..." important tasks are set. In this aspect, with an increase in the yield of valuable components and the intensification of the process, the additional extraction of tungsten during processing from the technogenic waste of the Ingichkin factory is important. The article proposes a technological scheme for the extraction of tungsten industrial products with a WO_3 content of up to 25-30% from industrial waste from the Ingichkinsky factory.

KEY WORDS: tungsten industrial product, jigging, scheelite, dump tailings, screw separator, concentration table.

I.INTRODUCTION

In modern conditions, requiring the expansion of the resource base of the Republic of Uzbekistan, ore mining is increasing and at the same time, the quality of the extracted minerals is changing. First of all, the content of the useful component decreases in them. Therefore, there is a development of technology for processing industrial waste from mining with the extraction of useful components from them.

Improvement of the processing technology of mineral raw materials, the use of more advanced methods and techniques, the selection of optimal technological schemes make it possible to economically justify from previously unpromising wastes cost-effective for processing. Over the years of independence, the total volume of waste, even with the most conservative estimates, has increased by at least ten times.

In addition, due to the departmental affiliation of the mining and processing enterprises, complex raw materials were processed only taking into account the necessary needs of the industry for a specific metal, which led to the irrational use of natural mineral resources and an increase in the cost of storing waste. Currently, more than 12 billion tons of waste has been accumulated, the content of valuable components in which in some cases exceeds their content in natural deposits.

II.SIGNIFICANCE OF THE SYSTEM

At the moment, a number of insoluble contradictions have been revealed between the change in the nature of the mineral resource base, i.e. the need to involve refractory ores and technogenic deposits in the processing, the environment is aggravated by the situation in the mining regions and the state of technology, technology and organization of the primary processing of mineral raw materials.

Issues of using wastes from enrichment of polymetallic, gold-bearing and rare metals have both economic and environmental aspects.

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An important component of the overall strategy of the ore industry, including tungsten, is the increase in the use of ore wastes as additional sources of ore-mineral raw materials, with a significant reduction in the extent of disruption of the geological environment in the region and the negative impact on all components of the environment.

The problem of processing the tailings of processing plants and the extraction of useful components from them with their subsequent use as secondary raw materials is one of the urgent. This problem has several aspects. Firstly, the metal extracted from the cake is much cheaper than the metal extracted from the ore as a result of a number of technical conversions. Secondly, after the extraction of metals from the cake, the latter can be useful to be disposed of.

III. LITERATURE SURVEY

The basis of non-waste technology is the development and implementation of fundamentally new technological processes that exclude any type of waste, various drainless technological schemes and water cycles based on effective cleaning methods, as well as the widespread use of waste as secondary raw materials.

An important problem of creating non-waste technology is its organizational principles, where a certain role is played by the choice of areas, the structure of units. In that regard, there is a positive experience of a number of enrichment enterprises, both foreign countries and CIS countries.

The Ingichkinskoye field is located in the southeastern part of the Zirobulak Mountains on the territory of the Kattakurgan region of the Samarkand region of Uzbekistan.

IV. METHODOLOGY

The terrain of the deposit area is relatively complex, weakly hill-ridden, cut by a series of anhydrous sais.

The enrichment plant is located on the prevailing elevations, which allows the use of lower-lying natural tanks under the tailing dump.

The results of chemical analysis and the mineralogical composition of stale tails are shown in table No. 1

Table 1
The chemical composition of tails Ingichki

Elements and oxides	Content %	Elements and oxides	Content %
SiO2	48,55	CO2	6,64
FeO3	14,70	S common	1,28
K2O	0,80	Mo	0,02
Na2O	1,20	As	0,01
CaO	18,95	Pb	footprints
MgO	2,21	Cu	0,02
Al2O3	3,96	Zn	0,001
TiO2	0,14	Amount	100,0
P2O5	0,11	FeO	10,42
MnO	1,40	SO3	0,15
WO_3	**0,066**	Loss on ignition	6,76

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The mineral composition of the tailings was determined according to the mineralogical analysis of the averaged sample and, using mineralogra- phy, from briquettes made of a sulfide product (foam product of flotation of a draft gravity concentrate).

The chemical composition of the samples was studied using quantitative X-ray fluorescence analysis on a PW-1404 instrument from the Dutch company Philips.

A known method of processing scheelite-containing tails in order to remove hazardous materials from them and process non-hazardous and ore minerals using an improved separation process.

A fine fraction of the tailings is subjected to screw separation with the release of the technological process into the secondary dump tailings of the bulk of the initial tailings. This allows you to dramatically reduce the burden on subsequent operations, capital costs and operating costs. The resulting tungsten product is subjected to purification on a screw separator to obtain a rough concentrate and tailings. The rough concentrate is refined on concentration tables to obtain gravity tungsten concentrate and tails.

Several series of experiments were carried out with the stale tails of the Ingichkinsky factory. Prepared 5 samples weighing 50 kg.

The first 2 experiments were carried out in an open cycle according to the following scheme:

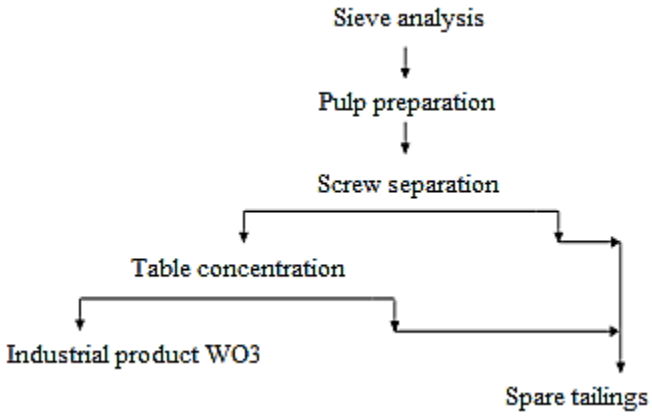

Fig.№ 1. The technological scheme of enrichment of the tailings of the Ingichkin factory by the gravitational method in an open cycle.

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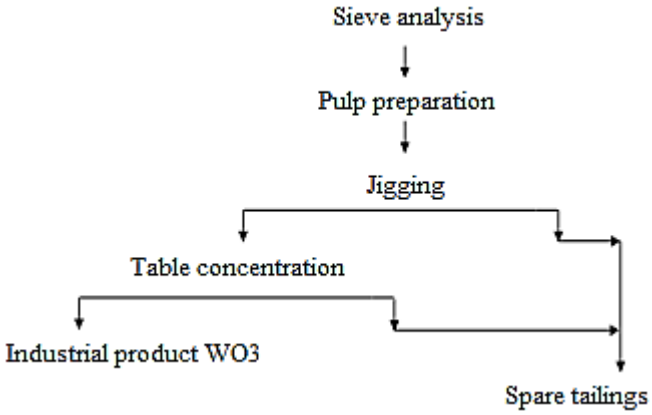

The following 3 experiments were also carried out in an open cycle according to the following flow chart:

Fig.№ 2. Technological scheme of enrichment of the tailings of the Ingichkin factory in an open cycle.

V. EXPERIMENTAL RESULTS

As a result, according to the technological scheme of Fig. 1, an intermediate product containing 6.6–9.8% WO_3 was obtained.

According to the technological scheme of Fig. 2 with cleaning, an intermediate product containing 11.52 -27.27% WO_3 was obtained.

When stale tailings are enriched by gravity methods on a jigging machine and on a concentration table with two cleanings, it makes it possible to obtain a tungsten intermediate product with a content of 28-30% WO_3.

The enrichment of stale tails on the screw separator and on the concentration table does not give the expected results. Thus, we offer enrichment of stale tails by the gravitational method on a jigging machine and on concentration tables with two cleanings.

The tests were carried out in the October-November month of 2019. During the tests in 24 hours, 300 kg of raw mineral raw materials were processed.

The dead tails of the Ingichkinsky factory (2-tail field) were enriched according to the recommended scheme on a depositing machine of the MOD-0.2 brand and on a concentration table SK-1 with cleaning.

When enriching the tailings of the Ingichkinsky factory according to the recommended scheme by gravity methods, initially on a jigging machine, then a tungsten intermediate product containing 27.27% WO_3 with 69.75% recovery was obtained on a concentration table with refining.

Table 2
The results of enrichment of the tails of the Ingichkin factory by the gravitational method on a jigging machine.

№	Product name	Output%	Content WO_3,%	ExtractionWO_3,%
I	Tungsten product	0.23	27.27	69.75
	Tails	99.77	0.31	30.25
	Source product	100.0	0.088	100
II	Tungsten product	0.2	24.6	61.3
	Tails	99.8	0.28	38.7
	Source product	100.0	0.073	100

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III	Tungsten product	0.21	26.6	63.0
	Tails	99.79	0.52	37.0
	Source product	100.0	0.088	100
IV	Tungsten product	0.19	22.3	64.8
	Tails	99.84	0.41	35.2
	Source product	100.0	0.067	100
V	Tungsten product	0.192	21.7	62.8
	Tails	99.808	0.44	37.2
	Source product	100.0	0.066	100

Table.3
The results of enrichment of the stale tails of the Ingichkinsky factory on a screw separator.

№	Product name	Output%	Content WO_3,%	ExtractionWO_3,%
I	Tungsten product	0.199	12.7	49.7
	Tails	99.8	0.73	50.3
	Source product	100.0	0.051	100
II	Tungsten product	0.18	9.2	51.2
	Tails	99.82	0.81	48.8
	Source product	100.0	0.033	100
III	Tungsten product	0.06	7.63	46.9
	Tails	99.94	0.74	53.1
	Source product	100.0	0.01	100
IV	Tungsten product	0.07	6.81	49.1
	Tails	99.93	0.49	50.9
	Source product	100.0	0.01	100
V	Tungsten product	0.08	6.09	47.3
	Tails	99.92	0.42	52.7
	Source product	100.0	0.01	100

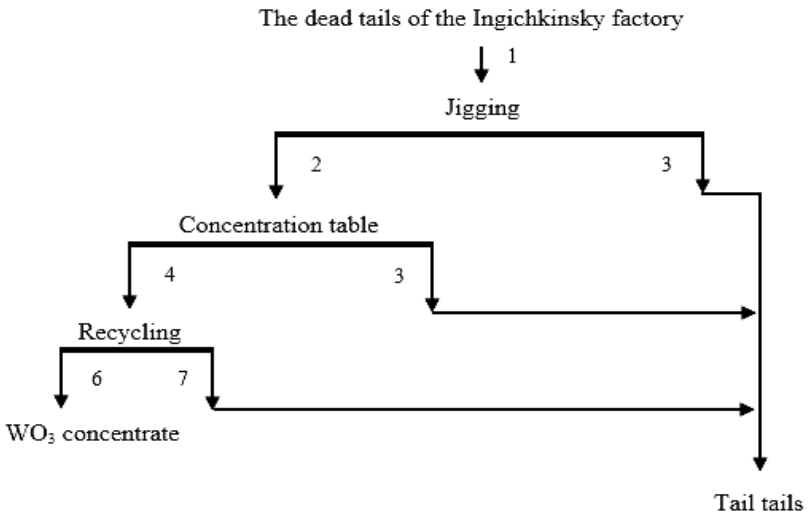

Fig. 3 Recommended technological scheme of enrichment of the tailings of the Ingichkinsky factory by the gravitational method.

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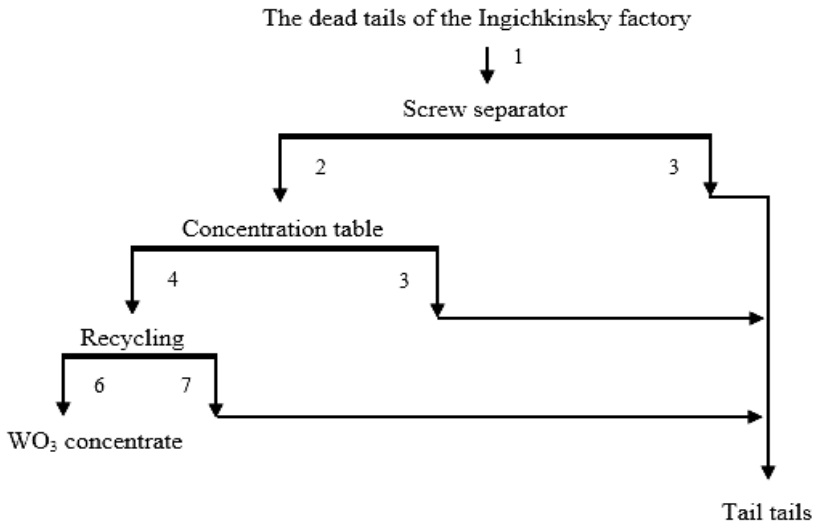

Fig. 4 Technological scheme of enrichment of the tailings of the Ingichkin factory by the gravitational method.

VI. CONCLUSION

The work provides a solution to the scientific and industrial problem: scientifically substantiated, necessary and definitely implemented effective technological methods for extracting tungsten from the stagnant tails of the Ingichkinsky factory.

The main results of the research, development and their practical implementation are as follows: The analysis of the current situation in the Republic of Uzbekistan with mineral resources of the ore industry, in particular, tungsten using the example of the dead tailings of the Ingichkin factory, shows that the problem of involving dead tailings in ore processing is relevant, having technological, economic and environmental significance.

The material composition and technological properties of the main W-containing technogenic formation of stale tails of the Ingichkinsky factory are established.

It is proved that the only effective and rational method for enriching the W-containing stale tails of the Ingichkin factory is the gravitational enrichment method.

An optimized technological scheme for the extraction of tungsten from their dead tailings at the Ingichkin factory made it possible to obtain tungsten concentrate and tungsten intermediate products, solved the problem of depleting the mineral resources of dead tailings at the Ingichkin factory, and reduced the negative impact of the enterprise's production activity on the environment.

The essential features of the developed technology for extracting tungsten from the stale tails of the Ingichki factory are:
- narrow classification by size of food of primary enrichment operations;
- Preferred use of gravity equipment.

During the semi-industrial tests of the developed technology for extracting tungsten from the stale tailings of the Ingichkin factory, a tungsten intermediate product with a WO3 content of 27.27-35% was obtained with 69.75% recovery.

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