BASED MIXES WASTE OF MINING AND METALLURGICAL INDUSTRY

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ANNOTATION
The article presents the optimal compositions and properties of backfill mixtures using waste rock sand, marble processing waste and copper smelting slag.

Keywords: Backfill mixture, optimal compositions, copper smelting slags, marble processing waste, additive, waste rock sand.

INTRODUCTION

The desire to increase the extraction of minerals from the subsoil, the creation of more favorable conditions for the separate extraction of multi-grade ores and the safety of underground mining predetermined the wide development of the development of deposits by systems with solidifying backfill of the mined-out space.

Analysis of the state of production of filling mixtures showed that the use of traditional calcium binders, in particular Portland cement, does not allow obtaining filling mixtures that fully meet the necessary requirements. The recommended ways to improve their physical and mechanical characteristics, as a rule, are associated with the need for significant overruns of the binder, the use of natural resources and technological methods that require additional labor and energy consumption [1, 2, 3, 4 and 5].

In this regard, scientists and material scientists are conducting research to improve the quality of the product and reduce the cost of using local raw materials and various industrial wastes in the production of filling mixtures to fill the mined-out area. Analysis of domestic and foreign literature has shown that in recent years, a new leap has taken place at ore mining facilities with backfill technologies. There is a tendency of increasing use for the preparation of hardening backfill as a binder and fillers of various wastes and by-products of the industry, primarily mining, fuel and energy and chemical.

The use of waste is beneficial from both economic and social points of view. Thus, compared with the use of natural raw materials, the costs of exploration, construction and operation of quarries are excluded, the costs of fuel, energy and transport are significantly reduced, the cost of mined ore and finished products is reduced, the land occupied for dumps is reduced, the raw material base of the building materials industry is expanding. , as well as the issues of environmental protection from pollution [6, 7].

Waste is generated in the production activities of the Almalyk Mining and Metallurgical Combine, which must be disposed of and create special dumps for storage.

Long-term scientific and technical cooperation of the AMMC with the Tashkent Institute of Architecture and Construction in solving the issue of rational use of the plant's waste and their use in filling mixtures for two decades has made it possible to significantly advance in solving this problem.

Earlier, for the plant, the compositions of filling mixtures were developed using fly ash from the Angren State District Power Plant, waste from the marble quarry "Kora-Khona", as well as mixtures based on a slag-alkaline binder, for which a patent of the Republic of Uzbekistan was obtained and regulatory documents were prepared [8, 9 and 10].

MATERIAL AND METHODS

At present, in connection with the completion of the marble quarry, problems have arisen to provide the combine with raw materials for the preparation of filling mixtures. To develop new optimal compositions of filling mixtures, the following types of waste generated at the plant itself were selected and studied:

- Waste rock sand obtained at the crushing plant at the Kauldy mine after the extraction of minerals. The limiting sand size is 5 mm;

- marble processing waste generated from the activities of the marble workshop of the combine. This additive is used as a plasticizer and reduces the abrasive properties of waste rock sand;

- slags of copper-smelting production, in the form of finely ground powder. Of the variety of metallurgical slags, copper-smelting and nickel slags are of no less interest for construction and the production of building materials. The general view of copper smelting waste is shown in Figure 1.

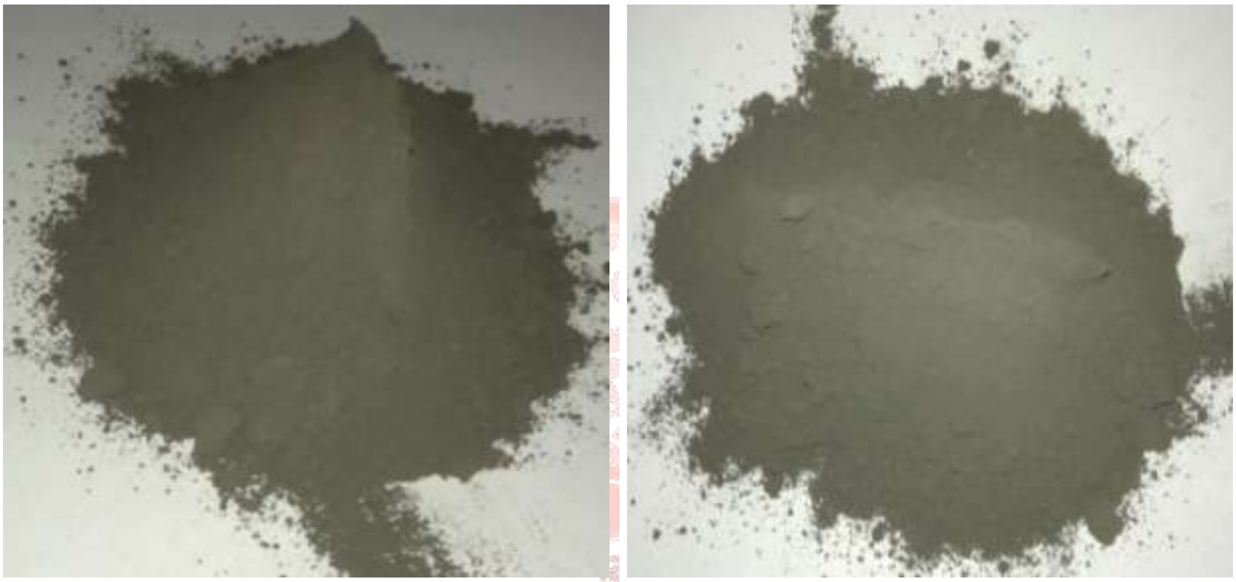

Figure 1. General view of copper smelter waste

It should be noted that the above wastes do not require additional technological processing and are used in their natural form.

RESULTS

The development of optimal compositions of filling mixtures was carried out using a mathematical method of planning an experiment, verified by a computational and experimental method, with further refinement in the manufacture of test mixes in laboratory conditions with testing the actual rheological and physical and mechanical characteristics of filling mixtures and solidified samples.

The test methodology for samples-cubes of filling mixtures based on waste with face sizes of 7 and 10 cm corresponded to the requirements of regulatory documents for conventional mortars. The test period for the cube samples was 28 days.

Waste of a marble quarry after processing on the classifier had a granulometric composition presented in table 1. The same table shows the grain size composition of rock sand.

Table 1 Granulometric composition of waste from a marble quarry and rock sand

Name	Private balances on sieves,%						Passed through a sieve 0.14	The amount of clay and dust particles	Size module
	5	2,5	1,25	0,65	0,315	0,14			
Waste from a marble quarry	0,15	15	15	25	16,5	18,5	9,5	07-09	1,7-1,9
Mountain sand	1,5	12,0	9,0	19,5	15,5	14,0	28,5	1,5	1,0-1,2

DISCUSSION

The results of the tests carried out for filling mixtures using waste rock sand, marble processing waste and copper smelting slags are shown in Tables 2, 3 and 4.

Table 2 Optimal composition of filling mixtures using waste rock sand for the Kauldy mine

Train numbers	Amount of materials per 1 m^3 of mixture, kg			Mixture mobility, cm	Average compressive strength, MPa
	Portland cement grade 400	Wasteland sand 5mm or less	Water		
I	100	1400	280	14-16	2,5
II	150	1400	280	14-16	4,0
III	200	1400	280	14-16	8,8
IV	250	1400	280	14-16	9,7
V	300	1400	280	14-16	13,5

Table-3 Optimal compositions of filling mixtures using waste rock sand and marble processing waste for the Kauldy mine

Train numbers	Amount of materials per 1 m^3 of mixture, kg				Mixture mobility, cm	Average compressive strength, MPa
	Portland cement grade 400	Wasteland sand 5mm or less	Waste from marble processing	Water		
I	100	1000	400	300	14-16	1,0
II	150	1000	400	300	14-16	1,5
III	200	1000	400	300	14-16	6,0
IV	250	1000	400	300	14-16	8,1
V	300	1000	400	300	14-16	11,5

When developing the technology for laying filling mixtures into the goaf, two schemes for the construction of artificial massifs were selected and tested:

- erection of artificial arrays using a homogeneous filling with a multi-strength (two-three-layer) filling mixture;
- erection of artificial massifs using a combined (rock-hardening) bookmark.

Table-4 Optimal compositions of filling mixtures using slags from copper smelting production and sand of waste rock

Components	Initial materials for 1 m^3 of mixture, kg			
	Compositions:			
Portland cement	250	200	150	120
Copper smelting slag	0	30	60	90
Sand of empty rock	1400	1400	1400	1400
Water	280	280	280	280
Average compressive strength, MPa (28 days)	12,6	12,1	11,4	9,2
Average bending strength, MPa (28 days)	2,24	2,1	1,9	1,6

CONCLUSION

The essence of the technology for the construction of a multi-strength filling array is as follows. In the treatment chambers (the shaft of the mine), the lower part is initially laid to a height of 1.5 - 3.0 m with the composition of the filling mixture, which ensures the standard strength of up to 1.0 MPa, in the last turn (the third layer), the upper layer is initially laid at a height of at least 0 , 5 m composition, providing standard strength 3-4.5 MPa. On average, the porosity of the filling mixtures is 18-21%. The density of the hardening fill was determined by weighing cubic standard specimens with face dimensions of 7 and 10 cm. It ranged from 1750 kg / m3 to 1830 kg / m3 [8, 11 and 12].

Analysis of the data obtained allows us to draw conclusions about the advisability of further research and use of the plant's waste for filling mixtures, since this expands the range of waste used, reduces the cost of mined ore and finished products, increases the strength indicators of filling mixtures, and also improves the environmental situation in the region by eliminating dumps.

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