GEOLOGICAL EXPLORATION OF THE TECHNOGENIC DEPOSIT - OLD FLOTATION TAILING PIT - BOR WITH THE POSSIBILITY OF LEACHING

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Abstract

Technogenic deposit of copper from the old flotation tailings pit - Bor was created by the deposition of flotation tailings that was created by processing ore from several ore bodies of the Bor copper deposits. The deposit of copper was explored with drilling from the surface. Research has established relatively low, evenly distributed contents of copper and gold. An experimental study of the leaching process of flotation tailings is done in the aim of valorization the present copper. The degree of copper leaching was about 60%, which is exactly the participation of oxide copper forms regarding to the total copper content of the flotation tailings.

***Keywords**: Flotation tailings, Bor, copper, leaching*

1. INTRODUCTION

Technogenic deposit of copper form the old flotation tailings pit in Bor was created by depositing material that remained after the flotation processing of the ore from the old Bor open pit and from the ore bodies that were excavated underground. Tailings were formed over a long period of time, since the beginning of the exploitation and processing of copper and gold ore, using different technological procedures, with different utilization of useful components, which means that a significant amount of copper and gold remained in them, which is probably possible to valorize.

2. GEOLOGICAL EXPLORATION OF THE TECHNOGENIC DEPOSIT - OLD FLOTATION TAILING PIT - BOR

The largest part of the material in the tailings was created by the exploitation of porphyry and massive sulphide deposits and ore bodies of copper and gold from the Bor, Veliki Krivelj, Cerovo and Majdanpek ore fields. Figure 1 shows the contours of the approved investigation area.

The tailings deposit is divided into two fields - Field 1 and Field 2. Based on geological documentation and made profiles, the thickness of material ranges from 25 m to 65 m. The entire area (Field 1 and Field 2) has an elliptical shape, and its area is about 0.6 km2 (Figure 2) [1].

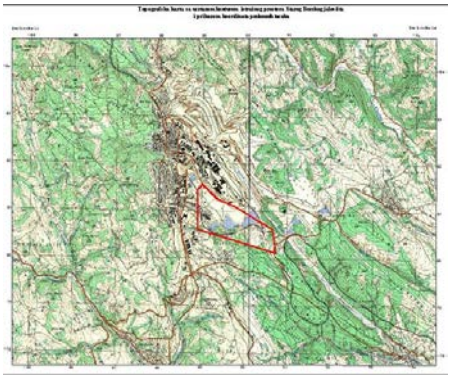

Figure 1 - Location of the research area Old flotation tailings pond Bor (red polygon).

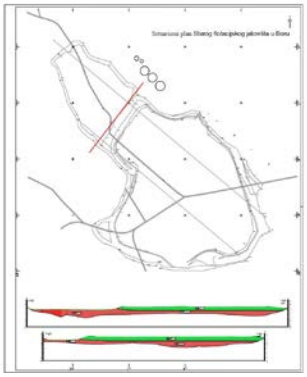

Figure 2 - Situational plan of the old tailings pit with longitudinal profiles.

3. APPLIED METHODS AND PROCEDURES OF MODERN GEOLOGICAL RESEARCH OF THE TECHNOGENIC DEPOSIT OLD FLOTATION PIT- BOR

For the subject of this work, the geological research conducted in the period 2018-2021 is particularly important. In addition, research was also carried out in order to obtain the necessary data for the recultivation of the area in question.

Sixteen drill holes were designed, in Field 2, with a total length of 500.7 m. The smallest depth of the drill hole is 10.0 m, and the largest is 63.5 m. The obtained results on the content and distribution of useful components obtained by chemical analysis were the basis for the spatial contouring of technogenic raw material deposits, as well as the determination of the quality and the calculation of the amount of technogenic raw mineral material.

Geological logging and photographing of the core was carried out by MMI Bor (Figure 3). The samples were analyzed in the MMI Bor laboratory. The sample for chemical tests was formed in this way, by taking the entire material of the core, 1 m long, for the sample. The preparation of the samples involved dividing one meter of the previously logged gore into two equal halves.

The technological tests gave good results regarding the utilization of copper from the flotation tailings.

Individual chemical analyzes of the samples included determination of the content of basic ore elements - Cu, Au and Ag.

Figure 3 - Core of technogenic raw material from the old flotation tailing pit - Bor

The distribution of copper and gold, as well as mercury and arsenic by samples are shown in the vertical profile of the characteristic drill hole B-14/2 (Figure 4).

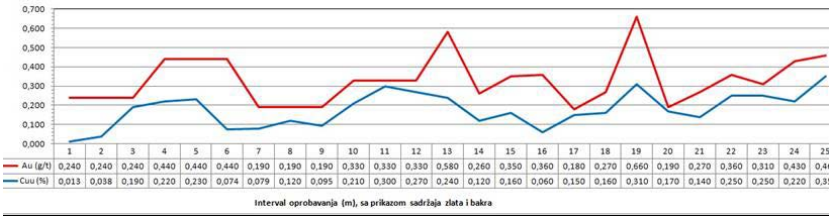

Figure 4 - The distribution of copper and gold

From Figure 4, it is possible to see that the distribution of copper and gold in the vertical profile of the analyzed drill hole is uneven with increases and decreases. It is important to know that elevated gold contents follow elevated copper contents, as well as that the gold contents are more unevenly distributed with more pronounced peaks. [1]

4. POSSIBILITY OF LEACHING

This study deals with the physico-chemical and mineralogical characterization of the flotation tailing pit and chemical characterization of the mine waste water from the accumulation 'Robule'. Technological composite samples (Table 1) are formed for laboratory testing of the leaching process of copper (Figure 5). The parameters of agitation leaching of flotation tailings with the mine waste water from the accumulation of 'Robule' were defined.

Table 1 - Chemical content of a composite sample of tailings

Element	Content, %	Element	Content. %
Cu	0.43	Au, g/t	<0.05
Cu, ox	0.18	Ag, g/t	0.8
Fe	16.56	Hg, g/t	0.2

Figure 5 - Composite sample of flotation tailings prepared for experimental testing

Leaching test and TCLP (Toxity Characteristic Leaching Procedure) test were carried out on a composite sample of flotation tailings. Experimental testing the leaching process of flotation tailings in order to determine the optimal parameters of copper extraction were performed on a laboratory scale. Samples from flotation tailing dump were treated by the agitation leaching method. The mine water from the accumulation Robule (mine waste water) was used as leaching solution,The highest degree of copper leaching of 56.21% was achieved at temperature of 80^{o}C. Based on the results of leaching, it can be stated that the time of development the leaching process has no significant effect on degree of copper. The highest degree of copper leaching of 56% was achieved in the following process parameters: temperature of 80°C, time 4 h and ratio S:L = 1:2.5. Solutions after leaching with copper content up to 1.5 g/dm3 are suitable for the SX-EW process.

5. CONCLUSION

Results of experimental laboratory testing of copper leaching from flotation tailings indicate that the highest degree of copper leaching was achieved in the following process parameters: time: 4

h, temperature: 80°C, ratio of solid: liquid is 1:2.5, pH of leaching solution: 1. The mine water from the accumulation Robule with correction of pH value was used as leaching solution, what presents a special contribution to solving the problems of use the integrated treatment of waste mine water and flotation tailings. This would be result both into economic and ecological effect by collecting the mine water, their recirculation in the controlled leaching process of mine waste.

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