

ADDITIONAL GOLD RECOVERY FROM TAILING WASTE BY ION EXCHANGE RESINS

The article describes the method of gamma activation analysis used to determine the gold content in rock samples using the «Aura» measuring complex, and also discusses the physicochemical basis of gold extraction in the process of cyanide leaching. A technology for extracting gold from solutions of tailings of tailings of hydrometallurgical plants of JSC «Navoi Mining and Metallurgical Plant» (NMMC) is presented. A technological scheme of an installation for extracting gold from tailing waste solutions is presented. The mechanisms of chemical reactions in the process of extracting gold from a tailings pond are described.

Concentrated sulfuric acid (98.3%) was added to the solution of tailing waste from the "pond" with $\text{pH} \approx 8.5$ and the acidity was adjusted to $\text{pH} = 3.3 \div 3.5$. The acidified solution was passed through chromatographic column No. 1 with an AM-2B anion exchanger weighing 2.0 g, through which 100.0 l of the "pond" solution was passed in dynamic mode at a speed of 3 ml/min, and through chromatographic column No. 2 with an anion exchanger VP-1P weighing 2.0 g passed 120.0 liters of tailings solution from the "pond" in dynamic mode at a speed of 3 ml/min. Then, qualitative and quantitative analysis of the saturated resin was carried out. It has been shown that in the dynamic mode of sorption of tailing waste solutions acidified to $\text{pH} = 3.3 \div 3.5$ through AM-2B and VP-1P ion exchange resins, gold is sorbed on ionite AM-2B up to 3.9 mg/g and on the VP-1P anion exchanger up to 1.5 mg/g (Table 1).

Table 1. Sorption of gold and base, alkali and alkaline earth metals on AM-2B ion exchanger from acidified tailing waste solutions.

Name of ion exchange resin Metals content in ion exchangers resin, mg/g

Au Ag Ni Cu Co Zn

AM-2B 3.9 0.22 0.12 0.05 3.2 0.78

VP-1P 1.5 0.08 0.12 0.05 2.6 0.15

Concentration of solution, mg/l

Pond tailing solutions 0.06 0.12 1.5 0.6 0.5 0.4

From table 1 it can be seen that at $\text{pH} = 3.3 \div 3.5$ gold is quantitatively sorbed on the AM-2B anion exchanger (3.9 mg/g), and on the VP-1P anion exchanger up to 1.5 mg/g [1]. At the same time, the capacity of the AM-2B anion exchanger exceeds the capacity of the VP-1P anion exchanger by 2.6 times. The VP-1P anion exchanger is completely saturated with gold and impurity metal cyanides, and the AM-2B anion exchanger is 45% saturated, because the total capacity of the AM-2B anion exchanger is 8.7 mg/g.

An aqueous technical solution of ammonia (25%) with a volume of 15.0 l was added to the tailings solution of the "pond" with a volume of 100.0 l and passed through a chromatographic column No. 3 with an AM-2B anion weighing 2.0 g in dynamic mode at a speed of 3 ml/min. Then, qualitative and quantitative analysis of the saturated AM-2B resin was carried out. The experimental results of the study showed that if an aqueous solution of ammonia is added to the alkaline solution of the tailings, then gold is sorbed on the AM-2B anion exchanger up to 3.0 mg/g in dynamic mode (Table 2.)

Table 2. Sorption of gold and base, alkali and alkaline earth metals on AM-2B ion exchanger from ammonia solutions of tailing waste.

Name of ion exchange resin Metals content in ion exchangers resin, mg/g

resin Au Ag Ni Cu Co Zn

AM-2B 3.0 0.25 0.13 0.08 3.0 0.8

Concentration of solution, mg/l

Pond tailing solutions 0.06 0.12 1.5 0.6 0.5 0.4

Thus, if the tailings solution is acidified with sulfuric acid or neutralized to a slightly alkaline medium with an aqueous solution of ammonia, in both cases the cyanide complex $[\text{Au}(\text{CN})_2]^-$ is not destroyed, because the cyanide complex of gold has a stability coefficient $\log K_{\text{Au}(\text{CN})_2} = 2 \cdot 10^3$ and gold is quantitatively sorbed on AM-2B [2].

References

1. Khudaibergenov U., Khodiev Yu., Ashrapov U.T. Method for extracting gold from solutions. Patent of the Republic of Uzbekistan No. IAP 04314. 2006. 3 p.
2. Minutes of meeting No. 118 on laboratory tests of a method for extracting gold from tailing solutions of the GMP-2 "pond" of the Central Laboratory of Gamma Activation Analysis of JSC NMMC. Zarafshan. 1995. 2 p.

Section

Radiation ecology and methods of analysis (Section 3)

Primary author: ASHRAPOV, Ulugbek (Institute of Nuclear Physics of Academy Sciences of Republic Uzbekistan)

Co-authors: Dr MALIKOV, Shavkat (Institute of Nuclear Physics of Academy Sciences of Republic Uzbekistan); Prof. SADIKOV, Ilkham (Institute of Nuclear Physics of Academy Sciences of Republic Uzbekistan); Dr MIRZAEV, Bakhodir (Institute of Nuclear Physics of Academy Sciences of Republic Uzbekistan); Prof. BOZOROV, Erkin (Institute of Nuclear Physics of Academy Sciences of Republic Uzbekistan)

Presenter: ASHRAPOV, Ulugbek (Institute of Nuclear Physics of Academy Sciences of Republic Uzbekistan)

Track Classification: The V International Scientific Forum “Nuclear Science and Technologies”: Radiation ecology and methods of analysis (Section 3)