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RESEARCH OF MOLYBDENUM EXTRACTION TECHNOLOGY FROM MOLYBDENUM – CONTAINING WASTE

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ABSTRACT

This article discusses the advantages and disadvantages of modern technologies for the extraction of molybdenum, rhenium, copper, iron and rare metals, as well as an analysis of traditional technologies for processing molybdenum solid industrial waste and waste solutions.

Key words: *molybdenum, sludge, magnetic separation, waste, sorption, reagent, molybdenum extraction.*

АННОТАЦИЯ

В данной статье рассмотрены преимущества и недостатки современных технологий извлечения молибдена, рения, меди, железа и редких металлов, а также проведен анализ традиционных технологий переработки молибдена в твердые промышленные отходы и отработанные растворы.

Ключевые слова: *молибден, шлам, магнитная сепарация, отходы, сорбция, реагент, извлечение молибдена.*

INTRODUCTION

The advantages and disadvantages of today's technologies for extracting of molybdenum , copper, iron, and rare metals are studied, also traditional technologies molybdenium industry solid waste and waste solution processing are analyzed.

Literature analysis shows that ion exchange technologies for extracting molybdenum from man-made solutions have been considered, methods for increasing the degree of separation of molybdenum have been studied, also studied foreign technologies of nitrate acid processing of molybdenum from solid waste. The results of the analysis of the literature determine that the research of methods for

accelerating the processes of sorption of molybdenum with the participation of highly effective resins is one of the urgent tasks.[1]

DISCUSSION

Objects of research on the formation of solid and liquid waste were identified, materials on chemistry and mineralogical composition-research object and analysis, based on the data of chemical and mineralogical analysis, research methods were developed for extracting valuable components from solid waste and industrial sewage, and a sequence of works was developed for each experiment, that's is to say, magnetic separation test of puff pastry, selective transfer of molybdenum, copper and other structural metals to solution, copper deposition from solution, sorption and extraction of molybdenum and rhenium from stored solutions and a sequence of processes was developed for their disposal using abandoned solutions.

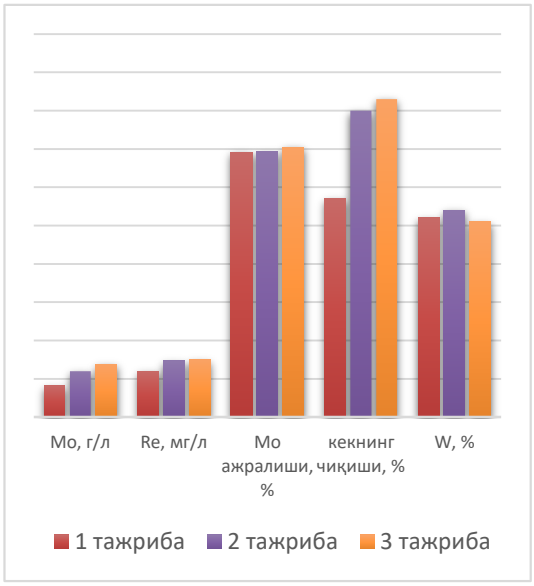
RESULTS

Experiments on the enrichment of suspension cake magnetic method are carried out on the laboratory sorter in a continuous mode at the strength of the magnetic field of 360 ka / c.When performing the work, the following parameters are variable: sorting duration (5, 10, 15 minute), S:L ratio=1: 1, 1:2, 1: 3, fever(20, 30, 40 0C).[2]

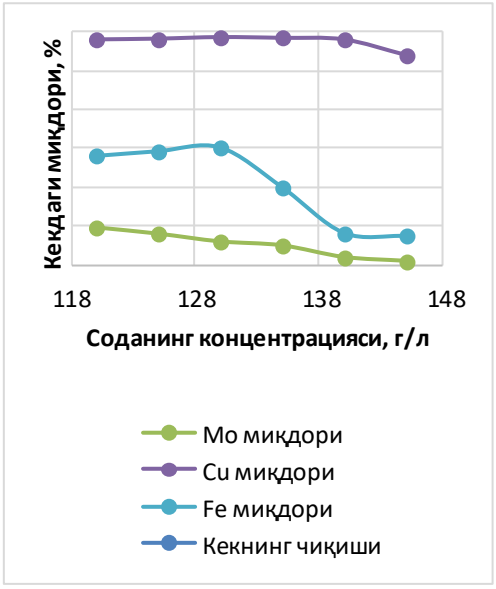
The results of experimental tests in which it was shown that magnetic separation of sludge-cake and enrichment of molybdenite, as well as treatment of applewood semi-finished product containing 12-15% sulfide iron with nitric acid oxidizes trivalent iron to the hydrated oxide form by 95.0-98.0% are presented. In addition, the puff cake contains large amounts of ferromolybdenite, which retains 30% of the iron hydroxide.Studies have shown that, since oxides and hydrated iron oxides have a low magnetic property, this is the basis for separating iron from the contents of the sludge kek. Studies have found that large amounts of iron can be transferred to enrichment using aqueous magnetic separation with the addition of magnetic particles and PAA(polyacrylamide) [3]

Images 3-4 show the results of phase 2 selective smelting experiments on the extraction of molybdenum and other expensive components from magnetic separation waste. From the pictures it can be concluded that the output of the kek is correctly proportional to the amount of Na2CO3 in the solution.

Figure 4 shows that when the concentration of soda was from 125 g/l to 135 g/l, there was a significant change in the process, that is, the output of the kek increased from 57.14% to 81.2%.

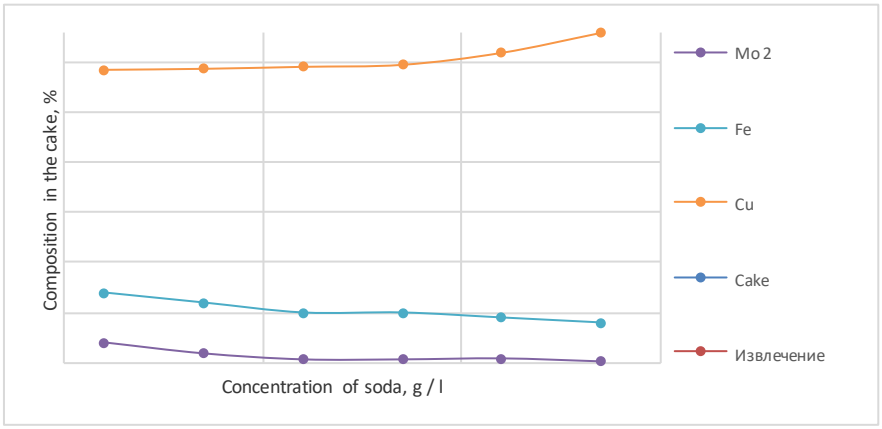


pic. 1. The graph of the dependence of the obtained product, cake yield and moisture on the concentration of soda



pic. 2. Soda Concentration on the Selective Dissolution Process (for Stage 2 Selective Dissolution)

Wash: With 1.48% molybdenum, 90.0 g of the second stage kek was loaded into a laboratory reactor with a mixer for washing q:S=1:5, and after two-stage washing, 4.2÷ 6, 2 g/l molybdenum, 32.0÷9.0 g/l of soda 1.52 liters of washed water were obtained. The output of the washed cake was 70.0, humidity 48,0 %, composition (%): Mo 1,2, Re 0,016, MoS2 0,48, Fe 1,7, Cu 3,93. The degree of separation of molybdenum into the washed solution was 56.3. Molybdenum separation from abandoned kek to solution as a result of two-stage selective melting and kek washing was 79.9 % 6 (**pic. 2**).



pic. 2.Effect of Soda concentrate on the selective dissolution process (Stage 2 for selective smelting)

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Figure 5 shows that when the concentration of soda was from 125 g/l to 135 g/l, there was a significant change in the process, that is, the output of the kek increased from 70% to 86%.

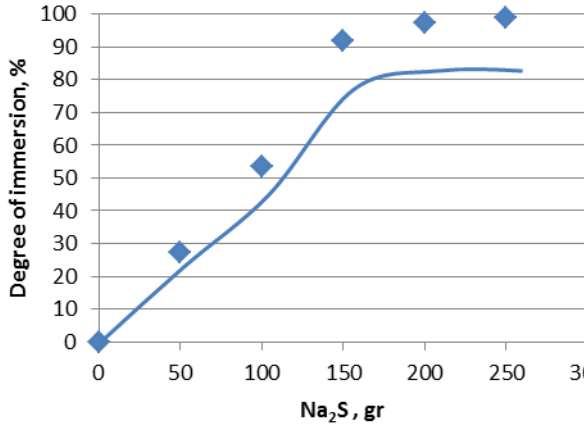
From Figure 3 and Figure 4, we can conclude that the important result of changing the process parameters is observed when the soda concentration changes in the range of 120÷135 g/L.

Later, the process of sorption of molybdenum and rhenium from mixed solutions in ion – exchange resins A – 100 (Mo) and A-170 was studied.

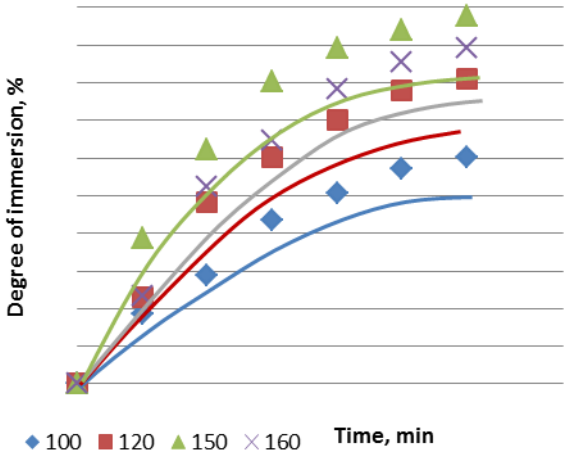
The proximity of the results of laboratory studies and experimental-industrial tests confirms that the developed technology of selective melting of two-stage soda with washing of the kek provides the transition of molybdenum to a solution of up to 89.3÷ 90.1%, while its content is 18.0-22.0 g/l molybdenum, and the taking kek contains 1.0 ÷ 1.03% molybdenum. The resulting kekk was found to contain copper (3.5÷3.9 %), gold 50.0 g/t, silver 84.0 g/t and it serves as a secondary raw material to extract useful components such as gold, silver, copper. It was found that the amount of rhenium in the solutions obtained during the selective thawing process is up to 670.0 mg/l.[6]

The abandoned solutions of the magnetic separation of the puff pastry are known to be the same in chemical composition as the abandoned solutions of the slurry field, because the slurry is separated from the same solution. The study of methods for extracting molybdenum, rhenium and other valuable components should be carried out from mixed solutions of a poof pastry field, abandoned solutions of magnetic separation of iron and current waste of molybdenum production, which produces ITB. The extraction of molybdenum, rhenium, copper, gold and silver from these solutions is of industrial importance. It is known that for the extraction of molybdenum and rhenium in these solutions, a harmful element is copper in the form of copper-sulfate. Theoretical and laboratory studies were carried out on the purification of abandoned solutions from copper. The methodology of the experiment of cementing copper from abandoned solutions is as follows: the density of the solution is obtained by polishing from d=1.15 g/dm3 to d=1.18 g/dm3, a laboratory reactor with a voltage of 5 l is injected with 3 liters of polished abandoned solution and to precipitate copper, 1-2 times sodium sulfide is added in the stoichiometric required amount, mixed in 60-80℃ temperature, a precipitate of copper sulfate is formed in the solution, and with the help of filtration, the precipitate is separated from the solution.

Picture 6 and picture 7 show the results of laboratory studies on the purification of abandoned solutions from copper. We can see that with the increase in sodium sulfide consumption, the rate of copper deposition increases, and the na2s consumption reaches 96% when it is 250 gr. Also, in laboratory tests, the effect of copper deposition time using sodium sulfide was studied, and the maximum copper deposition rate was achieved within 2 hours. As for the optimal method of settling (cementing) copper from abandoned solutions: The Na2s consumption is not less than 1.5 times the stoichiometric amount of copper deposition, at a temperature of 60℃, 30 minutes. In the built-in mode, the rate of deposition of copper from the solution reaches up to 95.8%.



pic. 3. Dependence of the degree of copper deposition from an abandoned solution on the effects of na2s consumption



pic. 7. Dependence of copper deposition from an abandoned solution on mixing time

An enrichment with 22.4% copper is obtained in the composition. It was found that solutions purified from copper contain 6.0 Cu; 86.6 Mo; 9.1 Re; 59.95 Fe (mg/l). The technical characteristics of the developed sorption technology of the resulting TMA and AMG are presented in Table 4.

Table-4

Chemical composition of TMA and PMA samples obtained as a result of the experiment

Pointer name	The norm						
	Ts 00193950-083:2018		ГОСТ 2677-78	Experience number			
Mass fraction	Type-1	Type-2		№1	№2	№3	№4

Molybdenum anhydride (MoO3), not less than %	76	74	78	67,33	83,66	92,87	91,17
Iron (Fe)%, no more than	0,03	0,2	0,007	0,0025	0,004	0,017	0,007
Aluminum (Al)%, no more than	0,005	0,04	0,005	0,0014	0,0014	0,0018	0,0017
Nickel (Ni)%, no more than	0,001	0,001	0,005	0,001	0,001	0,011	0,0037
Manganese (Mn)%, no more than			0,01	0,001	0,001	0,001	0,001
Silicon (Si)%, no more than	0,05	0,3	0,01	0,006	0,005	0,008	0,004
Calcium (Ca)%, no more than			0,004	0,006	0,003	0,005	0,005
Magnesium (Mg)%, no more than	0,001	0,001	0,0015	0,004	0,002	0,0036	0,0026
Arsenic (As)%, no more than	0,003	0,003	0,003	0,002	0,002	0,002	0,002
Phosphorus (P)%, no more than	0,002	0,002	0,002	0,002	0,003		

CONCLUSION

Laboratory experiments and experiment-in tests carried out on industrial machines, it was found that the most effective and high-selectivity molybdenum sorbent from the solutions under study is the "Purolite" brand A-100 (Mo) sorbent and the "Purolite" brand A-170 resin for the sorption of rhenium.

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