NORANDA RESEARCH CENTRE

LEACHING TESTS ON A MOLYBDENITE CONCENTRATE

Progress Report No.1.

Tests performed by R. N. Page
Report written by P. H. Jennings

Project N-121-6

28 April 1971

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LEACHING TESTS ON A MOLYBDENITE CONCENTRATE

Progress Report No.1

Introduction

Leaching tests on a molybdenum concentrate were requested by Mr. H. L. Ames(1) on 1 April, 1971, on behalf of Kerr Addison Mines Limited. The concentrate is routinely leached for 8 hours at ambient temperature in a solution containing 4-10% calcium chloride and 3.5% hydrochloric acid (37% basis). The object of the leach is to remove lead to a level of 0.02% but it is understood that there is a problem in attaining the desired results. It was suggested by Mr. Ames that, in addition to the standard leach used in the plant, the experiments should include (a) leaching in the same solution at higher temperatures, (b) leaching in solutions containing a higher acid concentration, (c) leaching with oxidizing agents, and (d) the Brenda leach.

Sample

A 25-lb. sample of molybdenum concentrate was received on 15 April 1971. It contained 26% moisture (wet basis) and a dried sample was found to contain 0.36% lead. This sample was taken when the Nokes Reagent had been temporarily cut off from the flotation circuit(2).

Test Procedure

Leaches were performed on 700-g. charges (210 g. concentrate, dry basis, 490 g. solution) at a pulp density of 30% solids. Lumps of concentrate were broken up before being introduced into the beaker. The slurry was agitated vigorously with a glass turbine. Any foaming (which was not severe) was controlled by adding a few drops of a 10% solution of Monawet Mo-70 defoamer. Slurry samples were filtered and washed on the filter by several applications of dilute hydrochloric acid (1% of 37% strength) and finally with distilled water. At the end of the test the remaining slurry was treated in the same way. The dried solids were analyzed for lead by atomic absorption spectroscopy.

Results

The results are given in Table I.

Although the final level of lead concentration attained varies from one experiment to another, the results show a certain similarity in that lead is removed rapidly in the first 1 - 2 hours, thereafter reaching a constant level. In all experiments except No. 5, which is the Brenda leach, the final lead concentration is above 0.02%. In the Brenda leach this level was attained within the first hour, which suggests that the desired results may be attainable under less severe conditions when the leaching time is several hours.

TABLE I

EXPERIMENTAL RESULTS

Expt. No.	Percent Solids	Solution Composition, %			Temp., °C	Lead Content (%) After Leaching for the Following Times (hrs)						
		$CaCl_2$	$FeCl_3$	37% HCl		1	2	3	4	6	7	8
2	29	3.4	-	3.4	25	-	0.12	-	0.16	0.08	0.085	-
1	29	3.4	-	3.4	50	0.095	0.065	0.065	0.07	-	-	-
6	30	4.0	-	3.4	100	0.06	0.04	0.04	0.04	-	-	-
3	30	-	-	10.2	25	-	0.10	-	0.07	0.08	-	-
7	30	10.0	-	3.4	25	-	0.04	-	0.06	0.06	-	0.06
4	30	4.0	4.0	1.65(1)	25	-	0.11	-	0.11	0.085	-	-
5	30	30.0	10.0	-(2)	100	0.02	0.02	0.02	0.02	-	-	-

(1) HCl added to give pH = 0.5

(2) Solution pH = 0.4

The leaching conditions must, however, be more severe than those normally employed for this concentrate, and this means that one or more of the following factors must be intensified:

1. Temperature
2. Calcium chloride concentration
3. Hydrochloric acid concentration.

The effect of temperature is summarized in Table II.

TABLE II

EFFECT OF TEMPERATURE ON FINAL LEAD CONCENTRATION

Temp., °C	3.4% HCl (37%)	
	3.4 - 4% $CaCl_2$	10% $CaCl_2$
25	0.085	0.06
50	0.065	
100	0.04	

It is possible that the desired level of 0.02% lead might be attained at 100°C in a 10% $CaCl_2$ solution. Failing this, an increase in calcium chloride concentration to 15 on 20% might be successful.

The results obtained so far provide no evidence that ferric chloride assists in dissolving the lead.

Future Work

The estimated expenditure of $500 on this project has been reached, but further tests can be carried out as soon as approval is received, with a view to finding the minimum leaching conditions that will give the desired results.

References

1. Ames, H. L., letter to Dr. W. H. Gauvin, 1 April 1971.
2. Hopland, N., letter to Dr. W. H. Gauvin, 2 April 1971.

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LEACHING TESTS ON A MOLYBDENITE CONCENTRATE

Progress Report No.2.

Tests performed by R. N. Page

Report written by P. H. Jennings

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LEACHING TESTS ON A MOLYBDENITE CONCENTRATE

Progress Report No.2.

Introduction

Following the earlier work on the leaching of the molybdenite concentrate(1) approval was received on 3 May 1971 for a few additional tests(2). The object of the additional tests was to study the effect of intensifying the calcium chloride - hydrochloric acid leach and to try out alternative reagents.

The tests were performed on the original sample of concentrate containing 0.36% lead, and the procedure was the same as that described in the first progress report.

Results

The first two tests in Table I show the effect of intensifying the leach in calcium chloride - hydrochloric acid. Both tests were done at 75°C. In one (No.8) the calcium chloride concentration was raised from the value of about 4% in the earlier tests to 20%, and the pH was adjusted to 0.5 by the addition of 0.52% concentrated hydrochloric acid. The results were very poor, the lead content being lowered only to 0.20%. Using 10% calcium chloride and 10% concentrated hydrochloric acid, the required lead content of 0.02% was closely approached after two hours.

The efficacy of sodium chloride as a substitute for calcium chloride was tested in two identical experiments (No. 9 and 13), using a solution containing 3.5% sodium chloride and 3.5% concentrated hydrochloric acid, at 100°C. The result of the first test was promising, but it was not reproduced in the second test.

After the first test using sodium chloride it appeared to be worthwhile to try using sea-water in order to reduce the reagent cost still further. This proved to be unsuccessful, with or without hydrochloric acid; the lead content was lowered in the first two hours, but then increased again. The reason for the increase is suspected to be the precipitation of lead iodide by the small iodide content of sea-water.

Conclusions

The results of all thirteen tests suggest that the temperature is the most important factor in lowering the lead content. Hydrochloric acid is probably the only essential reagent, but the substitution of calcium chloride for

part of the acid is permissible and, moreover, desirable in that it lowers the vapour pressure of HCl over the solution and should therefore limit the losses of this reagent when operating at high temperatures. It is not possible to state the best leaching conditions, but the limited number of tests suggest that the minimum conditions for lowering the lead content to 0.02% are as follows:

$CaCl_2$	10%
HCl (37%)	10%
Temp.	75°C
Time	2 hours

References

1. Leaching Tests on a Molybdenite Concentrate, Progress Report No.1, Noranda Research Centre, 28 April 1971.

2. Ames, H. L., telephone conversation with P. H. Jennings, 3 May 1971.

TABLE I

EXPERIMENTAL RESULTS

Expt. No.	Percent Solids	Solution Composition, %				Temp. °C	Lead Content (%) After Leaching for the Following Times (hr.)						
		$CaCl_2$	NaCl	Sea Salt	37% HCl		1	2	3	4	5	6	7
8	30	20	-	-	0.52*	75	0.21	0.20	0.20	-	0.20	-	-
10	30	10	-	-	10	75	-	0.025	-	0.025	-	0.04	0.015
9	30	-	3.5	-	3.5	100	-	0.025	-	0.025	-	0.012	0.035**
13	30	-	3.5	-	3.5	100	-	0.07	-	0.07	-	0.06	-
11	30	-	-	3.5	3.5	100	-	0.09	-	0.12	-	0.15	-
12	30	-	-	3.5	-	100	-	0.29	-	0.34	-	0.38	-

* HCl added to give pH = 0.5

** Repeat analysis 0.05