

SHORT COURSE

Copper Oxide Heap Leaching Testwork and Scale-Up



Presented by

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May 2022



HEAP IRRIGATION USING DRIPPERS



Copper Oxide Ore Heap Leaching Testwork & Scale-up

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Notes:

1. Sprays are also commonly used for heap irrigation.

SCOPING PHASE: SAMPLE SELECTION (CONT.): QUANTITIES PER POT

SAMPLE QUANTITIES-SCOPING STAGE			
Leaching Program (For 3 Crush Sizes)	Number of Tests	Sample Weight Per Test Kg	Total Weight Kg
Head Analysis	1	5.0	5.0
Size x Size Analysis @ 3 Crush Sizes	3	5.0	15.0
Bottle Roll Leach Tests @ 3 Grades	3	1.0	3.0
Percolation tests	see notes		88.1
Mini-Column Tests @ 12.5, 25, 50 mm	3		75.4
Supplementary tests (if required)			63.5
Total			250.0
Total if no agglomeration needed			150.0
Physical Tests	Number	Sample Weight Per Test Kg	Total Weight Kg
Abrasion Index	2	3.0	6.0
UCS	2	5.0	10.0
Total			16.0



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Notes:

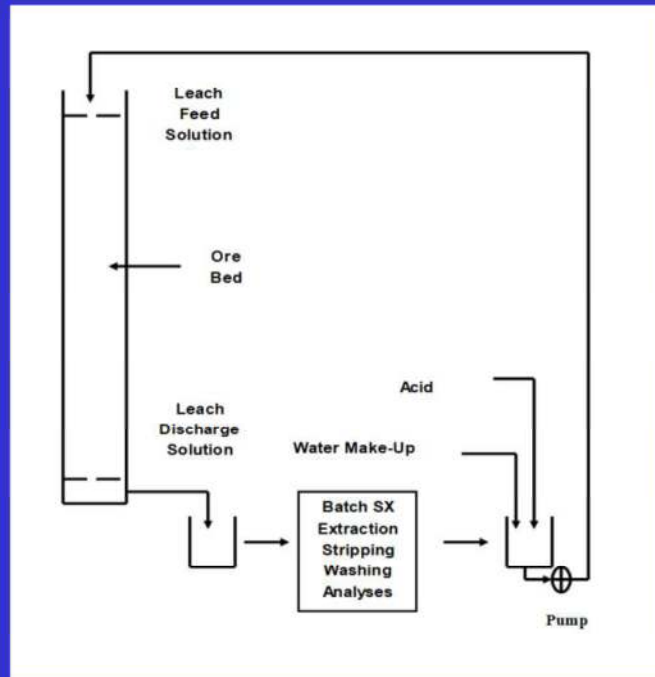
- Sample quantities below for mini-column and percolation tests are based on 1.6 crushed ore bulk density. A correction factor should be applied if the bulk density (BD) is different (i.e. multiply weight by BD/1.6).
- Details of column dimensions and sample charge weights given in table below:

CALCULATIONS						
	Crush Size mm	Ratio Diam/Size	Diameter mm	Bed Height m	BD	Weight
Percolation	12.5	8	100	0.5	1.6	6.3
	25	4	100	0.5	1.6	6.3
	50	4	200	0.5	1.6	25.1
Total						37.7
Mini-Columns	12.5	8	100	1	1.6	12.6
	25	4	100	1	1.6	12.6
	50	4	200	1	1.6	50.3
Total						75.4
Short Columns	12.5	8	100	2	1.6	25.1
	25	4	100	2	1.6	25.1

It is envisaged that the 1 m high columns to be used for the subsequent mini-column leach tests will be used for the percolation tests. However, a 75 mm diameter column could be used for the 12.5 mm crush size to reduce the sample requirement. The short 2 m columns are for the Prefeasibility Phase testwork.

- The number of percolation tests will depend on the ore characteristics. It is suggested that enough sample be available to carry out 5 tests at 12.4 mm crush, 5 at 25 mm, and 1 at 50 mm. The corresponding quantity is
 $5 \times 6.3 + 5 \times 6.3 + 1 \times 25.1 = 88.1 \text{ kg}$.
- If the material has no clays and few fines, the program could be reduced to 1 test each for the 12.5 and 50 mm crush sizes, reducing the sample requirement to 12.6 kg for the percolation tests.
- The coarsest crush size (50 mm) should be used when splitting samples for the test program.

**PREFEASIBILITY
PHASE:
SHORT COLUMN
LEACH OPTIMIZATION
TESTS FOR EACH OTC
(CONT.)**



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Notes:

1. The column are fed on a daily solution batch basis.
2. For each daily batch of leach solution, the volume, pH, Eh, and temperature are determined, and the solution is analyzed for Cu, Fe (total), Fe (ferrous), and free acid. These figures are used for controlling and monitoring the leach conditions, and leach performance.
3. The SX operation is on a manual batch basis. The leach solution is first mixed with organic to extract copper.
The mixture is allowed to separate into two layers, then the organic is removed and stripped on a manual batch basis by mixing with strong acid solution containing 180 g/L H₂SO₄ in potable water. The resulting solution is analyzed for copper and total iron, which provide useful checks on the overall column copper and iron balances.
4. The stripped organic is washed twice with potable water to remove residual strong acid. This prevents acid from being inadvertently transferred into the leach solution during the next SX operation, which would distort the acid balance.
5. Water is added to the leach solution to restore the correct volume, and acid is added ready for the next leach cycle.
6. Initially, the SX operation is needed daily. As the leach cycle proceeds, it can be less frequent as the amount of copper leached is progressively reduced. Guidelines for the organic composition can be obtained from the extractant suppliers.