

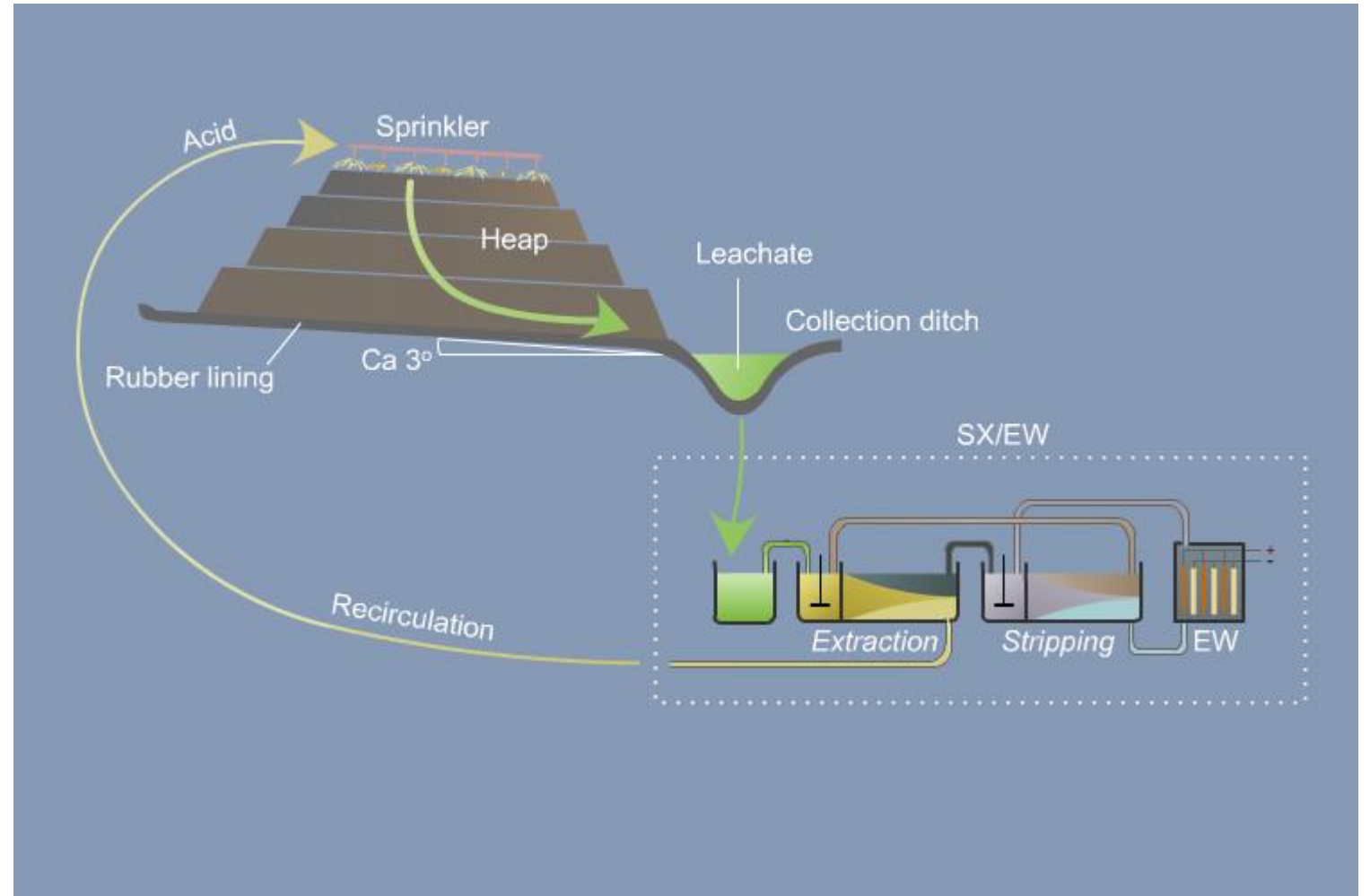
Copper Heap Leaching & SX-EW Slideshow

What is heap leaching & SX-EW?

A method used to recover pure copper (Cu) from copper oxide minerals (ie. cuprite, Cu_2O).

Overview

Heap leaching & SX-EW is a method of extracting pure copper from oxide ore by placing the crushed ore on a pad in a heap and spraying the leaching solution, sulphuric acid, over the heap. The acid trickles through the heap and dissolves the copper mineral into solution. The leach solution collects at the bottom of the pad in a collection pond. It is then piped to a SX-EW plant where first, the metal is extracted from the leach solution using special solvents, then the pure metal is recovered by electrowinning.



Location

First step in creating a heap leach is choosing a suitable location. It's important that the pad is built on gently sloping ground to facilitate the drainage and collection of the copper-bearing solution. The site can vary from a few 100m² to an entire valley. In some deserts the pads are built up like mesas and blend into the natural landscape.



Ground Preparation

The ground is first compacted by a layer of sand. A layer of clay is added on top of the sand to protect the impermeable plastic liner, from being damaged by the abrasive sand particles. The plastic liner extends beyond the toe of the pad, lining a collection pond which captures and stores the copper-bearing solution that seeps through the heap and drains away from the pad.



Ore Stacking

Broken or roughly crushed ore from the mine pit is conveyed to the site, and stacked in big heaps on the pad. The ore is not ground up in order to minimize the amount of fines in and maximize the permeability of the heap.



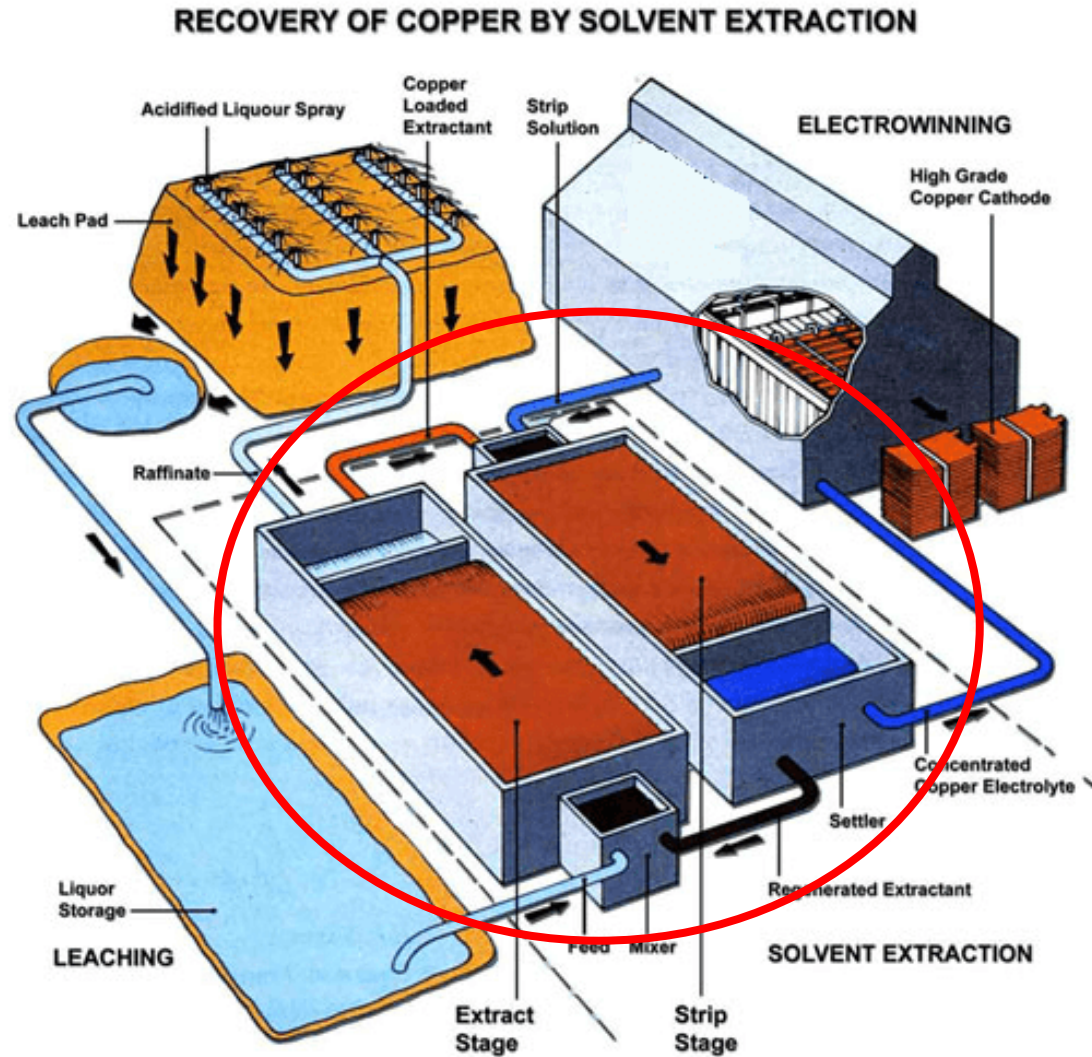
Leaching

A leaching solution of weak sulphuric acid is sprayed over the rock on the pad and allowed to percolate through to the base. As the solution passes through the heap, the copper-bearing mineral dissolves into solution. The copper-bearing solution accumulates in the collection pond and is piped to a nearby SX-EW plant for metal recovery.



Solvent Extraction (SX)

In the SX-EW plant, the copper-bearing acid solution from the collection pond is mixed with water and an organic solvent that preferentially binds to the copper ions. This mixture is allowed to settle and separate. The organic copper-rich portion floats to the top, and the metal-free portion falls to the bottom. This step is called solvent extraction (SX).



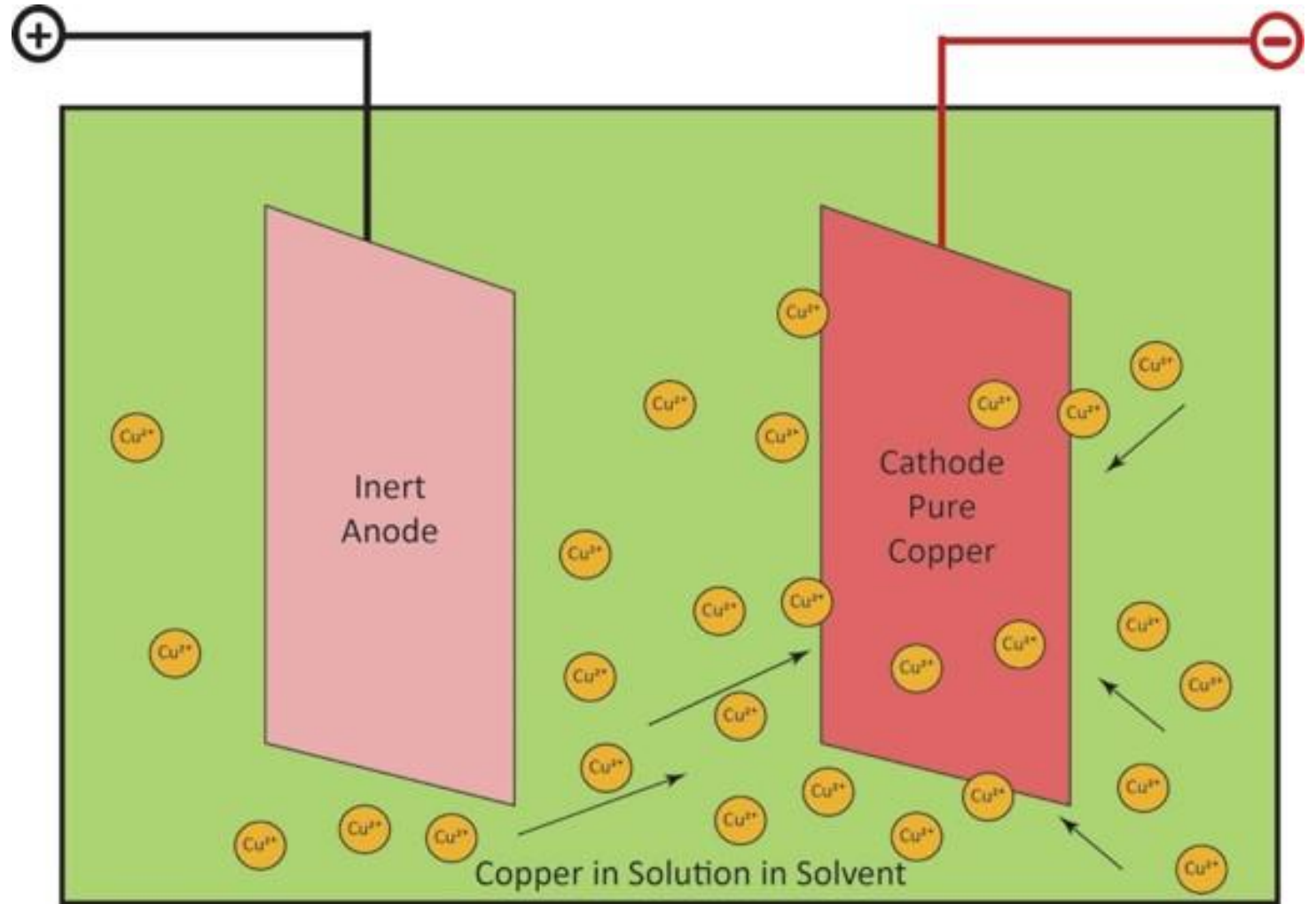
Copper Sulphate Solution

Next, the organic copper-rich solvent is mixed with strong sulphuric acid. The acid causes the metal ions to unbind from the organic solvent. The organic solvent is recycled back to the SX phase. The new *copper sulphate solution* is piped into an electrowinning (EW) tank.



Electrowinning (EW)

Large electrodes are inserted into the copper sulphate solution in the EW tank and hooked up to a power source. The anode plates (+) are made of lead, and the cathode plates (-) are made of steel. As an electric current passes through the copper sulphate solution, it causes the positively charged copper ions (Cu^{2+}) to plate onto the negatively charged steel cathodes.



Cathode Copper

The electrodes are left in the copper sulphate solution, continuously plating out the copper until there is none left; this may take a week.

The *cathode copper* (99.99% pure) is peeled from the steel cathode and sold to market for manufacture into a variety of goods.

