

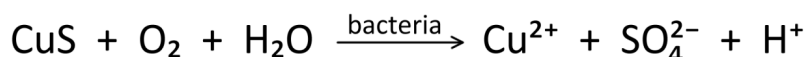


Bioleaching

What is bioleaching? Bioleaching is using bacteria to extract metals from their ores.

When is this used? It's used on low grade ores when other methods of extracting the metal aren't cost effective.

How does it work? Bacteria break down minerals in ores and release metal ions into a solution. The equation below shows an example of bioleaching occurring. This process produces a solution of metal ions called a **leachate**.



The copper ions can be extracted as copper metal by either electrolysis or by displacement reaction. Displacement reactions are much cheaper as we usually use iron to displace copper and iron is much cheaper than copper.

What are the advantages of bioleaching?

1. It's cost effective – it's relatively cheap as it doesn't need much energy for the reaction to take place. If electrolysis is used this will increase the cost though.
2. It doesn't need high temperatures – we don't have to heat the metal ore in order to extract the metal.

What are the disadvantages of bioleaching?

1. It is a slow process – it can take a long time for the bacteria to break down the metal compounds into ions.
2. Toxic products – bioleaching can produce acidic pollution and other toxic compounds which can damage the environment if they are not disposed of correctly.

Phytomining

What is phytomining? Phytomining is the process of using plants to extract metals from their ores.

When is this used? It's used on low grade ores when other methods of extracting the metal aren't cost effective.

How does it work? We plant some plants in a field. Let's say we plant a crop of wheat in a field. We then wait for the crop to grow and we harvest it when it's ready. While the crop was growing, the plant was absorbing metal ions from the soil to make its structures. After we harvest the crop we get the straw and burn it.

After it has been burned we are left with a metal rich ash. We can then do other chemical reactions such as using acids or electrolysis to extract the metals.

What are the advantages of phytomining?

1. **It's cost effective** – as we don't have to heat the metal to extract it. The costs of it are very low.
2. **Land cleaning** – phytomining can be used to remove toxic metal ions from soils if they have become contaminated due to pollution or accidents.
3. **Environmental** – phytomining is more environmentally friendly than normal mining which can cause damage to ecosystems and habitats as well as leading to pollution.

What are the disadvantages of phytomining?

1. **Slow** – as we have to wait for the plants to grow this process can take quite a long time.
2. **Depends on the plants growing well** – if the plant doesn't grow well or dies this will affect how much metal compounds that we get at the end of the process.
3. **Low yield** – phytomining produces a low yield for metal compounds compared to normal mining.