

MECHANISM OF BIOLEACHING

1. DIRECT BIOLEACHING:

In this bioleaching, bacteria directly oxidize minerals and solubilize metals.

In direct leaching, a physical contact exists between bacteria and ores and oxidation of minerals takes place through enzymatically catalysed steps.

Example; pyrite is oxidised to ferric sulphate



INDIRECT BIOLEACHING: In this type of bioleaching, bacteria produces the strong oxidizing agent such as ferric ion and sulfuric acid on oxidation of soluble iron or soluble sulfur respectively.

For indirect bioleaching , acidic environment is absolutely essential in order to keep ferric iron and other metals in solution.

Acidic environment maintain by oxidation of iron, sulfur, metal sulfides or by dissolution of carbonate ions.

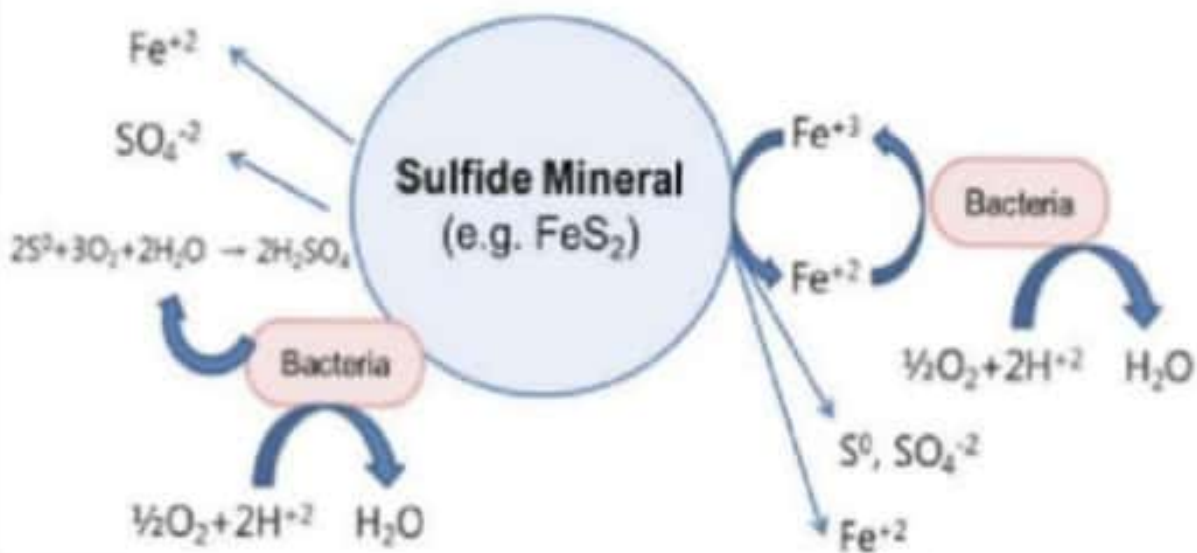
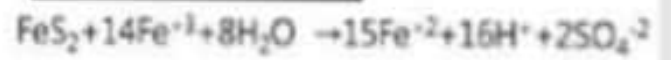
Ex; bioleaching of uranium



Direct mechanism



Indirect mechanism





Bioleaching plant in Tasmania, Australia.

Bacterial attachment on metal surface

Biobleaching of metal sulfides is caused by diverse group of bacteria.

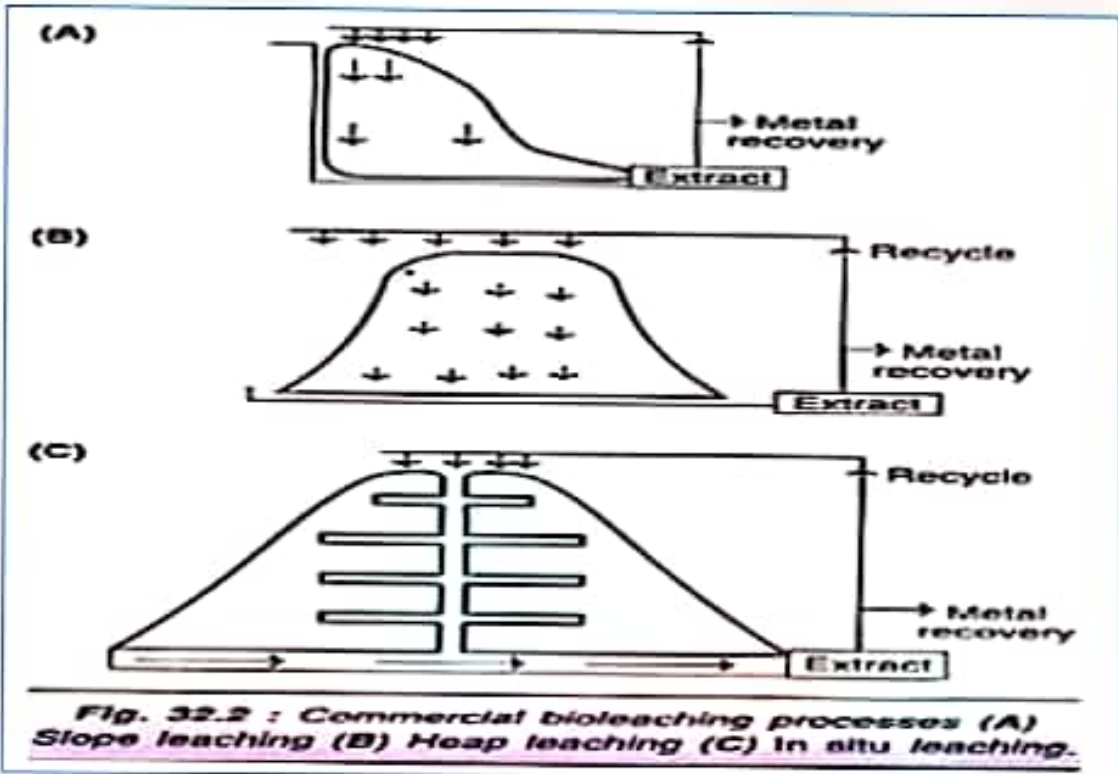
The direct mechanism requires the attachment of bacteria to the sulfide surfaces.

In case of thiobacilli, bacteria secretes exopolymer that facilitates attachment of bacteria to a metal surface, thus enhancing the leaching rate.

Commercial process of bioleaching

Naturally occurring mineral leaching is very slow. The microbial bioleaching process can be optimized by creating ideal conditions (temperature, pH, nutrient, O₂ and CO₂).

- Slope leaching.
- Heap leaching.
- In- situ leaching.



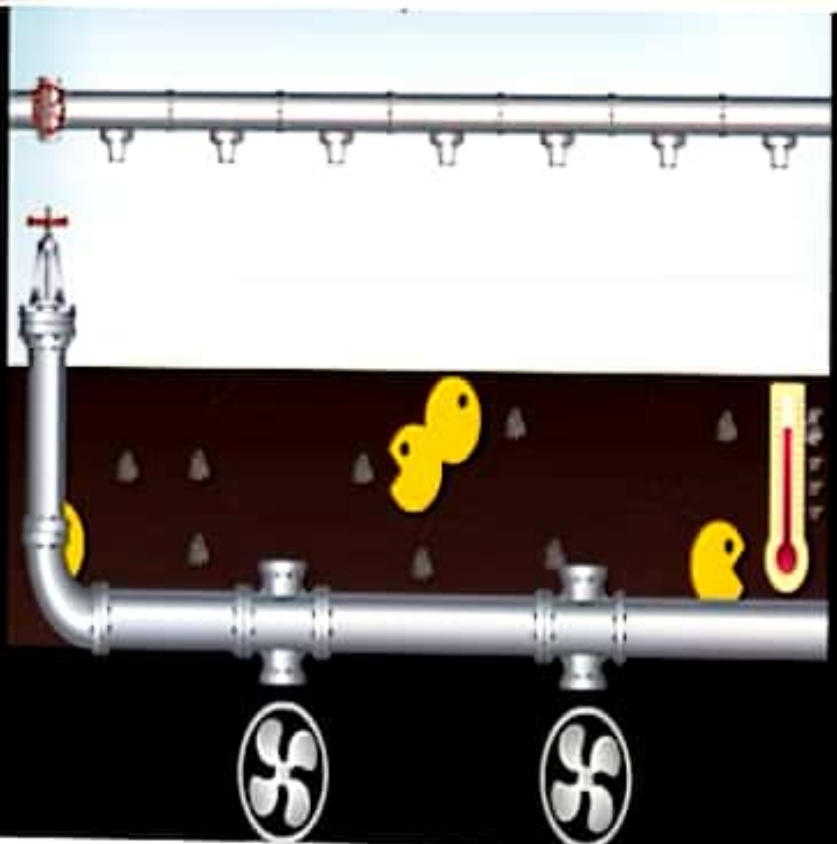
SLOPE LEACHING

In slope leaching the ore is finely ground and kept in large pile in a slope which is subjected to continuous sprinkling of aqueous solution of microorganisms. The liquor collected at the bottom of the ore is processed for metal recovery.

HEAP LEACHING

- In heap leaching the ore is arranged in heap and goes through the same treatment such a in slope leaching.
- The aqueous solution containing microorganisms works on the heap of ore and produces the leach liquor.
- The leach liquor is used for metal recovery.

HEAP LEACHING



IN-SITU LEACHING

- In situ leaching ore is subjected to bioleaching in its natural occurrence.
- Aqueous solution of microorganisms is pumped through drilled passages within the ore.
- The leach liquor collected at the bottom of the ore used for the metal extraction.
- The permeability of rocks is increased by blasting of rock.
- As the acidic water seeps through the rock, it collects at the bottom which is used for metal extraction.
- This water can be recycled and reuse.

IN-SITU LEACHING

