MAIN FACTORS AFFECTING ON BIOLEACHING...

Nutrients: Bacteria used for metal extraction are chemolithoautotrophs (inorganic compounds). Mineral nutrients obtained from environment and from material to be leached.

O_2 and CO_2:
For good growth of organisms adequate amount of oxygen is require. In laboratory this can be achived by aeration, stirring, shaking.

PH:
Adjustment of correct PH is required for the growth of leaching bacteria. It is necessary for the solubilization of metals. PH values in range of 2.0- 2.5 are optimum for bacterial oxidation of ferrus iron and sulphide.

Temperature:

Optimum temperature for ferrous iron and sulfide oxidation by T. ferrooxidans is 28-30 degree c. At low temperature decrease in metal extraction occure.

At high temperature thermophilic bacteria can be used for leaching purpose.

Surfactants and organic compounds:

Surfactant used and organic compounds used in extraction have inhibitory effect on leaching bacteria due to decrease in surface tension.

ADVANTAGES OF BIOLEACHING

- Simple.
- Inexpensive.
- Recovery of metals from low grade ore.
- To extract refines and expensive metals which is not possible by other chemical processes.
- Employed for collecting metals from waste and drainages.
- No poisonous sulfur dioxide emission as in smelters.
- No need for high pressure or temperature.
- Ideal for low-grade sulfide ores.
- Environment friendly process.
- It is ideally suited for developing the countries.

DISADVANTAGES OF BIOLEACHING

- The heat create from the dissolving process can kill the bacteria.
- Time consuming(6-24 months or longer).
- Low yield of minerals.
- Requires a large open area for treatment.
- High risk of contamination.

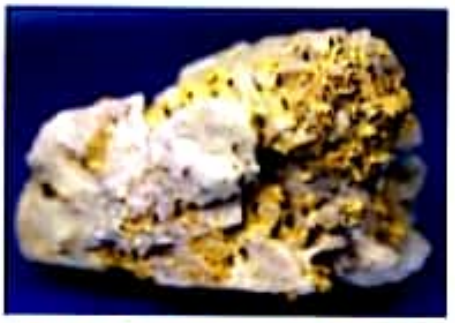
BIOLEACHING OF SOME MEATALS

GOLD:

- Gold ores: Calaverite($AuTe_2$), Sylvanite(Ag.Au)Te_2, Petzite(Ag_3AuTe_2).
- Gold cannot be extracted from low grade sulfidic ores.
- Iron and sulfur acidophilic bacteria are able to oxidise certain sulphidic ores. Thiobacillus ferrrooxidans is used in process.
- Gold ore first pretreated by roasting or pressure oxidation.

$$4Au + 8NaCN + 2H_2O + O_2 \longrightarrow 4NA(Au(CN)2) + 4NaOH$$

$$2Na(Au(CN)_2) + Zn \longrightarrow Na(Zn(CN)_4) + 2Au$$



COPPER

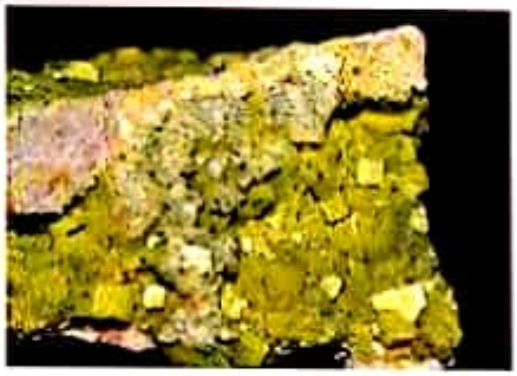
- Copper ores: Calcopyrite($CuFeS_2$), Chalocite(Cu_2S), covellite(CuS).
- Copper ore is low grade ore.
- In bioleaching of copper , the action of acidithiobacillus involves the oxidation of CuFeS2.

$$CuFeS2 + 4O2 \longrightarrow Cu2+ + Fe2+ + 2SO^{2-}_4$$

URANIUM

- Uranium ore: Uraninite or pitchblend (UO_2), Brannerite(UTi_2O_6).
- It is a low grade ore
- Converted to leachable form by oxidation with ferric ion.
- Acidithiobacillus ferrooxidans used for oxidation.

- $UO_2 + Fe(SO_4)_3 \longrightarrow UO_2SO_4 + 2FeSO_4$



OPERATING COST

- Oxidation process include the major categories of power, reagents, services and labor.
- Metal extraction is only the purpose of this process. However, low grade contamination with dissolved metal and salt can be observed.
- It is simple technology that's why does not require significant instrumentation or sampling to provide high metal recovery.
- Bioleaching process reduce the operating cost.

FUTURE DEVELOPEMENT

- Extraction of many metal will be possible by this method. At present bioleaching is being used only for recovery of copper, uranium, gold.
- This process will become important for other metals like zinc, nickel,cobalt and molybdenum not only for extraction but also for environmental clean-up.
- Pilot scale test work shows extreme thermophiles achieved efficient bioleaching of primary copper sulfide and nickel copper sulfide concentrates yielding higher than those achieved by bioleaching with either mesophilic condition.