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Economic tailings rehabilitation

The disposal of toxic mine tailings is one of the most-discussed environmental issues in the mining industry due to its costly treatment and its ability to easily develop into an environmental hazard. A solution for these leftover materials is a clean and cheap solution called bioleaching.

Summary:

Tailings are mine wastes left over when mineral concentrate are removed. Tailings are usually content about 10% to 20% of the economic minerals that could not be recovered from ore. Conventional means for recycling tailings are both costly and may in themselves lead to environmental pollution, for example the use of chemical leaching, usually by way of strong acids at high temperatures requires both expensive machinery and chemicals. it also produce chemical by products, for example strong acids are produced which must also be disposed of.

As mining techniques and price of minerals improve, along with the growing level of environmental awareness, it is economical and sensible for tailings to be reprocessed using new method to recover additional mineral. Bioleaching provides an alternative to more traditional physical-chemical methods. Bioleaching, also known as Bacterial oxidation technology, is the process of using bacteria to dissolved metal instead of chemical solution.

Bioleaching produces less pollution and little damage to geological formation, since the bacteria occur there naturally. This simple, cost effective method offer a smart choice for some certain areas and particular kind of metals.

1.Overview

The Australia economy is heavily dependent on mining and as a result there are several millions of tons of mine wastes are disposed annually, representing a serious potential for environmental pollution and public health hazard. In addition to the impact of mine sites, the cumulative impact of multiple sites within a historic mining district often has the potential to impair uses of local surface and groundwater. These waste rocks contain insufficient minerals to process economically, typical these wastes rocks and tailing are hauled from the site to waste dumps, tailing dams or erodable dump. A number of environmental impacts may occur at an abandoned mine site: acid drainage, air emissions and soil contamination.

It is necessary for Australia mining companies to adapt a new method to rehabilitate and eliminate mine wastes' impacts on environment, but also profitable. Tailings are usually content about 10% to 20% of the economic minerals that could not be recovered from ore. As mining techniques and price of minerals improve, along with the growing level of environmental awareness, it is economical and sensible for tailings to be reprocessed using new method to recover additional mineral. Bioleaching provides an alternative to more traditional physical-chemical methods.

2.What is Bioleaching?

Bioleaching, also known as Bacterial oxidation technology, employs the use of naturally occurring bacteria, harmless to both humans and the environment, to liberate precious and base metals from difficult to treat ores, concentrates and tailings. Recoveries of metals have been fairly high using bacteria, over 90% of the metal content in ore can be recovered. In addition, bioleaching can solve most of mine closure's impacts on environment in a cost-effective way compare to traditional methods.



3. Why bioleaching is an environmental friendly and cost effective treatment ?

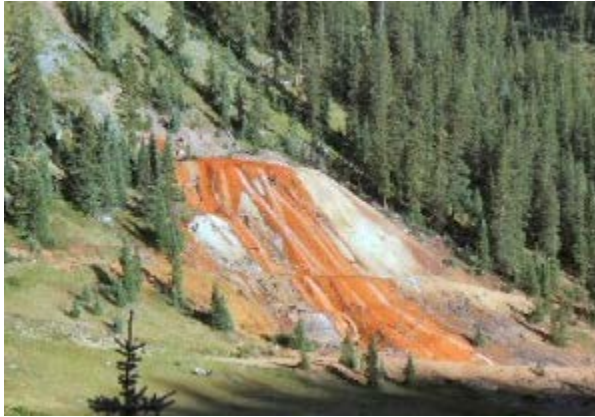


Photo 1: Acid Drainage in Red and Bonita Mine (EPA USA)

Acid Drainage is the biggest problem from hard rock metal mining, commonly referred to as Acid Rock Drainage. Acid Rock Drainage is not only the major contributor to loss of aquatic habitat and water pollution, but also decrease the overall profit of mining companies due to its costly treatment. Mine lands often contain un-mined material deposits, waste rocks, mine tailings which is high in concentrations of metal sulfides. When oxygen containing in rain water, stream water, and ground water comes into contact, chemical oxidation reactions occur which liberate the bound metals into solution and lower the pH of the receiving water. These metals contaminants once dissolved can move from operating sites to local ground and surface water and render surface water and groundwater useless as drinking water or aquatic habitat. A report by the Australian Government indicated that rehabilitation costs for acid drainage affected sites using traditional methods are likely to be in excess of A\$100,000 per hectare, excluding the cost of treating water from mine workings. In order to lower the cost of rehabilitation, a more economical treatment can be practiced by using bioleaching instead of smelting or roasting. Bioleaching can be an effective method for treating Acid Mine Drainage through the oxidation of sulfides, which are responsible for leaching metals into surrounding areas. As opposed to 'band-aid' solutions that treat contaminated water and soils indefinitely, bioleaching acts as a 'cure' by targeting the source, the sulfides in tailings, and thus preventing future acid generation from occurring.



Photo 2: Acid drainage after using bioleaching method.

Air emissions (vaporized zinc, arsenic, cadmium and greenhouse gasses). gaseous emissions are emitted during roasting or smelting. Metals such as zinc, arsenic, mercury and cadmium are metal that will vaporize when heated. These metals have detrimental impacts on the environment, for example zinc is phytotoxic at high concentration. Using bioleaching can eliminate air pollution as the process of bacteria liberate metal out of the ore occur naturally without using machinery.

Bioleaching produces less pollution and little damage to geological formation, since the bacteria occur naturally. This simple, cost effective method offer a smart choice for some certain areas and particular kind of metals.

4. Summary the strengths of bioleaching

Environmental

- The bacteria are naturally occurring and harmless to the environment and human health
- Prevention of future Acid Mine Drainage through sulphide neutralization
- Toxic heavy metals, like arsenic, are converted into stable, environmentally benign products
- No gaseous emissions (e.g. SO_2, As_2O_3)

Economic

- Revenues through the recovery of contained metals -- Au, Ag, Cu, Ni, Zn, Co, Pb
- Local opportunities for work, training, development and the start of a new 'green' industry
- Lower cost than the alternatives (e.g. pressure oxidation) and requires less capital

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