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Precious Metal Recovery

Abstract

Conventional biological methods have focused on the recovery of precious metals using sulfur-oxidizing bacteria. Bacteria are used as biological agents to recover precious ore values. Following treatment with the bacteria, the ore is leached to cause the dissolution of the precious metal in the ore. A conventional process includes the steps of distributing a concentrate of refractory sulfide minerals on top of a heap of material, biooxidizing the concentrate of refractory sulfide minerals, leaching precious metal values from the biooxidized refractory sulfide minerals with a lixiviant, and recovering precious metal values from the lixiviant. Global BioSciences, Inc.® has developed a technique to recover precious metals using alkane enrichment.

Background

Precious metal ores such as gold ores can be categorized as either free milling or refractory. Free milling ores are those that can be processed by simple gravity techniques or direct cyanidation. Refractory ores, on the other hand, are not amenable to conventional cyanidation treatment. Such ores are often refractory because of their excessive content of metallic sulfides, e.g., pyrite, and/or organic carbonaceous matter.

A large number of refractory ores consist of ores with a precious metal such as gold occluded in iron sulfide particles. The iron sulfide particles consist principally of pyrite and arsenopyrite. Precious metal values are frequently occluded within the sulfide mineral. For example, gold often occurs as finely disseminated sub-microscopic particles within a refractory sulfide host of pyrite or arsenopyrite. If the gold remains occluded within the sulfide host, even after grinding, then the sulfides must be oxidized to liberate the encapsulated precious metal values and make them amenable to a leaching agent.

Problems exist using sulfur-oxidizing organisms in bioleaching processes. These problems include nutrient access, air access, carbon dioxide access, the generation of sulfuric acid from reactions of the sulfur-oxidizing bacteria, and the generation of heat during the exothermic biooxidation reactions that can kill growing bacteria. Ores that are low in sulfide or pyrite, or ores that are high in acid consuming materials such as calcium carbonate or other carbonates, may also be problematic during heap biooxidation processes. The acid generated by these low pyrite ores is insufficient to maintain the low pH and high iron concentration needed for bacteria growth.

The GBI Approach to Biomining

Metals, particularly precious metals, are recovered from metal-containing support materials such as a mineral ore. The support material is contacted with a solution containing a hydrocarbon, with emphasis on butane, which stimulates the growth of hydrocarbon-utilizing bacteria.

Treatment of metal-containing support materials are conducted as "slurries" in lagoons, tanks or other vessels. Heap bioleaching techniques may also be used. In addition to concentrates of precious metal bearing sulfide minerals, there are many sulfide ores that contain metal sulfide minerals that can be treated using GBI's process. Biooxidation with hydrocarbon-utilizing bacteria can be used to cause the dissolution of metal values such as gold, silver, platinum, copper, zinc, nickel and uranium from concentrates of these ores.

References

One or more U.S. Patents Pending.