Non-Cyanide Gold Processing Options Fact Sheet

Non-Cyanide Gold Processing Options

Non-cyanide ore processing techniques include the following:

- **Gravity Separation:** separates minerals according to their relative density (specific gravity)
- **Microbial Leaching:** dissolves metals from ore-bearing rocks using microorganisms
- **Biological Gold Retrieval Methods:** uses microbial communities with varying species compositions and functions to bio-mine gold (including bioleaching, bio-oxidation, bioprecipitation, bio-flotation, bio-flocculation, bio-sorption, bio-reduction, bio-electrometallurgical technologies, and bioaccumulation)
- **Alternative Non-Cyanide Leaching Agents:** uses non-cyanide leaching agents, such as chloride, thiourea, and thiosulfate, to liberate gold from ore

How Can Thiosulfate Be Used in Gold Processing?

Thiosulfate can be used in gold processing as a leaching agent, to dissolve gold from certain gold-bearing ores without the use of cyanide. Two processes have been developed to obtain gold by thiosulfate leaching:

- **Resin-in-pulp technology:** gold thiosulfate is directly recovered from the leach pulp by adsorption on strong base anion exchange resin
- **Cementation:** gold from thiosulfate leach solution is cemented onto copper metal powder, or some other reductant, following separation of solids and liquids in the leach-slurry by filtration or countercurrent decantation

These processes are not suitable for all types of gold ore. Both thiosulfate leach processes are suitable for double refractory,[1] preg-robbing[2] carbonaceous ores. The type of gold ore at a specific site will dictate which gold processing methods can be used.

Where Is Thiosulfate Leaching Currently Used in Gold Mines?

There are currently no commercial gold processing facilities using the thiosulfate leach process in the U.S. The only commercial thiosulfate leach process was attempted at the Goldstrike Mine in Nevada, from 2014 to 2024, treating a double refractory, preg-robbing carbonaceous ore that was not amenable to recovery by conventional cyanidation. Sustainable gold recovery via thiosulfate processing was not achieved, however, and the process was converted back to a cyanide leach process for use with other ores. In addition, a demonstration facility in Western Australia tested a thiosulfate process in 2018, but it was not adopted as a commercial operation.

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[1] Double refractory gold ores have submicroscopic gold (invisible gold) finely disseminated within a sulfide-rich matrix within carbonaceous material, which makes them resistant to standard cyanidation and carbon adsorption processes. The gold in these ores is often encapsulated within sulfide or arsenic minerals, requiring specific pretreatment methods (such as ultrafine grinding, bio-oxidation, roasting, or pressure oxidation) to liberate the gold.

[2] "Preg-robbing" in gold mining refers to the phenomenon wherein carbonaceous matter in the ore adsorbs gold from a cyanide solution, inhibiting gold recovery (by competing with activated carbon used during the leaching and adsorption phase). Methods such as chemical oxidation, addition of kerosene, or roasting the ore can be employed to reduce this effect.