

EXTRACTION OF GOLD USING GLYCINE IN THE PRESENCE OF PERMANGANATE

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ABSTRACT

In this study, the effect of using strong oxidant, potassium permanganate, with alkaline glycine solution on the extraction and recovery of gold was investigated in the absence of any cyanide or oxygen addition. Prior research indicated that when using only alkaline glycine and air at ambient temperature in the absence of catalysts, leaching time would be too long for conventional tank leaching of gold ores (although catalysts, increased temperature and high glycine concentration may also achieve acceptable fast kinetics).

To be able to run at room temperature and low glycine concentrations, this study proposed a novel non-cyanide leaching system, i.e. glycine-oxidant, to extract gold from different resources, including gold oxide and sulfide resources and electronic waste (E-waste). The influence of the oxidant, such as potassium permanganate, hydrogen peroxide, sodium chlorate, potassium iodide, and potassium ferricyanide were initially evaluated in a screening test. The highest gold extractions were observed with potassium permanganate, where a gold recovery of 85.1% for oxide ores (compared to an 87.4% recovery against a conventional cyanidation benchmark) and lower gold extraction and higher permanganate consumption was observed for sulphide gold resources. For E-waste, the gold extraction using glycine-permanganate system reached 86.8%.

Other oxidants only achieved a recovery of 11% at the best, so permanganate was the focus of the optimisation work. Various variables, including glycine and permanganate consumption, type of pH modifier (ammonia, caustic and lime), pH value (9.5–11.3), pulp density (20–40%), the method of permanganate addition (direct addition vs staged addition) and temperature (room temperature–55°C), were evaluated. The deportment of copper during gold extraction from the sulfide ores and E-waste was also focused in detail. The downstream metal recovery using activated carbon was also discussed. The present study is expected to provide a non-cyanide and environmentally less harmful method to treat primary and secondary gold resources.

Keywords: Glycine; non-cyanide; gold; extraction; permanganate; e-waste