

Evaluations in the laboratory and in the field of a new non-toxic gold leach reagent

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ABSTRACT

Research into alternative lixiviants to cyanide has received much attention in recent years largely driven by the health, safety and environmental risks associated with the use of cyanide, as well as the low leaching efficiency of gold and/or the high cyanide consumption that is associated with the cyanidation of certain ores (e.g., carbonaceous ores and high-copper-containing gold ores). Among the potential lixiviants, thiosulfate appears to be the most promising with the first commercial operation having commenced in 2014 at Barrick's Goldstrike Mine in Nevada, U.S.A. CSIRO, in partnership with Barrick, made a significant contribution to this commercial application of thiosulfate.

CSIRO has also separately developed a thiosulfate-based reagent for gold leaching. This reagent has been undergoing intensive testing in the laboratory and in the field in preparation for commercialisation. The testing includes not only its leaching performance on a variety of ore types (including concentrates and tails), but also its health, safety and environmental benefits. This paper presents the leaching results for various gold ores using the CSIRO reagent, subsequent gold recovery from the pregnant leach solution and cyclic testing of an integrated process flowsheet incorporating leaching, pregnant-leach-solution treatment and the recycling of various solution streams. Thiosulfate consumption, polythionate generation and their deportment in the process are also discussed. The reagent is being developed to target markets where cyanide cannot be used and to unlock stranded small high-grade deposits. For the latter market, simple process flowsheet options, such as vat, heap or in-situ leaching, have also been tested. A demonstration plant that processes 30 tons ore per day by vat leaching has been operated successfully for more than 6 months to validate the reagent performance. The product was evaluated to have several orders of magnitude lower acute toxicity than sodium cyanide and no acute and chronic eco-toxicity.