

IN SITU EXTRACTION OF PRECIOUS METALS AND MINE REMEDIATION WITH POLYSULFIDES

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ABSTRACT

It is estimated that cleanup of metal bearing from abandoned mine lands across the U.S. alone will cost tens of billions of dollars. Recovery of valuable metals by reprocessing of mining wastes and in conjunction with water treatment has been considered but hindered by the potential risk of incurring liability in the commercial remediation of abandoned mine sites. Recent US EPA interest in this idea has heightened in the aftermath of the Gold King mine spill because of the potential for mine reclamation that pays for itself by secondary recovery of metal values. At one Superfund site in the southeastern US a pilot test is being developed to test polysulfides for recovery of precious metals while remediating mobile metal contaminants in mining wastes, acid rock drainage (ARD) and mine influenced water. Polysulfides are unique in that they have been used to both recover precious metals from ores (Earley and Berndt, 1997), and for in situ reduction and chemical stabilization of metals during remediation of contaminated sites (EPA, 2017). In situ treatment of mine pool waters and mine wastes is becoming more common to avoid perpetual water treatment (Nordstrom and Nicholson, 2017). Polysulfides could be used for in situ stope leaching while reducing acid generation and metal leaching from abandoned underground mines.

Polysulfides are generally recognized as safe, non-toxic, non-polluting and are routinely used in agricultural applications as well as remediation. Furthermore, polysulfides can be inexpensively produced from ARD and the mining wastes themselves (Hunter, 1997). The sulfur saturated system is self-buffering and maintains the optimal chemical environment for leaching precious metals and stabilization of metals such as mercury and base metals. Solvent extraction technology (Luo et al., 2006) has also been developed to recover gold from polysulfide solutions while recycling and conserving water for sustainable use in metal remediation and recovery.

Demonstrated recovery of precious metals from mined lands using acceptable lixiviants and methods and possibly a first step towards the wider application of in situ technology for precious metals in undeveloped ores. This paper also touches upon some of the concepts that may lead to the expansion of successful in situ recovery projects.

Keywords: In situ, precious metals, polysulfides, mine remediation

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