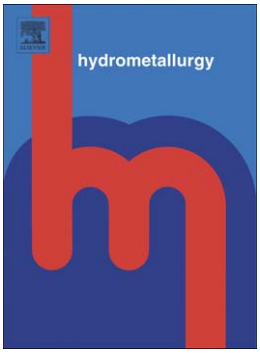

Application of fine desulfurised coal tailings as neutralising barriers in the prevention of acid rock drainage

A. Kotsiopoulos, S.T.L Harrison

PII: S0304-386X(16)30701-0
DOI: doi:10.1016/j.hydromet.2016.10.004
Reference: HYDROM 4440

To appear in: *Hydrometallurgy*

Received date: 14 February 2016
Revised date: 5 September 2016
Accepted date: 5 October 2016

Please cite this article as: Kotsiopoulos, A., Harrison, S.T.L., Application of fine desulfurised coal tailings as neutralising barriers in the prevention of acid rock drainage, *Hydrometallurgy* (2016), doi:10.1016/j.hydromet.2016.10.004

Application of Fine Desulfurised Coal Tailings as Neutralising Barriers in the Prevention of Acid Rock Drainage

A. Kotsiopoulos[1] and STL Harrison[1]*

[1]Centre for Bioprocess Engineering Research (CeBER), Department of Chemical Engineering, University of Cape Town, Rondebosch 7701, Cape Town, South Africa

*correspondence: Sue.Harrison@uct.ac.za, +27-(0)21-650-5501

Abstract

Sulphide-lean benign tailings obtained from a two-stage flotation process were used to reduce the permeability of acid-generating coal interburden or waste rock. These tailings present a means to conceal the exposed mineral surface from oxygen and water and more aggressive oxidants, including those generated by iron and sulphur oxidizing microorganisms, preventing the generation of acid rock drainage (ARD). Packing configurations comprising either alternating layered covers or blends of co-disposed waste rock with benign tailings were investigated. Long-term results in the presence of irrigation of the rock bed indicated successful mitigation with either packing. Repeated exposure of the co-mingled minerals to extreme conditions showed promise where structural integrity of the ore bed and low permeability were maintained. Inhibition of oxidation reactions in acidic environments was postulated to be related to the restriction in flow of the leachate through the column and surface contact with the acid generating waste rock surface.

Keywords: Acid rock drainage; acid mine drainage; desulfurized tailings; waste rock, mitigation

1. Introduction

As one of the largest global producers of coal and contributing to approximately 27% of the mineral sales within South Africa, the country's reliance on coal as a revenue generating commodity is heavily weighted both domestically and internationally (International Energy Agency, 2015; Statistics South Africa, 2015). Domestically, 77% of South Africa's energy needs are generated from coal. A consequence of beneficiation is the accumulation of coal waste discards; these are estimated to increase by 60 million tonnes per annum (Eberhard, 2011). This contributes to an increasing environmental concern as the sulfide minerals present in the coal are exposed to the elements. These react to form a highly toxic runoff commonly referred to as acid rock drainage (ARD). The oxidation of sulfides present in mineral ores acidifies the water and accelerates the leaching of heavy metals that either precipitate or dissolve affecting surrounding ecosystems. Unfavourable low pH conditions ensue in which more aggressive oxidants such as ferric ions and acid regenerated by iron and sulfur oxidising microorganisms prevail, promoting accelerated leaching reactions. Prevention and containment of ARD is therefore of primary concern at waste disposal sites at both active and abandoned mines.

Various methods to either manage or prevent ARD are practiced. Treatment methods require continual labour and monetary investment to manage effluent pH and trace metal ions that are