Title: A scaled-up continuous process for biooxidation as pre-treatment of refractory pyrite-arsenopyrite gold-bearing concentrates

Authors: Jiehua Hu, Huaiguo Huang, Hongzhen Xie, Lihui Gan, Jian Liu, Minnan Long

PII: S1369-703X(17)30253-X
DOI: https://doi.org/10.1016/j.bej.2017.10.001
Reference: BEJ 6795

To appear in: *Biochemical Engineering Journal*

Received date: 19-6-2017
Revised date: 11-9-2017
Accepted date: 1-10-2017

Please cite this article as: Jiehua Hu, Huaiguo Huang, Hongzhen Xie, Lihui Gan, Jian Liu, Minnan Long, A scaled-up continuous process for biooxidation as pre-treatment of refractory pyrite-arsenopyrite gold-bearing concentrates, Biochemical Engineering Journal https://doi.org/10.1016/j.bej.2017.10.001

A scaled-up continuous process for biooxidation as pre-treatment of refractory pyrite-arsenopyrite gold-bearing concentrates

Jiehua Hu[1,2], Huaiguo Huang [3], Hongzhen Xie[2], Lihui Gan[4], Jian Liu[4,*], Minnan Long [4,*]
1.College of the Environment & Ecology, Xiamen University, Xiamen361105, PR China
2.Xiamen Zijin Mining & Metallurgy Co., Ltd, Xiamen361101, PR China
3.Zinjin Mining Group Co.,Ltd,Shanghang364200, PR China
4.College of Energy, Xiamen University, Xiamen361105, PR China
* To whom correspondence should be addressed.
E-mail address: jianliu@xmu.edu.cn(Jian Liu), longmn@xmu.edu.cn (Minnan Long)
Tel: 86-592-5952787

Highlights

- **A novel bio-oxidation process was observed with double efficiency.**
- **The biological activity of releasing iron, arsenic and surphur were enhanced.**
- **The synergistic interaction of microbial community in bio-oxidation was revealed.**
- **An efficient approach of biological metallurgy was proposed.**

Abstract

This study describes using biooxidation as pre-treatment for refractory pyrite-arsenopyrite gold-bearing concentrates in both batch and continuous tests. The removal rates of the elemental constituents of arsenopyrite and pyrite were examined during a biooxidation pre-treatment of gold concentrate. Batch tests were performed in a 20-L reactor for 16 days. The continuous biooxidation experiments were conducted in six 300-L reactors configured as 3 primary and 3 secondary reactors, giving a 7-day cumulative retention time at the design feed rate. Real-time PCR was used to monitor the dynamic succession of the acidophilic bacterial population. Compared to the maximum removal rate of the batch tests (in the initial 10 days), the arithmetic average release rate in the continuous tests is nearly twice as high, because it can maintain the active microbial community composition and slow the ion accumulation in the slurry. Therefore, the residence time to attain a certain oxidation degree could be significantly reduced for the continuous scale-up operation. The biooxidation of refractory pyrite-arsenopyrite gold-bearing concentrates was reinforced efficiently in the continuous pilot experiments.

Keywords: biooxidation; removal rate; batch test; scale-up continuous test; sulfide ores

1 Introduction

The world faces a shortage in the supply of metal raw materials, driven by the increasing world population and modern industrialization processes [1, 2, 3]. Attempts to overcome this supply risk have highlighted the use of some complex refractory ores such as Long'nan gold concentrate, which is not economically feasible for using conventional metallurgical techniques. For this material, usually, 3 types