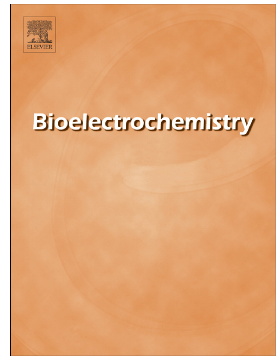
Accepted Manuscript



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PII: S1567-5394(17)30588-1
DOI: doi:10.1016/j.bioelechem.2018.04.021
Reference: BIOJEC 7157

To appear in: *Bioelectrochemistry*

Received date: 19 November 2017
Revised date: 25 April 2018
Accepted date: 29 April 2018

Please cite this article as: Biljana S. Maluckov, Miodrag N. Mitrić , Electrochemical behavior of pyrite in sulfuric acid in presence of amino acids belonging to the amino acid sequence of rusticyanin. The address for the corresponding author was captured as affiliation for all authors. Please check if appropriate. Biojec(2017), doi:10.1016/j.bioelechem.2018.04.021

Electrochemical behavior of pyrite in sulfuric acid in presence of amino acids belonging to the amino acid sequence of rusticyanin

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Abstract

The impact of different concentrations of three amino acids (cysteine, histidine and methionine) which are part of the amino acid sequence of rusticyanin on dissolution of pyrite is investigated by the application of electrochemical techniques. Cyclic voltammetric studies conducted in the anodic direction from corrosion potential have shown that in the vicinity of corrosion potential, histidine and methionine do not influence dissolution of pyrite independently on their concentrations. On the other hand, cysteine and solutions of these amino acids in the molar ratios Cys:His:Met/1:1:1 and Cys:His:Met/1:2:1 accelerate dissolution at concentrations 10^{-2} mol L^{-1} and 10^{-3} mol L^{-1}. Potentiodynamic polarization measurements showed that methionine does not affect the anodic and cathodic dissolution at all concentrations, while histidine does not affect significantly on the anodic dissolution at all concentrations. Cysteine and solutions of three amino acids in the molar ratio Cys:His:Met/1:1:1 and Cys:His:Met/1:2:1 cause intensive cathodic inhibition and anodic activation at concentrations 10^{-2} mol L^{-1} and 10^{-3} mol L^{-1} respectively.

Keywords: cysteine, methionine, histidine, pyrite, rusticyanin, electrochemistry

1. Introduction

Under the influence of water and air, the dissolution of pyrite and other sulfides (Schematic 1) in ore deposits comes naturally. The natural dissolution of sulfides increases in mining regions due to higher exposure to water and air, resulting in the formation of acid mine drainage (AMD).

Microorganisms develop in AMD and accelerate the dissolution of sulfide minerals (Schematic 1) which leads to the formation of larger quantities of acid mine water [1-3]. Microbiological processes may lead to damage of industrial plants by microbiologically induced corrosion [4-6]. On the other hand, microorganisms can be used for industrial purposes in order to recover metals [7-11] and for the pretreatment of gold containing ores for the dissolution of sulfides in which the gold is encapsulated [12, 13]. The acidophilus bacteria *Acidithiobacillus ferrooxidans* played the most important role in the development of industrial bacterial recovery of metals [14, 15], so-called bioleaching. It is responsible for the oxidation of iron Fe^{2+} to Fe^{3+} [16].