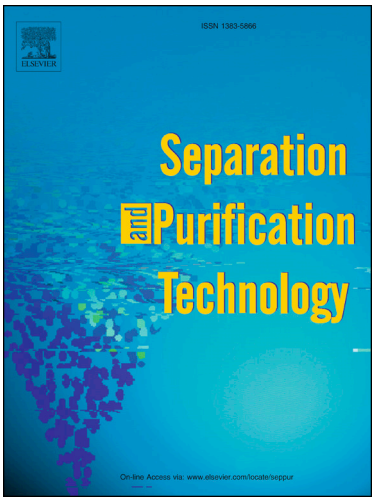

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Recovery of Copper from Alkaline Glycine Leach Solution using Solvent Extraction

B.C. Tanda[a], E.A. Oraby[a, b] and J.J. Eksteen[a, *]

[a]Department of Metallurgical Engineering and Mining Engineering, Western Australian School of Mines, Curtin University, GPO Box U1987, Perth, WA 6845, Australia

[b]Faculty of Engineering, Assiut University, Egypt

*Corresponding Author: jacques.eksteen@curtin.edu.au

ABSTRACT

Glycine solutions in an alkaline environment have been shown to be able to leach copper from its oxide, native and sulfide minerals as a copper glycinate complex. This paper explores the recovery of copper from its aqueous glycinate complexes at alkaline pH through solvent extraction. Solvent extraction of copper from synthetic glycinate liquor (with background sulfate anions) containing 2 g/L Cu has been studied using Mextral 84H (2-hydroxy-5-nonylacetophenone oxime) and Mextral 54-100 (1-benzoyl-2-nonyl ketone) extractants with a kerosene diluent. The effect of different parameters such as pH of aqueous phase, glycine and extractant concentrations, equilibrium time, temperature, extractant loading capacity as well as the concentration of sulphuric acid as stripping reagent were investigated. Over 99.9 % Cu was extracted with 5 % Mextral 84H at room temperature at an Aqueous-to-Organic (A:O) ratio of 2:1. Under similar conditions, 95.87 % Cu was extracted by 10 % Mextral 54-100. HPLC analysis for free glycine indicated that neither extractants take up glycine during the extraction process. Stripping experiments with spent electrolyte solution showed that copper loaded on Mextral 54-100 can be completely stripped in single stage at an O:A ratio of 10:1 while only 79.95 % Cu can be stripped from Mextral 84H with same conditions applied. Copper extraction from leachates of malachite and chalcopyrite ore samples was performed in order to validate extraction results from the synthetic solutions. Over 99 % copper was extracted from the malachite leachate (containing 2620 mg/L Cu) in a single stage by both 10 % Mextral 54-100 (raffinate pH of 9.76) and 5 % Mextral 84H (raffinate pH of 10.0) at an O:A of 2:1; with no impurity elements picked up by either extractants. At an O:A ratio of 2:1, single stage copper extraction from chalcopyrite leachate by 10 % Mextral 54-100 (raffinate pH of 9.87) was 93.20 % and 95.57 % by 5 % Mextral 84H (raffinate pH of 9.91) with the rejection of all impurity elements other than Zn in the aqueous raffinate. From the chalcopyrite leachate containing 2288 mg/L Cu and 699 mg/L Zn, the Zn co-extraction into the organic phase at an O:A ratio of 1 was found to be 16.5 % for Mextral 54-100 whilst Zn co-extraction was not noted with Mextral 84H under the alkaline conditions.

Keywords: copper, alkaline glycine, solvent extraction, Mextral 84H, Mextral 54-100