



A kinetics analysis applied to the recovery of Zn(II) content from mine drainage by using a surfactant liquid membrane

F. Valenzuela^{a*}, C. Basualto^a, J. Sapag^a, J. Romero^b, W. Höll^c, C. Fonseca^a, C. Araneda^a

^aLaboratorio Operaciones Unitarias, Facultad de Ciencias Químicas y Farmacéuticas, Universidad de Chile, Av. Vicuña Mackenna 20, P.O. Box 233, Santiago, Chile

Tel: +5629781660; fax +5622227900; email: fvalenzu@uchile.cl

^bDepartamento de Ingeniería Química, Facultad de Ingeniería, Universidad de Santiago, Alameda 3363, Santiago, Chile

^cInstitute for Technical Chemistry, Forschungszentrum Karlsruhe GmbH, 76344 Eggenstein-Leopoldshafen, Germany

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ABSTRACT

A kinetics analysis was conducted for the recovery of zinc (II) ions from a mine drainage sample by a liquid surfactant membrane containing di-(2-ethylhexyl)phosphoric acid as a carrier extractant and Span-80 as the surfactant. The extraction of metal was proportional to the concentration of carrier in the organic phase, inversely proportional to the zinc content in the feed solution, and was enhanced as the pH of the feed phase was increased. A minimum sulfuric acid content of 150 g/L in the stripping solution was necessary to favor the transport of metals from the external aqueous solution to the metal-receiving strip liquor. The experimentally observed results were analyzed by a metal extraction kinetics mechanism based on a facilitated transport model, which considers the interfacial chemical reaction between the metal and the carrier at the external interface of the liquid membrane as kinetic controlling step. The experimental results were fairly well explained by the model that takes into account the interfacial activity of both the surfactant and the carrier compound.

Keywords: Surfactant liquid membrane; Zinc; Mine drainage; Kinetics

1. Introduction

A major concern in countries, like Chile, has been the determination of the ecological and economic need for more specific systems for the recovery of increasingly scarce metals and/or the removal of toxic metal ions from dilute solutions, which has led to the development of new extractants, ion exchangers, and adsorbents [1,2]. The introduction and application of these new products has improved significantly the selectivity and efficiency of a large number of separation techniques, such as solvent extraction in

mixer-settler reactors (SX process) [3], ion-exchange (IX) [4], solvent-impregnated resins [5], and synthetic and natural adsorbents [6,7], among others. The theoretical principles that govern the operation of all these separation processes, as well as their practical technology, have been described in the technical literature, and it can be stated that all of them have some deficiencies that restrain their application under many operational and economic conditions.

In particular, waste and natural waters associated with mining activities are of great concern because of their load of surface and groundwater pollutants. These types of minewaters normally contain many and varied metallic ions. These ions are usually highly toxic

*Corresponding author