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A non-steady state model for the transport of iron(III) across *n*-decanol supported liquid membrane facilitated by D2EHPA

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Abstract

A non-steady state model to describe the permeation of iron(III) through a supported liquid membrane (SLM) based on *n*-decanol containing di-2-ethylhexyl phosphoric acid (D2EHPA) as a carrier is proposed. According to the model, two factors mainly contribute to the overall resistance for the iron(III) transport: the feed/organic interface chemical reaction and the diffusion of the complex Fe(III)-D2EHPA through the membrane liquid phase. The interface reaction is assumed first-order. The mole fractions of iron(III) in the three phases, the feed, the organic and the strip, were simulated by using a numerical method. Several series of experimental data were simulated and the simulated results fit very well the experimental data. The model accounts for the phenomenon of iron(III) retention in the organic phase and can simulate the iron(III) concentration in time in the membrane liquid phase. The rate controlling step for iron(III) transport from feed to strip is a combination between the interface reaction and the complex diffusion through the membrane.

Keywords: Supported liquid membrane; Facilitated transport; Iron; Model; Retention

1. Introduction

The selective removal of metal ions from solution is involved in many process for industrial clean production and resource recovery. Liquid membrane technology appears promising for the treatment of metallic ion solution as an alternative way to traditional techniques, such as adsorption, ion exchange and solvent extraction. The liquid membranes (LM), originally developed by Li [1], contain carriers to facilitate the selective transport of solutes [2].

Before scaling up a liquid membrane process, a theoretical model of the liquid membrane transport phenomena is needed in order to design an efficient system. Moreover, the development of theoretical models which account for the experimental results is fundamental to a complete understanding of the transport mechanisms in the separation process with liquid membranes, either emulsion liquid membrane or supported liquid membranes (SLMs). A reliable model allows one not only to explain but also to predict the behavior of a system under different experimental conditions.

De and coll. [3] provided an exhaustive analysis of the models which have been proposed to study carrier-facilitated transport through supported liquid membranes, and gave a brief survey of the models most frequently used by researchers in the field of SLMs. In fact, in the modeling of permeation of metal ions, most authors have assumed that the solute

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