EFFECT OF ORGANIC SOLVENT ON THE PERTRACTION OF Zn(II) AND Cu(II) CATIONS IN BLM CONTAINING D2EHPA AS A CARRIER

Piotr SZCZEPAŃSKI

Nicolaus Copernicus University, Faculty of Chemistry, Gagarina Str. 7, 87-100 Toruń, Poland; e-mail: piotrs@chem.uni.torun.pl

Liquid membrane processes with organophosphorus compounds such as di(2-ethylhexyl) phosphoric acid (D2EHPA) are frequently applied for recovery and separation of Zn^{2+} and Cu^{2+} cations [1-4]. The separation of cations by pertraction in liquid membranes results from the differences in diffusivity and affinity of a carrier towards cations present in a treated solution. Concentration of the feed and stripping solution, carrier concentration and the type of organic solvent are the most important factors influencing the pertraction process. The nature and composition of the organic phase also have a strong influence upon the interfacial activity of D2EHPA [5].

The aim of this study was to investigate the effect of a liquid membrane solvent on transport and separation of Zn^{2+} and Cu^{2+} cations in the bulk liquid membrane (BLM) with D2EHPA as the carrier.

The experiments were performed with a simple beaker-in-beaker type pertractor at 25ºC. The solution of Zn^{2+} and Cu^{2+} nitrates (125 cm^3 0.05 M) was used as the feed phase. The sulfuric acid solution (25 cm^3 0.1 M) was used as the stripping phase. The membrane contacting area was 16.45 cm^2 (f/LM interface) and 5.8 cm^2 (LM/s interface). 0.1 M D2EHPA (25 cm^3) in hexane, heptane, octane, nonane, decane and dodecane were used as the liquid membrane. The solutions were agitated with a glass stirrer (LM) at 375 rpm and magnetic stirrer (feed and stripping solution) at 150 rpm. The experiments were carried out 3 times in order to evaluate the standard error of respective fluxes. Under these experimental conditions, D2EHPA transports Zn^{2+} over Cu^{2+} and its selectivity increases with an increase in the molecular weight of alkane. Typical experimental results corresponding with the system containing octane as D2EHPA solvent are presented in Fig.1.

The effect of the organic solvent on the pertraction of Zn^{2+} and Cu^{2+} cations is presented in Fig.2. Some physicochemical properties and the topological indices (calculated from the chemical structure of the solvent) were applied to describe the solvent structure – BLM properties (flux) relationship by chemometric methods. It was concluded that a simple linear model is sufficient to describe the fluxes as a function of physicochemical properties (density, viscosity, refractive index) and topological indices (descriptors) of an organic solvent.

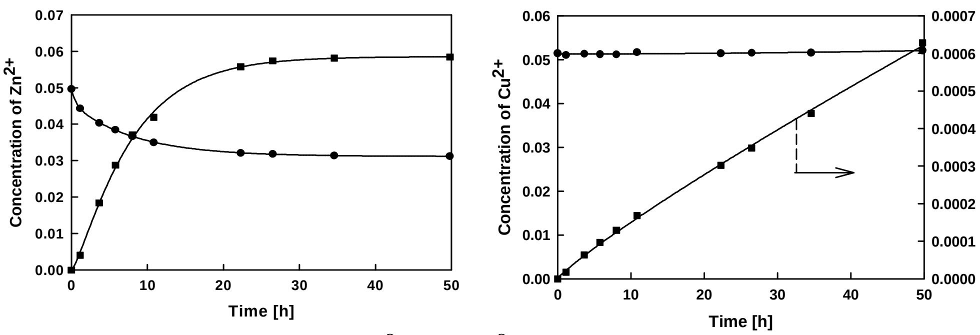

Fig.1. Experimental curves of Zn^{2+} and Cu^{2+} transport in BLM with 0.1 M D2EHPA dissolved in octane: (●) feed solution, (■) stripping solution membrane organic solvent

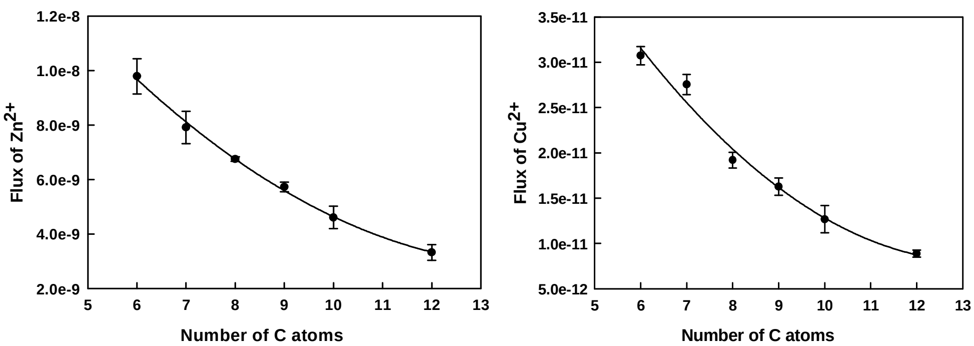

Fig.2. Dependence of Zn^{2+} and Cu^{2+} fluxes on the number of C atoms in liquid

REFERENCES

1. T.-Ch. Huang, R.-S. Juang, *J. Membr. Sci.*, 31(1987)209
2. D. He, X. Luo, Ch. Yang, M. Ma, Y. Wan, *Desalination*, 194(2006)40
3. R.-S. Juang, H.-L. Huang, *J. Membr. Sci.*, 208(2002)31
4. R.-S. Juang, H.-L. Huang, *J. Membr. Sci.*, 213(2003)125
5. J. Szymanowski, G. Cote, I. Blondet, C. Bouvier, D. Bauer, J. L. Sabot, *Hydrometallurgy*, 44(1997)163