



Competitive Transport Studies of Some Heavy Metal Cations Through Bulk Liquid Membrane Using 15-Crown-5 and Cyclam

F. Karimian, G.H. Rounaghi*, M.H. Arbab-Zavar

Department of Chemistry, Faculty of Sciences, Ferdowsi University of Mashhad Mashhad, Iran

* Author for correspondence. E-mail: ghrounaghi@yahoo.com; ronaghi@ferdowsi.um.ac.ir

F. Karimian; e-mail: fereshteh.karimian@gmail.com

Competitive transport experiments involving nickel(II), cobalt(II), zinc(II), cadmium(II), silver(I), chromium(III) and lead(II) metal cations from an aqueous source phase through an organic membrane into an aqueous receiving phase have been carried out using 15-crown-5 and 1,4,8,11-tetraazacyclotetradecane (cyclam) as ionophores present in organic membrane phase. The organic membrane phases include: dichloromethane (DCM), 1,2-dichloroethane (1,2-DCE), nitrobenzene (NB) and chloroform (CHCl₃) and also chloroform-dichloromethane (CHCl₃-DCM), chloroform-nitrobenzene (CHCl₃-NB) and dichloromethane-nitrobenzene (DCM-NB) binary mixed solvent solutions. The obtained results show that the selectivity and the efficiency of transport for the heavy metal cations change with the nature of the ligand and also the organic solvents, which were used as liquid membrane in these experiments. 15-crown-5 was a highly selective ionophore for Ag⁺ cation in NB and DCM membrane systems, but the highest transport efficiency for this cation was obtained in NB. But, no transport was observed for these metal cations by cyclam in all used solvents. The sequence of selectivity for silver (I) ion in organic solvents was found to be: NB > DCM > CHCl₃ > 1,2-DCE. The transport of Ag⁺ ion in DCM-NB, CHCl₃-NB and CHCl₃-DCM binary solvents is sensitive to the solvent composition. A non-linear relationship was observed between the transport rate of silver (I) ion and the composition of these binary mixed solvents. The amount of Ag⁺ transported follows the trend: DCM-NB > CHCl₃-NB > CHCl₃-DCM in the bulk liquid membrane studies. The influence of the stearic, palmitic and oleic acids as surfactant in the membrane phase on the ion transport was also investigated.

Key Words: Bulk liquid membrane transport, silver(I), nitrobenzene, dichloromethane, 1,2-dichloroethane, chloroform

Dispersive liquid-liquid microextraction combined with experimental design methods for preconcentration of dipyrindamole and its measurement in biological systems using high performance liquid chromatography

Maryam Rouhi¹, Eslam Pourbasheer^{1,2*}, Alireza Banaei¹

¹Department of chemistry, Payamenoor university, Ardabil, Iran

²National Elite Foundation of Iran

Dipyridamole is a well-known vasodilator drug that has been widely used for treatment of coronary heart diseases [1]. This drug is a classic platelet inhibitor which has been a key medicine in clinical therapy of thrombosis and cerebrovascular disease [2]. Detect very small amounts in the body fluids, especially in order to identify its toxic effects is important. Thus, a good method, dispersive liquid-liquid microextraction (DLLME) was developed for the extraction and preconcentration of dipyridamole in biological samples. This method, consists of two main steps: (1) injection of an appropriate mixture of extraction and disperser solvents into sample containing analyte, and (2) centrifugation of coldly solution [3]. In this work after centrifugation, the quantitative determination of analyte (dipyridamole) in sedimented phase has been made by high performance liquid chromatography. Simplicity of the operation, rapidity, low sample volume, low cost, high recovery and high enrichment factor are some advantages of DLLME. The experimental design techniques were used to reduce the number of experiments. As a result, costs are reduced and factors involved in the experiment can be optimized in less time. Then, the effective parameters of dispersive liquid-liquid microextraction such as volume of extraction and disperser solvents, temperature, and salt effect were inspected by a central composite design (CCD) to identify important parameters and their interactions [3]. Chromatographic separation was achieved on a C₁₈ column using a mobile phase consisting of methanol and ammonium acetate. The uv-vis detector was performed at a 227 nm [4]. The central composite design improved the recovery of microextraction.

References

- [1] G. Zhu, H. Ju, H. Zheng, Clin. Chim. Acta 348 (2004) 101-106.
- [2] T. Qin, F. Qin, N. Li, Sh. Lu, W. Liu, F. Li, Biomed. Chromatogr. 24 (2010) 268-273.
- [3] H. Sereshiti, M. Karimi, S. Samadi, J. Chromatogr. A 1216 (2009) 198-204.
- [4] K. Prakash, R.R. Kalakuntla, J.R. Sama, Afr. J. Pharm. Pharmacol. 5 (2011) 244-251.

Selective separation and preconcentration of manganese (II) in water and plant samples by the solid phase extraction on multi-walled carbon nanotubes

Fatemeh Sabermahani¹, Tahereh Rohani¹, Mohammad Ali Karimi¹,

Purva Javdani Esfahani¹

¹Department of Chemistry, Payame Noor University, PO BOX 19395-4697, Tehran, IRAN

In recent years, great attention has been paid to the application of nano-structure materials, especially carbon nanotubes (CNTs). Because of their special electronic, metallic and structural characteristics as well as the unique tubular structures of nano diameter and large length/diameter ratio [1], CNTs have been exploited in analytical chemistry and other fields [2,3]. The highly developed hydrophobic surface of multiwalled carbon nanotubes (MWCNTs) exhibits strong sorption properties toward various compounds and therefore MWCNTs may be used for the separation and preconcentration of trace analytes [4-6].

In this work, a solid phase extraction procedure is proposed for separation and preconcentration trace amounts of Mn(II) in an aqueous medium by using a column of multiwalled carbon nanotubes. MWCNTs were oxidized with concentrated HNO₃ and then were used as a solid sorbent for preconcentration of Mn(II) ions. The metal ion by complexation with ligand 2-(5-Bromo-2-pyridylazo)-5-diethylaminophenol (5-Br-PADAP) was retained on the 0.03 g of the nanotubes in the pH range 8-9, and then eluted with 5 mL of 3 mol L⁻¹ nitric acid prior to determination by FAAS.

Various parameters such as the effect of pH, flow rate, type and amount of eluent, breakthrough volume and interference of a large number of anions and cations on the recovery of Mn ions was studied. A preconcentration factor of 80 and relative standard deviation of ±2.4%, was obtained under optimum conditions. Calibration curve was linear in the concentration range of 0.02-5.0 µg mL⁻¹ in the final solution or 0.25-6.25 × 10 ng mL⁻¹ in the original solution. The equation of the line is A=0.088C+0.0079 with the regression coefficient 0.997 in the final solution. The method was successfully applied for separation and determination of manganese ions in water and plant samples.

References

- [1] N. Grobert, Mater. Today 10 (2007) 28-35.
- [2] A. Merkoci, Microchim. Acta 152 (2006) 157-174.
- [3] X. Tan, M. Fang, C. Chen, S. Yu, X. Wang, Carbon 46 (13) (2008) 1741-1750.
- [4] M. Tuzen, K.O. Saygi, C. Usta, M. Soylak, Bioresour. Technol. 99 (6) (2008) 1563-1570.
- [5] D. Afzali, A. Mostafavi, Anal. Sci. 24 (2008) 1135-1139.
- [6] M. Tuzen, M. Soylak, J. Hazard. Mater. 147 (2007) 219-225.