Turkish Journal of Chemistry

Turkish Journal

of

Chemistry

Optimization of the Nonaqueous Capillary Electrophoresis Separation of Metal Ions Using Mixture Design and Response Surface Methods

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Keywords
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Scientific Journals Home Page

Abstract: Mixture experimental design was used to enhance the separation selectivity of metal ions in nonaqueous capillary electrophoresis. The separation of cations (Ag, Fe, Cr, Mn, Cd, Co, Pb, Ni, Zn and Cu) was achieved using imidazole as UV co-ion for indirect detection. Acetic acid was chosen as an electrolyte because its cathodic electroosmotic flow permits faster separation. The composition of organic solvents is important to achieve the best separation of all metal ions. Simplex lattice design and response surface methods have proved to be an effective tool to optimize the composition of organic solvents in nonaqueous capillary electrophoresis. Full and reduced experimental design models were compared to obtain the optimum composition of solvents. Contour plots were presented to visualize the effect of the selected solvents on electrophoretic mobility. The highest electrophoretic mobilities were obtained with higher percentages of acetonitrile for all metal ions. Root mean square error (RMSE) and F-test were used to evaluate the models.

Key Words: Nonaqueous capillary electrophoresis, metal ions, mixture design, response surface methods

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Turk. J. Chem., **30**, (2006), 181-192.
Full text: pdf
Other articles published in the same issue: Turk. J. Chem.,vol.30,iss.2.