

# SEPARATION OF NITROPHENOLS BY CAPILLARY ZONE ELECTROPHORESIS



D.Kaniansky, M.Masár, J.Marák, V.Madajová, and F.I.Onuska\*

*Department of Analytical Chemistry, Faculty of Natural Sciences, Comenius University, Mlynská  
Dolina CH-2, 842 15 Bratislava (Slovak Republic)*

*\*Aquatic Ecosystem Protection Branch, National Water Research Institute, Environment Canada, 867  
Lakeshore Road, Burlington, Ontario L7R 4A6, (Canada)*

Nitrophenols are compounds of a general environmental concern. Their presence in the environment is not only due to human activities (e.g., applications of pesticides, some chemical processes) but also due to chemical processes in the atmosphere. For example, nitrophenols can be found in precipitations at low ppb concentrations.

To meet current requirements of environmental analytical chemistry the limits of detection at ppb-ppt concentrations are required. The use of a high-efficiency separation technique in the final analytical step is essential in achieving such performance parameters of the analytical procedure.

This work was aimed at investigating potentialities of capillary zone electrophoresis (CZE) in the separation of a group of nitrophenols of a key environmental interest (picric acid, 2,4-dinitrophenol; 2,5-dinitrophenol; 2,6-dinitrophenol; m-nitrophenol; p-nitrophenol and p-nitro-m-cresol).

Our experiments showed that a high pH is necessary to achieve migration of the nitrophenols. However, under such conditions (favouring the separations according to ionic mobilities) the resolutions of the individual nitrophenols was the main problem. To solve this problem CZE separations based on interactions of nitrophenols with water soluble polymers (polyvinylpyrrolidone) and host-guest complex equilibria ( $\beta$ -cyclodextrin) were investigated. None of these interactions was fully effective when used alone. Differing selectivities of these additives, however, provided a way to optimize the separations when used in a proper combination. The carrier electrolytes containing both additives enabled us to perform the CZE separations in less than 8 minutes with high separation efficiencies (ca. 150000-200000 theoretical plates per meter) also in a capillary tube of a higher sample load capacity (I.D.  $\approx$  300  $\mu$ m).

Preliminary experiments proved that the proposed CZE system can be used in an on-line combination with capillary isotachopheresis (ITP) to handle sample volumes as large as 30  $\mu$ l. This combination of the electrophoretic techniques provided an ITP concentration of the analytes into a narrow band and a sample clean-up in the same step. As a result the concentration limits could be reduced down to  $10^{-7}$ - $10^{-8}$  mol/l concentrations. By no means this can be considered as a definitive minimum as an optimized detection system should provide the limits of detection 1-2 orders of magnitude lower under otherwise identical working conditions.

