

Highly sensitive determination of nitrite and nitrate in seawater by capillary zone electrophoresis

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Summary

We describe a combination of selected ions as a terminating ion which is useful for transient isotachopheresis (ITP) in capillary zone electrophoresis (CZE) for the determination of nitrite and nitrate in seawater. In addition to 150 mM sulfate as the principal terminating ion, 10 mM bromate was added to a sample solution as the additional terminating ion. Artificial seawater containing 3 mM cetyltrimethylammonium chloride (CTAC) was adopted as a background electrolyte (BGE, pH 7.9). The limits of detection (LODs) for nitrite and nitrate were 2.2 and 1.0 $\mu\text{g/L}$ (as nitrogen), respectively. The LODs were obtained at a signal to noise ratio (S/N) of 3. The values of the relative standard deviation (RSD) of peak area for these ions were 1.9 and 1.4%. The RSDs of peak height were 1.7 and 1.9%. The RSDs of migration time 0.11%. The proposed method was applied to the determination of nitrite and nitrate in a proposed certified reference material for nutrients in seawater, MOOS-1, distributed by the National Research Council of Canada (NRC). The results were almost agreed with the assigned tolerance interval.

The amount of sample injected into the CE apparatus is limited as the effective mobility of nitrite was very close to that of nitrate using a BGE at pH 7.9. In order to further lower the LOD for nitrite, it was found that by lowering the pH of the BGE, the difference between the effective mobilities increased, hence permitting increased sample volumes to be tolerated and nitrite LOD to decrease. Therefore, subsequent experiments investigated the pH of the artificial seawater in the range 2.5-3.5 using phosphate buffer. For the purpose of reversing or decreasing the electroosmotic flow (EOF), the effect of dilauryldimethylammonium bromide (DDAB), CTAC and hydroxypropyl methylcellulose (HPMC) was examined. Investigations are in progress to examine analytical conditions including the applied voltage, the concentration of phosphate buffer, etc. After establishing the optimum procedure, it will be applied to the analysis of real seawater and the results will be compared to those obtained using the conventional spectrophotometric method.