A Rapid and Sensitive Method for Nitrite and Nitrate Analysis in Seawater Using Ion-Pair Chromatography with On-Line Photochemical Reaction and Chemiluminescence Detection

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Summary

Rapid and Sensitive determination of nitrite (NO_2^-) and nitrate (NO_3^-) ions in seawater is essential to understand the nitrogen cycle and for environmental protection in the ocean.   Recently, we reported a determination method that combines conventional ion-chromatographic (IC) separation of NO_2^- and NO_3^-, on-line photochemical conversion of these ions to peroxynitrite ($ONOO^-$) by irradiation with a 222-nm excimer lamp, and chemiluminescence from the reaction between luminol and $ONOO^-$.   Furthermore, by using a sample volume as small as 1 µL, the method was applied to measure NO_2^- and NO_3^- concentrations at sub-µM level in seawater samples. However, the method only combines the existing IC separation with a new detection method and does not optimize the separation.

The objective of this study was to maximize the performance of the detection method for NO_2^- and NO_3^- using a separation method suitable for on-line photochemical conversion and chemiluminescence detection with luminol. The separation of NO_2^- and NO_3^- was achieved within 3 min using a graphitized carbon column (3 µm, 2.1 x 30 mm) coated with cetyltrimethylammonium ion.   As a result, the analysis time was reduced to about 1/3 and the reagent consumption to 2/5 compared with the previous IC separation, although the measurement sensitivity remained the same.   However, the new separation method could not apply to measurement of seawater samples.   The reason for this is not yet clear, but we suspect it is due to incomplete separation from chloride ions.   Therefore, NO_2^- and NO_3^- concentration-depth profiles of seawater samples collected in Kagoshima Bay this report were obtained by the IC separation method.   In the future, we plan to achieve the measurement of seawater from Kagoshima Bay in the new rapid measurement method by improving the separation.