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A catalytic spectrophotometric method for determination of nanomolar manganese in seawater using reverse flow injection analysis and a long path length liquid waveguide capillary cell

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Abstract

A sensitive and precise method for determination of nanomolar manganese in seawater was developed, using reverse flow injection analysis, a long path length liquid waveguide capillary cell, and spectrophotometric detection. The reaction was based on manganese catalyzed oxidation of leucomalachite green with sodium periodate. Various experimental parameters were investigated and optimized. Foreign trace metal ions of iron, copper, zinc, nickel and aluminum did not cause obvious interference with manganese detection. Low manganese seawater was prepared and used as the blank and standards' matrix, to eliminate the seawater matrix effect. The method detection limit was 0.20 nmol L^{-1} , and the quantification range was $0.50\text{-}10.00 \text{ nmol L}^{-1}$, which should be sensitive enough and suitable for open ocean seawater analysis. The seawater certified reference material NASS-6 was used to test the accuracy, and good agreement was obtained. The proposed method was applied to analyze seawater samples collected at the SEATS station in the South China Sea. The vertical profile of the total dissolvable manganese is reported and discussed.

Graphical abstract

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