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Sequential determination of multi-nutrient elements in natural water samples with a reverse flow injection system

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ABSTRACT

An integrated system was developed for automatic and sequential determination of NO_2^-, NO_3^-, PO_4^{3-}, Fe^{2+}, Fe^{3+} and Mn^{2+} in natural waters based on reverse flow injection analysis combined with spectrophotometric detection. The system operation was controlled by a single chip microcomputer and laboratory-programmed software written in LabVIEW. The experimental parameters for each nutrient element analysis were optimized based on a univariate experimental design, and interferences from common ions were evaluated. The upper limits of the linear range (along with detection limit, $\mu mol \cdot L^{-1}$) of the proposed method was 20 (0.03), 200 (0.7), 12 (0.3), 5 (0.03), 5 (0.03), 9 (0.2) $\mu mol \cdot L^{-1}$, for NO_2^-, NO_3^-, PO_4^{3-}, Fe^{2+}, Fe^{3+} and Mn^{2+}, respectively. The relative standard deviations were below 5% (n=9-13) and the recoveries varied from 88.0±1.0% to 104.5±1.0% for spiked water samples. The sample throughput was about 20 h^{-1}. This system has been successfully applied for the determination of multi-nutrient elements in different kinds of water samples and showed good agreement with reference methods (slope 1.0260±0.0043, R^2=0.9991, n=50).

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