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On-line speciation analysis of inorganic arsenic in complex environmental aqueous samples by pervaporation sequential injection analysis

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ABSTRACT

A proof of concept of a novel pervaporation sequential injection (PSI) analysis method for automatic non-chromatographic speciation analysis of inorganic arsenic in complex aqueous samples is presented. The method is based on hydride generation of arsine followed by its on-line pervaporation-based membrane separation and CCD spectrophotometric detection. The concentrations of arsenite (As(III)) and arsenate (As(V)) are determined sequentially in a single sample zone. The leading section of the sample zone merges with a citric acid/citrate buffer solution (pH 4.5) for the selective reduction of As(III) to arsine while the trailing section of the sample zone merges with hydrochloric acid solution to allow the reduction of both As(III) and As(V) to arsine at pH lower than 1. Virtually identical analytical sensitivity is obtained for both As(III) and As(V) at this high acidity. The flow analyser also accommodates in-line pH detector for monitoring of the acidity throughout the sample zone prior to hydride generation.

Under optimal conditions the proposed PSI method is characterised by a limit of detection, linear calibration range and repeatability for As(III) of 22 $\mu\text{g L}^{-1}$ ($3S_{\text{blank}}$ level criterion), 50-1000 $\mu\text{g L}^{-1}$ and 3.0% at the 500 $\mu\text{g L}^{-1}$ level and for As(V) of 51 $\mu\text{g L}^{-1}$, 100-2000 $\mu\text{g L}^{-1}$ and 2.6 % at the 500 $\mu\text{g L}^{-1}$ level, respectively. The method was validated with mixed As(III)/As(V) standard aqueous solutions and successfully applied to the determination of As(III) and As(V) in river water samples with elevated content of dissolved organic

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