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PII: S0039-9140(16)30662-2
DOI: http://dx.doi.org/10.1016/j.talanta.2016.08.079
Reference: TAL16843

To appear in: *Talanta*

Received date: 19 May 2016
Revised date: 28 August 2016
Accepted date: 29 August 2016

Cite this article as: Shin-Ichi Ohira, Koretaka Nakamura, Mitsuki Chiba Purnendu K. Dasgupta and Kei Toda, Matrix isolation with an ion transfer devic for interference-free simultaneous spectrophotometric determinations o hexavalent and trivalent chromium in a flow-based system, *Talanta* http://dx.doi.org/10.1016/j.talanta.2016.08.079

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Matrix isolation with an ion transfer device for interference-free simultaneous spectrophotometric determinations of hexavalent and trivalent chromium in a flow-based system

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Abstract

Remained several problems on spectrophotometric determination of hexavalent chromium (Cr(VI)) with diphenylcarbazide (DPC) are addressed with ion transfer device (ITD) separation and flow injection analysis system. The remained problems were trivalent chromium (Cr(III)) cannot be directly detected with DPC spectrometry, and determination of Cr(VI) itself has serious positive interference from metal cations while any reductant present in the sample negatively affect the DPC chemistry. Ion transfer device, we previously developed for electrodialytic separation of Cr(III) and Cr(VI) has been adopted to DPC chemistry based flow injection analysis system. Cationic Cr(III) and anionic Cr(VI) can be separated into different acceptor solutions within ~5 sec by ITD. Aside from direct DPC-based measurement of Cr(VI), the system incorporates the use of a buffered H_2O_2 carrier to oxidize Cr(III) to Cr(VI) and measure it by DPC Chemistry. The optimized system provides the same response for Cr(VI) and Cr(III) with limits of detection (LODs, S/N =3) of 0.5 μg L^{-1} for each and a throughput rate of 30 samples h^{-1}. The ITD separation was also effective to interference and matrices isolations. Potential cationic interferences were not transferred into Cr(VI) acceptor stream. Elimination of organic compounds in soil extracts was proved by standard addition and recovery studies with the developed ITD – FIA system.

Graphical Abstract.

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