Flow injection based ultra-trace analysis of platinum group elements by ICP-MS

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INTRODUCTION

Due to the increased use of platinum group elements (PGE) in car exhaust systems, in medical applications and as catalyst metals, determination of PGE has received special interest over the past 20 years. Nevertheless, ultra-trace analysis of PGE in environmental and biological samples remains challenging, since even after suitable mineralization procedures numerous interferences impede accurate quantification strategies.

Improvement of analytical schemes therefore includes the development of appropriate sample preparation methods for pre-concentration of the low abundant analytes as well as elimination of interfering elements. Several procedures that provide these have been published, but the applied manual sample pre-treatment steps are complex, time-consuming and pose additional risks of contamination or handling errors. In order to enhance measurement reproducibility and to minimize potential source of error, flow injection (FI) procedures have proven to be suited due to the possible high automatization degree.

INSTRUMENTATION

FI-Setup

The designed FI-manifold (shown in Fig. 1) was based on a fully automated Agilent AEoCP pre-concentration system consisting of an isocratic pump, a 13 port/12 position and a 10 port/2 position valve. It was equipped with an additional 6 port/2 position valve from VICI to permit the reversible loading of the microcolumn with DEBT.

ICP-MS

To overcome the problems associated with the use of methanol as eluent, the ICP-MS system (ICP-QMS Elan 6100 DRC II) was equipped with a Peltier Chiller “Organic-Setup” for sample introduction.

RESULTS

Pre-concentration

Employing a sample loop volume of 1.7 ml and considering an elution peak width of approximately 2.5 minutes (corresponding to 250 µl eluent volume), a pre-concentration factor of ~6.8 could be achieved.

Elimination of Interferences

Due to the implemented cation exchange procedure, no significant interference could be observed, as shown in Figure 2.

OUTLOOK

- Optimization of the FI-parameters: 
  - sample flow rate and volume
  - ligand solution flow rate and volume
  - elution flow rate
- Adaption of the measurement routine for quantification by IDMS.
- Implementation of simultaneous Pt and Rh determination.

LITERATURE


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