Flow Injection Microcolumn Preconcentration of Cadmium(II) from Aqueous Samples with the Use of Salen Impregnated Silica Gel

Marta Gawin, Martyna Bryłka, Halina Mrowiec, Anna Tobiasz, Bartosz Trzewik, Stanisław Walas
Faculty of Chemistry, Jagiellonian University, Krakow, Poland

Aim of the work

Flame atomic absorption spectrometry (FAAS) suffers from insufficient limit of detection thus hindering its applicability to trace elements determination, e.g. Cd(II). The problem may be overcome by introducing a preconcentration step prior to detection. This may be realised with flow injection (FI) system [1]. A wide range of various sorbents has been proposed for separation and preconcentration of heavy metal ions, among them silica modified sorbents [2–4]. In this work salen impregnated silica gel has been proposed as a new sorbent to FI–FAAS preconcentration of cadmium(II).

Sorbent preparation

To prepare salen impregnated silica gel 42 mg of salen was dissolved in 5.4 mL of chloroform, then 1 g of silica gel was added and mixed thoroughly. The solvent was subsequently evaporated in room temperature. Thus obtained sorbent was ready to use.

Instrumentation

• FI–FAAS set: FIAS 400 coupled with atomic absorption spectrometer 3100, both Perkin Elmer.
• Homemade microcolumn (0.5 cm in length; 3 mm i.d.) filled with 24 mg of the sorbent.

Results

Sorbent optimal working conditions

• pH range: 7.4–8.8
• sample flow rate: 8 mL min⁻¹
• elution: 1% HNO₃, 8 mL min⁻¹

Matrix effect study

• Cadmium(II) preconcentration was free from Ni(II), Mn(II), K(I) and Mg(II) interferences up to 5 mg L⁻¹ and from Ca(II) interferences up to 15 mg L⁻¹.
• Matrix influence was observed for Cu(II), Pb(II), Fe(III) and Zn(II) starting from concentration 0.2 mg L⁻¹ of a given ion (sorbent mass: 21 mg).
• Sorbent mass increase (4–fold) eliminated interference effect from Zn(II), whereas for the rest of the interferences the effect was reduced.

Conclusions

The proposed salen impregnated silica gel proved to be a good sorbent for FI–FAAS cadmium(II) preconcentration. Enrichment factor obtained for 120–sec loading time (EF 115) enabled trace Cd(II) determination either in natural water samples or in a reference water sample – LOQ found at 1.7 µg L⁻¹ was below MAC for cadmium.

Further reading:

1. Z. Fang, Flow Injection Separation and Preconcentration, VCH, Weinheim, 1993