Application Note AN-V-221

Cadmium and lead in drinking water

Simultaneous determination by voltammetry using a Bi drop electrode

To reduce the toxic effects of cadmium on the kidneys, the skeleton, and the respiratory system, as well as to limit the neurotoxic effects of lead, the provisional guideline values in the World Health Organization's «Guidelines for Drinking-water Quality» are set to a maximum concentration of 3 µg/L for cadmium and 10 µg/L for lead in drinking water.

The completely mercury-free Bi drop electrode takes the next step towards converting voltammetric analysis into a non-toxic approach for heavy metal detection. Using this environmentally friendly sensor for anodic stripping voltammetry (ASV) allows the simultaneous determination of cadmium and lead in drinking water. With a 60 s deposition time, a limit of detection (LOD) of 0.1 µg/L for Cd and 0.5 µg/L for Pb can be reached. This outstanding sensitivity is more than sufficient to monitor the provisional WHO guideline values.

This method is best suited for automated systems or process analyzers, allowing the fully automatic determination of cadmium and lead in large sample series.

SAMPLE

Drinking water, mineral water

EXPERIMENTAL

The water sample and the supporting electrolyte are pipetted into the measuring vessel. The simultaneous determination of cadmium and lead is carried out with a 884 Professional VA using the parameters specified in Table 1. The concentration of both elements is determined by two additions of a cadmium and lead standard addition solution.

The Bi drop electrode is electrochemically activated prior to the first determination of cadmium and lead.

Figure 1. 884 Professional VA fully automated for VA

Table 1. Parameters

Parameter	Setting
Mode	DP – Differential Pulse
Deposition potential	-1.1 V
Deposition time	60 s
Start potential	-1 V
End potential	-0.35 V
Peak potential Cd	-0.7 V
Peak potential Pb	-0.5 V

ELECTRODES

- Working electrode: Bi drop
- Reference electrode: Ag/AgCl/KCl (3 mol/L)
- Auxiliary electrode: Glassy carbon rod

RESULTS

The method is suitable for the determination of cadmium and lead in water samples in concentrations up to 15 µg/L. The limit of detection of the method is 0.1 µg/L for approximately cadmium and 0.5 µg/L for lead.

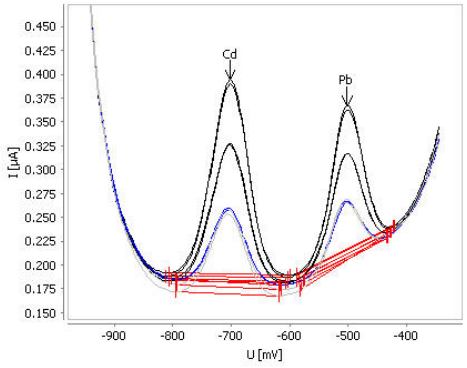

Figure 2. Determination of cadmium and lead in tap water spiked with β(Cd) = 2 µg/L and β(Pb) = 2 µg/L

Table 2. Results

Sample	Cd (µg/L)	Pb (µg/L)
Tap water spiked with β(Cd) = 2 µg/L and β(Pb) = 2 µg/L	2.0	2.3

REFERENCES

Application Bulletin 438: Determination of cadmium and lead in water samples by anodic stripping voltammetry with a Bi drop electrode

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CONFIGURATION

(MME) 884 Professional VA manual

用于多模式电极 (MME) 的 884 Professional VA manual 是借助多模式电极 pro 或 scTRACE Gold 或铋液滴电极使用伏安法和极谱法进行痕量分析的入门仪器。此项已经证实的瑞士万通电极技术与恒电位/恒电位仪以及外接的灵活 viva 软件联用,在重金属测定领域中展现了新的前景。带有经认证的校准器的恒电位仪在每次测量之前均自动冲洗进行校准,确保可能的高精度。

通过此仪器也可使用旋转圆盘电极进行测定,例如借助«循环伏安溶出法»(CVS)、«循环脉冲伏安溶出法»(CPVS)和计时电位法(CP)测定电镀池中的有机添加剂。借助可更换的测量头,可在使用不同电极的各种应用之间实现快速切换。

使用 viva 软件进行控制、数据采集和评估。

用于 MME(多模式电极)的 884 Professional VA manual 供货时配备大量附件,包括用于多模式电极 pro 的测量头。电极组和 viva 许可证则须单独订购。

VA Professional VA

完整的电极套件,用于伏安法测定重金属。包含铋滴电极、参比电极、玻璃碳辅助电极、量杯、搅拌器,电解液和其他附件。