



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

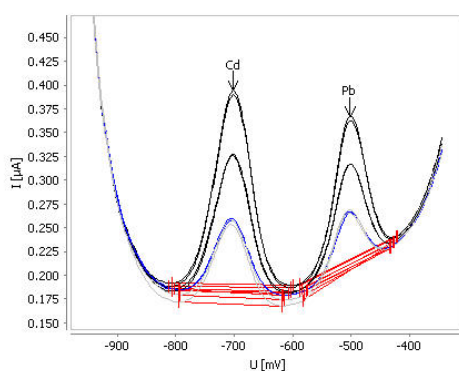
## ELECTRODES

- 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  $\mu\text{g/L}$ . The limit of detection of the method is

0.1  $\mu\text{g/L}$  for approximately cadmium and 0.5  $\mu\text{g/L}$  for lead.



**Figure 2.** Determination of cadmium and lead in tap water spiked with  $\beta(\text{Cd}) = 2 \mu\text{g/L}$  and  $\beta(\text{Pb}) = 2 \mu\text{g/L}$

**Table 2.** Results

Sample	Cd ( $\mu\text{g/L}$ )	Pb ( $\mu\text{g/L}$ )
Tap water spiked with $\beta(\text{Cd}) = 2 \mu\text{g/L}$ and $\beta(\text{Pb}) = 2 \mu\text{g/L}$	2.0	2.3

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

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