



Application Note AN-V-225

# Cadmium and lead in drinking water

Simultaneous determination on a mercury film modified glassy carbon electrode

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

The powerful anodic stripping voltammetry (ASV) technique on the ex-situ mercury film modified glassy carbon electrode is more than sufficient to monitor the proposed WHO guidelines for Cd and Pb in drinking water. The

main advantage lies in the ultrahigh sensitivity of this method. With a deposition time of 30 s, a limit of detection for  $\beta$  (Cd) = 0.02 µg/L and  $\beta$  (Pb) = 0.05 µg/L can be reached. The linear range for both elements goes up to approximately 50 µg/L using the same deposition time. The ability to re-plate the mercury film allows a quick and easy regeneration of the sensor. This method is best suited for both manual and automated systems, allowing the determination in a sample series comprised of a low to medium number of samples.

## SAMPLE

Drinking water, mineral water, sea water

## EXPERIMENTAL

Prior to the first determination, the ex-situ mercury film is deposited on the freshly polished glassy carbon electrode. In the next step, the electrodes are cleaned with ultrapure water and the measuring vessel is emptied. Then the water sample and the supporting electrolyte are pipetted into the measuring vessel. The

simultaneous determination of cadmium and lead is carried out with the 884 Professional VA using the parameters specified in **Table 1**. The concentration of both elements is determined by two additions of a cadmium, lead standard addition solution.



**Figure 1.** 884 Professional VA, fully automated for VA analysis

**Table 1.** Parameters

Parameter	Setting
Mode	DP – Differential Pulse
Deposition potential	-1.0 V
Deposition time	90 s
Start potential	-0.85 V
End potential	-0.25 V
Peak potential Cd	-0.65 V
Peak potential Pb	-0.48 V

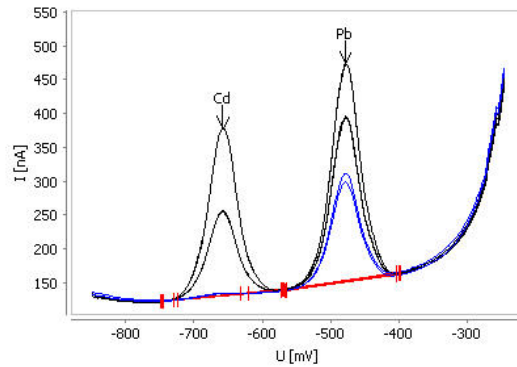
## ELECTRODES

- Working electrode: Glassy carbon (GC-RDE)
- 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 concentrations up to 25  $\mu\text{g/L}$ . The limit of detection for 30 s deposition

time is approximately 0.02  $\mu\text{g/L}$  for cadmium and 0.05  $\mu\text{g/L}$  for lead.



**Figure 2.** Determination of cadmium and lead in tap water

**Table 2.** Result

Sample	Cd ( $\mu\text{g/L}$ )	Pb ( $\mu\text{g/L}$ )
Tap water	0.02	1.76

## REFERENCES

Application Bulletin 241: [Determination of cadmium and lead by anodic stripping voltammetry at a mercury film electrode](#)

## CONTACT

メトロームジャパン株式会社  
143-0006 東京都大田区平  
和島6-1-1  
null 東京流通センター アネ  
ックス9階

metrohm.jp@metrohm.jp

## CONFIGURATION



### 884 Professional VA manual CVS

884 Professional VA manual CVS 仕様は、CVS (サイクリックホルタンメトリーストリッピング)、CPVS (サイクリックハルスホルタンメトリーストリッピング)、CP (クロノポテンシオメトリー) による電気めっき浴内の有機添加物のハイエント測定、または回転ディスク電極によるホルタンメトリー重金属測定へのエントリーレベル装置です。高性能のポテンシostat/カルハノスタットと、非常に柔軟な **viva** ソフトウェアとのコンビネーションにおける熟練した Metrohm の電極技術が CVS に新たな展望を開きます。性能が認証されたキャリフレータの付いたポテンシostatは、各測定前に自動的に新たに調整を行い、可能な限り高い精度を保証します。内蔵式温度電極インポート口により、測定中の溶液温度のモニタリングが可能です。

この装置により、ホルタンメトリー測定を実施することも可能です。交換可能な測定ヘッドにより、異なる電極を持つ様々なアプリケーション間の迅速な交換が可能となります。

コントロール、データ処理および評価のためにソフトウェア **viva** が必要となります。

884 Professional VA manual CVS仕様は、多数の付属品および回転ディスク電極のための測定ヘッドを付属して納品されます。電極セットおよび **viva** ライセンスは別途ご注文ください。



### VA electrode equipment with rotating disc electrode (RDE) made of glassy carbon for Professional VA instruments

Complete electrode set for voltammetric determinations, e.g. using mercury film method. Includes drive for rotating disk electrode, glassy carbon electrode tip, reference electrode, glassy carbon auxiliary electrode, measuring vessel, and electrolyte solution.