



Application Note AN-V-227

Chromium(VI) in drinking water

Ultra-sensitive determination on the mercury film modified glassy carbon electrode (DTPA method)

The guideline value for chromium in the World Health Organization's (WHO) «Guidelines for Drinking-water Quality» is 50 $\mu\text{g/L}$. It should be noted here that chromium concentrations are often expressed as total chromium and not as chromium(III) or (VI). Chromium(VI) is responsible for changes in genetic material, and is found in significantly lower concentrations than Cr(III). Therefore an extremely sensitive method is required to monitor Cr(VI) in drinking water.

The powerful adsorptive stripping voltammetry

(AdSV) technique on the ex-situ mercury film modified glassy carbon electrode using DTPA as complexing agent can be used to determine such low concentrations. With a deposition time of 90 s, the limit of detection of 0.05 $\mu\text{g/L}$ Cr(VI) can be reached. The ability to re-plate the mercury film allows a quick and easy regeneration of the sensor. This approach is best suited for both manual and automated systems, allowing determination in a sample series with 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 a 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 with complexing agent

(diethylenetriaminepentaacetic acid, DTPA) are pipetted into the measuring vessel. The determination of chromium(VI) is carried out with the 884 Professional VA using the parameters specified in **Table 1**. The concentration is determined by two additions of a chromium(VI) 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	-1.0 V
End potential	-1.5 V
Peak potential Cr(VI)	-1.28 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 chromium(VI) concentrations up to 1 $\mu\text{g/L}$. The

limit of detection for 90 s deposition time is approximately 0.05 $\mu\text{g/L}$.

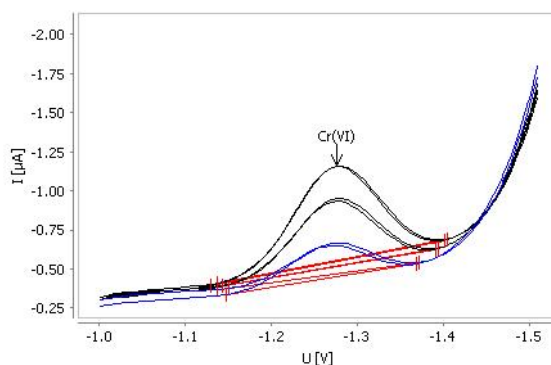


Figure 2. Determination of chromium(VI) in tap water spiked with 0.25 $\mu\text{g/L}$

Table 2. Result

Sample	Cr(VI) ($\mu\text{g/L}$)
Tap water spiked with 0.25 $\mu\text{g/L}$ Cr(VI)	0.28

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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ヘル装置です。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です。

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 disc electrode, glassy carbon electrode tip, reference electrode, glassy carbon auxiliary electrode, measuring vessel, and electrolyte solution.