



Application Note AN-V-227

Chromium(VI) in drinking water

Ultra-sensitive determination on a modified GCE (DTPA method)

The guideline value for chromium in the World Health Organization's (WHO) «Guidelines for Drinking-water Quality» is 50 µg/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 µg/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 $\mu\text{g/L}$.

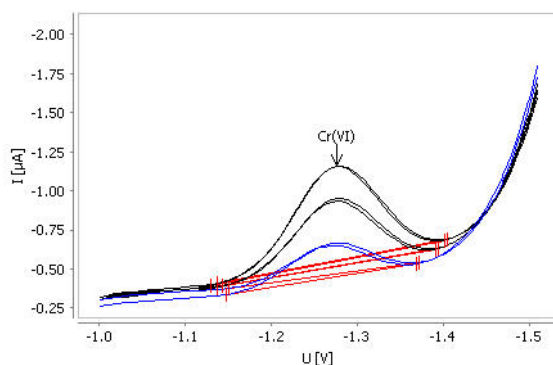


Figure 2. Determination of chromium(VI) in tap water spiked with 0.25 $\mu\text{g/L}$

Table 2. Result

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

Internal reference: AW VA CH4-0595-042020

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CONFIGURATION



884 Professional VA manual for CVS

884 Professional VA manual for CVS applications is the entry-level for high-end determinations of organic additives in electroplating baths with "Cyclic Voltammetric Stripping" (CVS), "Cyclic Pulse Voltammetric Stripping" (CPVS), and chronopotentiometry (CP), or voltammetric heavy metal determinations with rotating disk electrodes. The proven Metrohm electrode methods combined with a high-performance potentiostat/galvanostat and the extremely flexible **viva** software open up new perspectives in CVS. The potentiostat with a certified calibrator readjusts itself automatically before each measurement, thus guaranteeing maximum precision. The integrated temperature measurement input allows you to monitor the solution temperature during the measurement.

The instrument can also be used to perform voltammetric determinations. The replaceable measuring head enables rapid changes between the various applications with different electrodes.

The **viva** software is required for control, data collection, and evaluation.

The 884 Professional VA manual for CVS applications is supplied with extensive accessories and a measuring head for rotating disk electrodes. Electrode set and **viva** license need to be ordered separately.



VA electrode equipment with rotating disk 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.