Application Note AN-V-226

Zinc in drinking water

An ultra-sensitive method for a wide concentration range on the mercury film modified glassy carbon electrode

No health-based guideline value exists for zinc. However, to maintain good quality municipal drinking water, the United States Environmental Protection Agency (US-EPA) set a maximum concentration of 5 mg/L as the limit value. Typical concentrations in surface and ground waters are between 10–40 µg/L Zn. In tap water, this value can be up to 1 mg/L due to leaching of zinc from piping and fittings.

Anodic stripping voltammetry (ASV) on the ex-situ mercury film modified glassy carbon electrode provides a less complex alternative to atomic absorption spectroscopy (AAS) for zinc determination in drinking water. The main advantage of this method is the high sensitivity. With a deposition time of 10 s, the limit of detection for zinc is 0.15 µg/L. The linear working range goes up to approximately 300 µg/L. This method is suited for manual and automated systems.

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 are pipetted into the measuring vessel. The determination of zinc is carried out with the 884 Professional VA using the parameters specified in Table 1. The concentration is determined by two additions of a zinc standard addition solution.

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

Table 1. Parameters

Parameter	Setting
Mode	DP – Differential Pulse
Deposition potential	-1.4 V
Deposition time	10 s
Start potential	-1.2 V
End potential	-0.9 V
Peak potential Zn	-1.05 V

ELECTRODES

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

RESULTS

With the deposition time of 10 s, the method is suitable for samples between 10–150 µg/L zinc.

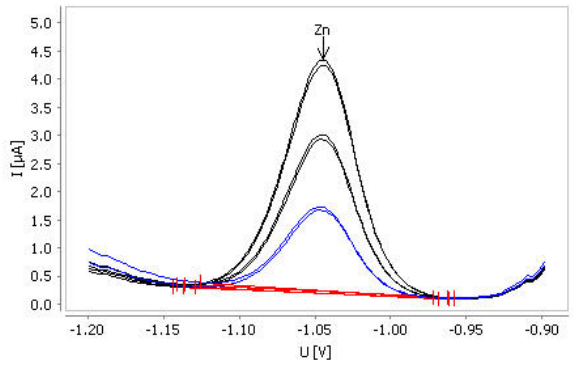

Figure 2. Determination of zinc in tap water (10 s deposition time)

Table 2. Result

Sample	Zn (µg/L)
Tap water	112

REFERENCES

Application Bulletin 254: Determination of zinc, cadmium and lead by anodic stripping voltammetry at a mercury film electrode

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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.