



Application Note AN-V-218

Bismuth in drinking water

Straightforward determination by voltammetry using a gold microwire electrode

Bismuth is considered as a metal with a very low toxicity. However, in high concentrations toxic effects have been described. There is no guideline value for bismuth in the World Health Organization's «Guidelines for Drinking-water Quality» because typical levels usually found in drinking water are of no concern.

Anodic stripping voltammetry is a viable, less

sophisticated alternative to atomic absorption spectroscopy (AAS) for the determination of bismuth in drinking water. While AAS (and competing methods) can only be performed in a laboratory, anodic stripping voltammetry can be used in the laboratory or alternatively in the field with the 946 Portable VA Analyzer. The determination is carried out on the scTRACE Gold electrode.

SAMPLE

Bottled mineral water

EXPERIMENTAL

The scTRACE Gold is electrochemically activated prior to the first determination. In the next step, the water sample and the supporting electrolyte are pipetted into the measuring vessel. The determination is carried out with the 884 Professional VA or with the 946 Portable VA Analyzer using the parameters specified in **Table 1**. The concentration is determined by two additions of a standard addition solution.



Figure 1. 946 Portable VA Analyzer (scTRACE Gold version)



Figure 2. 884 Professional VA fully automated for VA

Table 1. Parameters

Parameter	Setting
Mode	DP – Differential Pulse
Deposition potential	-0.1 V
Deposition time	30 s
Start potential	-0.2 V
End potential	0.3 V
Peak potential Bi	0.08 V

ELECTRODES

- scTRACE Gold

RESULTS

The limit of detection of the method is about 1 µg/L with the 946 Portable VA Analyzer, and approximately

0.03 µg/L with the 884 Professional VA.



Figure 3. Determination of bismuth (946 Portable VA Analyzer; 30 s deposition time)

Table 2. Results of the measurement of Bi in tap water

Sample	Bi (μg/L)
Tap water	20.4

Internal references: AW VA CH4-0568-042018, AW

VA CH4-0577-022019

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CONFIGURATION



884 Professional VA manual for Multi-Mode Electrode (MME)

884 Professional VA manual for Multi-Mode Electrode (MME) is the entry-level instrument for high-end trace analysis with voltammetry and polarography with the Multi-Mode Electrode pro or the scTRACE Gold or the Bismuth drop electrode. The proven Metrohm electrode methods in combination with a high-performance potentiostat/galvanostat and the extremely flexible viva software open up new perspectives for the determination of heavy metals. The potentiostat with a certified calibrator readjusts itself automatically before each measurement, thus guaranteeing maximum precision.

Determinations with rotating disc electrodes can also be performed with the instrument, e.g. determinations of organic additives in electroplating baths with "Cyclic Voltammetric Stripping" (CVS), "Cyclic Pulse Voltammetric Stripping" (CPVS), and chronopotentiometry (CP). 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 MME is supplied with extensive accessories and a measuring head for the Multi-Mode Electrode pro. Electrode set and **viva** license need to be ordered separately.



VA electrode equipment with scTRACE Gold for Professional VA instruments

Complete electrode set for the determination of arsenic or mercury. Includes holders for scTRACE Gold, scTRACE Gold, stirrer and measuring vessel.



viva 2.1 Full CD: 1 license

Computer program for control and data management of Professional VA/CVS instruments. The software permits checks, data acquisition, evaluation, and monitoring, as well as report generation.

Graphic user interface for routine operations, extensive database programs with reevaluation, graphic method editor with numerous templates, system configuration, very flexible user administration, extensive data export functions, individually configurable report generator.

Includes the measuring modes "Differential Pulse" (DP), "Square Wave" (SQW), "Cyclic Voltammetric Stripping" (CVS), "Cyclic Pulse Voltammetric Stripping" (CPVS), and Chronopotentiometry (CP). The following calibration techniques are supported: standard addition, external calibration, DT (Dilution Titration), LAT (Linear Approximation Technique), MLAT (Modified Linear Approximation Technique), RC (Response Curve).

Dialog languages: German, English, Chinese.

The following instruments are supported:

884 Professional VA, 894 Professional CVS

1 license for a maximum of 4 Professional VA/CVS instruments on a single PC.



946 Portable VA Analyzer (scTRACE Gold)

Portable metal analyzer for the determination of heavy metals such as arsenic, mercury, copper, lead, zinc, nickel, cobalt, iron, bismuth or antimony in the trace range. Instrument version for the scTRACE Gold. The system is comprised of potentiostat and separate measuring stand with integrated stirrer and replaceable electrode. The instrument is operated with the Portable VA Analyzer software. The power is supplied via the USB connector and via the integrated rechargeable battery. The instrument is supplied with all required accessories in a carrying case.