



Application Note AN-V-224

用水中的和

Simultaneous determination in low ng/L range on the GC-RDE modified with a bismuth film

Due to the toxicity and the detrimental effects of nickel and cobalt on human health, their concentrations in drinking water must be controlled. Therefore, EU the legislation specifies 20 $\mu\text{g/L}$ as the limit value for nickel in drinking water. The current provisional guideline value for Ni in the World Health Organization's «Guidelines for Drinking-water Quality» is set to a maximum concentration of 70 $\mu\text{g/L}$. To monitor the concentrations of Ni and Co with the 884 Professional VA, a method for simultaneous determination on the glassy carbon electrode (GC-RDE) modified with a Bi

film is used.

The simplicity of the bismuth film preparation step allows quick and easy regeneration of the sensing layer. The determination is based on adsorptive stripping voltammetry of both elements using dimethylglyoxime (DMG) as a complexing agent. This method results in excellent performance in terms of sensitivity, reaching a limit of detection of 0.05 $\mu\text{g/L}$ for Ni and 0.03 $\mu\text{g/L}$ for Co. This non-toxic method is best suited for both manual and automated systems, allowing the determination in sample series with low to medium number of samples.

SAMPLE

Drinking water, mineral water, sea water

EXPERIMENTAL

Prior to the first determination, an ex-situ bismuth film is deposited from a bismuth solution. In the next step, the electrodes are cleaned with ultrapure water and the bismuth solution is removed. The water sample is placed into the measuring vessel. Ammonium buffer together with the complexing agent (DMG) are

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



Figure 1. 884 Professional VA fully automated for VA

Table 1. Parameters

| Parameter | Setting |
|----------------------|-------------------------|
| Mode | DP – Differential Pulse |
| Deposition potential | -0.8 V |
| Deposition time | 30 s |
| Start potential | -0.85 V |
| End potential | -1.25 V |
| Peak potential Ni | -0.97 V |
| Peak potential Co | -1.12 V |

ELECTRODES

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

- Auxiliary electrode: Glassy carbon rod

RESULTS

With a 30 s deposition time, this method is suitable for the determination of both nickel and cobalt in water samples in concentrations from $\beta(\text{Ni}) = 0.2\text{--}8 \mu\text{g/L}$ and $\beta(\text{Co}) = 0.1\text{--}10 \mu\text{g/L}$.

Using a 90 s deposition time, the limit of detection can be lowered to approximately $0.05 \mu\text{g/L}$ for nickel and $0.03 \mu\text{g/L}$ for cobalt.

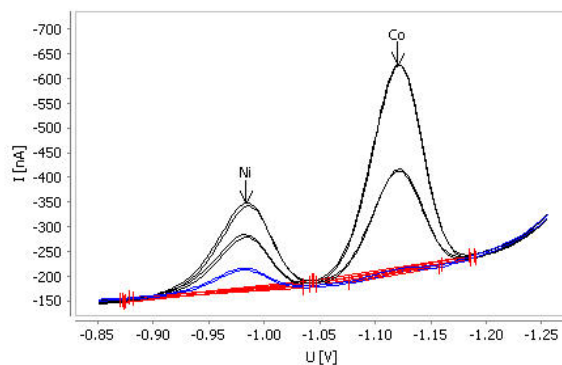


Figure 2. Determination of nickel and cobalt in tap water (30 s deposition time)

Table 2. Result

| Sample | Ni ($\mu\text{g/L}$) | Co ($\mu\text{g/L}$) |
|-----------|------------------------|------------------------|
| Tap water | 0.34 | <LOD |

Internal reference: AW VA CH4-0589-122019

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CONFIGURATION



CVS 884 Professional VA manual

用于 CVS 用的 884 Professional VA manual 是借助 «循环伏安溶出法»(CVS)、«循环脉冲伏安溶出法»(CPVS)和位法(CP)在池中有有机添加行定或采用旋位伏安法重金属定的入器。此已的瑞士万通技与恒位/恒位以及外接的活 **viva** 件用,展了新的 CVS 前景。有的校准器的恒位在每次量之前均自冲洗行校准,保精度。集成的温度量入端可在量程中控溶液温度。

通此器也可以行伏安法定。借助可更的量,可在使用不同的各用之快速切。

使用 **viva** 件行控制、数据采集和估。

用于 CVS(伏安量)用的 884 Professional VA manual 供有大量附件,以及用于旋的量。和 **viva** 可独。



VA Glassy Carbon RDE Professional VA

整套,用于伏安定,例如采用汞膜技。包含旋、玻、参比、玻助、量杯和解溶液。