



Application Note AN-V-232

Nickel and cobalt in drinking water

Simultaneous determination in low $\mu\text{g/L}$ range on the 11L SPEs modified with a Bi film

EU 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 $\mu\text{g/L}$. The adsorptive stripping voltammetry (AdSV) technique performed on the ex-situ bismuth film modified Metrohm DropSens 11L screen-printed electrode (SPE) can be used to simultaneously detect concentrations as low as 0.4 $\mu\text{g/L}$ for nickel and 0.2 $\mu\text{g/L}$ for cobalt with a 30 s deposition time. These limits can be lowered even further by increasing the

deposition time. Another advantage of this method lies in the innovative and cost-effective SPE. It is a combined sensor consisting of a carbon working electrode, Ag/AgCl reference, and carbon auxiliary electrode on a ceramic substrate. The disposable sensor does not require any maintenance such as mechanical polishing or mechanical cleaning. It can be used conventionally in the laboratory with the 884 Professional VA, or alternatively in the field with the 946 Portable VA Analyzer. This method is best suited for manual systems.

SAMPLE

Drinking water, mineral water

EXPERIMENTAL

Prior to the first determination, an ex-situ bismuth film is deposited from a Bi 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. Ammonia / ammonium chloride buffer along with the complexing agent (dimethylglyoxime) are added, and the simultaneous determination of nickel and cobalt is carried out using the parameters specified in **Table 1**. The concentration is determined by two additions of a nickel and cobalt standard addition solution.



Figure 1. 946 Portable VA Analyzer (SPE)



Figure 2. 884 Professional VA semiautomated

Table 1. Parameters

Parameter	Setting
Mode	DP – Differential Pulse
Deposition potential	-0.9 V
Deposition time	30 s
Start potential	-0.9 V
End potential	-1.3 V
Peak potential Ni	-1.05 V
Peak potential Co	-1.175 V

ELECTRODES

- Screen-printed carbon electrode (Metrohm DropSens 11L)

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 $\beta(\text{Ni}) = 0.4\text{--}5 \mu\text{g/L}$ and $\beta(\text{Co}) = 0.2\text{--}8 \mu\text{g/L}$.

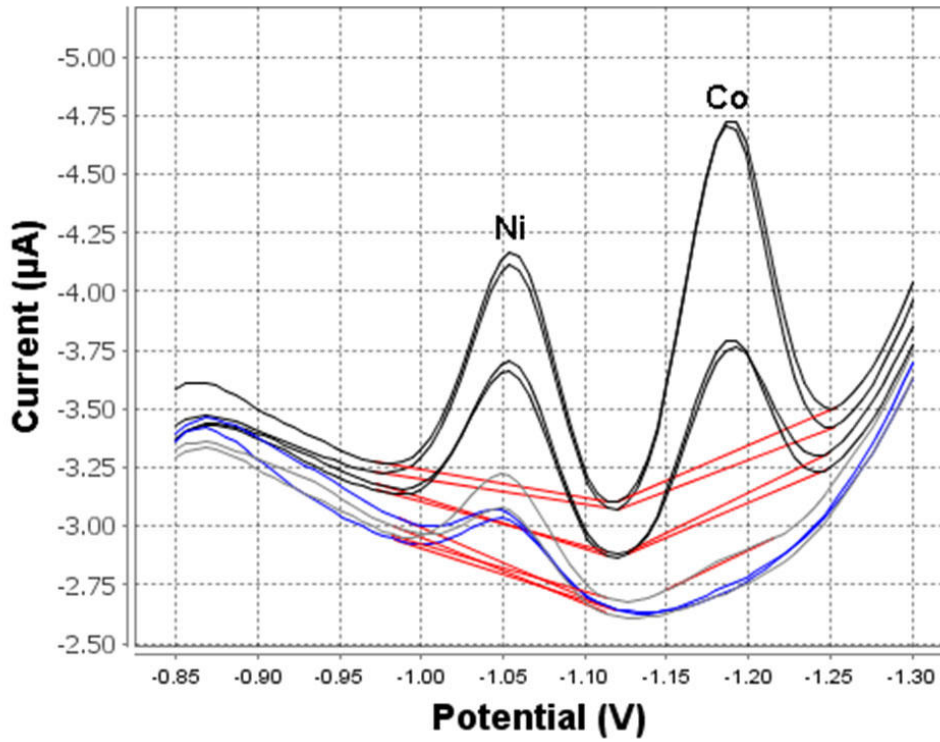


Figure 3. Determination of nickel and cobalt in tap water (946 Portable VA Analyzer; 30 s deposition time)

Table 2. Result

Sample	Ni (µg/L)	Co (µg/L)
Tap water	1.15	<LOD

Internal references: AW VA CH4-0597-062020; AW

VA CH4-0599-082020

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Gamme d'accessoires VA avec tige d'électrode SPE pour les appareils Professional VA

Gamme d'accessoires à utiliser avec les électrodes à film épais (*Screen-Printed Electrodes, SPE*). Comprend une tige pour électrodes à film épais, un agitateur et un bécher de mesure. Sans électrodes.



946 Portable VA Analyzer (SPE)

Analyseur de métaux portable pour déterminer les métaux lourds. Version de l'appareil pour électrodes à film épais (*Screen-Printed Electrodes, SPE*). Le système comprend un potentiostat et un banc de mesure séparé avec agitateur intégré et électrode interchangeable. L'appareil fonctionne avec le logiciel du Portable VA Analyzer. L'alimentation se fait par le connecteur USB et par la batterie rechargeable intégrée. L'appareil est livré dans une mallette contenant tous les accessoires nécessaires. Les électrodes à film épais ne sont pas fournies.



Électrode à film épais en carbone (aux. : C ; réf. : Ag/AgCl)

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