Nickel and cobalt in drinking water with a Bi drop electrode

Simultaneous ng/L determination using the Bi drop electrode

Summary

The main sources of nickel pollution are electroplating, metallurgical operations, or leaching from pipes and fittings. Catalysts for the petroleum and chemical industries are major application fields for cobalt. In both cases, the metal is either released directly, or via the waste water-river pathway into the drinking water system. Therefore in the EU the legislation specifies 20 µg/L as the limit value for the Ni concentration in drinking water.

The simultaneous and straightforward determination of nickel and cobalt is based on adsorptive stripping voltammetry (AdSV). The unique properties of the non-toxic Bi drop electrode combined with AdSV results in an excellent performance in terms of sensitivity. The limit of detection for 30 s deposition time is approximately 0.2 µg/L for nickel and 0.1 µg/L for cobalt, and can be lowered further by increasing the deposition time. This method is best suited for automated systems or process analyzers, allowing fully automatic determination in large sample series.

Configuration

2.884.0110 - 884 Professional VA manual for MME

884 Professional VA manual for 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. The proven Metrohm electrode methods in combination with a completely new design of potentiostat/galvanostat and the extremely high-performance viva software opens 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 various applications with different electrodes.The viva software is required for control, data acquisition, 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.

6.5339.080 - VA electrode equipment with bismuth drop electrode for Professional VA instruments

Complete electrode set for voltammetric determinations of heavy metals. Contains bismuth drop electrode, reference electrode, glassy carbon auxiliary electrode, measuring vessel, stirrer, electrolyte solution, and additional accessories.

Sample

Drinking water, mineral water, sea water

Experimental

The water sample is pipetted into the measuring vessel. Ammonia / ammonium chloride buffer and the complexing agent dimethylglyoxime (DMG) are added, and the simultaneous determination of nickel and cobalt is carried out with a 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.

The Bi drop electrode is electrochemically activated prior to the first determination.

Figure 1. 884 Professional VA fully automated for VA analysis

Table 1. Parameters

Parameter	Setting
Mode	SQW – Square wave
Deposition potential	-0.8 V
Deposition time	30 s
Start potential	-0.8 V
End potential	-1.3 V
Peak potential Ni	-0.97 V
Peak potential Co	-1.12 V

Electrodes

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

Results

The method is suitable for the determination of nickel and cobalt concentrations in water samples from (Ni^{2+}) = 0.2–8 µg/L and (Co^{2+}) = 0.1–10 µg/L.

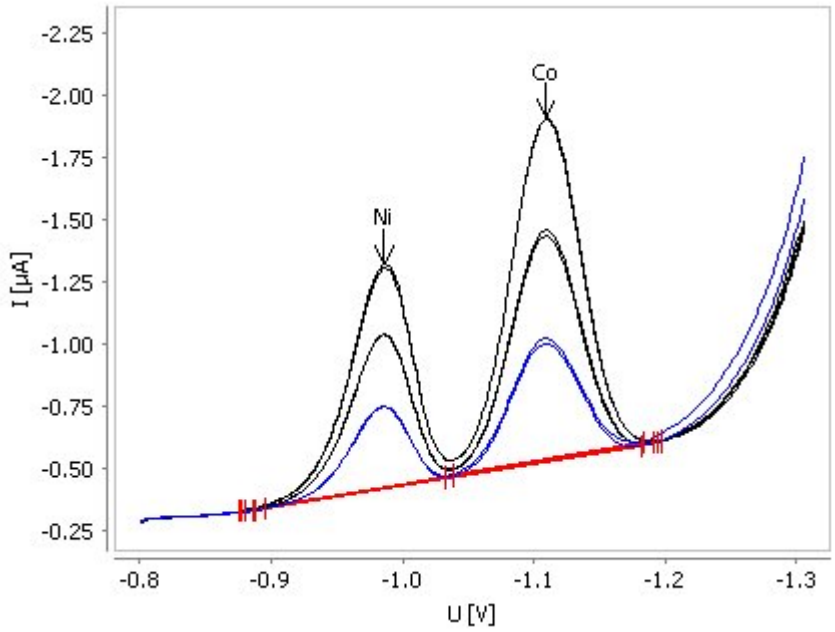

Figure 2. Determination of nickel and cobalt in tap water spiked with (Ni) = 0.5 µg/L and (Co) = 0.5 µg/L

Table 2. Result

Sample	Ni (g/L)	Co (g/L)
Tap water spiked with (Ni) = 0.5 µg/L and (Co) = 0.5 µg/L	0.58	0.54

References

Application Bulletin 440: Determination of nickel and cobalt in water samples by adsorptive stripping voltammetry with a Bi drop electrode

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