



Application Note AN-V-223

Nickel and cobalt in drinking water

Simultaneous determination in the ng/L range on the Bi drop electrode

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 $\mu\text{g/L}$ 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 $\mu\text{g/L}$ for nickel and 0.1 $\mu\text{g/L}$ 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.

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

$\beta(\text{Ni}^{2+}) = 0.2\text{--}8 \mu\text{g/L}$ and $\beta(\text{Co}^{2+}) = 0.1\text{--}10 \mu\text{g/L}$.

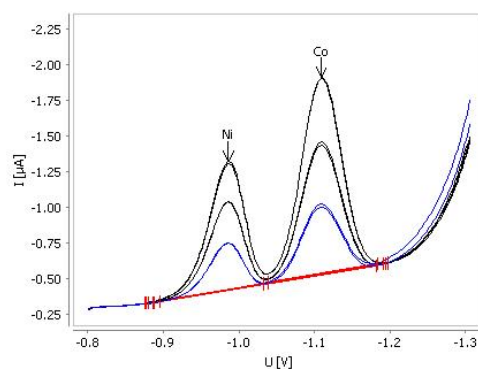


Figure 2. Determination of nickel and cobalt in tap water spiked with $\beta(\text{Ni}) = 0.5 \mu\text{g/L}$ and $\beta(\text{Co}) = 0.5 \mu\text{g/L}$

Table 2. Result

| Sample | Ni ($\mu\text{g/L}$) | Co ($\mu\text{g/L}$) |
|---|------------------------|------------------------|
| Tap water spiked with $\beta(\text{Ni}) = 0.5 \mu\text{g/L}$ and $\beta(\text{Co}) = 0.5 \mu\text{g/L}$ | 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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