Application Note AN-V-222

Iron determination in drinking water

Wide linear range with a low detection limit using the Bi drop electrode and the triethanolamine method

The presence of iron in drinking water can lead to an unpleasant, harsh metallic taste or reddish-brown stains. In addition, «iron bacteria» which can grow in waters containing Fe as low as 0.1 mg/L, create a reddish-brown slime that can clog plumbing and cause an offensive odor. Over a longer period, the formation of insoluble iron deposits is problematic in many industrial and agricultural applications, such as water supply, system cooling, or field irrigation. To avoid these problems, the U.S. Environmental Protection Agency (EPA) defines the Secondary Maximum Contaminant Level (SMCL) for water treatment and processing plants as 0.3 mg/L Fe in drinking water.

The voltammetric determination of the iron triethanolamine complex on the non-toxic Bi drop electrode does not require enrichment. This system uses catalytic signal enhancement, allowing both the detection at very low levels (limit of detection of 0.005 mg/L) and measurements in a wide range of concentrations up to 0.5 mg/L. This method is best suited for automated systems or process analyzers, allowing fully automatic determination of iron in a large sample series.

SAMPLE

Drinking water, mineral water, sea water

EXPERIMENTAL

The water sample and the supporting electrolyte are pipetted into the measuring vessel. The determination of iron is carried out with a 884 Professional VA using the parameters specified in Table 1. The concentration is determined by two additions of an iron standard addition solution.

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

Figure 1. 884 Professional VA fully automated for VA

Table 1. Parameters

Parameter	Setting
Mode	DP – Differential Pulse
Start potential	-0.75 V
End potential	-1.25 V
Peak potential Fe	-1 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 iron in water samples in concentrations from β(Fe) = 10–500 µg/L. The limit of detection of the method is approximately β(Fe) = 5 µg/L.

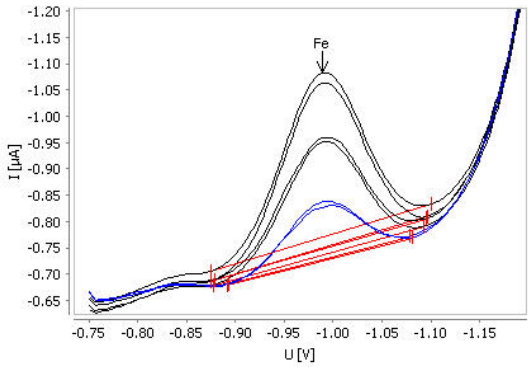

Figure 2. Determination of iron in tap water spiked with β(Fe) = 20 µg/L

Table 2. Result

Sample	Fe (µg/L)
Tap water spiked with β(Fe) = 20 µg/L	19.1

REFERENCES

Application Bulletin 439: Voltammetric determination of iron in water samples with a Bi drop electrode

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