

Iron determination in drinking water

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

Summary

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.

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 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 (Fe) = 10–500 µg/L. The limit of detection of the method is approximately (Fe) = 5 µg/L.

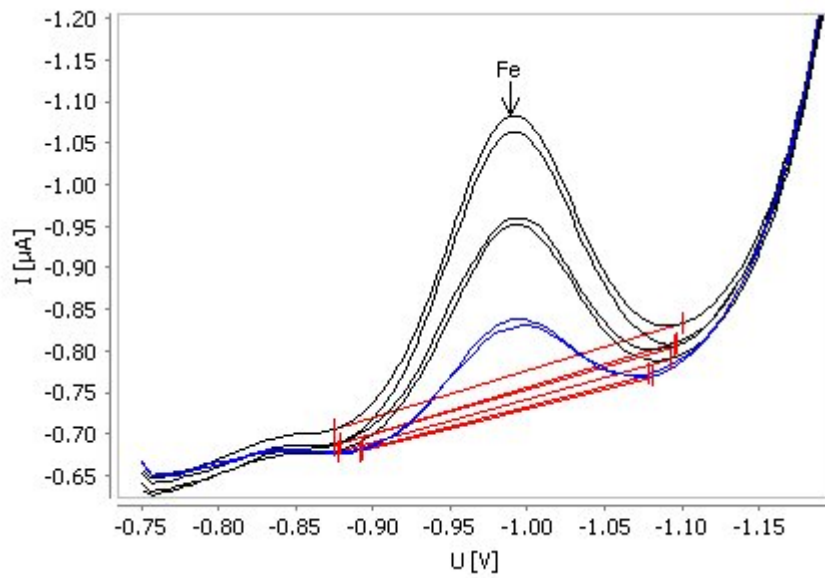


Figure 2. Determination of iron in tap water spiked with (Fe) = 20 $\mu\text{g/L}$

Table 2. Result

| Sample | Fe ($\mu\text{g/L}$) |
|---|------------------------|
| Tap water spiked with (Fe) = 20 $\mu\text{g/L}$ | 19.1 |

References

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

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