

Application Note AN-H-144

Ferrous iron in iron sucrose injection

Rapid and reliable determination by thermometric titration

Iron sucrose injections are used during the treatment of iron deficiency anemia. They contain a mixture of ferric iron (Fe^{3+}) and ferrous iron (Fe^{2+}). Ferrous iron content may be determined by subtracting the ferric iron content from the total determined iron content. Yet, this increases the measurement error due to error propagation. Alternative determination of iron(II) with cerium(IV) by potentiometric titration may be hampered, as the equivalence point cannot be determined unequivocally.

Determination by thermometric titration is a more robust and therefore more reliable alternative, as this method is unaffected by the sample matrix. Here, the endpoint of the titration is indicated by a fast-responding thermometric sensor. Endpoint detection is further improved by spiking the sample with 0.2% ammonium iron(II) sulfate (FAS), increasing the reliability of the determination.

Compared to potentiometric titration, thermometric titration is faster and more convenient as no sensor maintenance is required. One determination takes about 2–3 minutes.

SAMPLE AND SAMPLE PREPARATION

The method is demonstrated for three batches of iron sucrose solution.

The contents of several ampoules from the same batch are combined in a centrifuge tube previously flooded with nitrogen. The centrifuge tube is capped tightly afterwards to prevent the entrance of air.

EXPERIMENTAL

An OMNIS Titrator which is equipped with a dThermoprobe and controlled by the OMNIS software is used for this application (Figure 1).

An aliquot of sample is weighed directly into the titration vessel. Both the spike solution (ferric ammonium sulfate, FAS) to improve the detection of the endpoint and diluted sulfuric acid solution are dosed to the sample. The mixture is then made up to a total volume of approximately 30 mL with deionized water. The sample is titrated with standardized ceric ammonium nitrate until after the exothermic endpoint.



Figure 1. OMNIS Titrator equipped with a dThermoprobe. Example setup for the thermometric titration of ferrous iron.

RESULTS

The analysis demonstrates acceptable and reproducible results with a clear exothermic endpoint.

The results are summarized in Table 1, and an example titration curve is displayed in Figure 2.

Table 1. Mean ferrous iron content determined by thermometric titration (n = 3).

Batch	Fe(II) / %	SD(abs) / %
1	0.238	0.001
2	0.220	0.007
3	0.227	0.003

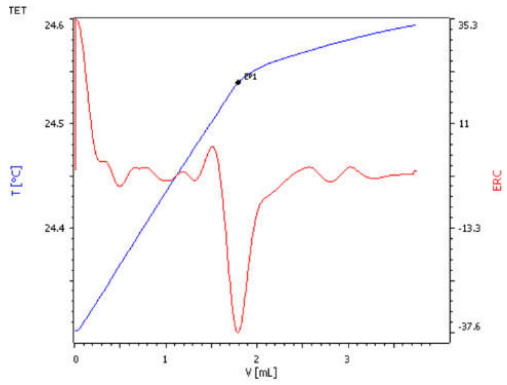


Figure 2. Example titration curve for the determination of ferrous iron by thermometric titration.

CONCLUSION

The determination of ferrous iron by thermometric titration is a quick and reliable method to assess the Fe^{2+} content alone, independent of its sample matrix. Furthermore, only one titration is necessary, whereas potentiometric titration requires two.
The dThermoprobe does not require any maintenance nor conditioning or other preparation steps, making thermometric titration easy and convenient.

Internal reference: AW TI CH1-1268-012019

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CONFIGURATION



OMNIS Titrator with magnetic stirrer, without function license

Innovative, modular potentiometric OMNIS Titrator for stand-alone operation or as the core of an OMNIS titration system. Thanks to 3S Liquid Adapter technology, handling chemicals is more secure than ever before. The titrator can be freely configured with measuring modules and cylinder units and can have a stirrer added as needed. Thanks to various software function licenses, various measuring modes and functionalities are possible.

- Control via PC or local network
- Connection option for up to four additional titration or dosing modules for additional applications or auxiliary solutions
- Connection option for one rod stirrer
- Various cylinder sizes available: 5, 10, 20 or 50 mL
- Liquid Adapter with 3S technology: Secure handling of chemicals, automatic transfer of the original reagent data of the manufacturer

Measuring modes and software options:

- Endpoint titration: "Basic" function license
- Endpoint and equivalence point titration (monotonic/dynamic): "Advanced" function license
- Endpoint and equivalence point titration (monotonic/dynamic) with parallel titration: "Professional" function license



dThermoprobe

High-sensitivity digital temperature sensor for thermometric titration with OMNIS.

The Thermoprobe has a short response time and a high resolution, which enables precise recording of even the smallest temperature changes.

This sensor can be used in aqueous and nonaqueous solutions which do not contain any HF, for determinations such as:

- Acid number (TAN) in accordance with ASTM D8045
- Total base number (TBN)
- Free fatty acids
- Ca/Mg determination
- Phosphate



Cylinder unit OMNIS special, 10 mL

Intelligent 10 mL cylinder unit for one OMNIS Titrator, Titration Module or Dosing Module. This cylinder unit is especially recommended for the following solutions:

- Aqueous alkaline solutions
- Titrant 5
- Silver nitrate solutions
- Nonaqueous alkaline solutions
- Permanganate solutions
- EDTA solutions

Includes dosing tubing and antidiffusion tip.

OMNIS

A WHOLE NEW LEVEL OF PERFORMANCE

Function license Thermometric Titrator

Function license "Thermometric Titrator" for the OMNIS Titrator

Contains the function modes

- Thermometric Titration (TET)
- MEAS U/T/pH
- Liquid Handling
- Titration only with internal buret of an OMNIS Titrator