

Ferrous iron in iron sucrose injection

Rapid and reliable determination by thermometric titration

Summary

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.

Configuration



2.859.1010 - 859 Titrotherm complete with tiamo™

Computer-controlled titrator for thermometric titration. Including complete accessories for the titration (10 mL buret, titration stand with rod stirrer, Thermoprobe, titration vessel and tiamo™ light).



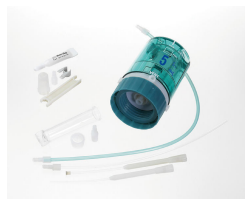
2.800.0010 - 800 Dosino

Drive with write/read hardware for intelligent Dosing Units. With fixed cable (length 150 cm).



6.3032.210 - Dosing Unit 10 mL

Dosing unit with integrated data chip with 10 mL glass cylinder and light protection, mountable on reagent bottle with ISO/DIN GL45 thread. FEP tubing connection, anti-diffusion buret tip.



6.3032.150 - Dosing Unit 5 mL

Dosing unit with integrated data chip with 5 mL glass cylinder and light protection, mountable on reagent bottle with ISO/DIN GL45 thread. FEP tubing connection, anti-diffusion buret tip.

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



Figure 1. 859 Titrotherm with tiamo. Example setup for the thermometric titration of ferrous iron.

An 859 Titrotherm which is equipped with a Thermoprobe and controlled by *tiamo*TM is used for this application.

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.

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

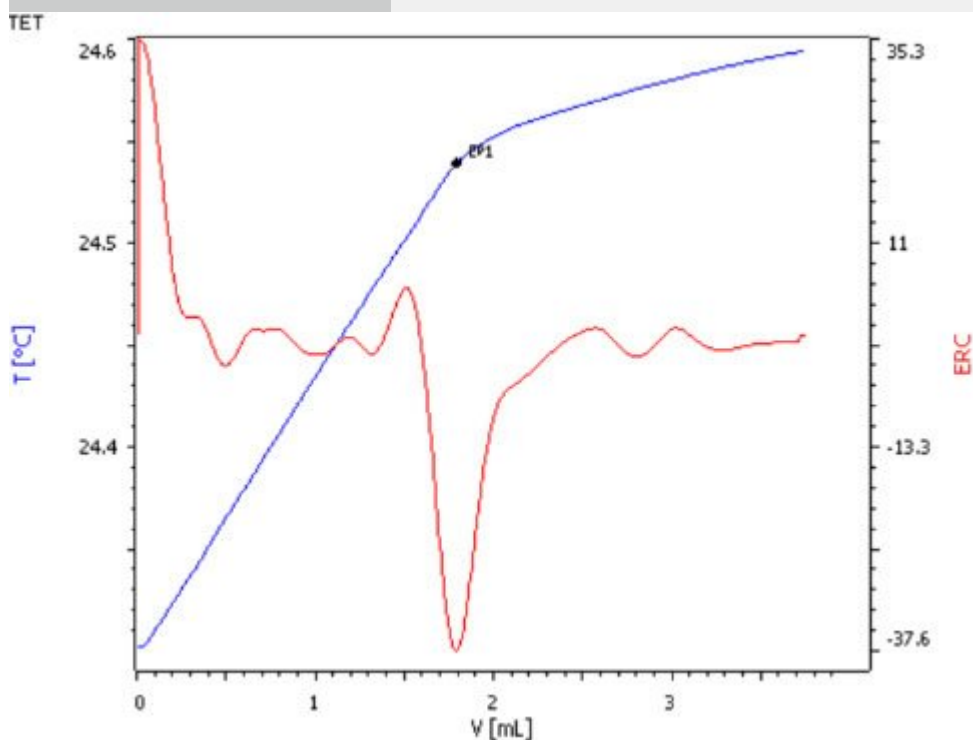


Figure 2. Example titration curve for the determination of ferrous iron by thermometric titration.

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 Thermoprobe does not require any maintenance nor conditioning or other preparation steps, making thermometric titration easy and convenient.

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