Application Note AN-V-127

Fe(II) in iron sucrose injection (USP)

Polarographic determination of limit of iron(II) according to USP–NF

Iron sucrose injection is a medical product commonly used for the treatment of iron deficiency anemia. Iron sucrose is a dark brown liquid which contains sucrose and iron(III) hydroxide in an aqueous solution. Once administered to the blood stream the iron (III) is stored in the protein ferritin where it is available for the production of the protein hemoglobin as a part of the red blood cells, which are essential for the transport of oxygen.

As a medical product, iron sucrose is subject to strict controls. Among other tests, the U.S. Pharmacopeia (USP) requires to monitor the limit of Fe(II) in the iron sucrose injection solution by polarography. The benefit of polarography is that Fe(II) and Fe(III) show signals at different potentials, and therefore an easier determination of Fe(II) without a previous separation of the two oxidation states is possible.

The 884 Professional VA together with the viva software allows a straightforward determination of the Fe(II) content of iron sucrose injection solution following the requirements of the USP. The Fe(II) content is automatically calculated and stored in a database together with all relevant determination and calculation parameters.

SAMPLE

Iron sucrose injection solution ampoules

EXPERIMENTAL

The concentration of Fe(II) is determined in iron sucrose injection solutions using polarography. Sodium acetate supporting electrolyte is deaerated for 5 minutes. Then the sample is added, and the polarogram is recorded using the parameters listed in Table 1.

Figure 1. 884 Professional VA.

Table 1. Parameters

Parameter	Setting
Working electrode	SMDE
Mode	DP – Differential Pulse
Start potential	-0.1 V
End potential	-1.75 V
Peak potential Fe(III) -> Fe(II)	-0.75 V
Peak potential Fe(II) -> Fe^0	-1.4 V

ELECTRODES

- Working electrode: Multi-Mode Electrode pro with standard glass capillaries
- Reference electrode: Ag/AgCl/KCl (3 mol/L) reference electrode with electrolyte vessel. Bridge electrolyte: KCl (3 mol/L)
- Auxiliary electrode: Platinum rod electrode

RESULTS

Two signals are recorded, one for the reduction of Fe(III) → Fe(II), and the second for the reduction of Fe(II) → Fe^0. The concentration of Fe(II) is calculated as follows:

$$w(Fe^{2+}) = \left[1 - \frac{2}{R}\right] \times w(Fe(total)) \quad \left[{}^{\%w}/_{v}\right]$$

in which R is defined as:

$$R = \frac{peak\ height\ (Fe^{2+} \rightarrow Fe^{0})}{peak\ height\ (Fe^{3+} \rightarrow Fe^{2+})}$$

The total iron concentration w(Fe(total)) is determined in a separate analysis by AAS (atomic absorption spectroscopy).

The calculation in this application can be done automatically in the viva software.

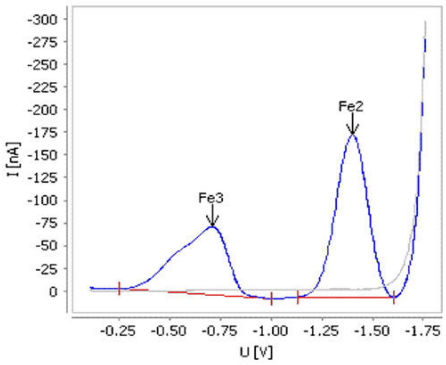

Figure 2. Determination of iron in iron sucrose injection

Table 2. Result

Sample	Fe(II) concentration
Iron sucrose injection	0.33%

REFERENCE

United States Pharmacopeia USP 39–NF 34

Internal references: AW CH4-0452-112006; AW VA CH4-0565-042017

CONTACT

CÔNG TY TNHH METROHM
VIỆT NAM
Tòa nhà Park IX, số 08
Đường Phan Đình Giót,
Phường Tân Sơn Hòa
null Thành phố Hồ Chí Minh
info@metrohm.vn

CONFIGURATION

884 Professional VA manual for Multi-Mode Electrode (MME)

884 Professional VA manual for Multi-Mode Electrode (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 or the Bismuth drop electrode. The proven Metrohm electrode methods in combination with a high-performance potentiostat/galvanostat and the extremely flexible viva software open 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 the various applications with different electrodes.

The viva software is required for control, data collection, 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.

VA electrode equipment with Multi-Mode Electrode pro for Professional VA instruments

Complete electrode set for polarographic and voltammetric determinations. Includes Multi-Mode Electrode pro, reference electrode, platinum auxiliary electrode, measuring vessel, stirrer, electrolyte solution and additional accessories for setting up and operating the Multi-Mode Electrode.

viva 2.1 Full CD: 1 license

Computer program for control and data management of Professional VA/CVS instruments. The software permits checks, data acquisition, evaluation, and monitoring, as well as report generation.

Graphic user interface for routine operations, extensive database programs with reevaluation, graphic method editor with numerous templates, system configuration, very flexible user administration, extensive data export functions, individually configurable report generator.

Includes the measuring modes "Differential Pulse" (DP), "Square Wave" (SQW), "Cyclic Voltammetric Stripping" (CVS), "Cyclic Pulse Voltammetric Stripping" (CPVS), and Chronopotentiometry (CP).

The following calibration techniques are supported: standard addition, external calibration, DT (Dilution Titration), LAT (Linear Approximation Technique), MLAT (Modified Linear Approximation Technique), RC (Response Curve).

Dialog languages: German, English, Chinese.

The following instruments are supported:
884 Professional VA, 894 Professional CVS

1 license for a maximum of 4 Professional VA/CVS instruments on a single PC.