



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.

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**.

The Fe(II) content is automatically calculated and stored in a database together with all relevant determination and calculation parameters.

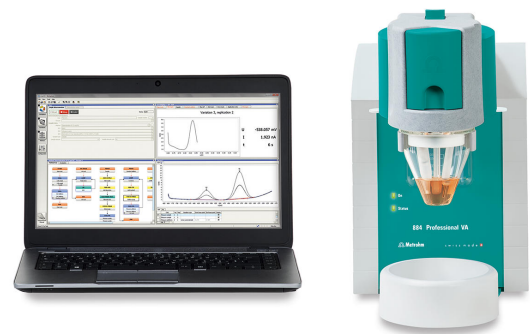


Figure 1. 884 Professional VA.

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 $\text{Fe(III)} \rightarrow \text{Fe(II)}$, and the second for the

reduction of $\text{Fe(II)} \rightarrow \text{Fe}^0$. The concentration of Fe(II) is calculated as follows:

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

in which R is defined as:

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

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

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

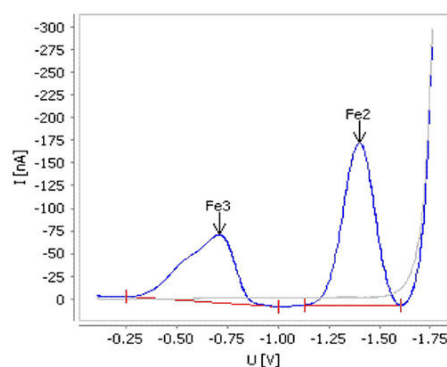


Figure 2. Determination of iron in iron sucrose injection

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 CH4-0565-092017

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CONFIGURATION



(MME) 884 Professional VA manual

マルチモード電極（MME）のための 884 Professional VA manual は、マルチモード電極 pro、scTRACE Gold または滴下ビスマス電極を使用したボルタンメトリーおよびポーラログラフィーによるハイエンド微量分析へのエントリーレベル装置です。高性能のポテンショスタット/ガルバノスタットと、非常に柔軟な viva ソフトウェアとのコンビネーションにおける熟練した Metrohm の電極技術が重金属の測定に新たな展望を開きます。性能が認証されたキャリブレーションの付いたポテンショスタットは、各測定前に自動的に新たに調整を行い、可能な限り高い精度を保証します。

この装置と組み合わせることで、例えばCVS (サイクリックボルタンメトリーストリッピング)、CPVS (サイクリックパルスボルタンメトリーストリッピング)、CP (クロノポテンショメトリー) による電気めっき浴内の有機添加物の測定など、回転ディスク電極による測定を実施することも可能となります。交換可能な測定ヘッドにより、異なる電極を持つ様々なアプリケーション間の迅速な交換が可能となります。

コントロール、データ処理および評価のためにソフトウェア **viva** が必要となります。

884 Professional VA manual MME仕様は、多数の付属品およびマルチモード電極 pro のための測定ヘッドを付属して納品されます。電極セットおよび **viva** ライセンスは別途ご注文ください。



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.