

Application Note AN-V-219

Sn(II) in radiopharmaceuticals

Polarographic determination of stannous tin in sodium pertechnetate ^{99m}Tc injection kits

^{99m}Tc radiopharmaceuticals are widely used in medical imaging diagnostic procedures. They can help to diagnose a large number of diseases affecting the bones and major organs of the body such as the heart, brain, liver, kidney, and thyroid.

^{99m}Tc radiopharmaceuticals are usually prepared from so-called «cold kits». A cold kit consists of the ligand to which ^{99m}Tc is complexed, a reducing agent, a buffer, stabilizers, and further ingredients. Sn(II) is a typical reducing agent. It reduces the Tc(VII) that is

added to the cold kit to a lower oxidation state which then forms the stable organic complex.

For quality control, the Sn(II) content has to be determined in the kit vial. Sn(II) can be selectively determined using differential pulse polarography. The freeze-dried content of the vial is dissolved in diluted nitric acid prior to determination.

Polarography is a straightforward, sensitive, selective, and interference-free method for the determination of mg/L levels of Sn(II) in radiopharmaceuticals.

SAMPLE

Cold kit for preparation of sodium pertechnetate (^{99m}Tc) injection.

EXPERIMENTAL

After dissolving and diluting the sample with nitric acid supporting electrolyte, the polarographic determination of Sn(II) is carried out on the 884 Professional VA with the Multi-Mode Electrode pro as working electrode using the parameters listed in **Table 1**. The concentration of Sn(II) is determined by three additions of Sn(II) standard addition solution.

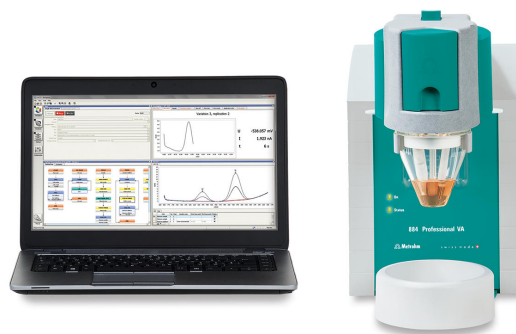


Figure 1. 884 Professional VA

Table 1. Parameters

| Parameter | Setting |
|-----------------------|-------------------------|
| Working electrode | DME |
| Mode | DP – Differential Pulse |
| Start potential | -0.22 V |
| End potential | -0.66 V |
| Peak potential Sn(II) | -0.35 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

The determination of Sn(II) in cold kits for sodium pertechnetate (^{99m}Tc) injection can be carried out in a simple and straightforward manner. The method is

selective and free of interferences. It is suitable for concentrations in the mg/L range.

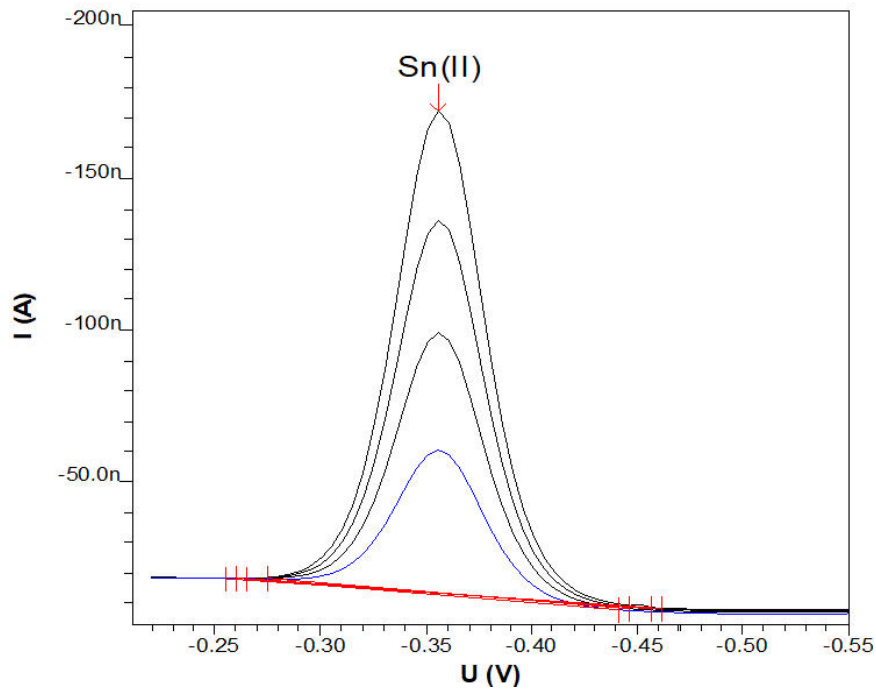


Figure 2. Determination of Sn(II) in a ^{99m}Tc injection preparation kit with 3 standard additions.

Table 2. Result

| Sample | Concentration [mg/L] |
|---|----------------------|
| ^{99m}Tc injection preparation kit | 22.1 |

REFERENCES

1. International Atomic Energy Agency, Technical Report No. 466 «Technetium-99m Radiopharmaceuticals: Manufacture of Kits», Vienna, 2008
2. Zolle, Ilse (Ed.), Technetium-99m Pharmaceuticals Preparation and Quality Control in Nuclear Medicine, Springer, 2007

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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.