Application Note AN-T-244

Standardization of sodium thiosulfate

Titration procedure for titer of 0.01 and 0.002 mol/L sodium thiosulfate.

Accurate titer determinations of titrant solutions are essential for reliable and precise titration results. Titrations sometimes involve diluted solutions (e.g., 0.01 and 0.002 mol/L) which present unique challenges. The low concentration of the titrant can lead to sluggish electrode responses, making it difficult to obtain stable readings during the titration. This situation requires slow titration parameters to avoid overtitration and to smooth the titration curve, with the aim of obtaining the «S» shaped plot expected for a good potentiometric titration curve.

Additionally, the small amounts of primary standard required for these dilutions can introduce weighing errors and contribute to increased variability in the final titer values. To prevent this, the most accurate alternative is to prepare solutions of the primary standard with the same concentration as the titrant and use a macro pipette to carry out the aliquoting.
This Application Note describes the procedure for performing a titer determination of sodium thiosulfate (0.01 and 0.002 mol/L) using the OMNIS Titrator and a Pt Titrode.

AUXILIARY SOLUTIONS

The following solutions are required for this study. These should be prepared with analytical grade reagents.

- 0.01 and 0.002 mol/L $Na_2S_2O_3$ – titrant
- 0.01 and 0.002 mol/L KIO_3 – standard
- 1% KI
- 0.1 mol/L H_2SO_4

EXPERIMENTAL

$Na_2S_2O_3$ – 0.01 mol/L

Pipet 1 mL of 0.01 mol/L KIO_3 standard solution, add 10 mL of 1% KI, then add 10 mL of 1 mol/L H_2SO_4 and deionized water until the bulb and metal ring of the Pt Titrode are covered. Titrate to the first endpoint at approximately 6 mL.

$Na_2S_2O_3$ – 0.002 mol/L

Pipet 1 mL of 0.002 mol/L KIO_3 standard solution, then add 2 mL of 1% KI, 2 mL of 0.1 mol/L H_2SO_4, and add deionized water until the bulb and metal ring of the Pt Titrode are covered. Titrate to the first endpoint at approximately 6 mL.

RESULTS

Results of the titer determination of $Na_2S_2O_3$ – 0.002 mol/L (Table 1) and 0.01 mol/L (Table 2) – were calculated according to the following equation where $c_{standard}$ is the concentration of KIO_3 standard solution, $V_{standard}$ is the volume of KIO_3 standard solution, V_{EP} is the volume of thiosulfate titrant, and 6 is the stoichiometric factor. An example titration curve for the titer determination is shown in Figure 1.

$$\text{Molarity (mol/L)} = \frac{c_{standard} \times V_{standard} \times 6}{V_{EP1}}$$

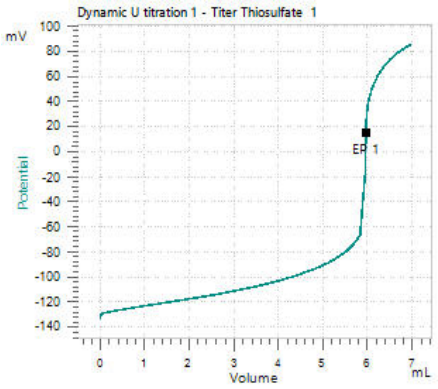

Figure 1. Exemplary titration curve of the titer determination of sodium thiosulfate with the OMNIS Titrator and a Pt Titrode.

Table 1. Results of the 2 mmol/L sodium thiosulfate titer determination.

No. (n = 5)	Mean value in mmol/L	s(abs) in mmol/L	s(rel) in %
1	2.008	0.013	0.6

Table 2. Results of the 10 mmol/L sodium thiosulfate titer determination.

No. (n = 5)	Mean value in mmol/L	s(abs) in mmol/L	s(rel) in %
1	10.057	0.041	0.4

COMMENTS

The drift is set to 30 mV/min; the minimum volume increment is 20 µL, and maximum increment is 150 µL.

CONCLUSION

The OMNIS Titrator equipped with a Pt Titrode reliably determines titer concentration in diluted titrants through sensitive and flexible analyses combined with high-end software.
Only fine adjustment of the titration parameters and the Pt Titrode electrode are necessary when using the OMNIS Titrator. The electrode is sensitive enough to respond adequately to potential differences during titration, resulting in an ideal titration curve.

CONTACT

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CONFIGURATION

OMNIS Professional Titrator with magnetic stirrer

Innovative, modular potentiometric OMNIS Titrator for stand-alone operation or as the core of an OMNIS titration system for endpoint titration and equivalence point titration (monotonic/dynamic). 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 rod stirrer added as needed. Including "Professional" function license for parallel titration with additional titration or dosing modules.

- Actuation 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: Safe handling of chemicals, automatic transfer of the original reagent data from 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 5-way parallel titration: "Professional" function license

Cylinder unit OMNIS 20 mL

Intelligent 20 mL cylinder unit for an OMNIS Titrator, Titration Module or Dosing Module. Includes dosing tubing and antidiffusion tip.

OMNIS

A WHOLE NEW LEVEL OF PERFORMANCE

dPt Titrode

Digital, combined platinum ring electrode for OMNIS with a pH glass membrane as reference electrode. This maintenance-free electrode is suitable for redox titrations when the pH value remains constant, e.g.:

- Iodometry
- Chromatometry
- Cerimetry
- Permanganometry

This electrode is stored in distilled water.
dTrodes can be used on OMNIS Titrators.

OMNIS Stand-Alone license

Enables stand-alone operation of the OMNIS software on a WindowsTM computer.

Features:

- The license already includes one OMNIS instrument license.
- Must be activated via the Metrohm licensing portal.